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Equity and efficiency in long-term care policies:

Empirical evidence from France and the Netherlands

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ÉQUITE ET EFFICIENCE DANS LES POLITIQUES DE SOINS DE LONGUE DUREE : CONTRIBUTIONS EMPIRIQUES A PARTIR DES CAS FRANÇAIS ET NEERLANDAIS

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THÈSE

pour obtenir le grade de

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Marianne TENAND

EQUITY AND EFFICIENCY IN LONG-TERM CARE POLICIES :
EMPIRICAL EVIDENCE FROM FRANCE AND THE NETHERLANDS

Doctorat de l'Université de recherche Paris Sciences et Lettres,

préparé à l'Ecole normale supérieure et à l'Ecole d'économie de Paris,

sous la direction de Pierre-Yves GEOFFARD et d'Agnès GRAMAIN

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General outline / Plan d'ensemble

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<p align="center">★ ★ ★</p>

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<div align="center">★ ★ ★</div>

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<p style="text-align:center">★ ★ ★</p>

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<p style="text-align:center">★ ★ ★</p>

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<div align="center">★ ★ ★</div>

« Certains naissent dans les choux, d'autres dans la merde
[...]
Pourquoi quand moi je plonge, lui passe sa thèse ?
Pourquoi les cages d'acier, les cages dorées agissent à leur aise ?
Son astre brillait plus que le mien sous la grande toile
Pourquoi ne suis-je pas né sous la même étoile ?
La vie est belle le destin s'en écarte
Personne ne joue avec les mêmes cartes
Le berceau lève le voile, multiples sont les routes qu'il dévoile
Tant pis on n'est pas nés sous la même étoile »

IAM. « Nés sous la même étoile ». *L'École du Micro d'Argent*. EMI, Delabel et Virgin, 1997.

Research funding / Financements des recherches

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[1] www.modapa.cnrs.fr.

[2] https://www.opening-economics.com/.

[3] https://www.netspar.nl/en/research/projects/.

Reading guide / Guide de lecture

English follows.

Cette thèse se structure sur la base de quatre articles empiriques, chacun d'eux explorant des questions de recherche spécifiques. Chaque chapitre a été rédigé de manière à pouvoir être lu de manière indépendante. En particulier, chaque chapitre est accompagné d'un résumé, de mots-clefs, de sa classification JEL et d'annexes propres. De ce fait, certaines des explications fournies sur les aspects institutionnels et des faits stylisés se retrouvent dans plusieurs chapitres.

L'Introduction générale vise à fournir une vue d'ensemble des questions à laquelle cette thèse entend apporter des éléments de réponse. Elle présente également le contexte général dans lequel s'insère cette recherche et sa pertinence au regard tant de la littérature économique que des politiques publiques. La thèse se clôt par une Conclusion générale qui résume ses contributions, expose ses principales limites et esquisse des pistes pour le prolongement des recherches.

Il a été choisi de rassembler l'ensemble des références bibliographiques dans une Bibliographie générale insérée à la fin de la thèse. A chaque fois qu'une référence est citée dans le texte, les noms des auteurs ainsi que l'année de publication sont mentionnés. Lorsque les auteurs sont plus de deux, seul le premier est cité, suivi de la mention « *et al.* » dès le premier appel de référence. Si plusieurs références des mêmes auteurs ont été publiées la même année, les lettres a, b, c etc. sont ajoutées après l'année de publication. Lorsqu'un même premier auteur a écrit plusieurs articles avec des ensembles de co-auteurs différents la même année, l'ensemble des auteurs est cité dans le texte.

Des tables des figures et des tableaux sont proposées en fin d'ouvrage. La numérotation des figures et des tableaux se fait chapitre par chapitre. Ainsi la figure 3.2 renvoie à la seconde figure insérée dans le chapitre 3 ; le tableau 2.C.4 renvoie au quatrième tableau de l'annexe C du chapitre 2 etc. Les figures et tableaux numérotés par un simple chiffre renvoient à l'Introduction générale.

L'essentiel de cette thèse a été rédigé en anglais, afin de faciliter la dissémination et la discussion de ces travaux dans les milieux universitaires et les institutions non-francophones. Bien que les trois premiers chapitres traitent des politiques françaises de l'accompagnement des personnes en situation d'incapacité, les questions abordées ont une pertinence en termes scientifiques et de politiques publiques qui va au-delà du seul contexte français. Certains résultats du chapitre 1 ont été publiés dans une revue française et la rédaction d'une version française du chapitre 3, à destination d'une revue faisant le pont entre la recherche

en sciences sociales et l'administration publique, est prévue. Le chapitre 4 a quant à lui été écrit avec des co-auteurs belge et néerlandais. Un résumé long de la thèse en français est également fourni.

Bien que la concision ait été systématiquement recherchée, elle ne s'avère pas toujours au rendez-vous. En espérant que l'écriture parfois prolixe de cette thèse ne constitue pas un obstacle à une agréable lecture.

<p style="text-align:center">★ ★ ★ ★ ★</p>

This thesis is based on four empirical papers : each of them investigates specific research questions. Each chapter was written so that it can be read as a standalone essay. It comes with a summary, key-words, JEL classification and own detailed appendices. As a consequence, some explanations about institutional features and stylized facts are repeated in several chapters.

The General introduction aims at providing a comprehensive overview of the research questions I tackle in this thesis, as well as of the broad context my research fits in and its relevance with respect to both the economic literature and public policies. The thesis ends with a General conclusion that reviews the contributions, discusses the main limitations and sketches directions for future research.

All bibliographic references are gathered in a general Bibliography placed at the end of the thesis. Each time a reference is referred to in the text, the authors' names and the year of publication are mentioned. When there are more than two authors, only the first one gets cited and I add the mention "*et al.*" to indicate that there are more. If several references from the exact same authors were published in the same year, the letters a, b, c etc. are added after the year of publication. When a first author has co-authored several papers with different sets of co-authors in the same year, all authors are cited in the text.

Lists of the figures and of the tables are inserted at the end of the thesis. The numbering of figures and tables is done chapter by chapter. Figure 3.2 refers to the second figure inserted in Chapter 3 ; Table 2.C.4 refers to the fourth table of Appendix C of Chapter 2 etc. The figures and tables numbered by a simple numeral are placed in the General introduction.

Most of this thesis is written en English, in order to facilitate the dissemination and discussion of my research in non French-speaking academic circles and institutions. Even though the first three chapters deal with French long-term care policies, they aim at tackling research questions that have scientific and policy relevance beyond the French context. Chapter 4 was co-authored with Belgian and Dutch co-authors.

Although I have made my best to be concise, the final product is fairly long, if not long-winded in some instances. I hope this is not an obstacle to a pleasant reading.

Résumé long en français

Dans les pays de l'Organisation économique de coopération et de développement (OCDE), le vieillissement démographique et la prévalence croissante de certaines maladies chroniques conduisent à une hausse marquée des effectifs de personnes ayant besoin d'assistance pour réaliser les activités de la vie quotidienne, qui est appelée à se poursuivre et s'amplifier dans les décennies à venir. L'augmentation du nombre de personnes âgées dites dépendantes constitue une préoccupation sociétale de premier plan et un défi majeur pour les politiques publiques. L'ensemble des pays de l'OCDE a mis en place des dispositifs publics, de type assurantiel ou relevant de l'aide sociale, visant à permettre aux individus de recevoir ou de financer des aides médico-sociales (aussi dites soins de longue durée, de l'anglais *long-term care*). Ces aides recouvrent une large palette de services, englobant les soins infirmiers, les soins au corps, les aides ménagères et d'autres formes d'assistance dans les activités de la vie quotidienne ; elles peuvent être apportées par des professionnels (aides formelles) ou par des proches (aides informelles). Ces aides peuvent être reçues soit au domicile de la personne, soit au sein d'un hébergement spécialisé (maison de retraite en particulier). Dans la plupart des pays, la couverture du risque dépendance par la puissance publique est limitée, ce qui contribue à expliquer l'implication importante des familles sous forme d'aides matérielles et d'assistance dans les activités de la vie quotidienne. Même en l'absence de changements dans les dispositifs actuels, les pays de l'Union européenne (UE) anticipent une augmentation des ressources qui seront affectées au financement de la dépendance : la dépense publique consacrée aux aides médico-sociales passerait ainsi de 1,4 % à 4,3 % du Produit intérieur brut (PIB) de l'UE entre 2015 et 2060. Si le débat relatif aux arbitrages budgétaires à consentir pour maintenir ou ajuster le niveau de protection sociale offert aux personnes en situation d'incapacité reste fondamentalement sociétal et politique, l'analyse économique peut contribuer à éclairer les tenants et les aboutissants des options de réforme envisageables.

Dans cette optique, cette thèse traite de deux questions économiques et de politique publique : les politiques visant à financer les soins de longue durée sont-elles efficientes ? Dans quelle mesure sont-elles équitables ? Cette problématique, très générale, est déclinée en des questions de recherche plus spécifiques, à caractère empirique et se rattachant à des enjeux théoriques. Comment les dispositifs publics visant à financer les aides médico-sociales affectent-ils les aides formelles et informelles reçues par les personnes en situation d'incapacité ? Observe-t-on des disparités socio-économiques dans la consommation de soins de longue durée ? Les restes-à-charge supportés par les individus sont-ils équitables ? Quelles caractéristiques des dispositifs existants pourraient être modifiées de manière à rendre les systèmes plus efficients et plus équitables ? Les analyses proposées sont pour partie posi-

tives et pour partie normatives ; elles sont regroupées en quatre investigations empiriques, qui constituent autant de chapitres.

La thèse s'ouvre sur une Introduction générale qui s'organise en trois grandes sections. La première partie vise à préciser l'objet d'étude, à partir des définitions des concepts d'incapacité, de dépendance et des soins de longue durée. Elle présente également le contexte dans lequel s'insèrent les questionnements de la thèse, en offrant une vue d'ensemble des tendances démographiques et épidémiologiques ainsi que des politiques publiques de financement des soins de longue durée dans les pays de l'OCDE.

La seconde partie situe la problématique de la thèse dans la littérature économique existante. La question de l'efficacité des dispositifs de financement des soins de longue durée peut, dans une certaine mesure, s'appuyer sur les analyses des dispositifs assurantiels offrant à l'assuré une réduction du prix des traitements en cas de maladie (*health insurance theory*). Ces analyses ont mis en avant l'importance du paramètre d'élasticité-prix de la demande de soins médicaux et l'existence d'un aléa moral ex post induit par la couverture assurantielle. Transposer ce cadre d'analyse à l'étude des dispositifs de couverture du risque dépendance permet d'attirer l'attention sur deux éléments empiriques. D'une part, les effets-revenu dans la consommation de soins de longue durée conditionnent l'existence des gains d'efficience associés au transfert de ressources vers les personnes dépendantes que vont permettre les dispositifs. D'autre part, c'est la substituabilité entre soins de longue durée et autres biens de consommation dans les préférences individuelles qui conduirait les dispositifs prenant la forme d'une subvention sur le prix des aides médico-sociales à s'accompagner d'inefficiences allocatives. Si des études empiriques menées en France et à l'international ont montré l'existence d'une sensibilité au prix et au revenu de la demande d'aide à domicile, elles n'ont pas abouti à une quantification des paramètres d'élasticité-prix et d'élasticité-revenu.

Concernant l'équité des politiques de soins de longue durée, la revue de littérature souligne que relativement peu de travaux empiriques ont été produits à ce jour. Ceux-ci se focalisent sur l'existence d'iniquités horizontales dans le recours aux aides liées au statut socio-économique ou à la région de résidence. Etudier l'équité des dispositifs consiste à poser la question du caractère juste de l'allocation des soins de longue durée ou de la répartition de leur financement au sein de la population, et requiert donc tant de documenter les inégalités existantes au regard de ces deux dimensions que de mobiliser des jugements de valeur. Or les analyses empiriques existantes discutent peu les principes de justice sociale auxquels elles se rattachent. C'est de fait le principe de la tradition égalitariste selon laquelle l'allocation des soins doit se faire selon les « besoins » qui est mobilisé. Là encore, l'économie de la santé peut apporter un éclairage utile à l'analyse de l'équité dans le champ des soins de longue durée, dans la mesure où de nombreux travaux théoriques et empiriques ont proposé et mis en regard différentes définitions possibles de l'équité en santé. En particulier,

les développements récents autour de la théorie de l'égalité des opportunités font ressortir trois éléments centraux dans toute évaluation empirique de l'équité dans la consommation de soins se plaçant dans une veine égalitariste. Premièrement, la partition des caractéristiques individuelles entre besoins et déterminants illégitimes du recours aux aides est un exercice empirique dont la portée normative est essentielle ; deuxièmement, les hypothèses faites sur l'équité *verticale* dans la consommation de soins conditionnent les conclusions relatives à l'équité *horizontale*. Enfin, l'analyse empirique doit statuer sur le rôle à donner aux préférences individuelles. La revue de littérature s'achève par une discussion du « besoin d'aide », terme fréquemment utilisé dans les analyses économiques sans qu'une définition claire en soit proposée. A la différence du système de santé, les dispositifs de soins de longue durée prévoient généralement une évaluation des besoins comme préalable aux aides ; la pertinence de l'utilisation des droits ouverts comme mesure des besoins dans le cadre d'une analyse normative des dispositifs publics doit toutefois s'apprécier au regard du contexte institutionnel.

La thèse apporte des contributions empiriques à la littérature sur l'efficience et l'équité des dispositifs de financement des soins de longue durée dans le contexte de deux pays européens, la France et les Pays-Bas. Bien que connaissant des situations économiques et démographiques relativement proches, ces deux pays se caractérisent par des systèmes de financement des soins de longue durée sensiblement différents. Les Pays-Bas ont mis en place un système d'assurance sociale du risque de perte d'autonomie, qui offrait jusqu'à récemment une couverture publique généreuse et intégrée d'un large ensemble de services. La couverture publique offerte en France repose quant à elle sur l'assemblage de dispositifs répondant à des logiques d'intervention distinctes ; elle se distingue en outre par l'existence d'une barrière d'âge, qui conduit les personnes âgées de moins de 60 ans à relever des dispositifs « handicap », tandis que les personnes de 60 ou plus peuvent prétendre aux aides à la « dépendance ». Les deux pays ont toutefois en commun de connaître depuis quelques années un débat public et politique nourri sur les évolutions à apporter aux dispositifs existants alors même que des réformes importantes ont déjà été mises en œuvre ces dernières années. Dans ce contexte, il apparaît utile de documenter la performance des politiques existantes en matière d'efficacité et d'équité, tant pour anticiper les effets des réformes récentes que pour discuter les orientations des mesures à venir.

Dans une dernière et troisième partie, l'Introduction générale détaille les questions de recherche spécifiques abordées dans chacun des quatre chapitres de la thèse. Cette section présente également les outils analytiques et les méthodes empiriques mises à profit. Les analyses s'appuient pour partie sur la théorie microéconomique néoclassique, et en particulier la théorie du consommateur. Les résultats empiriques sont obtenus principalement à partir des données observationnelles individuelles, complétées dans un chapitre par des simula-

tions. Les méthodes microéconométriques utilisées s'inspirent des méthodes d'évaluation des politiques publiques en forme réduite ou répondent à une approche plus structurelle. L'évaluation des inégalités et iniquités dans la consommation de soins de longue durée se fait notamment à partir d'indices de concentration et d'iniquité horizontale largement utilisés en économie de la santé. Les analyses empiriques s'appuient sur plusieurs types de données – données d'enquête, données administratives et fichiers-clients d'un service d'aide à domicile ; certaines ont été pour partie collectées dans le cadre d'un projet de recherche collectif (projet MODAPA), les autres étant mis à la disposition des chercheurs par les instituts statistiques néerlandais et français. Le périmètre des soins de longue durée auquel se réfère chacune des analyses est précisé. L'introduction s'achève par une mise en regard des définitions empiriques du besoin d'aide et des approches de la question de l'équité proposées dans les différents chapitres.

Chapitre 1

Le premier chapitre étudie les effets de la barrière des 60 ans dans les dispositifs publics de financement des soins de longue durée. Schématiquement, un individu de moins de 60 ans résidant en logement ordinaire et ayant des restrictions d'activité pourra prétendre à la Prestation de compensation du handicap (PCH), tandis qu'il pourra faire une demande d'Allocation personnalisée d'autonomie (APA) s'il a 60 ans ou plus. La distinction qui est faite entre les personnes « handicapées » et les « personnes âgées dépendantes » n'apparaît pas conforme à l'environnement légal de l'Union européenne, selon lequel l'accès aux dispositifs de compensation des incapacités ne doit pas dépendre de l'âge de l'individu. Alors même que le débat sur le caractère discriminant des dispositifs français s'est intensifié depuis 2005, avec la promulgation d'une loi prévoyant l'uniformisation des dispositifs handicap et dépendance, l'effet de la barrière des 60 ans sur la façon dont les restrictions d'activité et limitations fonctionnelles sont compensées au quotidien n'avait jusqu'alors pas fait l'objet d'une évaluation quantitative. La comparaison des dispositifs « sur le papier » est rendue difficile par le fait qu'il existe des différences multiples entre les dispositifs ; PCH et APA se distinguent ainsi tant par les critères d'éligibilité, la nature des aides humaines pouvant être subventionnées, le barème de la participation financière des bénéficiaires ou encore les conditions de rémunération de proches aidants.

Afin de nourrir le débat par des éléments empiriques, le chapitre mobilise des méthodes économétriques pour répondre à la question suivante : est-ce-que le fait d'être considéré comme une personne âgée dépendante plutôt que comme une personne handicapée affecte la nature des soins de longue durée reçus ? Deux dimensions complémentaires sont explorées : il s'agit tout d'abord d'évaluer l'effet de la barrière des 60 ans sur les aides formelles et informelles reçues au domicile des personnes résidant en logement ordinaire ; puis de tester

l'impact de la discontinuité institutionnelle sur les configurations résidentielles, en l'occurrence sur la probabilité de résider dans un établissement spécialisé.

L'analyse s'appuie sur une enquête en population générale, l'enquête Handicap-Santé (HS) réalisée par l'Institut national de la statistique et des études économiques (Insee) et la Direction de la recherche, des études, de l'évaluation et des statistiques (Drees) en 2008-2009. Cette enquête comporte un volet réalisé sur les individus résidant en logement ordinaire, appelé HSM, qui comporte des informations tant sur l'état fonctionnel, la santé et les aides formelles et informelles reçues que sur les caractéristiques démographiques et socio-économiques et l'environnement familial des enquêtés. Sont sélectionnés dans l'échantillon les individus âgés de 50 à 74 ans ayant des restrictions dans les activités de la vie quotidienne (N=3 121) afin de pouvoir comparer les aides reçues par deux sous-populations d'individus relativement proches, les 50-59 ans d'une part et les 60-74 ans d'autre part, séparées cependant par la barrière institutionnelle des 60 ans. Un modèle probit bivarié est estimé pour tenir compte de la simultanéité entre les décisions de recours aux aides formelles et informelles ; un riche ensemble de variables de contrôle ainsi que des effets d'âge sont inclus afin d'isoler l'effet d'avoir 60 ou plus sur la probabilité de recevoir une aide formelle ou une aide informelle. L'enquête dispose également d'un volet réalisé sur les individus résidant en hébergement spécialisé (volet HSI) et d'une base de données spécifique réunissant des informations issues d'HSM et d'HSI. De cet échantillon représentatif de l'ensemble de la population française, nous retenons à nouveau les 50-74 ans (N=12,784) ; afin d'estimer l'impact du fait d'avoir 60 ans sur la probabilité de résider en institution, nous mettons en œuvre une technique d'estimation paramétrique par régression sur discontinuité (RDD).

Trois principaux résultats se dégagent de l'analyse. Premièrement, la probabilité de recevoir une aide à domicile formelle est plus élevée pour les personnes âgées dépendantes que pour les personnes handicapées de moins de 60 ans, à caractéristiques observables données ; la probabilité de recevoir une aide informelle est au contraire plus faible, mais cet effet apparaît moins robuste. Deuxièmement, au sein de la population résidant en logement ordinaire, les effets sont hétérogènes selon le genre et la sévérité des incapacités. Les hommes de 60 ans et plus sont ainsi plus susceptibles de recevoir une aide formelle mais aussi une aide à la vie quotidienne apportée par leur entourage, tandis que l'effet positif de relever des dispositifs dépendance sur la probabilité de recevoir une aide professionnelle à domicile n'est détecté que pour les individus ayant des restrictions dans les activités de la vie quotidienne au sens strict (AVQ). Troisièmement, la probabilité de résider de manière permanente dans un établissement spécialisé est plus forte pour les personnes âgées dépendantes, toutes choses étant égales par ailleurs.

Lever le voile sur les mécanismes expliquant ces effets n'est pas aisé, les données ne permettant pas de connaître les montants des prestations handicap ou dépendance per-

çues par les individus. Nos estimateurs capturent un effet global des différences de dispositif, qui englobe tant le différentiel d'accès à des aides et la générosité de celles-ci que des différences dans l'offre de services. Côté domicile, l'offre de Services de soins infirmiers à domicile (SSIAD) pour les personnes de moins de 60 ans était en 2008 encore très limitée, ce qui pourrait expliquer que les personnes handicapées ont une probabilité plus faible de recevoir des aides aux corps apportées par des professionnels. L'interprétation des résultats doit aussi se faire à la lumière d'une caractéristique importante du plan d'échantillonnage de l'enquête Handicap-Santé : si les personnes âgées dépendantes ont été considérées comme résidant en institution dès lors qu'elles étaient entrées en maison de retraite, les personnes de moins de 60 ans régulièrement hébergées dans des établissements pour adultes handicapés mais revenant au domicile familial de manière ponctuelle dans l'année ont été considérées comme résidant à domicile. Ceci implique que les individus de moins de 60 ans considérés comme résidant en logement ordinaire dans l'enquête ont une probabilité plus forte de recevoir des aides professionnelles dans des établissements spécialisés, lesquelles ne sont pas observées dans le volet HSM de l'enquête, que les personnes âgées.

Globalement, les résultats obtenus suggèrent que la barrière des 60 ans dispositifs de financement des aides médico-sociales en France a un impact sur les modalités d'accompagnement des personnes ayant des restrictions d'activité. L'interprétation doit rester prudente, du fait de certaines limites de l'enquête au vu de la question de recherche et de l'approche économétrique en forme réduite. Par ailleurs, les implications des résultats en termes économétriques doivent être discutées sur la base de considérations normatives : ainsi, si les préférences pour l'aide informelle, relativement à l'aide formelle, varient avec l'âge ou la génération, les différences observées en termes de configurations d'aide à domicile ne reflètent pas nécessairement une iniquité horizontale dans le recours aux aides médico-sociales.

Chapitre 2

Le chapitre 2 a été co-écrit avec Quitterie Roquebert. Il prend comme point de départ une implication du Chapitre 1, lequel suggère que les individus ayant des restrictions dans les activités de la vie quotidienne modulent leur consommation de soins de longue durée en fonction des subventions à l'aide à domicile dont ils peuvent bénéficier. Mais dans quelle mesure ? L'objectif du chapitre 2 est de contribuer à la littérature internationale évaluant les effets des dispositifs de financement des aides à domicile sur la consommation de ces aides en proposant une quantification des réactions comportementales des personnes âgées dépendantes, et en particulier de la mesure dans laquelle celles-ci ajustent la quantité d'aides consommées au prix qu'elles doivent débourser de leur poche pour les financer. L'ensemble des pays de l'OCDE s'étant engagé dans la voie du maintien à domicile des personnes âgées dépendantes, disposer d'estimateurs de l'élasticité-prix et de l'élasticité-revenu de la de-

mande d'aide à domicile s'avère essentiel pour mieux comprendre les effets des programmes de subvention de l'aide à domicile en termes d'efficience allocative, ainsi que anticiper l'impact des réformes de ces dispositifs sur les volumes consommés et les restes-à-charge supportés par les bénéficiaires.

Le chapitre 2 propose une estimation de la sensibilité au prix des bénéficiaires de l'APA résidant en logement ordinaire dans leur consommation d'aides ménagères, aides au corps et autres services d'assistance dans les activités de la vie quotidienne. L'APA fonctionne comme une subvention horaire sur le prix facturé par les services d'aide à domicile au bénéficiaire, le taux de la subvention étant d'autant plus fort que le revenu est faible. La subvention est accordée dans la limite d'un nombre d'heures individualisé, appelé plan d'aide, sur la base d'une évaluation des besoins faite par une équipe médico-sociale. Si le bénéficiaire désire consommer des heures au-delà de son plan d'aide, il peut le faire à condition de payer l'intégralité du prix facturé par le service d'aide à domicile – la subvention horaire APA ne s'appliquant plus. En termes microéconomiques, l'APA créé ainsi un coude dans la contrainte budgétaire des bénéficiaires, localisé au niveau de leur plan d'aide.

Comme aucune base de données existante en France ne rassemble des informations sur la quantité de soins de longue durée consommée et leur prix, l'analyse exploite des fichiers individuels sur les bénéficiaires de l'APA collectés de manière *ad hoc*, dans le cadre du projet de recherche MODAPA. L'APA étant mise en œuvre par les départements, un Conseil départemental a été sollicité pour permettre aux membres de l'équipe d'accéder à ses données de gestion. Celles-ci contiennent une information précise sur le plan d'aide, la quantité d'aide effectivement consommée sur une base mensuelle, le taux de subvention APA ainsi que sur le revenu, l'âge, le genre, la situation matrimoniale et la commune de résidence de l'ensemble des bénéficiaires de l'APA à domicile. Par ailleurs, nous disposons d'une information exacte sur le reste-à-charge horaire supporté par les bénéficiaires s'adressant à des prestataires dits autorisés. Ces services constituent le type de structures d'aide à domicile fournissant la majorité des heures subventionnées par l'APA ; le tarif horaire que chacun de ces services doit facturer aux bénéficiaires APA est arrêté une fois par an par le Conseil départemental. L'échantillon retenu est constitué de l'ensemble des bénéficiaires de l'APA du département ayant reçu une aide fournie par un service prestataire autorisé aux mois d'octobre 2012, 2013 et 2014 (N=8 190).

L'approche semi-structurelle adoptée permet d'obtenir un estimateur du paramètre d'élasticité-prix de la demande, supposée constante. Ce paramètre est identifié principalement par les variations inter-individuelles dans les prix facturés par les services d'aide à domicile, tandis que les variations inter-individuelles de revenu permettent d'identifier l'élasticité-revenu de la demande. Notre stratégie empirique répond à deux écueils. Premièrement, seule la consommation des heures subventionnées par l'APA est enregistrée dans

les données administratives départementales dont nous disposons ; pour chaque individu, les heures potentiellement consommées au-delà du plan d'aide ne sont pas observées. Afin de tenir compte de la censure par la droite de notre variable dépendante, nous utilisons un modèle Tobit de régression censurée. Deuxièmement, les bénéficiaires sont en théorie libres de s'adresser au service d'aide à domicile de leur choix, ce qui peut conduire à une endogénéité des variations inter-individuelles dans les niveaux de prix des services d'aide à domicile. Cette dernière est prise en compte au moyen d'une stratégie d'estimation par variable instrumentale. Le prix du service auquel s'adresse un bénéficiaire donné est instrumenté par le nombre de communes desservies par ce service ; la corrélation positive entre ces deux variables peut s'expliquer par les coûts de transport et de planification que doivent subir les services desservant un territoire géographique étendu. En l'absence d'indication empirique d'un rationnement de l'offre dans certaines zones, on peut supposer que la variabilité géographique dans la zone de desserte des services d'aide à domicile n'a pas d'incidence sur le volume individuel de consommation d'aide.

Les estimations suggèrent qu'une augmentation de 10 % du reste-à-charge horaire des individus conduirait à une baisse de 4 % du nombre d'heures d'aide à domicile consommées à la marge intensive. A taux de subvention APA inchangé, une augmentation de 10 % du revenu induirait une augmentation symétrique de 4 % des heures consommées, suggérant que les services d'aide à domicile que finance l'APA sont des biens de nécessité au sens de la théorie du consommateur. Nos estimateurs révèlent également que dans le cadre de l'APA, une augmentation du revenu a peu d'effet sur la consommation d'aide dès lors qu'elle s'accompagne d'une revalorisation de la participation financière à la charge du bénéficiaire : effet-prix et effet-revenu se compensent. Les estimateurs de l'élasticité-prix et de l'élasticité-revenu obtenus sont combinés afin de dériver une valeur de l'élasticité-prix de la demande hicksienne d'aide à domicile, de -0,4 à -0,3.

Ces résultats impliquent que les dispositifs de subvention de l'aide à domicile ont un impact sur la consommation d'aide à domicile via des effets-revenu mais également des effets de substitution : ce type de dispositif s'accompagne ainsi de pertes brutes d'efficience allocative. L'élasticité-revenu étant positive mais de faible ampleur, il est possible que les gains d'efficience que permet le transfert de ressources qui s'opère envers les bénéficiaires de l'APA soient faibles. Ces deux éléments tendent à laisser penser que l'APA est un dispositif peu performant à l'aune du seul critère de l'efficience allocative. Il convient toutefois de souligner que notre analyse ne prend pas en compte les externalités négatives qu'un faible recours à l'aide professionnelle peut laisser peser sur les aidants informels ou la santé du bénéficiaire ; elle n'intègre pas non plus les gains d'efficience ex ante que permet l'existence d'un dispositif d'assurance contre le risque financier associé à la dépendance. Nos estimations indiquent également que les individus ayant un revenu supérieur à la médiane sont plus sensibles au

prix dans leur décision de consommation. L'existence d'un taux de participation croissant en le revenu du bénéficiaire pourrait ainsi répondre à un enjeu d'efficience tout autant qu'à un objectif de redistribution. En dépit d'une précision statistique relativement faible, nos estimateurs pointent en outre vers une élasticité-prix inférieure à 1 en valeur absolue, ce qui implique qu'une réduction du reste-à-charge horaire de l'aide à domicile devrait conduire à une hausse moins que proportionnelle de la consommation, et donc à une réduction des restes-à-charge totaux supportés par les bénéficiaires. Nos résultats invalident le présupposé selon lequel les personnes âgées ayant des restrictions d'activité seraient extrêmement sensibles dans leur consommation d'aide professionnelle à domicile.

Chapitre 3

Le chapitre 3 approfondit l'étude du dispositif APA à domicile, en se concentrant sur la question de l'équité du dispositif. Si l'APA permet de redistribuer des ressources des contribuables vers les personnes âgées dépendantes, deux caractéristiques importantes de cette allocation semblent par ailleurs limiter les inégalités dans la consommation d'aide à domicile et dans les restes-à-charge associées entre bénéficiaires. Premièrement, le taux de la subvention horaire est d'autant plus élevé que le revenu du bénéficiaire est faible, ce qui permet d'accentuer l'effort financier en faveur des bénéficiaires plus modestes. Deuxièmement, l'existence du plan d'aide individualisé, déterminé sur la base d'une évaluation des besoins et soumis à des plafonds nationaux dont le montant est d'autant plus élevé que le groupe iso-ressource (GIR) du bénéficiaire indique un niveau de dépendance sévère, permet d'accroître la redistribution de ressources vers les individus les plus dépendants.

En attendant la prochaine mise à disposition d'une nouvelle enquête en population générale (CARE, Insee-Drees), documenter précisément les écarts de consommation d'aide professionnelle et de restes-à-charge entre les bénéficiaires APA appartenant à des GIR distincts ou ayant des niveaux de revenu différents s'avère difficile, pour deux raisons. Tout d'abord, les registres administratifs que tiennent les Conseils départementaux sur leurs bénéficiaires APA (cf. chapitre 2) ne contiennent aucune information sur les heures d'aide professionnelle que peuvent consommer les bénéficiaires au-delà de leur plan d'aide. Les données collectées et mobilisées dans le chapitre 2 indiquant qu'environ 40 % des bénéficiaires du département considéré ont une consommation d'aide subventionnée égale à leur plan d'aide, il paraît légitime de s'interroger sur la proportion effective des personnes âgées dépendantes bénéficiant de l'APA mais consommant une aide professionnelle non subventionnée en sus, ainsi que sur l'impact de cette « surconsommation » sur les restes-à-charge supportés. Le deuxième facteur qui rend difficile l'appréciation des restes-à-charge est la marge de manœuvre laissée aux Conseils départementaux dans l'application du barème de la subvention APA ; en particulier, le calcul de la subvention horaire sur la base d'un tarif for-

faitaire observé dans certains cas conduit à ce que même les bénéficiaires ayant un taux de participation légal APA supportent un reste-à-charge horaire non nul. On soulignera finalement que les données d'enquête existantes (avant CARE), en particulier l'enquête HSM (cf. chapitre 1) offrent une information riche sur les aides formelles consommées mais ne permettent guère d'apprécier les sommes déboursées pour ces aides ni de repérer de manière précise les bénéficiaires des dispositifs publics.

Afin de compléter les estimations de consommations d'aide à domicile et de restes-à-charge proposées par la Drees, le chapitre 3 s'appuie sur des données observationnelles originales, collectées dans le cadre du projet de recherche MODAPA : il s'agit des fichiers-clients d'un important service d'aide à domicile de type prestataire, ayant son activité dans un département métropolitain. Pour le mois d'octobre 2014, ces données renseignent la consommation subventionnée d'aide à domicile ainsi que les éventuelles heures consommées au-delà du plan d'aide de chacun des clients du service. On observe également le taux de subvention APA, le tarif forfaitaire auquel ce taux est appliqué et, partant, le reste-à-charge horaire. Ces données permettent ainsi de documenter de manière précise les consommations et les restes-à-charge pour un échantillon de bénéficiaires de l'APA. Les données mobilisées présentent toutefois l'inconvénient de mesurer de manière imparfaite le revenu et le GIR. Des imputations sont proposées pour pallier cette limite.

Outre une visée descriptive, le chapitre 3 revêt une dimension normative : il s'attelle à évaluer si l'équité horizontale dans la consommation d'aide et l'équité verticale dans le financement direct sont assurés par le dispositif APA. En l'occurence, il s'agit de vérifier si les bénéficiaires de l'APA ayant les mêmes besoins, mesurés ici par leur GIR, ont une consommation d'aide qui ne dépend pas systématiquement de leur revenu, et si les restes-à-charge représentent une proportion du revenu qui ne décroît pas avec celui-ci.

L'évaluation faite à partir des données observationnelles permet de documenter la situation avant qu'une réforme importante du dispositif APA à domicile soit mise en place en 2016. Cette dernière a consisté en une série de mesures dont l'objectif était d'accroître l'effort public en direction des individus les plus défavorisés, des classes moyennes ainsi que des bénéficiaires les plus dépendants. Le seuil de revenu en-deçà duquel le taux de participation légal est nul a été abaissé ; le taux de subvention a été augmenté plus fortement pour les bénéficiaires de la moitié haute de la distribution des revenus ; le taux de subvention est également devenu fonction du plan d'aide, permettant une participation financière horaire moindre pour les individus les plus dépendants ; enfin, les plafonds nationaux applicables aux plans d'aide ont été relevés. L'impact de ces mesures sur la distribution des consommations et des restes-à-charge selon le niveau de dépendance et le revenu, et donc sur l'équité du dispositif APA, n'est pas aisé à anticiper, car il dépend en particulier des réactions comportementales des bénéficiaires aux modifications dans leur contrainte budgétaire que va

induire la réforme.

Comme nous ne disposons d'aucune source de données individuelles permettant une évaluation ex post des effets de la réforme, le chapitre 3 propose également une évaluation ex ante à partir d'une simulation des modifications de consommations et de restes-à-charge. Cette simulation s'appuie sur un certain nombre d'hypothèses ; en particulier, celle que les équipes médico-sociales réévalueront l'ensemble des plans d'aide de manière proportionnelle à la hausse des plafonds nationaux décidée par la réforme. L'ajustement de la consommation d'aide par les bénéficiaires de l'APA est simulé à l'aide des valeurs d'élasticité-prix et d'élasticité-revenu dérivées dans le chapitre 2.

Les données mobilisées indiquent que, avant la réforme, les différences entre niveaux de revenu dans la consommation d'aide professionnelle à domicile semblaient limitées, les bénéficiaires au milieu de la distribution des revenus tendant toutefois à consommer un volume d'aide moindre – à niveau de dépendance donné. Les restes-à-charge apparaissent élevés pour les bénéficiaires en GIR 1 et 2 en particulier (avec une moyenne de près de 350 € mensuels) et sont non négligeables même pour les bénéficiaires du quintile inférieur de revenu, dont le taux de participation légal à l'APA est pourtant très faible. Les simulations des consommations post-réforme laissent anticiper une augmentation du volume d'heures d'aide formelle consommées pour l'ensemble des bénéficiaires, de 12 % en moyenne. Lorsqu'on contrôle par le GIR, la consommation des bénéficiaires appartenant aux quintiles de revenu 1 et 4 reste toutefois inférieure à celle des autres bénéficiaires - en moyenne -, ce qui suggère que la réforme n'a pas complètement permis d'atteindre l'*équité horizontale* dans l'utilisation d'aide formelle. Il est également prédit que la réforme s'accompagnera d'une baisse des restes-à-charge totaux pour les bénéficiaires appartenant aux quintiles de revenu 3 à 5, qui profitent le plus de la baisse du taux de participation légal. Du fait d'une hausse marquée de la consommation d'aide, les restes-à-charge totaux pourraient en revanche augmenter en bas de la distribution des revenus ; la réforme pourrait ainsi conduire à une dégradation de l'*équité verticale* dans la participation financière des bénéficiaires. La baisse importante des taux d'effort pour les bénéficiaires des GIR 1 et 2 que prédisent les simulations laisse anticiper une amélioration de la couverture du risque financier associé à une prise en charge à domicile des dépendances lourdes, grâce à la réforme.

L'extrapolation de ces résultats doit être faite avec prudence, dans la mesure où l'échantillon utilisé n'est a priori pas représentatif de l'ensemble des bénéficiaires de l'APA à domicile. Néanmoins, cette analyse exploratoire illustre l'intérêt des techniques de simulation dans l'évaluation d'une réforme d'un dispositif de subvention de l'aide à domicile. Elle met également en lumière l'importance de documenter et d'anticiper les réactions comportementales des agents, dans la mesure où celles-ci peuvent infléchir les visées redistributives des réformes des dispositifs de solvabilisation des aides médico-sociales.

Chapitre 4

Le quatrième et dernier chapitre de la thèse se focalise sur le système d'accompagnement de la dépendance aux Pays-Bas. Il vise dans un premier temps à documenter les éventuelles inégalités socio-économiques dans la consommation d'aides médico-sociales ; et dans un deuxième temps, à évaluer si les individus ayant des mêmes besoins de prise en charge reçoivent des services similaires, de manière indépendante de leur revenu. Bien que l'assurance sociale néerlandaise du risque de perte d'autonomie soit perçue comme garante d'un accès aux soins de longue durée très égalitaire, peu d'éléments empiriques viennent appuyer ce constat. Documenter la performance du système au regard de l'équité horizontale dans le recours aux soins de longue durée aux Pays-Bas apparaît d'autant plus important à l'heure actuelle, à mesure que des modifications substantielles sont apportées aux dispositifs publics existants. En particulier, les changements récents intervenus dans le barème de la participation financière des bénéficiaires aux coûts des soins et les discussions portant sur la pertinence de modifications ultérieures invitent à s'interroger sur le lien empirique observé entre la consommation d'aides médico-sociales d'un individu et ses ressources financières.

L'étude proposée dans le chapitre 4, co-écrite avec Pieter Bakx et Eddy van Doorslaer, s'appuie sur des données administratives extrêmement riches et bien adaptées à une analyse distributionnelle. Le cœur du jeu de données est constitué des les registres exhaustifs des décisions d'éligibilité à une solvabilisation publique de soins de longue durée, pour l'ensemble de la population néerlandaise. Ces registres sont mis en regard avec les aides médico-sociales effectivement consommées. Les volumes consommés des différents types d'aide à domicile qui peuvent être solvabilisés par l'assurance sociale néerlandaise (soins infirmiers, aide au corps, etc.), ainsi que les séjours en institution spécialisée sont directement renseignés ; les données fournissent également une information sur le recours à une prestation monétaire plutôt qu'à une aide en nature, qui relève aux Pays-Bas du choix du bénéficiaire. Ces données sur l'éligibilité aux soins de longue durée et leur utilisation effective sont appariées avec les registres fiscaux et municipaux, permettant ainsi d'avoir une information précise sur les revenus et le patrimoine des bénéficiaires, leur situation matrimoniale, leur lieu de résidence, la composition de leur foyer, mais aussi leur origine ethnique ainsi que leur âge et leur genre. L'étude se focalise sur les individus ayant 60 ans ou plus en 2012 et ayant été éligibles à un financement public de leurs soins de longue durée, en 2012, en raison d'une situation de perte d'autonomie (N= 616,934).

L'analyse repose sur le calcul d'indicateurs synthétiques, l'indice de concentration et l'indice d'iniquité horizontale. En mettant en regard la valeur monétaire de l'ensemble des soins de longue durée consommés par les individus de la population d'intérêt avec leur revenu imposable individualisé, l'indice de concentration permet de mesurer de manière synthétique l'éventuelle concentration des soins de longue durée reçus parmi la population riche, ou

pauvre, définie en termes relatifs. La mesure de l'iniquité horizontale découle quant à elle de la distinction faite entre les inégalités dans la consommation de soins de longue durée considérées comme légitimes – car reflétant les besoins de prise en charge –, des inégalités considérées comme illégitimes. L'originalité de l'analyse proposée tient à la manière dont est conceptuellement et empiriquement défini le besoin légitime d'aide. Les travaux existants s'appuient sur une dérivation statistique d'une mesure du besoin, reposant sur l'hypothèse relativement forte d'absence d'*iniquité verticale* en moyenne dans la consommation de soins ; nous mobilisons en revanche une variable unique et explicite, à savoir la valeur monétaire de l'ensemble des soins de longue durée pour lesquels un individu a été jugé éligible. Ce choix se justifie par le contexte institutionnel néerlandais : l'évaluation des besoins est confiée à une agence centrale indépendante, appelée CIZ, dont les agents s'appuient sur une grille précise pour déterminer l'ensemble des services pour lesquels un individu sera autorisé à recevoir une aide publique. Ainsi, l'hypothèse sur laquelle s'appuie notre évaluation de l'équité horizontale dans la consommation de soins de longue durée est que les décisions d'éligibilité prises par l'agence CIZ incarnent et révèlent la norme d'équité verticale dans l'utilisation des soins qui prévaut dans le système d'assurance sociale néerlandais.

L'analyse indique que les individus dans le bas de la distribution des revenus tendent à consommer davantage de soins de longue durée, en valeur. La concentration « pro-pauvre » des soins de longue durée se maintient même lorsqu'on tient compte du fait que le besoin d'aide, tel que reflété par les décisions d'éligibilité de l'agence CIZ, décroît avec le revenu. On observe notamment que les bénéficiaires appartenant au premier décile de revenu consomment en moyenne 25 % plus de soins de longue durée —- en valeur — que les bénéficiaires appartenant au décile de revenu supérieur ; l'indice d'iniquité horizontale est ainsi négatif. Une décomposition de l'indice d'iniquité est réalisée sur la base d'une régression linéaire de la consommation de soins sur les caractéristiques démographiques et socio-économiques qui, conditionnellement au besoin d'aide, sont considérées comme des déterminants illégitimes du besoin d'aide. Cette décomposition a vocation non pas à identifier des relations causales, mais à mettre en lumière les facteurs corrélés simultanément avec le revenu et avec l'utilisation faite des soins de longue durée. Cet exercice met en lumière la contribution importante du fait de résider avec un conjoint : avoir un conjoint en vie, qui est une situation plus fréquente chez les personnes âgées relativement aisées, est associé à une consommation d'aide formelle plus faible. Par ailleurs, le revenu lui-même est fortement et négativement corrélé à la consommation de soins. En revanche, les inégalités inter-régionales observées dans l'utilisation de soins ne recoupent pas les inégalités de revenu au sein de la population âgée néerlandaise : le lieu de résidence ne contribue donc pas à l'iniquité horizontale mesurée.

A l'inverse des données d'enquête mobilisées par les quelques études empiriques sur

l'équité horizontale dans la consommation de soins de longue durée liée au statut socio-économique qui ont pour l'heure été menées, nos sources administratives donnent à voir conjointement les prises en charge à domicile et en institution. Elles permettent d'observer que, parmi les individus qui ont été déclaré éligibles à un accompagnement en institution, ceux appartenant au décile inférieur de revenu sont davantage susceptibles d'entrer effectivement en institution ; les individus relativement plus aisés qui se trouvent éligibles à une prise en charge institutionnelle ont davantage tendance à demander la conversion de leurs droits en un ensemble de services à recevoir au domicile ou, pour les plus riches, en une prestation monétaire, ce que permet le système néerlandais. L'accompagnement en institution ayant une valeur monétaire plus élevée que les services à domicile proposés par équivalence, la propension plus grande des bénéficiaires relativement aisés à substituer de l'aide à domicile à une entrée en institution contribue ainsi à expliquer que les bénéficiaires modestes tendent à avoir une utilisation de soins de longue durée plus importante en valeur que les bénéficiaires plus aisés.

Globalement, l'analyse révèle l'existence d'inégalités socio-économiques dans la consommation de soins de longue durée dans le système d'assurance sociale néerlandais. Les implications des résultats en termes d'équité dépendent en revanche des mécanismes à l'œuvre derrière ces inégalités ainsi que des jugements de valeur adoptés. L'organisation du système de provision des soins de longue durée pourrait conduire à ce que, à besoins donnés, les bénéficiaires modestes se voient attribuer de manière prioritaire certains types d'aide. La substitution d'aide à domicile à l'institutionnalisation pourrait également découler de l'existence d'une participation financière aux coûts des soins, qui est fortement croissante avec le revenu bien que plafonnée. Il n'est pas non plus possible d'exclure que les résultats reflètent des différences systématiques selon le statut socio-économique dans les préférences pour certaines configurations d'aide ; si, selon la tradition welfariste ou la théorie de l'égalité des opportunités, les préférences doivent être considérées comme des déterminants légitimes de la consommation de soins, alors l'existence d'un indice d'iniquité horizontal négatif ne devrait pas s'interpréter comme la preuve d'une iniquité horizontale « pro-pauvre ». On notera enfin que la plus grande propension des individus les plus défavorisés économiquement à entrer en institution peut découler du fait que la prise en charge en institution semble être un bien inférieur au sens de la théorie micro-économique. Une telle interprétation conduirait à conclure à l'existence d'une iniquité horizontale en *défaveur* des plus modestes, et à s'interroger sur l'efficience d'un système où les bénéficiaires les moins favorisés au regard de leur situation socio-économique se trouvent contraints de recourir à des formes de prise en charge socialement coûteuses bien qu'étant individuellement et collectivement peu valorisées.

La thèse se clôt par une Conclusion générale qui synthétise les principales conclusions des différents chapitres tout en en soulignant les principales limites. Bien que l'aide fournie par les proches représente la plus grande partie des aides reçues par les personnes âgées résidant en logement ordinaire, l'utilisation de données administratives et de fichiers-clients dans les chapitres 2 à 4 ne permet pas de prendre en compte l'aide informelle potentiellement reçue par les populations d'intérêt, alors qu'elle pourrait modifier le diagnostic porté sur l'efficience et l'équité des dispositifs étudiés. Si les analyses des chapitres 2 et 3 ont pu être conduites grâce à des données inédites, la collecte ad hoc de ces informations a dû se faire à un niveau local, ce qui limite a priori la validité externe des résultats obtenus. Par ailleurs, si l'accent mis sur l'APA à domicile dans les chapitres 2 et 3 permet de documenter précisément les propriétés de ce dispositif, il implique également que les dispositifs publics alternatifs ou complémentaires à l'APA à domicile, et notamment l'institutionnalisation, ne sont pas intégrés à l'analyse.

Des enrichissements substantiels du système d'information sur la consommation d'aides médico-sociales et les bénéficiaires des dispositifs publics en France devraient permettre à des travaux ultérieurs de vérifier la robustesse des résultats présentés dans la thèse et d'explorer des problématiques adjacentes. L'appariement de données administratives et de données d'enquête néerlandaises devrait par ailleurs permettre de déceler d'éventuelles inégalités dans l'activation des droits des personnes âgées aux Pays-Bas.

General introduction / Introduction générale

Préambule

En France, l'actualité sociale du début de l'année 2018 a été marquée par un mouvement de grève inédit : celui des personnels des établissements accueillant des personnes âgées dépendantes. Infirmiers et aides-soignants réclament davantage de moyens financiers, à la fois pour améliorer leurs conditions de travail et pour permettre un accompagnement des résidents qui soit garant de leur dignité et d'une meilleure qualité des soins. Cette vague de revendications a surpris sans surprendre. Si elle est portée par des professionnel·le·s d'un secteur structurellement peu enclin aux mobilisations collectives, elle fait écho à un sentiment largement partagé par l'opinion publique : nous ne faisons pas assez pour nos aînés les plus fragiles.

Sous cet apparent consensus, se font rapidement jour des questionnements fondamentaux sur le sens à donner à ce diagnostic et les réponses à y apporter. Qui devrait être davantage mobilisé pour améliorer l'accompagnement des personnes en situation d'incapacités, en particulier au grand âge : la puissance publique ? Dans ce cas, à quels arbitrages budgétaires faudra-t-il consentir ? Doit-on attendre davantage des familles ? Celles-ci, déjà largement impliquées dans l'accompagnement des personnes handicapées et dépendantes, se trouvent reconfigurées par la baisse de la fécondité et l'évolution des comportements en matière d'unions et de participation au marché du travail. Doit-on alors en appeler davantage à la responsabilité individuelle et aux solutions proposées par le marché ?

Au niveau individuel, le développement d'incapacités physiques, sensorielles ou cognitives à l'âge adulte est un risque, dont la probabilité d'occurrence augmente avec l'accroissement de la longévité. A l'échelle des sociétés ayant achevé leur transition démographique, c'est en revanche une certitude qui s'impose : celle de voir le nombre de personnes âgées augmenter fortement et représenter une proportion croissante de la population totale. Au vieillissement démographique s'est ajoutée la double crise économique et des finances publiques dans les pays de l'Organisation de co-opération et de développement économique

(OCDE), produisant un contexte dans lequel le rôle des pouvoirs publics dans l'organisation et le financement de l'accompagnement des personnes en situation d'incapacités est mis en question. La question des ressources humaines et financières à consacrer aux personnes âgées dépendantes surgit dans l'intimité des familles comme sur les bancs de l'Assemblée Nationale ; elle constitue une des grandes questions sociétales et politiques de notre époque.

Sans évidemment prétendre constituer la seule approche disciplinaire pertinente, la science économique, par ses outils conceptuels et empiriques, peut apporter des éclairages précieux sur les politiques d'accompagnement de la dépendance. Elle se révèle particulière-ment bien outillée pour aborder la question suivante : dans quelle mesure les dispositifs publics de prise en charge des soins de longue durée existants sont-ils efficients et équitables ? C'est à cette interrogation générale que cette thèse entend apporter des éléments de réponse et contribuer ainsi au débat public. Pour ce faire, elle s'appuie sur un ensemble d'analyses empiriques. Comment les dispositifs existants influencent-ils les aides reçues par les personnes en situation d'incapacités ? Observe-t-on des inégalités socio-économiques dans le recours aux aides médico-sociales ? L'allocation de ces aides est-elle équitable ? Les contributions financières demandées aux bénéficiaires des aides publiques le sont-elles ? Ces contributions sont-elles compatibles avec une bonne couverture du risque financier as-socié à la dépendance ? Sous quelles conditions des réformes peuvent rendre les dispositifs existants plus justes et plus efficients ?

Nous proposons pour commencer une introduction générale à la thèse, qui s'organise en trois grandes parties. La première partie vise à préciser l'objet d'étude, à partir des défi-nitions des concepts d'incapacité, de dépendance et de soins de longue durée. Elle présente également le contexte dans lequel s'insèrent nos questionnements, en offrant une vue d'en-semble des tendances démographiques et épidémiologiques et des politiques publiques de prise en charge des soins de longue durée dans les pays de l'OCDE. La seconde partie situe la problématique de la thèse dans la littérature économique existante. Elle met en outre en regard les systèmes de prise en charge des soins de longue durée des deux pays sur lesquels portent nos analyses, la France et les Pays-Bas, et montre l'intérêt de leurs contextes institu-tionnels au regard de notre problématique. La dernière partie passe en revue les questions de recherche soulevées dans les différents chapitres, les principaux résultats obtenus et leurs implications. Elle précise également les outils conceptuels et les méthodes utilisés, les don-nées mobilisées ainsi que les définitions empiriques des soins de longue durée, du besoin d'aide et des principes d'équité qui sont utilisées dans la thèse.

Le reste de cette thèse est rédigé en anglais.

Preamble

In France, the year 2018 started with an unprecedented strike hitting the news: that of the employees of nursing homes. Nurses and other professional caregivers are claiming more financial resources from the government, in order to improve their working conditions, increase the quality of care and guarantee the elderly residents' dignity. Although the protest was unexpected, it did not come as a surprise. Even though the strike was led by the workers of a sector that is structurally little prone to collective protests, it echoes a feeling largely shared by the public opinion: too little is done to help our most fragile elders.

Behind this apparent consensus, many fundamental questions arise, relating to the sense that we should give to this diagnosis and the remedies to offer. Who should be more involved in supporting the disabled individuals, in particular the elderly: the government? In such a case, which budgetary trade-offs have to be accepted? Should we rather expect more from the families? Those are already greatly involved in the provision of informal care; in addition, they are being reconfigured by lower fertility rates and the evolution of behaviors in terms of unions and females' labor market participation. Should we then call for more individual responsibility and more room for market-based solutions?

At the individual level, the onset of physical, sensory or cognitive limitations in adult life is a risk, whose probability can increase along with the rise of longevity. At the level of the countries that have completed their demographic transition, it is certain that the number of the disabled elderly will keep increasing and represent a growing share of total population. In the countries of the Organization for economic co-operation and development (OECD), the economic and public finance crisis came on top of population aging; this has resulted in a context in which the role of the government at large in the financing and in the organization of care provision for disabled individuals is being challenged. The question of the human and financial resources that should be devoted to long-term care arises both in the intimacy of families but also in Parliamentary discussions; it is one of the major societal and political questions of our time.

Thanks to its conceptual and empirical tools, economics can shed light on this question, even if it is certainly not the only relevant disciplinary approach to it. It shows well adapted to tackle the following question: to what extent are public long-term care policies efficient and equitable? This is the general issue that this thesis intends to address and thereby contribute to the public debate.

The thesis starts with a general introduction. The first part aims at exposing the general topic, starting with definitions of the concepts of disability, dependency and long-term care. It also offers a broad overview of the demographic and epidemiological trends as well as of the long-term care policies in OECD countries. The second part relates the general question

addressed in the thesis to the existing economic literature. It also presents the long-term care systems in the two countries under investigation in the empirical analysis, France and the Netherlands, and highlights the interest of their institutional features with respect to the questions being discussed. The third section reviews the specific research questions that are tackled in each Chapter, the main results and their implications. It also presents the conceptual tools, the empirical methods, the data as well as the empirical definitions of long-term care, care needs and the equity principles that are used in this thesis.

Contents of the General introduction

1   Object of study and context

1.1   Disability, dependency and long-term care: some definitions

This thesis investigates into the *long-term care* (hereafter LTC) policies designed for the *disabled*, or *dependent*, individuals.

In the international economic literature, the terms "disability" or "dependency" are often used interchangeably to designate individuals who are not able to perform the activities of daily living without any assistance. In the conceptual framework proposed by the World Health Organization as the International Classification of Functioning (ICF), disability corresponds to "any restriction or lack ... of ability to perform an activity in the manner or within the range considered normal for a human being" (WHO, 2002). Disability is dynamically produced by the interactions between health, other personal characteristics — such as age, gender, life style, education and socio-economic characteristic — and environmental factors – such as public services and policies, social norms and relationships, or technology. In this model, the concept of disability covers both functional limitations, activity restrictions and limitations in social participation. *Functional limitations* correspond to the difficulties to make use of physical, sensory or cognitive functioning to perform basic activities, such as walking, engaging into a conversation, remembering the day, etc. Functional limitations reveal the functional status of the individual, which depends on her past and present diseases including sarcopenia, accidents and malformations. They are independent from the individual and environmental resources that the person may mobilize to limit their impact on her daily life (Cambois and Robine, 2003). *Activity restrictions* have to do with what the individual can effectively do or not in terms of daily activities, given her resources. The epidemiological literature usually distinguishes between the Activities of daily living (ADLs) and the Instrumental activities of daily living (IADLs) (Katz *et al.*, 1970; Lawton and Brody, 1969). The former designate restrictions in personal care activities (grooming, dressing, eating) or in essential mobility (getting up from a bed or a chair), while the latter designate activities that may be more straightforwardly delegated (going grocery shopping, preparing the meals, doing the paperwork and the house chores, etc.). The term "dependency" is used to refer to situations in which an individual, given her disability, depends on external supervision or assistance to carry out these daily activities.

The word "dependency" is however often used in a more specific context, that of disability taking place at an old age. This is explicitly the case in France: the term entered the legislative framework when the first public scheme devoted to individuals aged 60 and older was created.[4] Such a use is also encountered in the economic literature. The recent impor-

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[4] *Loi 97–60 du 24 janvier 1997.*

tant development of empirical studies in geriatrics, epidemiology and public health relating to the concept of frailty (Fried *et al.*, 2001; Rockwood *et al.*, 1994) may reinforce the geriatric conception of dependency. Yet the decision to set apart, or not, "old age disability" may be due more to political and societal considerations (Mormiche and Jourdain, 2013). Under that regard, the definition adopted by the Council of Europe in 1998 specifies that "dependency may affect any section of the population and not only elderly people".[5]

In economic terms, disability is associated with two types of costs (Stapleton *et al.*, 2008). First, *revenue* costs correspond to the difference between an individual's actual income and her counterfactual income had she no disability. Second, disability induces *expenditure costs*, which can be loosely defined as the extra expenditures incurred by a disabled person to reach the situation of an individual similar in all regards but with no disability. Expenditure costs cover the monetary and opportunity costs of the services required on a long term basis by an individual to perform the activities of daily living, that is to say *long-term care*.

In the same way ill-health differs from disability, LTC should be distinguished from acute care: the latter aims at curing a disease, while the former aims at "alleviating pain and reducing or managing the deterioration in health status for people with a degree of long-term dependency" (OECD, 2017*a*). While acute care treatments have an explicit end, LTC generally has to be provided on a permanent basis, although restoration of functioning may sometimes be observed even for elderly patients (Cambois and Lièvre, 2004). The distinction becomes more delicate when we take chronic diseases into account: in many cases, their treatments are not curative and are provided on a permanent basis.

Figure 1 – The range of long-term care services.
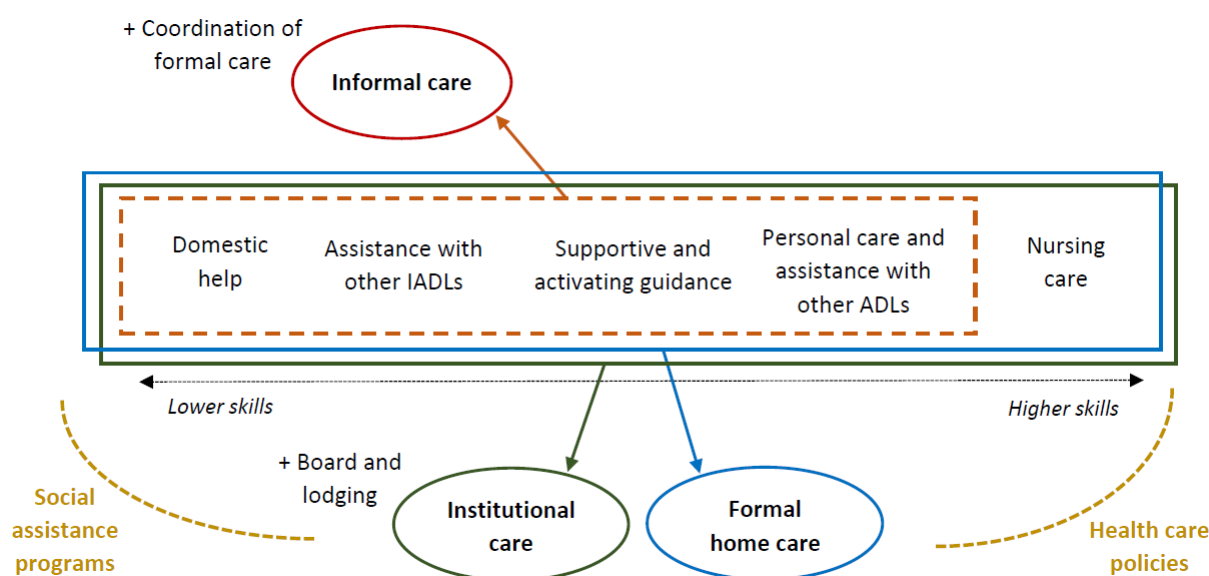
LTC may also be defined positively by the types of services it encompasses (Figure 1). As noted by Norton (2000),

> "LTC, however, is anything but a homogeneous good" (p. 958).

LTC services include domestic help and assistance with other IADLs (e.g. help preparing the meal or do the shopping), as well as supportive guidance (help the person organizing and managing her day) and activating guidance (help the person adapting her behavior when behavioral or psychological problems are observed) that will help a community-dwelling person to keep on living independently. They also cover personal care (i.e. grooming, bathing and dressing), assistance with other ADLs (e.g. getting up from bed) and nursing care (e.g. dressing wounds, administering injections). LTC encompasses various levels of skills: nursing care requires medical qualifications, while domestic help depends less crucially on the specific skills of caregivers. The classification of certain categories of services may be difficult in practice: the medical treatments for disabling diseases (such as symptomatic treatments for Alzheimer's Disease) may not be specifically considered as LTC but rather as general health care. Similarly, services such as "meals-on-wheels" or even domestic help itself are often regarded as part of general social assistance or support programs. Under its 2011 System of Health Accounts (SHA), the Organization for Co-operation and Economic Development (OECD hereafter) provides definitions of the services to be included in the health component and social component of LTC (OECD, 2017b). The OECD however acknowledges that:

> "... due to differing administrative, financing and provision standards, the national boundaries of long-term care may not necessarily be aligned with the SHA-defined boundaries" (p. 92).

LTC may be provided either in the community, and in particular at the home of the disabled person, or in a specialized institution, such as a nursing home or a residential care home. The cost of board and lodging charged to the residents of specialized institutions is generally considered as a LTC cost. In some countries, such as the Netherlands, it is directly included in the public daily rate for institutional stays. In other countries, such as France, it is charged to residents separately from the price covering nursing and personal care provision, but it is still considered one of the costs associated with disability.

When provided in the community, LTC can be either informal (provided by relatives) or formal (provided by professional workers). Informal caregivers typically lack the relevant skills for providing nursing and other medical care, but they often substitute for professional provision of personal care, domestic help and assistance with other IADLs (see e.g. Bonsang (2009)). In additional, informal caregivers are often in charge of coordinating the various professional caregivers, especially when the LTC system is fragmented.

1.2 The prevalence of disability in OECD countries

A variety of empirical measures of disability

What is the proportion of the population who lives with a disability? There exists no standardized measure of disability at the international level (Roy, 2016). Empirical works in epidemiology, public health and health economics rely on different definitions, which in many cases may make it difficult to compare results from different studies. The measures of disability may be epidemiological and rely on the concepts of functional limitations and activity restrictions discussed earlier; those are constructed using general population surveys or epidemiological cohorts. Alternative indicators are the numbers of individuals benefiting from LTC policies or using LTC services, computed on the basis of administrative records (Ravaud *et al.*, 2002).

Let us take the case of France, which this thesis will extensively deals with. The 2008–2009 Disability and Health survey is representative of the entire French population. On section of the survey (HSM) investigates community-dwelling individuals while the second section (HSI) surveys individuals who live in an institutional setting. HSM allows to measure the proportions of individuals who: (i) declare at least one functional limitation, (ii) declare they are totally unable to perform one ADL or IADL. It additionally contains the Global Activity Limitation Indication (GALI), which makes it possible to compute the share of individuals who have been experiencing a limitation in their daily life for at least 6 months due to a health condition.[6] Among individuals living in the community (i.e. not in a residential care facility) and aged 16 or older, 11.5 million (23%) were disabled under one of the three indicators (Roy, 2016). This proportion reaches 45% among those aged 60 and older. Although the large majority of individuals with activity restrictions also have functional limitations (Barberger-Gateau *et al.*, 1993), 11% of the 16+ have functional limitations without any absolute activity restrictions. If we define disability as meeting all the three criteria simultaneously and add up the individuals residing in handicap centers, residential care homes and nursing homes, only 6% of the adult population (16% of the 60+) are disabled.[7] Using two very recent surveys conducted on the French 60+ population, Brunel and Carrère (2017*a*) and Brunel and Carrère (2017*b*) confirm that the number of the disabled varies widely depending on the way we define disability.

Turning to administrative records, about 840,000 individuals aged 60 or older benefited from a home care subsidy paid by the departments in 2014, and additional 550,000 were living in an institution (Amar *et al.*, 2016; Bozio *et al.*, 2016). With this administrative

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[6]The standard wording of the GALI question is "For at least the past 6 months, to what extent have you been limited because of a health problem in activities people usually do?" (Jagger *et al.*, 2010).

[7]These figures were derived using the numbers presented in Roy (2016) and the 2008 French legal populations (Insee, 2013).

definition of disability, only 8.9% of the French 60+ are found to be disabled. All in all, there is no such thing as *the* number of the disabled elderly.

The prevalence of disability increases with age

Whatever the definition, the prevalence of disability increases with age. Using the Health and Disability Survey presented earlier, Dos Santos and Makdessi (2010) documents that the proportion of community-dwelling individuals who are *dependent*[8] is of 0.5% among the 20–39 years-old, of 1.0% among the 40–59; it then reaches 3.3% among the 60–79 and 13.7% among the 80+. Severe limitations in locomotion are the most frequent limitations for the elderly. With the more frequent onset of dementia, the prevalence of severe cognitive limitations also increases markedly with age, as those affect 11% of the 60–64 years-old and 26% of the 80+.

Focusing on the 60+ population, we observe that the prevalence of cognitive and physical functional limitations, of restrictions in grooming and of general limitation under the GALI definition are higher for women at each age (Brunel and Carrère, 2017*a*). Combined with the higher life expectancy of women, this implies that the majority of the disabled elderly are women. This is indeed the case for almost 3/4 of the beneficiaries of the main French home care subsidy program (Amar *et al.*, 2016).

Cross-country variations in the prevalence of disability

What is the situation of countries other than France? In order to ease international comparison, surveys such as the EU–SILC (*European Survey on Income and Living Conditions*) collect individual-level information on disabilities that are consistent across countries. Based on the GALI indicator, the share of the 16+ population with a severe limitation ranges from a low 3.7% in Sweden and Bulgaria, to a high 11% in the United Kingdom and in Greece.

The GALI is also used to compute the disability-free life expectancy (DFLE), defined as the number of years an individual may expect to live without limitations under the current conditions of mortality and morbidity. For individuals who have reached age 65, DFLE is equal to 9.4 years in the European Union, for both males and females (European Commission, 2018). As 65-years old men can expect to live 17.9 more years, against 21.2 years for women, they can expect to live a higher proportion of their shorter life without disability. Countries exhibit large differences in their DFLE: 65-years old Italian women can expect to live only 1/3 of their remaining 22 years of life without disability, while this proportion rises to 71% for their Norwegian counterparts. These gaps stem from disparities not only in

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[8]In Dos Santos and Makdessi (2010), an individual is said to be dependent when she has physical and cognitive functional limitations that come along with restrictions in the activities of daily living.

epidemiological conditions but also in the demographic structure of the population and in socio-economic conditions. They imply that there are factors of cross-country heterogeneity in the economic costs of disability and in the demand for LTC services in the aggregate.

The share of LTC users also shows evidence of cross-country heterogeneity (OECD, 2017a). In the 18 countries who were able to report the share of individuals using LTC either at home or in institution, 13% of the 65+ received formal LTC in 2014. This was the case for less than 8% of the elderly in Portugal, Spain and Korea but of more than 15% in the Nordic countries, the Netherlands, Switzerland and Israel. France ranks in the bottom of the distribution, with less than 11% of its elderly population using formal LTC. Interpretation of these figures must remain cautious: LTC benefits and LTC utilization rates do not merely reflect the population functional status, they also heavily depend on family structures, local norms regarding the provision of care and the institutional features of LTC policies.

Figure 2 – Formal LTC utilization rates in the 65+ population, across OECD countries.
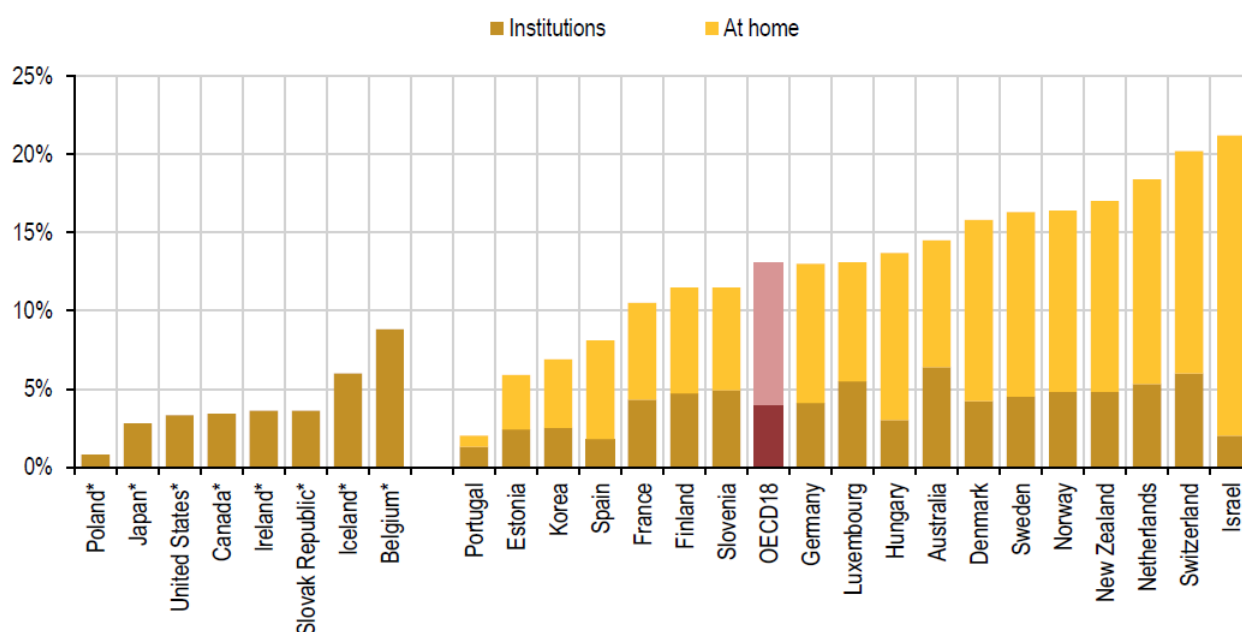
SOURCES: OECD (2017a); graph taken from Muir (2017).
NOTES: Data from 2014 or from nearest year. Countries with a star only report LTC recipients in institutional settings.

1.3 The coverage of long-term care costs across OECD countries

Quantifying the financial risk associated with old-age disability

Prevalence rates and life expectancies are aggregate indicators conveying only a partial picture of the economic implications of disability at the individual level. What is the probability for a given individual to eventually face disability? What costs can she expect to incur?

In the United States, Kemper *et al.* (2005) estimate that 62% of the 65-years old will not face LTC costs before they die whereas 16% will be exposed to LTC costs in excess of USD 100,000 over their remaining lifetime. In the United Kingdom, these figures are estimated to be of 1/4 and 1/10 respectively (Dilnot, 2011). Hurd *et al.* (2013) report that a 50-years old American has more than 50% chances to enter a nursing home one day, and estimate that the average duration of a stay in a nursing home is 1 year, conditional on entry.

The unit cost of formal LTC services relative to GDP varies widely from one country to the other, even within the Old Europe (Colombo *et al.*, 2011; Muir, 2017). It depends on geographical factors and the LTC market structure, but it is also influenced by public regulations regarding the status of providers, staffing requirements and other quality standards. Yet for severe disability, in all OECD countries the financial costs of formal LTC, whether received in institution or at home, exceed the median disposable income of individuals aged 65 and older (Muir, 2017).

Disability is thus a risk that entails substantial and variable financial consequences. This risk may be covered in four different ways: (i) the individual has assets that she can spend down; or (ii) she has relatives willing, and able, to provide informal care; (iii) she holds a private LTC insurance policy; or (iv) the government steps in. How is the coverage of LTC costs ensured across OECD countries? How does this translate into aggregate LTC costs and public spending on LTC policies? In what follows, I focus on the case of disability taking place after retirement and, consistently, the schemes made available to the elderly.

The public coverage of long-term care costs

In Europe, the medical components of LTC (medical treatment of dementia and chronic diseases, and in some cases nursing care) are often integrated in health care insurance systems; as such, the out-of-pocket costs on these services tend to be limited. To help disabled individuals meeting other LTC costs, all OECD countries have implemented some social protection schemes. LTC policies may consist in the public provision of LTC, subsidies on care, cash benefits or support to informal caregivers. The organization and financing of LTC policies are often decentralized at the regional or municipal level. In some countries, access to public support depends on age and the schemes made available to the elderly differ from those offered to the working-age population (e.g. England, France). More generally, there are cross-country variations in the way LTC systems are financed and organized, and in the types and generosity of the benefits they offer.

Over the past, one salient difference between LTC systems was the emphasis on institutional care, with Scandinavian countries having much higher institutionalization rates of the disabled elderly than Mediterranean Europe. This is less marked today: all countries have defined "aging in place" as a priority policy orientation. Although cost savings may be elusive

(Konetzka, 2014), home care seems more in line with the ex ante preferences of individuals regarding LTC provision, as documented by opinion polls. 63% of the French adults refuse to contemplate living in a nursing home in the future and 80% would prefer their close relatives to stay home in the event of disability (Grobon, 2014).

Initiatives from the OECD and from the international research project ANCIEN (*Assessing Needs for Care in European Nations*; see Kraus *et al.* (2010)) have provided detailed descriptions of LTC systems covering the elderly population in OECD and EU countries. They also propose several typologies. Muir (2017) distinguishes between: (i) universal, tax-funded LTC systems offering a comprehensive coverage (found in the Nordic countries), (ii) separate LTC insurance schemes offering comprehensive (e.g. the Netherlands and Japan) or more partial coverage (Germany and Korea), (iii) systems relying extensively on cash benefits as opposed to in-kind care provision (e.g. Austria, Italy), and (iv) heavily means-tested LTC systems ensuring a safety net (the United States and the United Kingdom).

As a result of these differences, public expenditures as a share of GDP differ substantially from one country to the other. The Scandinavian countries devote more than 2.3% of their GDP to public coverage of LTC costs, while this figure is at most twice lower for some countries with similar economic conditions (e.g. Canada, Germany, Italy or the US) (Figure 3). Differences in demographic contexts and epidemiological conditions cannot explain such large differences.

Figure 3 – Public spending on LTC as a share of GDP.
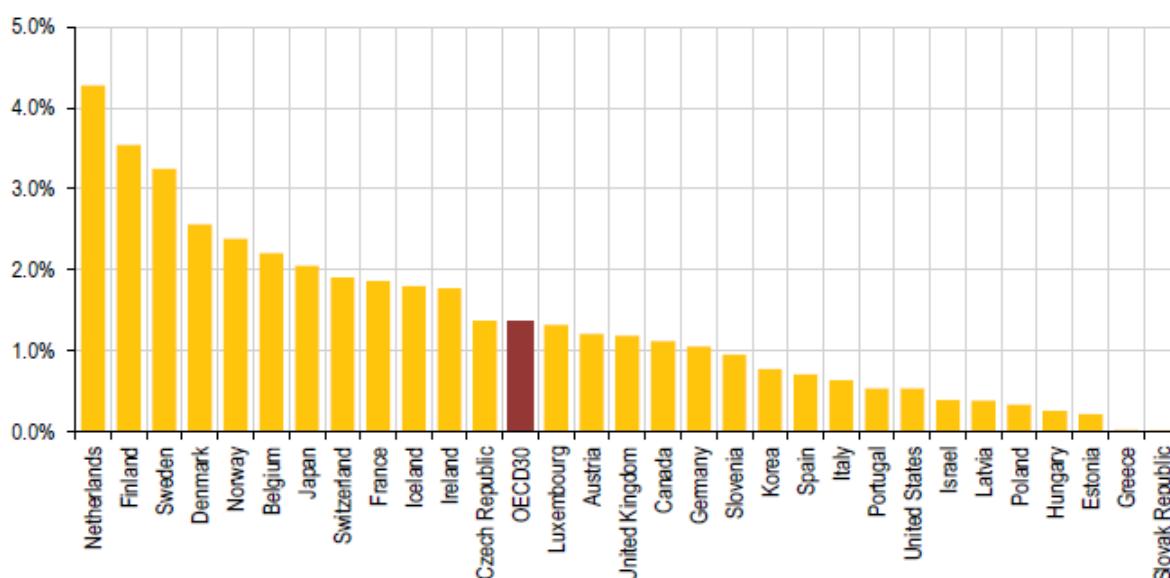
Public expenditures per se say nothing about the degree of coverage of total LTC costs. Aggregate figures on private spending on formal LTC may be not sufficiently robust for accurate cross-country comparisons (Colombo *et al.*, 2011). To overcome informational gaps, the OECD has adopted a bottom-up approach implemented in 14 OECD countries (Muir, 2017). The authors define 3 levels of disability and 3 levels of incomes. For each disability level, the OECD estimates associated LTC costs in each country. It then uses the eligibility rules and conditions relating to public LTC schemes to compute, for each disability-income profile: (i) the share of LTC costs that is publicly financed, and (ii) the individual's out-of-pocket cost on LTC and how it compares with income.

The outcomes are contrasted, depending on the country, but several patterns are observed. First, most countries apply some means-testing by income in access to public LTC financing, resulting in individuals with relatively low income and moderate or severe needs not being able to afford professional *home care*. Second, countries generally meet the costs of *institutional care* for individuals with severe needs and limited financial resources. To benefit from this safety net, individuals may be required to contribute all of their income, left aside a pocket money allowance that is set at a low level in France and in the United States. Third, the average public coverage of institutional care tends to be lower than the coverage of home care for individuals with median to high income, as many countries require specific user contributions on board and lodging costs. On the one hand, the limits set on the public support to home care costs, which are explicit and binding in several countries (e.g. Canada and France) aim at orienting individuals with severe disability towards institutional care, which become less expensive than home care for demented or bedridden patients. On the other hand, higher cost-sharing on institutional care aims at increasing the financial participation of well-off individuals when they use those costly services.

In short, current social protection schemes imply that, in many countries: (i) patients with moderate needs, who do not qualify for comprehensive coverage in an institutional setting, often incur high out-of-pocket cost on home care or have to rely extensively on their relatives; and (ii) individuals in the top half of the income distribution are not provided public coverage against the risk of asset depletion linked to LTC financing. We can anticipate these features of LTC policies to weigh on socio-economic inequalities in the use of LTC and on the social welfare gains achieved by public intervention.

Informal care: a free but costly form of long-term care

For a significant part, LTC is provided informally, by the family. Among the disabled elderly, men are typically provided care by their spouse, whereas women, who are more often widowed (Trabut and Gaymu, 2016) are more frequently helped by their children. Daughters and daughters-in-law are on the front line for the provision of personal care and domestic

help. Sons are more often involved in assistance with administrative tasks and the coordination of care (Pennec, 2009). Informal caregivers may also provide financial assistance and psychological support, in particular when their relative is institutionalized. Survey data indicated that 4/5 of the community-dwelling disabled elderly in France receive some informal care and 1/2 receive some formal care; 1/3 combine both types of care (Soullier and Weber, 2011). Informal care seemingly amounts to 3/4 of total home care hours.

Assessments of the economic costs of informal care were conducted in several countries. The economic literature has proposed several methods to assign informal care, which is generally provided for free, with a unit cost (Davin *et al.*, 2015). The time that caregivers devote to care activities may be valued using the unit labor cost of formal care; this gives the cost of replacing informal care with formal care (*substitution costs* method). A second option is to refer to the opportunity cost of informal care for the caregiver, by using her own actual or potential wage (*opportunity costs* method). In the case of France, except for nurses, most professional LTC workers are paid at the minimum wage; the substitution costs method gives a lower aggregate value of informal care than the opportunity costs method. A third option is to use contingency evaluation methods and the willingness-to-pay for care provision of informal caregivers. This technique may be undermined if informal caregivers are unable or refuse to attach a monetary value to the care they provide (Paraponaris and Davin, 2015).

Using the substitution cost method, the French High Family Council estimates the value of informal care provided to the disabled elderly to reach 11 billion euros, an amount equivalent to the cost of formal LTC set aside nursing care and the cost of board and lodging in institution (HCF, 2011). According to some estimates (cited in Brown and Finkelstein (2011)), the economic costs of informal care would exceed the financial cost of formal LTC in the United States.

Despite informal care being a major component of the LTC received across all OECD countries, there is international variation regarding the degree of involvement of relatives and the public support they receive (Kraus *et al.*, 2010). As the potential adverse health consequences of informal caregiving are being better acknowledged and that individuals in their late 50s and early 60s are increasingly encouraged to remain in the labor force, alleviating the "burden" of informal care has become a policy orientation in most OECD countries (Muir, 2017).

The private long-term care insurance market: still a minor role

Theoretically, the pooling of the old-age disability risk could be done by private markets. The development of the LTC insurance market yet suffers from severe ex ante information asymmetry on the disability risk. Adverse selection, whereby those with a higher willingness to pay for an insurance policy are those with higher expected costs, is circumvented by

the medical selection operated by insurers (Hendren, 2013). Medical selection implies that a high share (up to 25% of the 65+ in the US) are not able to buy a LTC insurance. Adverse selection also exerts an upward pressure on prices; so do the very substantial loading factors in the sector (Brown and Finkelstein, 2007). Those are partly explained by the long-term horizon of the insured risk, the uncertainty regarding future epidemiological conditions, LTC costs and LTC policies, and imperfect competition in the sector (Braun *et al.*, 2017). Uncertainty makes it necessary for insurers to keep high liabilities in their books. High market prices imply that LTC insurance policies are bought either by individuals with no close relatives likely to provide informal care, or by relatively wealthy individuals (Brown and Finkelstein, 2011). The contracts currently offered leave a substantial residual risk on the clients, as they offer monetary annuities (in France) or capped reimbursements (in the US) instead of a coverage up to the marginal cost of LTC services. On the demand side, denial of the risk of severe disability and bias towards the present further reduce the willingness-to-pay for such contracts (Fontaine *et al.*, 2014).

As a consequence, the development of LTC insurance products is extremely limited, except in a few countries where a mandate for private LTC insurance was introduced (HCFEA, 2017). Setting aside these countries, France and the US are the two countries where the take-up of private insurance is the highest. In France, about 12% of the adult population hold a LTC insurance policy but less than 4% are provided a lifelong coverage (as opposed to a one-year guarantee; Zerrar (2016)). In the United States, the insurance ownership rate was of 14% in the 60+ population in 2008 (Brown and Finkelstein, 2011).

The overall picture that emerges from this snapshot is that the coverage of LTC costs is today a major individual concern and policy challenge. We now provide an overlook of the future demographic and epidemiological trends to show that challenges are growing more pressing.

1.4 Looking at the past, looking at the future: trends in disability and long-term care spending

An aging population

Over the past 50 years, the more developed countries[9] have witnessed a rapid population aging. In 2016, in the European Union (EU 28), the persons aged 65 and older represented 19% of the total population (European Commission, 2018). The increase in the relative number of the 65+ is partly due to the decrease in fertility rates: the EU 28 average crude birth rate

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[9]The United Nations defines the more developed regions as Australia/New-Zealand, Europe, Northern America and Japan.

has fallen from 18 to 10 per 1,000 between 1996 and 2016. The population aging observed across the more developed regions is however primarily due to the large decrease in mortality in adult life, which took place over the last 50 years thanks to improvements in living conditions and in the survival rates associated with cardio-vascular diseases and cancers. Life expectancy at birth has increased by 10 years in Europe between 1960 and 2015 and now reaches 82.6 years for females and 76.8 years for males (European Commission *et al.*, 2017). Yet aging is not equally pronounced even within Europe, with Southern, Western and Baltic Europe totaling today a higher share of their population aged 75 and older in 2015 than Northern and Central Europe (Gaymu, 2017).

What should we expect for the coming decades? Figure 4 compares the age composition of the the European population today and what it is projected to be by 2080.

Figure 4 – Age pyramid in the European Union: 2016 *versus* 2080.
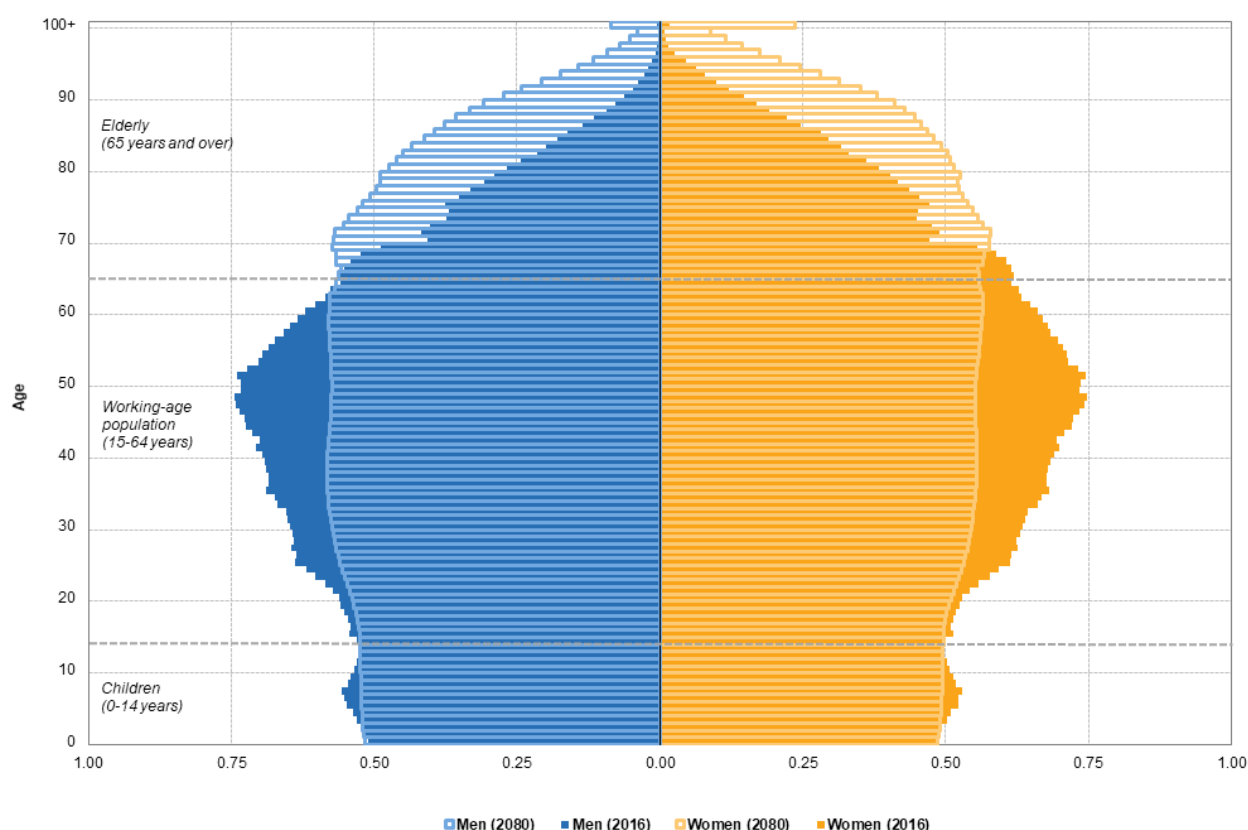
SOURCES: European Commission (2018); the graph is taken from Eurostat website.
NOTES: Each blue (yellow) horizontal bar gives the number of males (females) of a given age in the European Union (EU–28), in 2016 (estimations) or in 2080 (projections).

The European Commission projects the share of the 65+ to reach 29% by 2070, and the share of the very old (80 and older) to go up from 6% today to 13% (European Commission *et al.*, 2017). In the EU–28, there are 11 adults aged 15-64 for every person aged 80 or older

today, but there will be less than 4 in 2070. While fertility rates are expected to slightly increase, the continuing rise in life expectancy should maintain a structural "aging by the top" (Blanchet and Le Gallo, 2013). Population aging will be pronounced until 2040 due to large baby boom cohorts reaching age 65 (Blanpain and Buisson, 2016b). The pace of aging will then slow down and the share of the 60+ in the more developed regions of the world should stagnate around 1/3 between 2050 and 2070. The rest of the world is also entering a phase of sustained population aging, as the share of the 60+ will be multiplied by 2.5 between 2015 and 2050 in the less developed countries (Piggott and Woodland, 2016). The gender composition of the elderly population is also expected to change: males' mortality rates should decrease more than female mortality with the progress of cardiovascular disease treatments. While there were about 75 men for 100 women aged 60 and older in 2015 in the more developed regions, this number should exceed 85 by 2070.

How reliable are these projections? In the more developed countries, the baby boom phenomenon implies that there is little doubt about population aging being sustained in the two decades to come. Projections at a more distant future, and in particular those regarding the number of the very old, are more sensitive to the assumptions made on future life expectancy gains (Blanpain and Buisson, 2016b). Looking backward at its past predictions, the UN acknowledges that the projected population of the 80+ has been repeatedly underestimated. Future mortality reduction may again be underestimated, meaning that there remains substantial uncertainty regarding the magnitude of population aging (Piggott and Woodland, 2016).

Uncertainty regarding future epidemiological conditions

A the aggregate level, population aging induces an increase in the number of the disabled elderly absent any epidemiological evolution. Yet the increase will be further magnified (counteracted) if mortality reduction translates into a rising (falling) prevalence of disability at a given age. As a consequence, the demographic trends alone are not sufficient to build projections of the disabled elderly population: we need some insights into the extent to which additional life years will be spent without disability.

The epidemiological literature has proposed 3 scenarios regarding how the reduction in mortality rates at old age should relate to morbidity. In the "expansion of morbidity" scenario (Gruenberg, 1977), reduced mortality induced by successful medical research would lead to survive more years with chronic disabling conditions. In the "compression of morbidity" scenario (Fries, 1980), changes in life styles would postpone the onset of diseases at older ages. The number of years without any disability is expected to increase. Finally, the "dynamic equilibrium" scenario (Manton, 1982) offers an intermediate perspective. If medical treatments allow to slow down the progression of disabling diseases, then the increase in

life expectancy may come with both a reduction in the time spent with severe disability and an increase in the time spent with chronic conditions and moderate disability.

Which of this scenario most closely describes the past decades? Original studies and reviews of international studies have suggested a decrease in the prevalence of IADL restrictions and cognitive impairments in the late 1980s and 1990s in the elderly population (Cutler, 2001; Freedman et al., 2002). Evidence regarding ADL disability is conflicting (Freedman et al., 2002), potentially reflecting measurement issues. All in all, most OECD countries witnessed a dynamic equilibrium in the 1990s after experiencing a compression of disability in the 1980s (Cambois et al., 2013).[10]

More recent trends have been less clear: over the years 2000-2005, in Europe and North America, some countries experienced a decrease in the prevalence of ADL restrictions while others saw this prevalence increase (Lafortune and Balestat, 2007). In the United States, Crimmins et al. (2016) document an increase in the share of life expectancy at age 65 spent with no disability between 2000 and 2010. There was however no such relative compression of morbidity for the working-age population. Cambois et al. (2013) also find evidence of an expansion of disability for those aged 50–65 in France in the 2000s.

How can we expect these figures to evolve in the future? What does this imply for the number of the disabled elderly? Projections have to rely on assumptions regarding the evolution of morbidity, of which discovery of new medical treatments of disabling conditions (e.g. against neurodegenerative diseases) or further changes in life style are major but hard-to-predict determinants. Statistical institutes and the European Commission typically construct different scenarios reflecting the standard three epidemiological assumptions (European Commission et al., 2017). Given the evolution observed in the past decades, the scenario of an *absolute* compression of morbidity, whereby the number of years spent with disability would decrease over time, is generally deemed too optimistic. For example, the French Ministry of Health implements 3 alternative scenarios; for all of them, it is assumed that the time spent with the most severe ADL restrictions and cognitive impairments will remain constant (Lecroart et al., 2013). The scenarios differ with respect to how the time spent with moderate disability will increase, or remain constant. Depending on the scenario, the number of the disabled elderly is predicted to increase by 60%, 105% and 135% respectively between 2010 and 2060. They would represent between 2.5% and 3.6% of the French population by 2060. This relatively wide range does not even reflect the uncertainty regarding the evolution of life expectancy itself.

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[10]The reviews by Christensen et al. (2009) and Crimmins and Beltrán-Sánchez (2011) conclude to increased prevalence of chronic diseases such as heart condition, cancer, arthritis and diabetes as well as of obesity in most OECD countries and in the United States. It however came along with a decrease in the onset of disability and an increase in the *proportion* of disability-free life years. Finally, Crimmins et al. (2009) document a stability in the *number of years* spent with ADL and IADL restrictions.

Trends in long-term care expenditures

Predicting the number of the individuals who may use LTC services is only the first step in forecasting future LTC spending. Further assumptions need to be made.

First, the future costs of formal LTC use will depend on the extent to which the disabled elderly will receive informal care (OECD, 2011b). The likelihood to be provided informal care in old age may change with the evolution of family structures. On one hand, low fertility and the higher participation rate of women are expected to lower the number of potential caregivers among children. On the other hand, the rising life expectancy of men means that women will be more likely to have their spouse still alive when experiencing restrictions in the activities of daily living, even though more frequent couple break-ups partially offset this trend (Gaymu, 2017). The OECD uses the current country-specific shares of the population who provide informal care by age and gender to predict the number of informal caregivers by 2050 in some European countries and in the US. It concludes that the number of informal caregivers would rather need to be 20% to 40% higher to keep the ratio of family carers to the number of disabled individuals to its current level. It is yet far from granted that the behaviors in terms of informal caregiving will remain constant (Fontaine and Arnault, 2016).

Second, future *aggregate* LTC spending will depend on the *unit* cost of care. Contrary to the health care sector, the LTC sector is extremely labor-intensive. The development of new technologies (e.g. robotics) may however allow productivity gains in the future, lowering the cost of LTC relative to the average wage. On the other hand, higher quality requirements may increase the demand for skilled workers, exerting an upward pressure of wages in the sector. In addition, as the population of the oldest old rises, the average institutionalization rate may grow and increase the average unit cost of LTC.

Third, the evolution of LTC use and costs will critically depends on policy decisions. Public spending in particular, will depend on changes in the mix between public and private financing (OECD, 2011b). Actually, in some countries, public spending as a share of total spending on LTC is expected to decline if current policies are left *unchanged*. This follows from indexation rules of LTC benefits. In France, public LTC benefits are indexed on prices. If real GDP grows in the future decades and that the unit LTC cost follows the same pace, this implies that, *absent a policy change*, public coverage of LTC costs will decrease. This is illustrated through a simplified example in Table 1, by the comparison of Columns (1) and (2). Furthermore, Column (3) shows that *even if* LTC benefits were indexed on the unit cost of LTC, the disabled elderly's out-of-pocket spending on LTC as a share of their income is expected to increase, as pension benefits are indexed on prices. Given the relatively limited coverage that public benefits currently offer in France, it is dubious that current policies can be politically sustained if they imply substantial increases in effort rates on LTC spending.

For these reasons, the French Ministry of Health assumes in its central scenario that the

Table 1 – The impact of indexations of pensions and LTC benefits on future coverage and effort rates: A simple illustration.

	Reference year	Alternative scenarios for the future		
	t_0 (1)	$t_0 + t$ (2)	$t_0 + t$ (3)	$t_0 + t$ (4)
Assumptions				
Nominal GDP (wages) index	1.0	1.5	1.5	1.5
Nominal prices index	1.0	1.2	1.2	1.2
Nominal unit LTC cost index	1.0	1.5	1.5	1.5
Indexation of pension benefits on:	–	Prices	Prices	Wages
Indexation of LTC benefits on:	–	Prices	Wages	Wages
Pension benefits [a]	100	120	120	150
LTC costs [b]	50	75	75	75
LTC benefits [c]	30	36	45	45
Out-of-pocket LTC costs [d]	20	29	30	30
Public coverage of LTC costs [c]/[b]	0.60	0.48	0.60	0.60
Effort rate on LTC [d]/[a]	0.20	0.33	0.25	0.20

NOTES: Pension benefits, LTC costs and LTC benefits are expressed in nominal units. It is assumed that between time t_0 and time $t_0 + t$ nominal GDP would increase by 50% and prices by 20%. LTC unit cost is assumed to increase like GDP and wages.

value of LTC benefits will rise at a pace in-between prices and nominal wages (Darcillon, 2016; Renoux *et al.*, 2014; Roussel, 2017). Using a micro-simulation approach, it projects public LTC spending to increase from 1.1% of GDP in 2014 to 2.1% in 2060. Under alternative assumptions on the number of the disabled elderly and indexation rules, this figure varies between 1.85% and 2.25%. Unlike pension expenditures, projected public spending little depends on the macroeconomic scenario – but private effort rates do. Absent a policy change, the out-of-pocket spending of the French elderly would increase by 0.64 to 0.79 pp. of GDP, amounting to a rise comprised between 11% and 38% of the out-of-pocket cost to GDP per disabled elderly (Roussel, 2017).

At the international level, the OECD's and the European Commission's projections rely on macro-simulation models (Economic Policy Committee, 2015; OECD, 2011*a*). The 2015 Aging Working Group (AWG) scenario projects public LTC expenditures to reach 4.3% of GDP by 2060 in the EU, following an increase by 2.9 percentage points. Projected increases differ widely across countries: in Norway and in the Netherlands, it is assumed to exceed 3pp of GDP, translating into public expenditures on LTC of more than 7% of GDP in 2060 while this figure would not exceed 2pp. in the countries who are currently low spenders. These projections integrate recent reforms that were made either to curb LTC spending (e.g. in the Netherlands) or to improve coverage (e.g. in Spain).

Three key messages should be taken away. First, OECD countries expect a substantial increase in their disabled elderly population and of the aggregate costs associated with LTC use. Second, the baby-boom will greatly emphasize these trends between 2030 and 2045.

Third, the uncertainty regarding future demographic and epidemiological conditions makes it necessary to design social protections schemes that are resilient to unfavorable scenarios. Whatever the scenario that comes true, governments will have to make budgetary trade-offs and find adequate fiscal resources if they are willing to accept the large projected increases in public spending on LTC. If the status-quo regarding the public coverage of the old-age disability risk is deemed unsatisfactory, fundamental policy decisions will have to be made. This is where economic analysis can prove especially useful by highlighting the implications of the different options.

2 What this thesis is about

2.1 The general issues under investigation

My PhD research tackles two broad economic and policy questions: how efficient are public LTC policies? And how equitable are they? It intends to sheds light on how existing public LTC schemes affect the use of LTC and the coverage of their costs for the disabled adults. My research addresses empirical questions, which connect with theoretical issues. It involves both positive analysis — describe and understand the world – and normative statements — state how the world should be. I mostly focus on the situations of individuals who have already retired. Consistently with the design of some of the LTC schemes I study, I define the elderly as the individuals aged 60 or older.

In this section, I review the existing economic literature relating to efficiency and equity in LTC systems. I then provide an overview of LTC policies in France and in the Netherlands and justify why these countries provide interesting institutional contexts for empirical investigations into equity and efficiency in LTC use and financing.

2.2 Efficiency and equity of long-term care policies: what does the economic literature tell us?

The interest of economists in LTC is relatively recent. Early works date back to the late 1980s and mostly originated in the United States. They were fostered by the collection of longitudinal survey or experimental data. As policy concerns about LTC costs gained prominence and new survey data were collected, many more empirical investigations have been produced since the beginning of this century, especially in Europe. Today, the applied literature on LTC is sizable and combines the insights from different fields of economics: economic demography, family economics, labor economics, health economics and insurance theory (Norton, 2000). Many studies shed light on aspects of *efficiency* and *inequalities* in

LTC systems. Yet the empirical literature suffers from several blind spots on these questions and a limited number of studies investigate into the *equity* of LTC schemes.

Efficiency of long-term care policies: from health insurance theory to the public economics of long-term care

Regarding efficiency aspects, economic theory predicts that there is a welfare gain associated with reducing the risk borne by risk-averse agents. LTC policies operate a pooling of the risk of (old-age) disability at the population level, thereby they reduce individual uncertainty regarding the economic costs of disability and increase ex ante allocative efficiency in the economy.

Ex post allocative efficiency requires LTC services to be consumed at a level such that their marginal cost equals individuals' willingness-to-pay for them. Studying ex post efficiency of LTC schemes may be done drawing inspiration from the health insurance theory. As of today, there exists a prolific economic literature with both theoretical and empirical contributions on the welfare effects of health care insurance. Prior to the path-breaking analysis of Nyman (1999), the price effect in health care use associated with health care reimbursement policies was entirely considered as an inefficient distortion in the allocation of resources (Pauly, 1968). The critical role given to ex post *moral hazard*, whereby an individual spends more on health care when she bears only part of its full cost, motivated numerous estimations of the price elasticity of the demand for health care (e.g. the RAND experiment, Aron-Dine *et al.* (2013)).

Under a health insurance that provides a reduction on the price of health care, the increase in the consumption of care for the insured should actually be decomposed into two components: (i) an ex post *income effect*, which arises because the insurance price payoff induces a transfer of income from those who remain healthy to the ill who consume medical care, and (ii) a *substitution effect* that stems from the fact that the relative price of health care is made lower by the health insurance (Nyman, 2006). Nyman (1999) has defended the idea that the inefficiency loss due to ex post moral hazard corresponds to the substitution effect alone. Any change in the use of care that is attributable to the income effect alone is instead a welfare gain: it reflects the fact that the willingness-to-pay for medical care is made higher by the ex post transfer of resources enabled by the insurance. In the case medical care does not substitute for other consumption goods at the margin, the insurance price payoff allows the individual to reach a higher ex post utility whereas the price distortion itself has no effect on the individual consumption of health care. But as soon as individual preferences exhibit some substitutability between medical care and other consumption goods, a health insurance that takes the form of a price payoff comes with some (gross) efficiency costs.

Transposing this framework to LTC insurance implies that (i) the existence of ex post wel-

fare gains associated with the insurance-induced income transfer depends on the income elasticity of the demand for LTC services, and (ii) the existence of ex post welfare loss associated with the insurance-induced change in the relative price of LTC depends on the degree of substitutability between LTC services and other consumption goods in individual preferences. Assessing substitution effects, or the price elasticity of the *hicksian* demand for LTC, and income effects in the demand for LTC of the disabled elderly is critical to the understanding of the welfare effects of LTC subsidy programs. The common a priori view regarding substitutability of LTC services is expressed by Norton (2000):

> "Public home care has an obvious moral hazard problem. Who would not want some paid help at no out-of-pocket cost with household chores?" (p. 960).

Consistently, moral hazard is expected to be smaller for medical LTC services than for domestic help and assistance with other IADLs.

The economic literature has provided evidence that the demand for LTC is price-elastic. Some studies have detected a statistically significant effect of home care subsidies, in North America (e.g. Ettner (1994); Stabile *et al.* (2006)) and in France (Fontaine, 2012; Rapp *et al.*, 2011). Evidence on the price elasticity of institutional care use is more mixed: in the United States, state or time variations in Medicaid and Medicare reimbursement rules were found to affect nursing home stays by Hoerger *et al.* (1996); Garber and MaCurdy (1990) and Reschovsky (1998). On the contrary, Grabowski and Gruber (2007) and Reschovsky (1996) conclude to an inelastic demand for institutional care. In any case, the reduced-form approach adopted in existing papers does not allow to distinguish between substitution and income effects.

Regarding income effects, several papers have provided evidence of a socio-economic gradient in the use of LTC services. On a sample of European elderly from the SHARE survey, Bonsang (2009) find that the 50% income-richest individuals use more domestic help, at both the extensive and intensive margins. But this does not hold in all countries. Bakx, de Meijer, Schut and van Doorslaer (2015) find a positive income gradient in the home care utilization rate in Germany but not in the Netherlands. Other comparative analysis provide contrasted results depending on the country under study (see Ilinca *et al.* (2017) for a recent review). Deriving income effects from the differential use of care by income levels is made difficult by the fact that, in many countries, public subsidies on LTC are higher for low-income individuals.

The potential substitution between formal care and informal care is a major reason why the analogy between health care insurance and LTC insurance does not fully hold. The welfare gains associated with LTC insurance also depend on how informal care provision changes when formal care use is subsidized and, underneath this relationship, the motivations behind informal caregiving (Pestieau and Ponthière, 2016). They also depend on

whether parents value informal care more than formal care (Pauly, 1990); and what the full economic costs of informal care are.

An extensive literature has assessed the effects of informal care provision on the use of formal home care and institutional care (see e.g. Juin (2016) for a review). Theoretical and empirical contributions suggest that the cross-price elasticities between informal care and formal care are non-zero but differ depending on the skill content of the task. The use of informal care or of formal home care is also found to reduce the use of hospital care and some inpatient care (Van Houtven and Norton, 2004; Rapp *et al.*, 2015). An optimal LTC system should limit the inefficiency associated with such "offsetting effects" between LTC and health care, in the same way as the design of an efficient health care system has to anticipate and minimize the offsets between different types of medical care (Chandra *et al.*, 2007; Gaynor *et al.*, 2007).

Regarding the costs and benefits of informal care, three strands of literature have emerged. First, some studies have documented the opportunity costs of informal care channeling through its impact on the labor market participation of caregivers (see Lilly *et al.* (2007) for a review). A second strand has assessed the effects of informal care on the cognitive and mental health of the disabled elderly (e.g. Barnay and Juin (2016)). Finally, several papers have provided an empirical assessment of the "burden of care", by detecting negative effects of caregiving on one's physical and mental health (e.g. Do *et al.* (2015); Van den Berg *et al.* (2014)). We can take away two implications from these results. First, efficient subsidies on formal LTC should be relatively higher (lower) when formal care complements (substitutes) for informal care. Second, if there happens to be external costs of informal care on both the disabled elderly and the caregivers, then an efficient LTC policy may rather aim at decreasing some forms of informal care use, in particular intensive ones.

Additional features of disability and LTC limit the analogy with health and health care. The fact that the prevalence of disability increases steeply with age embeds the financing of LTC and the provision of informal care in inter-generational transfers and bequest considerations (Masson, 2009). The current inability of the private insurance market to deal with information asymmetry and uncertainty regarding future epidemiological conditions seem to make the case for social insurance especially strong (Barr, 2010).

Recent contributions from the theoretical literature shed light on levers for achieving efficiency in the design of LTC systems (Klimaviciute and Pestieau, 2018). To keep the models tractable, each paper builds in only some of the most salient features of LTC provision. Cremer *et al.* (2016) focus on the design of LTC insurance in the presence of ex post moral hazard and information asymmetry on informal care supply. The presence of informal caregivers induces the optimal *reimbursement rate* to be lower for LTC than for health care, at least at the margin. Klimaviciute (2017) focuses on *intra-family moral hazard* (Pauly, 1990), whereby an

individual is less prone to insuring against the disability risk if she anticipates that holding an insurance will decrease the incentives of her relatives to assist her. Lump-sum benefits, as opposed to proportional reimbursement of LTC costs, are a way to mitigate intra-family moral hazard, although they inefficiently leave some risk uninsured. In the real world yet, *lump-sum benefits* may turn inefficient if they can be captured by family members; they also tend to have a lesser political acceptability. Assuming no moral hazard but high loading costs, Drèze *et al.* (2016) find that the optimal LTC insurance policy would provide full insurance above a *deductible*.[11]

From a policy point of view, the theoretical literature has thus not come to a consensual conclusion as to how efficient LTC benefits should be designed. Ultimately, assessing the relative welfare gains and costs of each option requires empirical investigation.

Equity in long-term care: an empirical literature in its infancy

The theoretical literature just reviewed usually draws on the public economics approach to an optimal policy and integrates a trade-off between efficiency and redistribution objectives (Atkinson and Stiglitz, 2015): depending on the definition of social welfare that is assumed, incurring some efficiency loss may be warranted if it allows to reach a more equitable situation.

Concerns about the disabled elderly not receiving appropriate care or sufficient financial public support are pervasive in the public debate. Investigating into *equity* in the field of LTC amounts to asking whether the *allocation of LTC services* in the population and the *financial contributions* made to the schemes are deemed to be fair. Answering this question presupposes to: (i) document inequalities in the allocation and financing of care, and (ii) state value judgments about what is to be regarded as a fair situation.

Very few empirical studies on equity in LTC have been conducted so far. The feeling that:

> "The "academic-papers-written-to-public-expenditures" ratio is far lower for long term care than for the health sector as a whole."

expressed by Brown and Finkelstein (2011) seems especially true when it comes to normative questions.

Empirical assessments of equity in LTC

The empirical economic literature interested in equity in LTC has so far addressed two main questions: that of *territorial inequity* and that of *socio-economic horizontal equity in the use* of LTC. The first strand provides evidence of systematic differences in LTC use across

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[11]See Klimaviciute and Pestieau (2018) for a detailed review of this literature.

the territory in different countries, once differences in morbidity and socio-economic conditions are controlled for (e.g. Arrighi *et al.* (2015); Miller (2002); Pulkki *et al.* (2016)). In the Netherlands, Duell *et al.* (2017) have documented the existence of inter-regional disparities in *eligibility* for publicly-subsidized LTC, which yet show little correlation with indicators of local care supply. The concern that individuals in different places have different access to formal LTC partly stems from the fact that the implementation of LTC policies is decentralized in many countries.

A few papers have tested the existence of socio-economic horizontal inequity in LTC use, defined as individuals with the same "needs for care" but different socio-economic status receiving different amounts of LTC services. They rely on concentration and horizontal inequity indexes: those have been widely used in the empirical health economics literature to provide a synthetic measure of income-related inequalities and horizontal inequity in the use of care services respectively (Kakwani *et al.*, 1997; Wagstaff and van Doorslaer, 2000*a*). With this approach, individuals are ranked by a continuous measure of socio-economic status (e.g. income or wealth). Individual characteristics are partitioned between "need variables", i.e. the factors that lead to legitimate differences in LTC use (e.g. health and functional status) and "non-need factors", i.e. factors inducing differences in LTC use that are deemed unfair (e.g. socio-economic status or ethnicity). A negative (positive) horizontal inequity index indicates that the poor (the rich) tend to consume more LTC services than the rich (the poor) when we control for systematic differences in care needs across the income or wealth distribution. Following this approach, García-Gómez *et al.* (2015) find professional home care use to be disproportionately concentrated among the rich elderly in Spain. Ilinca *et al.* (2017), Rodrigues *et al.* (2017) and Carrieri *et al.* (2017) exploit the SHARE survey to estimate horizontal inequity indexes in European countries. Carrieri *et al.* (2017) conclude that there is at most limited income-related horizontal inequity in the use of personal or nursing care at the extensive margin, in Southern Europe as in Nordic countries, unlike in Continental Europe.

How do empirical studies connect with the theories of social justice?

Given the normative nature of empirical equity assessments, it is important to unveil the theories of social justice they connect with.

The theoretical approach to the public economics of LTC discussed earlier generally models the efficiency-equity trade-off by assuming a *utilitarian* social welfare function (e.g. Pestieau and Ponthière (2016)). With utilitarianism, a fair allocation of resources across individuals maximizes the sum of individual utilities; the financing of a LTC policy by income-dependent contributions can be fair if the marginal utility of income is decreasing. Instead, the "equal care for equal needs" principle tested by the empirical

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literature (Carrieri *et al.*, 2017; García-Gómez *et al.*, 2015; Rodrigues *et al.*, 2017) reflects an *egalitarian* distributional objective. It is however not clear why the allocation of LTC services, separately from other goods and services, is a legitimate concern; nor how the focus on socio-economic-related or territorial horizontal inequity can be reconciled with other dimensions of inequity.

In the field of health economics, there has been much debate about the normative implications of different measures of inequity (Fleurbaey and Schokkaert, 2011; Wagstaff and van Doorslaer, 2000*a*). One item for discussion is whether we should be ultimately interested in the allocation of *health care* or in the allocation of *health*. One line of argument states that allocation of health care should matter only inasmuch as health care is instrumental to health. The parallel with LTC is not straightforward, as restoring of individual functional status is generally not possible. From an ex post perspective, the objective of a LTC policy cannot be to ensure a fair allocation of *functionings*. It thus makes more sense to look at the allocation of *LTC services*.

In a large number of studies (reviewed in van Doorslaer and van Ourti (2011)), equity in the allocation of health care has been assessed on the basis of the "equal treatment for equal needs" (ETEN) principle. This principle has been promoted by the Marxists and the 20th egalitarian school of thought (Rochaix and Tubeuf, 2009). It is often paired with another principle that has generated an extensive empirical literature: the principle that the financing of health care should reflect individual ability to pay. These two principles have been shown to command a large support among physicians and policy makers in Europe (Culyer *et al.*, 1992); there are the explicit cornerstones of the French Health Insurance (Jusot *et al.*, 2017). Investigations of horizontal inequity in use based on the ETEN principle have often used the concentration and horizontal inequity indexes. Systematic differences in need variables are netted out with an indirect standardization method (O'Donnell *et al.*, 2008), which provides a measure of the difference between the actual use of LTC and the use we would observe if it would only depend on need variables. Isolating horizontal inequity in use yet requires an assumption on the norm of *vertical equity in the use* of care, i.e. how health care should optimally be apportioned to needs. The literature has commonly relied on the assumption that "on average, the system gets it right": the empirical average quantity of health care received by individuals with same needs is used to infer how different health care use should be across different levels of needs. Rather than ruling out average vertical equity in use of health care, Sutton (2002) has proposed a way of testing for it, but his attempt has not given rise to a new strand of studies.

Regarding equity in financing, most studies have focused on *vertical equity in financing*, i.e. whether individuals with different abilities to pay make appropriately different payments to health care. The most common normative standpoint tested in the literature is that an eq-

uitable health care system should have a *progressive financing*, i.e. that payments for health care should represent a larger share of income for individuals with higher income (Wagstaff and van Doorslaer, 2000*a*).

Two criticisms have been made to this literature. First, in a system that does not completely sever the link between care use and payments, as it is generally the case for LTC, lower payments to the scheme arise if individuals forgo treatment. A focus on vertical equity in financing alone, with no information on the distribution of use across the income distribution, may be misleading (Fleurbaey and Schokkaert, 2011). Second, most empirical tests of the ETEN principle have focused on territorial or socio-economic-related inequalities, leaving aside part of the systematic correlation between care use and illegitimate determinants of care use other than socio-economic status or place of residence, such as ethnic origin or gender.

Fleurbaey and Schokkaert (2009) have proposed a framework to connect the partial approach to horizontal inequity in use based on the concentration index with the more general approach of *equality of opportunity*, or *responsibility-sensitive egalitarianism*, applied to health care. Responsibility-sensitive egalitarianism relies on the idea that the influence of certain factors on health care use should be *compensated*, while the inequalities induced by other variables should be ignored. It relies on two critical elements: first, a partioning of the determinants of health care in *circumstances* versus *effort*; second, a *compensation principle*, which defines the fair allocation of health care across individuals with the same effort but potentially different circumstances. In the context of health care, effort may include medical needs and preferences for treatment (Fleurbaey and Schokkaert, 2011). The compensation principle then states that to be fairly distributed, health care should be the same for individuals with the same care needs and preferences, irrespective of non-need factors; this provides a definition of *horizontal equity in use.* To be complete, the theory of equality of opportunity yet requires a second principle: the *reward principle,* which states how care should be allocated among individuals with the same circumstances, or non-need variables, but different efforts. The liberal reward thus corresponds to the norm of *vertical equity in care use.* Fleurbaey and Schokkaert (2011) have proposed an empirical measure of the individual disadvantage, the fairness gap, that is consistent with the compensation principle. They show that the indirect standardization method, on which the horizontal inequity index and a number of empirical studies rely, is equivalent to this fairness gap when the reward principle is defined based on the conventional assumption that:"on average, the system gets it right".

Plugging the standard empirical approach to horizontal inequity in care use into the theory of equality of opportunities highlights three lessons that will be critical to any empirical investigation of equity based on egalitarian principles of fair allocation. First, the partioning

of individual characteristics in needs versus non-needs factors is a first empirical step with crucial normative content. Second, assumptions regarding the norm of *vertical* equity in use will condition conclusions regarding *horizontal* equity in use. Third, the classical ETEN principle from traditional egalitarianisms implicitly considers preferences to be irrelevant for equity. More precisely, the fact that preferences are often not accounted for in empirical studies may rely on two alternative premises: (i) preferences for health care are not disregarded but they merely reflect care needs, (ii) preferences are irrelevant for the definition of a fair allocation of care.

The premise on the role of preferences relates to another intensively-debated question: should we care about *access* to or *use* of care services (Culyer *et al.*, 1992; Mooney *et al.*, 1991)? Referring to access instead of use has been promoted as a standpoint more respectful of individual preferences (Mooney *et al.*, 1991). Let alone the conceptual and empirical difficulties raised by the definition of access (Le Grand, 1991), it is not even clear that equivalizing access is compatible with the cornerstone of Paretian welfare economics, that the optimal allocation of resources depends on individual utilities and thus on preferences (Wagstaff and van Doorslaer, 2000*a*). On the other hand, if the ETEN principle applied to LTC *use* comes along with the premise that preferences are irrelevant, it unambiguously implies a non-Welfarist conception of equity. Whether such a position is ethically acceptable is a deep normative question: some consider that the respect for preferences is a necessary condition for the essential respect for freedom (Fleurbaey, 2008), but others reject the idea that considerations about individual responsibility and utility should be taken into account in the evaluation of social justice.

Whatever the premise on preferences, one important question remains: why should we care about equity in health care, or equity in LTC, more than in other goods or services? In the case of LTC, we can point towards two justifications. One pragmatic reason is that policy-makers and the public opinion tend to express concerns about the allocation of certain services in isolation from the set of other market goods and services. A more fundamental justification is that, for individuals with activity restrictions, LTC services are considered to be necessary to ensure that human dignity is respected and that individuals have the capacity to "flourish" as human beings (Gillon, 1986; Sen, 1992). Of course, this justification comes with a gray area: what do we intend exactly by human dignity and flourishing? Should we ensure equity in the use of very basic LTC services, such as assistance with ADLs and IADLs, or does this induce an ethical mandate for providing the disabled with the means to participate into social activities and the public life?[12]

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[12]Economists are certainly not the best equipped to answer these questions, but they have to make sure that the outcomes they refer to do not clash with the insights provided by moral philosophy, psychology, social sciences and other relevant disciplines about what a decent life is acknowledged to be.

How should we define the needs for long-term care?

As soon as we adopt an egalitarian standpoint, one critical issue is to define needs. As Culyer (1995) puts it:

"Neither [vertical nor horizontal] equity [in health care use] is operational if the concept of "need" is not sufficiently quantifiable for judgments of sameness or difference to be made with acceptable precision..." (p. 727).

This implies that both the concept of needs for care and its measurement should be made clear. In the health care context, the debate has progressively converged towards the idea that a sensible definition of needs takes into account the scarcity of resources and is contingent on what the health care system can actually achieve in terms of treatment (Culyer, 1995). One popular definition proposed by Culyer and Wagstaff (1993) defines needs as the *minimum amount of resources required to exhaust one's capacity to benefit from health care at the margin.*

By contrast, the concept of "needs for LTC" has not deserved much attention in empirical works. In the chapter on "Long-term care" in the *Handbook of Health Economics*, Norton (2000) writes:

"The theory of demand for LTC is straightforward. The most important factors are health status, which determines need, and the out-of-pocket price relative to the price of close substitutes."

Like this example, many papers use the term "needs" with no specific normative content, to designate disability and health status in a vague way. The wording used in some studies suggest that individuals have a zero price elasticity and reach a satiety level in their consumption of LTC services; or that needs for LTC should be understood as the level of LTC services such that any inferior consumption is life-threatening. In the egalitarian framework of equity assessments, the definition of the "needs for LTC" should rather encompass all individual characteristics whose impact on the demand for LTC is deemed legitimate.

To make things clearer, let us refer to a simple graphical representation. In the middle part of Figure 5, we find the core elements of a *positive* analysis of the use of LTC services, whether formal or informal. Demand for formal (informal) care interacts with its supply, and demands for informal and formal care may influence each other through the relative price of care services.

[Figure 5 to be found on the following page.]

Figure 5 – What do we mean by long-term care needs? A schematic representation.
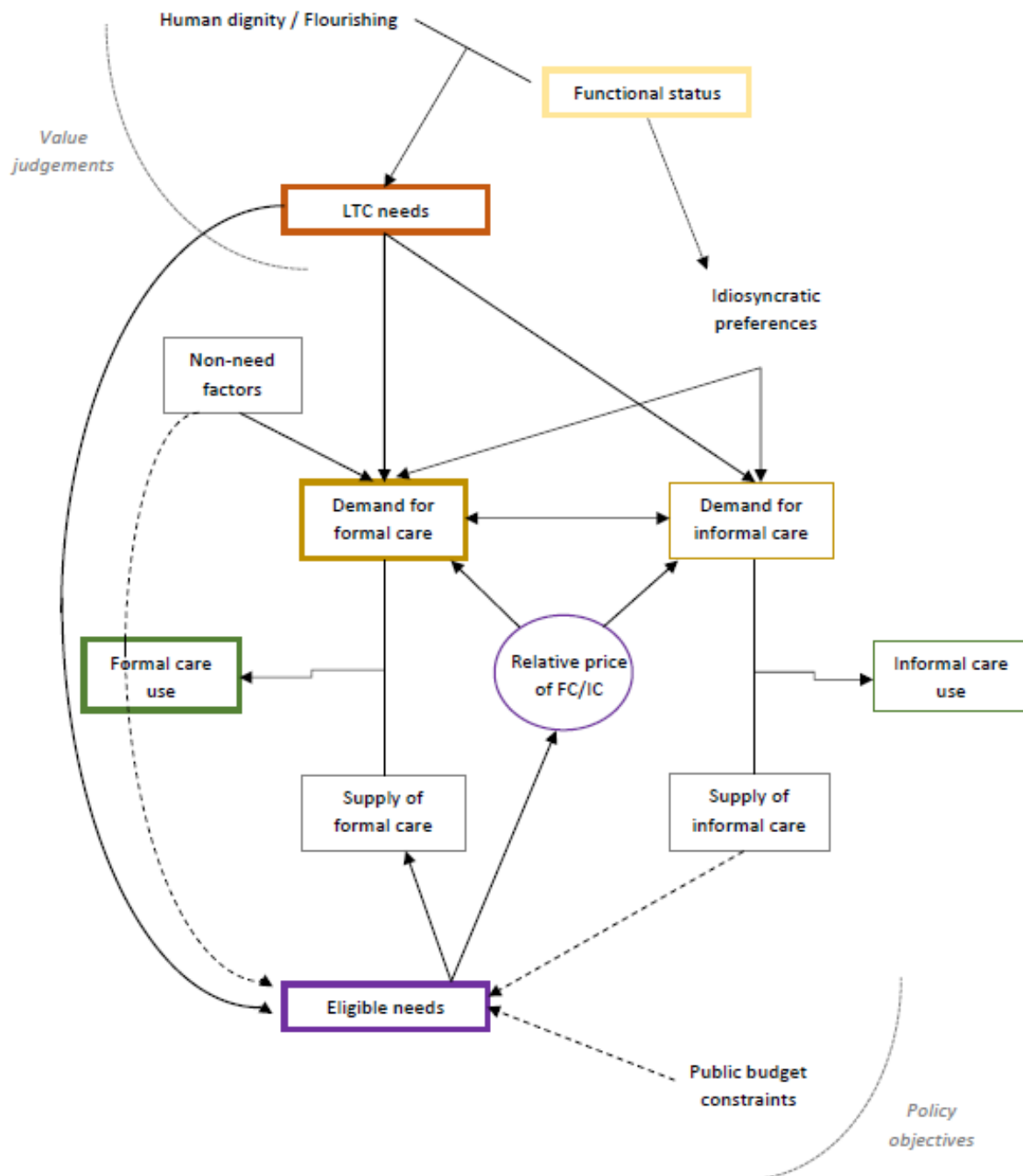
READING: All elements that are included in a circle or a box can be empirically measured; in the case of the (normative) "LTC needs", the box means that an empirical measure can be constructed under definite value judgments. By contrast, the remaining elements are typically more difficult to measure or non-empirical. The arrows show the relationship between the different elements. Dashed arrows are used when the links they represent are critical for the scope of empirical assessments of equity that take eligible needs as a sensible measure of normative needs. Bold boxes indicate the elements that are mostly studied throughout the thesis.

I then enrich the graph to highlight how the "normative needs" for LTC referred to in equity assessments may be related to the standard quantities used in the positive empirical literature. LTC needs are represented in the red box. They stem from the individual functional status and health conditions, filtered through ethical considerations about what makes LTC a special good. Let us focus first on formal LTC. Needs are not the only determinants of the demand for formal care: other individual factors, such as income, may influence LTC use in a way that is socially deemed illegitimate. Preferences over LTC, which may be influenced by health and functional limitations, also condition the demand for LTC. I also add to the picture what I call the "eligible needs" (purple box), i.e. the amount of public support an individual is entitled to given her personal situation. *Eligible* needs are expected to partially overlap with *normative* needs; but there are several reasons why the former may not provide a sensible measure of the latter. Eligibility for publicly-subsidized LTC may depend on income or wealth (in countries with means-tested LTC schemes), on age (where LTC schemes have age conditions), or on the region of residence (when LTC policies are decentralized). Constraints on public budgets may also weigh on eligibility decisions in a non-transparent way. Depending on the institutional context, eligible needs may thus partly reflect determinants of LTC use that will be deemed illegitimate.

In some countries, eligible needs are contingent on the presence of potential informal caregivers. This brings about two very important issues that do not arise in the context of health care: should we take into account the supply of informal care when defining the normative needs for formal care? Does it make sense to focus on the allocation of formal LTC, in isolation from the allocation of informal care? If we transpose the definition of health care needs presented earlier into the LTC context, we may say that an individual will have a *positive marginal capacity to benefit from LTC* (i.e. LTC needs) as soon as there are activities of daily living that she is unable to perform alone and that are not being done by someone else, or through a technical device, for her. With such a definition, the LTC needs of a person become zero if she receives extensive help from her relatives. Is this an acceptable definition of LTC needs?

If, following Culyer (1995), we believe that:

"[A practical measure of care needs should] be directly derived from the objective(s) of the ... care system" (p. 727).

then for the purpose of empirical investigations, it makes sense in the first instance to refer to how the LTC system in which we are interested treats informal caregiving. If eligibility for publicly-subsidized formal care is independent from (depends on) the presence of informal caregivers, need variables should exclude (include) family composition. In their study of income-related horizontal inequity across European countries, Ilinca *et al.* (2017)

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has explored the sensitivity of the horizontal inequity index to the classification of household composition as a need variable or as a non-need factor. As higher-income elderly individuals tend to live more often with a spouse and closer to their children, taking household characteristics as legitimate determinants of formal care use results in less pro-poor/more pro-rich horizontal inequity in *formal* home care use.

The available empirical studies of socio-economic or territorial inequity in LTC use have focused on the use of formal care, separately from the use of informal care. Rodrigues *et al.* (2014) and Ilinca *et al.* (2017) have also documented socio-economic horizontal inequity in the utilization of informal care. Italy is an interesting case, as it exhibits pro-poor horizontal inequity in informal care utilization and pro-rich inequity in the utilization of formal home care. It is not clear under which conditions we can conclude that, in the aggregate, two forms of inequity compensate for each other (Fleurbaey and Schokkaert, 2011).

2.3   Two countries under investigation: France and the Netherlands

This doctoral thesis brings empirical contributions to the economic literature on efficiency and equity just reviewed, in the settings of two European countries: France and the Netherlands. As part of the old continental Europe, these two countries share fairly similar economic and demographic characteristics, even though the Dutch GDP per capita is about 20% higher than the French one in purchasing power parity. The share of the 75+ population reaches 9% in France and is of 7.5% in the Netherlands, and both countries expect a doubling of their 75+ population by 2050 (Gaymu, 2017). Yet, in 2014, public spending on LTC reached 4.3% of GDP in the Netherlands and did not exceed 1.9% in France (OECD, 2017*a*).

In what follows, I briefly review the French and Dutch LTC systems as they stood before 2015. I then provide some elements about the recent reforms that were implemented in each country. Although the LTC systems of the two countries differ in many fundamental ways, they both have recently witnessed an intense political debate about the future of LTC policies. Concerns about the equity and the efficiency of the schemes are ubiquitous in the two countries. This makes the research questions I address practically relevant in these two institutional contexts.

General organization of the Dutch and French long-term care systems

In 1968, the Dutch government established a national social insurance ensuring universal coverage of the expenditure costs associated with disability (the *Algemene Wet Bijzondere Zietkekosten*, or AWBZ scheme).[13]

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[13]In 2015, the system was fundamentally reformed. I describe the system as it was before 2015 and bring some elements on the reform here-below.

The construction of the French LTC system was more progressive and consisted in the overlay of different schemes, with varying operating principles and philosophies. Over the 20th century, the issue of "old-age disability" has been alternatively considered as part of either disability policies or of social assistance to the destitute elderly (Capuano, 2017*a*). Since 1997, the French LTC system has been split in two different policies: the *handicap* policies, targeted to the individuals who became disabled before age 60; and the *dependence* policies, devoted to the disabled elderly. Chapter 1 of the thesis specifically studies the impact of the French age threshold in LTC policies and presents the handicap schemes. Given that the remainder of my research focuses on the 60+ population, in this general overview I focus on the schemes available to the *dependent* elderly.[14]

The long-term care services covered and the benefits offered

The Dutch social LTC insurance covers a broad range of services provided either at-home or in an institutional setting. The elderly may enter a nursing home or instead a residential care home, where they benefit from an independent living unit and a package of LTC services accessible to all residents. Nursing care, assistance with ADLs and assistance with some IADLs (supportive and activating guidance) are covered by AWBZ. In institutions, the costs of board and lodging are not distinguished from other LTC costs. Domestic help, however, has not been part of the AWBZ scheme since 2007. Municipalities are responsible for the provision and financing of domestic help, under the WMO (*Wet Maatschappelijke Ondersteuning*) social support scheme. AWBZ covers 95% of public expenditures on LTC, while WMO covers the remaining 5%.

In France, there is public coverage of a wide range of LTC services through different schemes. Personal care and assistance with IADLs, including domestic help, are paid for through the *Allocation personnalisée d'autonomie* (APA). Created in 2002, the APA scheme provides universal benefits, under the form of a partial subsidy on the costs of home care (except for nursing care) or the services received in institutions.[15] The development of home care and institutional care has been little integrated, leading to a dual system with little room for intermediary living arrangements (Bozio *et al.*, 2016). In institutions, board and lodging are not considered as LTC services and are not covered by APA. Individuals can benefit from a means-tested benefit (ASH), which pays for the nursing home fees of individuals who have exhausted their assets. The descendants of the beneficiary can legally be asked to reimburse the ASH benefits, if they can afford to. For individuals living in the community, nursing care and some personal care are provided by nursing services (SSIAD) or private nurses, who are paid by the national Health Insurance.

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[14]In French, these schemes are conventionally referred to as "*dispositifs de prise en charge de la dépendance*".
[15]*Article L232-2 du Code de l'Action sociale et des familles.*

The French Ministry of Health has recently developed integrated accounts bringing together information on spending of the different dependence schemes (*Comptes de la dépendance*). In 2014, the health care component represented 50% of public spending on LTC; the "pure LTC" component amounted to 35%, while the remaining 15% correspond to the benefits paying for the board and lodging costs (Roussel, 2017).

Needs assessment and eligibility

In the Netherlands, the entry point into the LTC system is the needs assessment made by an agency called CIZ (*Centrum Indicatiestelling Zorg*). CIZ is an independent and central agency, which was created in 2004 to address concerns about territorial inequity in entitlements to public support (Schut and Van Den Berg, 2010). Through its regional offices, CIZ processes all claims for LTC benefits: depending on her disability level and environment, an individual can be made eligible for home care or for institutional care.

In France, the elderly can choose to apply either to the at-home APA program or to a nursing home stay: there is not a unique assessment procedure ensuring that the option retained is the less costly one (Bozio *et al.*, 2016). For the at-home APA scheme, eligibility is processed by each Departmental Council. Evaluation teams are made of nurses and social workers and have to base their decisions on the activity restrictions of the claimant. Eligibility for nursing care is assessed by general practitioners (GPs) for their own patients.

In France, access to public home care support does not depend on potential and actual informal caregiving; the law does however not explicitly states whether the volume of subsidized care an individual is granted should depend on her family environment. In practice, there is anecdotal evidence that evaluation teams may take into account the family environment (Gramain, Billaud and Xing, 2015*b*; HCFEA, 2017). Instead, the Dutch AWBZ scheme explicitly provides that the household members of a disabled elderly provide her with some "usual care", i.e. an amount of personal care and domestic help along a norm of mutual assistance among family members. Eligibility for WMO benefits also depends on the family environment.

Financing and out-of-pocket payments

In the Netherlands, the AWBZ budget is financed through income-dependent social contributions (2/3) and general taxation (1/4). 8% are financed by direct co-payments. Co-payments in the AWBZ depend on the individual's financial resources and the consumption of care. The WMO scheme is financed by general taxation and by co-payments, the schedule of which is freely chosen by municipalities (Schut and Van Den Berg, 2010).

The French LTC system is a mixed system with features of both Beveridgian and Biscmarckian models, with a major role left to families (Esping-Andersen, 1990; Joël *et al.*, 2010).

The national Health Insurance is financed by social security contributions levied on wages and, to a lesser extent, on other forms of income. Cost-sharing on services paid by the Health Insurance is limited and independent from income. On the contrary, the APA benefit comes with an income-dependent co-payment. 30% of the APA program resources were collected by a specific social protection fund, called CNSA (*Caisse nationale de solidarité pour l'autonomie*), which allocates resources across departments. CNSA funding come from tobacco taxes, a tax on all types of income (CSG) and two roughly proportional contributions levied on labor and pensions respectively (CSA and CASA). The Departmental Councils (*Conseils départementaux*), who have a legally "leading" role in LTC policies, finance about 70% of APA spending. The financing of APA as well as of the Dutch AWBZ scheme includes some fiscally regressive taxes.

In spite of the good coverage provided by the national Health Insurance, private financing of LTC is high in France (Joël *et al.*, 2010; Muir, 2017). Although APA can be complemented with tax rebates and other social assistance schemes, the out-of-pocket payments on LTC services (left aside board and lodging and at-home nursing care) represent 23% of costs (Roussel, 2017). Under some assumptions on unobserved private spending, the Ministry of Health estimated that out-of-pocket payments reached €300 a month on average for at-home APA beneficiaries prior to 2016 (Fizzala, 2016), or over one fifth of the average pension benefit (Solard, 2015). The ratio of out-of-pocket payments to income (the effort rate) was conjectured to exceed 40% for the most severely disabled. Despite co-payments being increasing in income, the effort rate *decreases* with the income level (Fizzala, 2016). Public schemes in France cover only 47% of the costs of board and lodging (Roussel, 2017). Out-of-pocket payments on nursing homes exceed income for beneficiaries earning less than €1,800 per month. Even after the means-tested ASH steps in, the effort rate on institutional care remains *decreasing* in income (Fizzala, 2016).

Instead, the Dutch AWBZ is such that out-of-pocket payments increase with income for moderate to severe disability when LTC is received in the community and, unless income is very high, for institutional care.

Out of the 10.4 billion euros of estimated private spending on LTC in France, only 2.4% are reimbursed by private LTC insurance (Drees, 2016*b*; HCFEA, 2017). According to the typology of LTC systems established by the ANCIEN research project, France belongs to the cluster of systems with emphasis on formal LTC use but with simultaneously a strong orientation towards informal care (Kraus *et al.*, 2010). By contrast, informal care represents a lower share of the care provided to the elderly in the Netherlands. According to Bolin *et al.* (2008), the average volume of the informal care received by the single-living Dutch elderly is one of the lowest in Europe.

The policy debates and recent long-term care reforms

At the end of the 2010s, in both countries LTC policies were increasingly seen as "unsustainable", but for different reasons. This diagnosis triggered the important reforms that took place between 2013 and 2016.

In the Netherlands, the high projected increase in public LTC expenditure has motivated a wave of reforms seeking to improve the allocative efficiency of the LTC system. In 2013, co-payments were increased by taking into account a higher share of the wealth of beneficiaries (van Ginneken and Kroneman, 2015). More emphasis was placed on "aging in place": institutional care is now accessible only to the patients requiring constant supervision or 24h care due to physical problems or severe dementia (Maarse and Jeurissen, 2016). In 2015, an important reform led to the creation a new social assistance scheme (known as WMO-2015): it has upgraded the role of municipalities in LTC financing and provision, by entrusting them with the provision of more care services relating to ADLs and IADLs. In parallel, nursing care and support in grooming and dressing have been entrusted to the regional health insurers. More largely, the Dutch LTC system has been undergoing a "normative reorientation" (Maarse and Jeurissen, 2016): while universality and national solidarity have been the cornerstones of the LTC social insurance since its creation, a greater weight is now placed on individual responsibility and the support that can be provided by families and local community networks.

Concerns about this wave of reforms have been expressed by many actors of the LTC system, including patients organizations and unions of LTC workers. Reduced budgets have led some municipalities to ration care and contract with providers at lower tariffs, threatening the economic sustainability of home care providers — an issue that is also frequently encountered in France. Fears also relate to unjustified territorial inequalities in the access to LTC and coordination difficulties in the provision of different types of LTC services due to the lack of integration of the new system (Maarse and Jeurissen, 2016; van Ginneken and Kroneman, 2015). The latter problem has been longstanding in France, where it is being addressed by local initiatives and experimental programs encouraging cooperation between different care providers (Gand *et al.*, 2017).

In France, the public debate has been rather calling for decreasing the responsibility left to the dependent elderly and to their families. The existence of high co-payments, in particular for the most severely disabled and those with low incomes, has been one of the major criticisms addressed to the system, so as the lack of respite care options for informal caregivers. Horizontal (geographical) and vertical equity in the financing of LTC policies is undermined by the important role of local authories, which rely on local taxes that are not all income-based to finance their LTC spending (Chevreul and Brigham, 2013). As the Departmental Councils have been financially strained since the European public budget crisis,

substantial territorial inequalities in the public support offered to the disabled individuals have been documented (Billaud *et al.*, 2012) and have become a major concern for policy makers (HCFEA, 2017).

In 2011, a "national debate" on dependence policies was launched by the French President of the Republic, in order to set the scene for an ambitious reform. Several policy options were considered, among which: the recognition of dependency as a social risk and the creation of a new social insurance scheme (Vasselle, 2011); or the setting of a mandate for a private LTC insurance (Rosso-Debord, 2010). Due to the public finance crisis, the reform was however postponed sine die in 2011. While many specialists were not expecting a reform any time soon (Chevreul and Brigham, 2013), the year 2015 ended with a law that brought substantial changes to the at-home APA scheme.[16] The design of the APA benefit was substantially reformed to make it more generous with the poorest, the middle-class beneficiaries and those requiring high volumes of professional home care. The reform was tailored such that the expected increase in public spending can be financed by a new tax levied on pensioners. An allowance to finance respite care for informal caregivers was also created. The reform also enacted a modification of the financing of nursing homes, which has triggered a wave of protests from LTC professionals in the recent months. In early 2018, the Ministry of Health initiated consultations to improve the funding of institutional care and its quality and the propositions of the government are expected to be made public in the Fall of 2018. Even more recently, the President of the Republic announced that a broader reform of LTC benefits and their financing would soon be discussed.

While LTC policies remain a topic high on the political agenda in France and in the Netherlands, there has not been sufficient time since the reforms were implemented to make ex post evaluations available. By bringing descriptive and analytical empirical elements on how the Dutch and French LTC systems worked before the reforms, this thesis aims at modestly enlightening the policy discussions on the evolution of LTC policies, in these two countries and beyond.

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[16] *Loi 2015–1776 du 28 décembre 2015 relative à l'adaptation de la société au vieillissement.*

3   Outline and contributions

3.1   Intended contributions to the literature

Regarding efficiency aspects of LTC policies, my thesis focuses on questions that have been little documented by the empirical literature: How do LTC beneficiaries adjust their consumption of formal home care services to a change in the out-of-pocket price of care? How important are substitution effects, as opposed to income effects, in the behavioral reactions to distortions in the relative price of home care services?

As evidenced by the literature review, many fundamental questions regarding equity in LTC have not yet been tackled by applied economists. I intend to bring contributions in this field by empirically addressing the following questions in the French and Dutch institutional contexts. How do the consumption of LTC services and the out-of-pocket payments vary with disability levels and income? Are these differences fair? Which features of LTC policies induce undesirable inequalities across population groups?

By referring to the principles of "equal treatment for equal needs" and "from each according to her ability to pay", I adopt the normative standpoint of "old-egalitarianism". I yet pay a particular attention to the definition of LTC needs and propose an original way to define the norm of vertical equity in care use, so that my normative stances make sense in the institutional contexts under scrutiny. In addition, I discuss the role of preferences to tentatively bridge the gap with Welfarist conceptions of social justice.

3.2   Overview of the Chapters

This thesis is organized in four Chapters; each of them addresses specific research questions. Chapters 1 to 3 investigate into the French LTC policies, while Chapter 4 deals with the Dutch LTC system. Whereas Chapters 1, 3 and 4 concentrate on equity considerations, the analysis in Chapter 2 conveys implications primarily in terms of the efficiency of LTC policies.

Chapter 1

Chapter 1 investigates into the effect of the age 60 barrier in the French LTC policies. The distinction between the "handicapped adults", who are aged less than 60, and the "dependent elderly" clashes with the legal environment of the European Union, which provides that access to LTC benefits should not depend on age. Over the past decade, the debate over the discriminatory nature of French LTC schemes has been fierce. Yet the effects of the age 60 threshold on the way disability is compensated on a day-to-day basis had not been previ-

ously documented. In order to bring empirical elements to this policy debate, I address the following issue: does it make a difference to be a dependent elderly rather than a handicapped adult, in terms of the LTC services you receive?

A general population survey allows me to tackle two complementary questions: first, what is the effect of the age 60 threshold on the formal care and informal home care received by community-dwelling individuals? Second, does the age barrier affect the probability to live in an institution rather than in the community? Three main results emerge from my analysis. First, the probability to receive formal home care is higher for the dependent elderly than for the handicapped adults among those living in the community, while the probability to receive informal care is suggested to be lower. Second, the results differ by gender and by disability level. Third, the probability to be recorded as living in an institution is higher for the dependent elderly, all other things being equal.

The results imply that individuals who are similar in all aspects but their age tend to receive different LTC services. Does this mean that the French LTC system does not ensure horizontal equity in the use of LTC services, i.e. that individuals with equal needs are treated differently? If we focus on the community-dwelling individuals and define the relevant "treatment" as "receiving some home care", whether formal or informal, the answer would be no. Indeed, the age 60 threshold has no effect on the probability to receive some home care. But the two main French home care subsidies are not subsidiary, suggesting that we should consider the use of *formal* care as the relevant treatment. Even then, differences in the utilization of formal care may stem from age-related differences in the preferences regarding care provision, although little research supports this assumption (Kane and Kane, 2001). If so, such deviations from the "equal treatment for equal needs" principle may be considered as fair; unless adaptation mechanisms actually explain why care arrangements differ between those who have suffered from a disabling condition since a relatively young age and those who became disabled quite late in life.

Although this analysis has policy relevance primarily in the French context, it may be of interest for countries with age barriers in their LTC or other social policies. It also fits into the critical debate on ageism in social policies.

Chapter 2[17]

The starting point of Chapter 2 is an indirect result of Chapter 1: the disabled elderly adjust their care consumption to the home care subsidies they may benefit from. But by how much? Empirical studies from the international literature had not been able to quantify this effect. The aim of Chapter 2 was to overcome this limitation by studying the behavioral reactions, and in particular the price sensitivity, of the beneficiaries of the largest French

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[17]This Chapter was co-authored with Quitterie Roquebert.

home care subsidy program, the *Allocation personnalisée d'autonomie* (APA).

The price elasticity of the demand for LTC is a crucial empirical parameter, for two main reasons. First, it provides an indication of the magnitude of ex post moral hazard in LTC use, which conditions the welfare gains associated with public LTC insurance schemes (cf. Section 2.2). Second, it allows to anticipate how potential reforms of LTC subsidies will affect the use of LTC services and thus public spending.

Our semi-structural approach allows us to identify both a price elasticity and an income elasticity parameters. A 10% increase in the out-of-pocket price of care is predicted to decrease the consumption of professional care by 4% at the intensive margin. A 10% increase in the individual income is predicted to increase care use by 4% for APA beneficiaries, suggesting that professional home care is a necessity good.

Our estimates imply that home care subsidies affect the use of home care through both income and substitution effects, suggesting that such programs come with some gross efficiency loss. The income elasticity of home care use being low, the welfare gain from the additional home care use generated by the APA-induced income transfer towards beneficiaries may be relatively low. This alone would suggest that home care subsidies do not induce significant welfare gains; but our analysis is blind to their potential positive external effects on medium-run health and on informal caregivers, as well as to the traditional risk-bearing gain. We also find suggestive evidence that high-income beneficiaries are more sensitive to the price of care. By setting higher cost-sharing on those who are more reactive to a change in the relative price of care, the APA scheme may not only meet redistributive objectives but also increase the efficiency of the policy.

Our research was embedded into a larger research project, the MODAPA project. The project sought to obtain price elasticity estimates by the means of different databases and varying identification assumptions. Hege (2016) and Bourreau-Dubois, Gramain, Lim and Xing (2014) find a price elasticity estimate of -0.15 and -0.55 respectively. Low statistical precision makes it impossible to reject that our three estimates are identical. Our studies point to a price elasticity lower than unity in absolute value, implying that a reduction in the out-of-pocket price of care should lead to a less than proportionate increase in care consumption, and thus to a reduction in total out-of-pocket payments. The a priori view that the use of home care services, and in particular domestic help, is extremely price-sensitive is not supported by our empirical analysis.

Chapter 3

Chapter 3 digs further into the "economics of the APA scheme" and addresses the three following questions: how do professional home care use and out-of-pocket payments vary along the income distribution and across disability levels for APA beneficiaries? Are these

distributions equitable? How may the 2016 reform of APA have affected equity in the use and in out-of-pocket financing of home care?

Presumably, the design of the at-home APA aims at reducing inequity in the use of home care and in out-of-pocket payments. Indeed, the at-home APA policy comes with two critical features: depending on her disability level, each beneficiary is entitled to a maximum number of hours on which she can receive the APA subsidy. Moreover, the subsidy is computed on the basis of an income-dependent co-payment rate. The 2016 reform precisely sought to accentuate public effort towards the very low-income and middle class beneficiaries as well as towards the most disabled, who were deemed to incur excessive out-of-pocket payments. Data limitations have yet made it difficult to document the extent of the resource transfers among APA beneficiaries prior to the reform; they also explain why no ex post evaluation of the reform had been conducted.

I use original data from 2014 providing precise information on the use of care and out-of-pocket payments for a sample of APA beneficiaries. I define normative stances and accordingly assess how equitable the pre-reform APA scheme was. Finally, I propose a simulation of post-reform home care use and out-of-pocket payments, based on the price and income elasticities estimated in Chapter 2.

The pre-reform data show novel evidence of high out-of-pocket payments on home care for low-income beneficiaries, due to the leeway left to the Departmental Council in computing the co-payment levied on beneficiaries. The average effort rate[18] is roughly constant across all five income quintiles, signaling pro-rich vertical inequity in the direct financing of the scheme. High effort rates also arise for the severely disabled beneficiaries, consistently with the absence of a stop-loss mechanism in the APA and the low ceilings that bind the care plans. I also find evidence of a slight pro-rich horizontal inequity in home care use.

I predict that the 2016 reform would increase home care use across all disability groups and income levels. Out-of-pocket payments would increase for the poorest and decrease for the richest, thereby accentuating vertical inequity in financing. This unexpected consequence of the reform critically depends on the assumption of constant elasticity parameters across income levels. The reform would induce the most disabled to consume more hours of care while decreasing their out-of-pocket payments, thus reducing vertical inequity in use and improving the coverage of the financial risk associated with severe disability.

Together with the companion analysis by Hege (2018), which was similarly conducted within the MODAPA research project, our simulations offer the first assessment of the effect of a major reform of the APA scheme. Our ex ante evaluations illustrate that behavioral reactions may lead the reforms of home care subsidy schemes to deviate from their objectives in terms of redistribution and equity.

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[18]Effort rate is defined as the ratio of out-of-pocket payments on home care use to individual income.

Chapter 4[19]

Chapter 4 leaves France and lands in the Netherlands. It aims at (i) documenting income-related inequalities in the use of LTC services in the Netherlands, and (ii) assessing whether individuals with the same needs for care receive similar LTC services.

From an international perspective, the Dutch public LTC insurance stands out for offering a generous coverage of LTC costs. It is also perceived as a very egalitarian system, although no systematic evidence supports this view. As the Dutch LTC systems is undergoing major changes, insights into inequity in the pre-reform system should come in handy to policy discussion.

We measure inequalities and inequity in LTC consumption using standard concentration and horizontal inequity indexes. Our analysis however contrasts with the existing empirical literature in the way "needs for care" are defined. We take advantage of an important feature of the Dutch social LTC insurance: eligibility for publicly-subsidized LTC is based on a need assessment conducted by a centralized and independent agency. We consider that eligibility decisions reveal the legitimate needs for care and the norm of vertical equity in use prevailing in the Dutch LTC system. Our horizontal equity assessment does not have to rely on the standard yet strong assumption that "on average, the system gets it right".

One additional strength of our analysis with respect to the scarce existing literature is that we use high-quality, exhaustive administrative data on eligibility for and use of publicly-subsidized LTC by the Dutch elderly. We are able to observe both individuals living in the community and those who are institutionalized. We use national tariffs of LTC services to aggregate care use over the different types of services.

Individuals with low income are found to use on average more LTC (in value) than high-income individuals. When eligible for institutional care, those with a higher income are more likely to convert their entitlements into a package of home care services or to use cash benefits, which are less costly types of LTC than institutional care. The income-rich are also more likely not to use any LTC when eligible for it. As a consequence, differential use across the income distribution remains large even when we control for systematic differences in needs.

The policy implications of our results crucially hinge upon how we interpret them. Our "pro-poor" horizontal inequity index might imply that the Dutch LTC system overshoots its goal of ensuring equitable use of LTC. Co-payments on institutional care steeply increase with income and this creates a monetary disincentive for the rich to enter a nursing home. If the Dutch public LTC insurance aims at ensuring an equal access to institutional care for the rich and the poor, our results question further increases in co-payments for richer beneficiaries. But if our findings stem from institutional care being an inferior good, they imply that the Dutch social LTC insurance does not allow the poor to access more preferred LTC

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[19]This Chapter was written with Pieter Bakx and Eddy van Doorslaer.

options. If we adopt a Welfarist definition of social justice, we conjecture that equity and efficiency may both be improved if alternatives to institutional care were fostered. In any case, the prior that the comprehensive Dutch LTC system ensures horizontal equity in the use of care is challenged by our analysis.

3.3   Concepts, sources and methods used in the thesis

Analytical tools and methods from economics

This thesis draws on various analytical tools and empirical methods from economics. The general approach is *micro*: it focuses on individual behaviors and the allocation of scarce resources. The analysis draws on neoclassical micro-economic theory, in particular on the consumer theory. Individuals are implicitly or explicitly assumed to trade-off utility gains from marginal LTC consumption with its out-of-pocket cost. To fit the design of the French APA scheme, I use the analytical framework of consumption decisions in the presence of a kinked budget constraint.

The findings of this thesis are derived mainly from observational data. In Chapter 3, simulations are conducted to overcome the lack of individual-level data in the post-APA reform period. Empirical analysis make use of several microeconometric methods. The analysis in Chapter 1 is conducted within the spirit of a policy evaluation. It first derives reduced-form evidence from a very standard multivariate regression analysis; it additionally exploits the regression discontinuity design created by the French LTC policies to obtain quasi-experimental evidence (Lee and Lemieux, 2010). Chapter 2 adopts a more structural approach. A censored regression model (Tobit) is used to deal with observational issues and an instrumental variable estimation allows to address endogeneity concerns. Identification is achieved parametrically, by Maximum likelihood estimation. Finally, Chapters 3 and 4 estimate linear regression models that allow simple tests on interaction terms and the implementation of decomposition techniques (Wagstaff and van Doorslaer, 2000*b*; Wagstaff *et al.*, 2003).

The measurement of income-related inequalities and horizontal inequity in LTC use in Chapter 4 relies on synthetic indexes that have been widely use in applied health economics. The concentration index and the horizontal inequity index (Kakwani *et al.*, 1997) embed several implicit assumptions that are important for the interpretation of the results. These indexes measure *relative* inequalities, as opposed to absolute inequalities; they provide an indication of system-wide average inequality by attributing implicit weights on the inequalities at different parts of the income distribution (Bleichrodt and van Doorslaer, 2006).

Data sources

The contributions of this thesis are essentially empirical, meaning that the strengths and weaknesses of the data that were used are critical to the scope of my results. Finding out the data that were the most appropriate given my research questions has been an important aspect of the thesis. I review here the trade-offs I faced in selecting the sources.

All the datasets used in the thesis provide individual-level information. Chapters 1 and 4 rely on data that are readily available to researchers, under some conditions. The data used in Chapters 2 and 3 were instead collected ad hoc. Chapters 2 and 4 exploit administrative records of publicly-subsidized LTC beneficiaries, Chapter 3 uses the customers files of a home care provider and Chapter 1 relies on population survey data.

Survey data

In Chapter 1, I use the Disability and Health (HS) survey from 2008 to compare the LTC received by the "dependent elderly" with the care received by the "handicapped adults". One section of the survey (*Handicap-Santé Ménages*, HSM) is representative of the community-dwelling population, while another section surveyed the institutionalized population (*Handicap-Santé Institutions*, HSI). A small dataset matching information from HSM and from HSI is made available and provides a sample representative of the entire French population. The fact that HS is a general population survey provides me with a sample of both individuals below and individuals above the age 60 threshold I am interested in.

The HS survey is made accessible through the academic network *Réseau Quételet* and has been extensively used in applied economics studies. Its cross-sectional nature limits the analysis in certain ways. A two-wave survey similar to HS was conducted in 1999 and 2001 (*enquête HID*),[20] but the LTC schemes I assess the effects of were reformed in the early 2000s.

Administrative data

Chapter 2 required individual-level information on the consumption of home care services, on out-of-pocket prices and a reliable measure of income for APA beneficiaries. As of today, there is no national dataset that contains all three sets of information. Departmental Councils are responsible for the implementation of the APA policy on their territory and for the records they keep. All metropolitan departments now keep electronic records on APA beneficiaries, including each beneficiary's care plan volume, some information on the home care provider she selected and her APA co-payment rate. However, until new legal provisions

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[20]For a critical overview of this survey, see Mormiche (2003).

were enacted following the 2016 APA reform, Departmental Councils had no requirement to forward individual-level information to the statistical office of the Ministry of Health and Social Affairs (Drees). In 2011, the Drees launched a collection of departmental records on a voluntarily basis. This dataset, called *Remontées individuelles APA*, however contains no information on provider prices. Therefore, it does not allow to precisely infer the out-of-pocket price of care.[21]

In order to estimate the price elasticity of the home care demand, one strategy consists in working with exact information on out-of-pocket prices thanks to departmental data. This requires liaising with one Departmental Council and obtaining its APA records. This is the approach adopted in Chapter 2. We collected the APA records (January 2012 to December 2014) of one metropolitan department.[22] Actual use of subsidized home care and out-of-pocket prices are precisely observed for individuals served by an authorized home care provider, which is the case of the majority of APA beneficiaries at the levels of this department and of metropolitan France as a whole.

Chapter 4 relies on exhaustive national administrative records, reflecting the centralization and quality of the information system on LTC benefits in the Netherlands. Under some conditions, Statistics Netherlands (CBS) provides access to an extensive set of tax and death registers, to the registers that the Dutch municipalities keep of their resident population and to the records of eligibility for and use of publicly-subsidized LTC services. Researchers may be granted the authorization to link together these datasets through individual and household identifiers.[23] The use of the administrative data on LTC is quite recent. Because they cover the entire population and the large majority of LTC services being used in the Netherlands, these data are especially suited for studying distributional questions.

Customer files of a home care provider

Chapter 3 exploits the customer files of a large home care provider operating in one French department. For APA beneficiaries receiving care from this provider, these data contain exact information on the total consumption of home care, including the hours that are consumed beyond the maximum volume of care subsidized by APA. Administrative APA records from Departmental Councils contain information only on the hours *subsidized* by the scheme; using these data to document income-related inequality in the use of home care would have hidden the differential propensity to consume unsubsidized home care

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[21]For more details on these data, see drees.solidarites-sante.gouv.fr/etudes-et-statistiques/ open-data/handicap-et-dependance/article/les-donnees-individuelles-apa-ash.

[22]In order to preserve the confidentiality of the data we collected, ad hoc agreements for access to and use of the data were signed.

[23]To avoid any leak from these highly identifiable data, access is only provided through a remote access system operated by CBS.

across the income distribution. These customer files also make it possible to retrieve precise information on the out-of-pocket payments borne by APA beneficiaries, contrary to other available sources. Although the sample can hardly be assumed to be representative of the total French population of APA beneficiaries, the data enable simulating the effects of modifications in the APA design.

Data costs

Table 2 summarizes the characteristics of each of the datasets used in the thesis. For a researcher, the decision to use, and in some cases to collect, specific data should take into account both monetary and non-monetary costs.

The HS survey and Dutch administrative data are made available to researchers under the form of clean and well-documented files. CBS charges a relatively high price for access in order to cover the costs associated with the provision of clean data, the maintenance of the remote access service and the use of powerful computer servers. While the HS survey is provided for free, the collection of such an ambitious general population survey was costly; for this reason, it has not been followed by a second wave nor replicated yet. For Departmental Councils and home care providers, sharing their data with researchers should come at a limited marginal cost — provided their information systems are functional.[24] For researchers, the ad hoc collection and cleaning of data involve high time costs, which are better recouped within a collective project.

[Table 2 to be found on the following page.]

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[24]That being said, I acknowledge that this cost is non-zero; I again sincerely thank our interlocutors in the Departmental Council and home care provider for their good will in providing access to the data.

Table 2 – The datasets used in the thesis: contents, blind spots and costs.

	*Chapter 1**	*Chapter 2*	*Chapter 3*	*Chapter 4*
	France (home care)			The Netherlands
General information				
Type of data	Population survey	Administrative records	Customer files	Administrative records
Years	2008	2012–2014	October 2014	2012
Time dimension	Cross-sectional	Panel	Cross-sectional	Cross-sectional
Representation	National	One department	One home care provider	National
Contents of the data				
Formal care use	Extensive information, with some imprecision	Precise information on APA-subsidized care for a sub-population of APA beneficiaries	Precise information on total care use	Exhaustive for publicly-subsidized care
Informal care use	Extensive information	No information	No information	No information
Provider prices + out-of-pocket price of care	None	Exact for a sub-population of APA beneficiaries	Exact	Partial
Total out-of-pocket payments	No information	Exact for sub-population of APA beneficiaries	Exact	No information but can be retrieved
Individual income	Noisy	Good	Good	Excellent
Socio-demographics	Extensive	Limited	Very limited	Extensive
Costs of use				
User costs	Data treatment	Data collection, cleaning & treatment	Data collection, cleaning & treatment	User fees & data treatment
(Marginal) social costs	Very costly survey	Relatively limited	Relatively limited	High
Number of observations				
In the selected samples	3,121	8,190	1,616	616,934

NOTES: * The description of the data used in Chapter 1 that I include in this Table refers only to HSM, the section of the HS survey that was collected on community-dwelling individuals. The number of observations refers to the size of the samples that were selected for the analysis presented in this thesis.

The MODAPA research project

As a matter of fact, the data used in Chapters 2 and 3 of this thesis were collected for the purpose of the collective MODAPA research project. Initiated in 2014, this project brings together a dozen of French researchers working in the field of LTC policies. The collection of data and the analysis presented in Chapter 2 was conducted after four researchers of the team had accessed and analyzed the APA records of a first department.[25] In working at the departmental level, we favor internal validity over external validity. Conducting two separate studies on the same type of data, with empirical strategies adapted to each local context, was a way to assess the robustness of the results.

The customer files used in Chapter 3 were initially collected in order to test for another identification strategy of the price elasticity of the demand for home care.[26] Working with the censored measure of home care use provided by the departmental data makes it necessary to make assumptions on the stability of preferences when studying behaviors in terms of home care demand (Chapter 2). By exploiting the customer files of a home care provider, which contain the total use of home care, weaker assumptions can be made. This however comes at the cost of a reduced external validity, as the sample is further restricted to the APA beneficiaries of one department *who are served by a given provider*.

The unique features of the dataset have allowed researchers of the group to document the empirical relationships between the APA national ceilings, the care plan volumes and the actual use of care.[27] Finally, these data have been used by two members of the group (Robin Hege and mysef) to document the distribution of home care use, out-of-pocket payments and public spending.[28]

The perimeter of long-term care in each Chapter

As a consequence of the differences in the datasets being used as well as in institutional contexts, what I call "long-term care services" differs from one Chapter to the other.

As summarized in Table 3, my definitions of *formal home care* include assistance with ADLs and with IADLs, at least partially. For France, I am able to retrieve information on any *personal care* an individual may benefit from when I use the HS survey; this is not the case when I focus on LTC eligible for APA subsidies (Chapters 2 and 3), as some personal care may be provided by nurses. For the Chapters dealing with the French case, the definition of home

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[25]The results from this study, conducted by Cécile Bourreau-Dubois, Agnès Gramain, Helen Lim and Jingyue Xing, are presented in Bourreau-Dubois, Gramain, Lim and Xing (2014) and in Bourreau-Dubois, Gramain, Lim, Xing and Roquebert (2014).

[26]The collection of the dataset and initial analysis were conducted by Léna Gazaix (Gazaix, 2015). Two other researchers of the group, Agnès Gramain and Olivier Supplisson, are currently working on an estimation of the price elasticity of home care demand based on this dataset.

[27]See Fontaine and Gramain (2017).

[28]The analysis by Robin Hege is presented in his doctoral thesis: Hege (2018).

care systematically excludes *nursing care*, which is paid by the Health Insurance and not by LTC schemes strictly speaking. On the contrary, nursing care is included in the definition of home care used in Chapter 4, as it is subsidized by the Dutch social LTC insurance scheme. For symmetrical reasons, *domestic help* is included in the definition of home care for Chapters 1 to 3 but not in the Chapter dealing with the Netherlands. One shortcoming of relying on some forms of administrative data (as in Chapters 2 and 4) is that it limits the ability to take into account potential substitution between the LTC services that are not subsidized by the same schemes. This may hide some offsetting effects (Ramos-Gorand, 2015).

Only the survey data used in Chapter 1 allow to observe *informal caregiving*. Utilization of *institutional care* is observed in the HSM-HSI dataset (Chapter 1) for individuals who live in an institution on a permanent basis; all nursing home and residential care stays are observed in the Dutch data used in Chapter 4.

Table 3 – The definition of long-term care in each Chapter.

	France				The Netherlands
	Chapter 1		*Chapter 2*	*Chapter 3*	*Chapter 4*
	HSM-HSI	HSM			
Formal home care					
Nursing care	✗	✗	✗	✗	✓
Personal care (assistance with ADLs)	✗	✓	Partially	Partially	✓
Assistance with IADLs (other than housekeeping)	✗	✓	✓	✓	✓
Domestic help	✗	✓	✓	✓	✗
Informal care					
Assistance with ADLs/IADLs	✗	✓	✗	✗	✗
Institutional care					
Any	✓	✗	✗	✗	✓

NOTES: "HSM-HSI" refers to the dataset of the HS survey that brings together information on the community-dwelling respondents and on the institutionalized respondents.

The definitions of needs for care and of equity in each Chapter

As a final element of this General introduction, I present and compare the definitions of equity and the empirical measures of the "needs for LTC" that I use in the different Chapters. They are summarized in Table 4.

Table 4 – The definition of LTC needs and equity principles in each Chapter.

	Chapter 1	*Chapter 3*	*Chapter 4*
Equity principles	Horizontal inequity in use of LTC if the age 60 threshold causally affects formal LTC use	(1) Income-related horizontal inequity in use if home care use correlates with income when controlling for needs	Income-related horizontal inequity in use if LTC use correlates with income when controlling for needs
		(2) Vertical inequity in direct financing if effort rate is non-increasing in income	
		(3) Vertical inequity in use if home care use of the more severely disabled is "too low" w.r.t home care use of the less severely disabled	
Measure of needs	Not explicit	Administrative disability groups (GIR)	CIZ-assessed entitlements to publicly-subsidized LTC

I start this review with Chapter 4, as the Dutch institutional context and data offer a close to ideal setting for the empirical assessment of *horizontal equity in use.* In this Chapter, we assess whether the ETEN principle[29] is respected, i.e. whether there is a correlation between the monetary value of LTC services used and income, once we have controlled for systematic differences in LTC needs across the income distribution. We define *LTC needs* as the monetary value of the entitlements for publicly-subsidized LTC decided upon by the CIZ agency. Referring back to Figure 5 (page 32), our measure of needs corresponds to "eligible needs" (highlighted in the purple box). Eligible needs in the Netherlands are the product of 3 main elements: (i) the functional status of the individual, and in particular her restrictions in the activities of daily life, her health status, age and gender; (ii) the "conversion grid" that CIZ workers have to rely on in order to map elements (i) into the types and quantities of LTC services the individual should legitimately have access to; and finally (iii) the household composition and potential supply of informal care. As explained in Section 2.3, the Dutch social LTC insurance considers it legitimate that some amount of LTC services is provided by household members: eligible needs are thus reduced by the expected supply of "usual care" from co-residing family members.

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[29]ETEN stands for "Equal treatment for equal needs" (cf. Section 2.2).

In defining needs and a norm of vertical equity in use, Chapter 4 thus adopts the normative viewpoint of the CIZ agency and of its assessors, which have to abide by explicit and strict guidelines. Given the independence of CIZ, eligible needs are not expected to depend on budgetary considerations.

In the French APA scheme that I study in Chapters 2 and 3, there also exists an explicit volume of home care up to which a beneficiary is entitled to receive an APA subsidy. The care plan volume, which I observe in my data, is set by an evaluation team of the Departmental Council. The law frames the mapping of individual activity restrictions and functional limitations into 6 administrative disability groups (called GIR), by the means of a disability grid (called AGGIR).[30] If the claimant is classified in one of the 4 most severe disability groups, she is eligible for APA.[31] Until the 2016 APA reform, the law was relatively vague regarding how information about the disability level, demographic characteristics and the living environment should be converted into the care plan volume.[32] Evaluation teams retain leeway in this conversion and Departmental Councils may differ in the guidelines they provide to their assessors. In particular, the incentive structure of the APA scheme (in which the Departmental Councils are both the need *assessors* and the marginal *payers*) and anecdotal evidence make it reasonable to consider that budgetary constraints influence the levels of care plan volumes.

The analysis conducted in Chapter 3 makes use of local data. Suppose budgetary constraints affect the aggregate volume of care plans of a department, but do not affect the care plan of beneficiary A *relative to* that of beneficiary B. Then, if we believe that *relative* inequalities matter, the individual care plans might still provide a relevant measure of needs for inter-individual comparisons. There are two reasons why I reckon this to be a debatable assumption. First, the APA scheme comes with national ceilings that are binding and set at relatively low levels, especially for severe disability. This may lead the evaluation teams to truncate some care plan volumes and not others (Fontaine and Gramain, 2017). Second, it is not clear how evaluation teams take into account household composition and informal caregiving when setting the care plan volume. All in all, the care plan is better seen as a complex policy tool, which reflects both *normative needs* for care and budgetary targets.

For these reasons, I use the administrative disability group (GIR) as the measure of needs for LTC in Chapter 3. I would conclude to the existence of *income-related horizontal inequity in use* if, among the APA beneficiaries of a given disability group, there is a systematic correlation between income and home care use. There are yet two shortcomings associated with

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[30] *Article R232–3 du Code de l'Action sociale et des familles.*

[31] *Article R232–4 du Code de l'Action sociale et des familles.*

[32] *Articles R232–7 et L232–6 du Code de l'Action sociale et des familles.* The 2016 APA reform provides that national guidelines released by the Ministry of Old-Age have now to be used by the evaluation teams. In this discussion, I focus on the pre-reform situation.

using the disability group as a measure of needs. First, as a 4-category discrete variable, it is a rough measure; second, although I try to address recording issues in my dataset, there might be residual measurement error. May we additionally suspect the administrative groups to be influenced by local factors, as care plans probably are? We observe high inter-departmental variability in the share of the population aged 75 or more who is assessed to be in GIR 4 (least severely disabled individuals among those eligible for APA) (HCFEA, 2017). Together with ethnographic evidence, this suggests that Departmental Councils are able to manipulate the disability assessment grid (AGGIR) to influence the number of individuals that are made eligible for APA support (Billaud *et al.*, 2012). If this is the case, then I may miss individuals with zero *eligible needs* for LTC but with non-zero *normative needs*. Without general population data, there is probably no way to go round this issue, which also arises if there is an income gradient in the non-take-up of LTC benefits.

The empirical strategy I adopt in Chapters 3 and 4 does not allow to control for systematic differences in unobserved *preferences for LTC* across the income distribution. If we adopt a strict egalitarian view, in the Marxist tradition, then any deviation from the principle that the allocation of LTC services should be made according to needs is a *sufficient* condition for the existence of inequity in use — even if preferences alone would explain this deviation. Even though I do not formally test an alternative normative framework, I provide elements of discussion of the interpretation of the results of Chapter 4 in light of equity definitions that better accommodate the respect of preferences.

In Chapter 3, I also investigate into *vertical inequity in the use* of home care among APA beneficiaries. To avoid making an arbitrary assumption regarding how much beneficiaries with higher needs are expected to consume more, I assume that prior to the 2016 APA reform the system was *inequitable*. I then conclude to an improvement in the vertical equity in use if the increase of home care use following the APA reform turns out to be higher for those with disability is more severe.

The last dimension of equity I study in Chapter 3 is equity in *financing*. I conclude to the existence of *vertical inequity in direct financing* of home care use if the ratio of out-of-pocket payments to income (the effort rate) is non-increasing in income. I thus take a fair system to be one ensuring *progressivity* in the financing of care. I also document how out-of-pocket payments evolve with income to leave the door open to an alternative criterion of equity in financing.

For all the equity principles that I study but one, the definition and measurement of income are critical. For the assessment of income-related horizontal equity in *use*, income is used to *rank* individuals; for the assessment of equity in *financing*, income should capture the contributory capacity of individuals. Across all Chapters, I take income to be the equivalized household income. The choice of the equivalence scale is not innocuous; in Chapters

2 and 3, we stick to the scale used in the APA program to define the co-payments; in Chapter 4, we use the more common square-root scale.

Chapter 1 proposes a different approach to inequity: the aim is to assess the *causal* impact of the age 60 threshold in LTC policies on the existence of *age-related horizontal inequity in the use* of LTC. Instead, in Chapters 3 and 4, I do not assess whether income causally induces inequity. Put if differently, the question I tackle in Chapter 1 is not: "is there a systematic difference in the care received by the handicapped adults and the dependent elderly, once we control for legitimate needs for care?"; it is instead: "is there a systematic difference in the care received by the handicapped adults and the dependent elderly, once we control for all the potential determinants of LTC use *but* eligibility for public LTC support?". Note that the Regression Discontinuity approach offers a way to control for age-related differences in the unobserved preferences for LTC, provided they do not vary discontinuously at age 60.

The approach adopted in Chapter 1 implies two things. First, detecting an effect of the age 60 threshold is a *sufficient condition* for age-related horizontal inequity in the use of care, not a necessary one. Second, I do not have to classify the determinants of LTC use into needs *versus* non-need factors.

I believe the reader has now all the relevant elements at hand to grasp the contributions brought by my four empirical analyses and how they connect with each other.

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Chapter 1

Being *dependent* rather than *handicapped* in France: Does the institutional barrier at 60 affect care arrangements?

Summary of the chapter

Individuals having difficulties to perform the activities of daily living may benefit from public long-term care (LTC) support. France distinguishes between *handicap* benefits, accessible to individuals below 60, and *dependence* schemes, for individuals aged 60 and older. This paper assesses the effects of the age 60 threshold in the French LTC policies using the French Health and Disability Survey (HS 2008–2009) in two ways. First, we estimate the effect of being 60 and older on the probability to receive non-medical formal care and informal home care, controlling for a rich set of socio-demographic characteristics and age effects. Being a "dependent elderly" rather than a "handicapped adult" little affects the probability to receive home care; however, it increases formal care utilization and, to a lesser extent, decreases the probability to receive informal care. Second, we implement a Regression Discontinuity (RD) approach and provide evidence that the institutional age threshold affects living arrangements, as individuals above age 60 are more likely to be recorded as living in an institution. The architecture of LTC policies affects the way individuals' day-to-day difficulties are being compensated, thereby undermining horizontal equity in the use of formal LTC.

Classification

Acknowledgments for this chapter

Publication relating to this chapter

A first set of results from this Chapter was published as:

Tenand M. "La barrière des 60 ans dans les dispositifs de compensation des incapacités : quels effets sur les aides reçues à domicile par les populations handicapée et dépendante ?", *Revue française des affaires sociales*, October–December 2016, 2016/4, pp. 129–155.

A description of how this Chapter relates to the publication is provided in Appendix 1.G.

Contents of the Chapter

1 Introduction

In France, about 12% of the adult population has difficulties to perform one or more activities of daily living, due to physical or cognitive limitations (Drees, 2008b). Developed countries have implemented public transfers and specific regulation aiming at compensating such difficulties. Besides accessibility obligations and the provision of income replacement for those who cannot work because of their disability, most countries offer cash or in-kind transfers to help individuals paying for the assistance in daily life required on a long-term basis. In economic terms, these long-term care (LTC) programs aim at covering part of the *expenditure costs* of disability, which can be loosely defined as the extra expenditures incurred by a disabled person to reach the situation of an individual similar in all regards but with no disability (Stapleton *et al.*, 2008).

About 1.9 million individuals (3.6% of the adult population) benefited from public LTC benefits in France in 2014, for a public spending of 18 billion euros, or 0.6% of GDP (Amar *et al.*, 2016; Amar, 2016; Drees, 2016b).[1] One remarkable feature of the French LTC policies is that the schemes vary with the age of individuals. A person aged less than 60 with restrictions in the activities of daily living will be considered as "handicapped", while she will be classified as a "dependent elderly" if she is 60 and older. The administrative threshold of age 60 creates two groups for public action: belonging to one population rather than to the other has consequences upon eligibility to LTC subsidies and their generosity.

In 2005, a law was passed[2] in response to the new conception of disability endorsed by the World Health Organization[3] and to the numerous voices calling for a universal right to disability compensation (Bonnet, 2004; Frinault, 2005). The 2005 law announced the convergence of handicap and dependence schemes. Unification has not been implemented so far, partly because of the public finance crisis; nonetheless, the law has reinforced the debate around the "barrier of age 60" (Weber, 2011). Little is known though about the effects it induces. Because of lack of appropriate data, few quantitative studies include both the "handicapped adults" and the "elderly dependent". Yet, in order to assess the fairness of the system and calibrate a possible reform, it is necessary to evaluate whether current schemes cause an "elderly dependent" to be compensated differently from a "handicapped adult" with similar needs.[4]

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[1]This figure does not take into account the transfers or in-kind care provided to children. It includes public spending covering either disability compensation or the boarding and lodging costs for individuals residing in an institution. It does not include nursing services provided in the community nor medical care provided in institution.

[2]*Loi 2005-102 du 11 février 2005 pour l'égalité des droits et des chances, la participation et la citoyenneté des personnes handicapées, JORF du 12 février 2005.*

[3]The International Classification of Functioning, Disability and Health, or ICF, was officially adopted in 2001 (WHO, 2002). In particular, it states that disability compensation should not be based on age.

[4]Following the economic theories of responsibility, we may reject the consequentialist approach to disabil-

In this paper, we estimate the impact of the institutional threshold at age 60 on the LTC received by individuals with restrictions in the activities of daily living. What we aim at capturing is the effect of falling within a regime of social rights (dependence schemes) rather than within another (handicap policies), on the probability to use LTC. Our outcomes of interest include both formal care and informal care utilization. Indeed, the bulk of daily assistance to the disabled is provided under the form of human care, as opposed to technical assistance. Most LTC schemes subsidize professional care and disabled individuals often also receive the help of relatives, especially when they keep living in the community. In addition, informal care use may also benefit from some financial compensation in France and its provision may thus be directly affected by the age 60 threshold.

We use the 2008 French Disability and Health Survey on Households (HSM) to get a sample of 3,121 community-dwelling individuals aged 50 to 74 years-old with activity restrictions. A bivariate probit is used to take into account both the binary nature of our outcomes and the simultaneity of the decisions of formal home care utilization and informal care provision. We control for a rich set of socio-demographic and family characteristics that may affect home care use and include age effects.

We find that individuals who are considered to be "dependent elderly" have a higher probability to receive formal care, without changes in epidemiological conditions and in other factors influencing home care use fully explaining the observed pattern. Conversely, they have a lower probability to be provided assistance with the activities of daily living by their relatives, although this effect is less robust. Our results suggest that belonging to the policy perimeter of "dependence" policies increases access to professional home care services, which then partly substitutes for informal care provision. This pattern is consistent with evidence showing informal care and non-medical formal home care being substitutes (Bonsang, 2009; Van Houtven and Norton, 2004).

These effects hold conditional on living in the community. Complementing our data with a small dataset gathering community-dwelling and institutionalized individuals (N=12,784), we implement a sharp Regression Discontinuity Design strategy and find that the age 60 institutional threshold also affects the probability to live in an institution on a permanent basis.

Our paper contributes to the existing literature in three ways. First, it stands as the first quantitative evaluation of the age 60 threshold embedded in the French LTC design. It thus provides empirical elements currently missing in the debate around LTC policies, above and beyond the results of the two existing studies that documented the impact of LTC public support on home care use among either the dependent elderly (Fontaine, 2012) or the hand-

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ity, and imagine social justice criteria that would justify differential rights to compensation. To our knowledge, such criteria have not been put forward yet in the French debate; we thus consider here that compensating expenditure costs associated with handicap and dependence at different levels is *a priori* not a fair policy.

icapped (Espagnacq, 2013).

Second, we add to the recent studies of the impact of the architecture of social policies on care arrangements. By comparing the LTC policies in different countries, recent studies have shown that the design of LTC schemes not only influences formal care use, but also has an impact on the relationship between professional care and informal care provision (Motel-Klingebiel *et al.*, 2005; Bakx, de Meijer, Schut and van Doorslaer, 2015).

Third, our article contributes to the literature more specifically interested in the effects of home care subsidies on formal and informal care utilization. Overall, past studies have evidenced a substantial effect of home care programs on the use of professional care for community-dwelling disabled elderly (Christianson, 1988; Ettner, 1994; Pezzin *et al.*, 1996; Stabile *et al.*, 2006; Rapp *et al.*, 2011; Fontaine, 2012). Whether an increased use of formal care crowds-out informal care provision is less clear-cut, depending on the types of tasks that are considered and whether effects are investigated at the extensive or intensive margin. Given the substantial impacts institutional contexts were found to have on LTC arrangements, it is important to assess whether existing evidence is robust across time and countries. By exploiting variation in individual benefits due to an arbitrary institutional rule, we provide credible evidence that, in France, not only the use of home care but also living arrangements are sensitive to the design of LTC policies and the underlying financial incentives and characteristics of LTC services being supplied. Though in an indirect way, our results also confirm that professional care consumption is price-elastic, as demonstrated by Bourreau-Dubois, Gramain, Lim and Xing (2014); Hege (2016); Non (2017) and Roquebert and Tenand (2017) [Chapter 2 of this thesis].

The paper proceeds as follows: Section 2 provides an overview of the French LTC schemes for individuals living in the community. After presenting the data (Section 3), we explain our empirical strategy (Section 4) and present the set of results on home care use (Section 5). Section 6 discusses the interpretation of the results and assesses the impact of the age threshold on living arrangements. Section 7 concludes.

2   Institutional context

2.1   The age 60 barrier in the French LTC schemes

In France, national solidarity towards disabled individuals is part of the Welfare State, which provides tax- and contribution-funded LTC support. In 1975, a law gave the "disabled persons" an official recognition and created the first public scheme intended to help individuals getting assistance with the activities of daily living.[5] Although eligibility rules were

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[5] *Loi 75-534 du 30 juin 1975 d'orientation en faveur des handicapés, JORF du 1er juillet 1975.*

very restrictive, the *Allocation compensatrice pour tierce-personne* (ACTP) was the first institutional recognition of the needs of a regular human assistance induced by disability.

The 1970s and 1980s also witnessed the emergence of a medical conception of aging. The expression of "dependent elderly" was coined by geriatricians who argued that elderly individuals' physical and cognitive decline makes them essentially "dependent" on others (Delomier, 1973). Combined with growing concerns over population aging and the sustainability of the welfare system, this conception gave rise to the creation of a program specific to the elderly in 1997. Since then, the threshold of age 60, which was chosen in reference to the minimum retirement age at the time, has shaped LTC public schemes. As displayed in Figure 1.1, for individuals below 60, *handicap* policies apply, while individuals 60 and older may benefit from old-age and *dependence* schemes.[6]

Figure 1.1 – LTC schemes in France, for individuals living in the community: Age thresholds of ages 60 and 65.
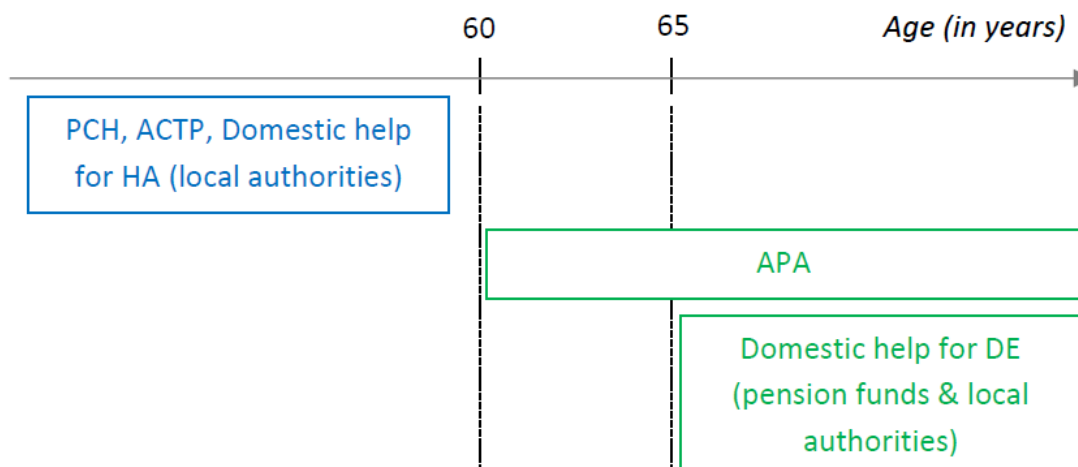
NOTES: "HA" stands for handicapped adults, "DE" stands for dependent elderly. Schemes listed in the blue box are accessible to handicapped adults, while schemes listed in the green box are open to the dependent elderly. The figure describes the schemes applying since the creation of PCH in 2006.

2.2   The existing at-home LTC schemes

Overview of the schemes

In the 2000s, both handicap and dependence schemes were reformed, so as to benefit more individuals. In 2002, the *Allocation personnalisée d'autonomie* (APA) was created as the new LTC scheme targeted to the elderly. Accessible to individuals with a certain severity

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[6]A more detailed history and institutional analysis of French LTC schemes can be found in Bonnet (2004); Frinault (2005); Ennuyer (2013); Capuano and Weber (2015); Capuano (2017*b*).

of disability, no matter their income, APA subsidizes home services that make possible for individuals aged 60 and older who live in the community to "age in place".[7]

In 2014, about 1,1 million individuals living in the community benefited from the LTC benefits managed by the departments. The majority of recipients (77%) are aged 60 and older. APA is the largest scheme, with 740,000 beneficiaries. About 240,000 individuals aged less than 60 received either PCH or ACTP (respectively 83% and 17%). As shown by Table 1.1, more public money is spent on the elderly than on the handicapped adults, but the average benefit of recipients under 60 is 50% higher. Of course, this is only weak evidence of differences in schemes' generosity.

Table 1.1 – LTC schemes: Spending and number of community-dwelling recipients in 2014.

	Total spending, in million euros over the year	**Number of recipients**	**Average benefit, per recipient**, in euros per month
LTC transfers for beneficiaries with age below 60	M€1,636	255,386	€562
LTC transfers for beneficiaries aged 60 and older	M€3,843	837,387	€382

SOURCE: Drees, *La protection sociale en France et en Europe en 2014* (Drees, 2016*b*).
NOTES: "M" stands for million. Figures do not include domestic help provided to the elderly by pension funds, nor specific transfers available to juveniles. Figures only include community-dwelling beneficiaries of LTC schemes and associated spending. In 2014, 9% of LTC beneficiaries aged 60+ benefit from *handicap* schemes given that their handicap was recognized before age 60.

Eligibility conditions

Eligibility is defined thanks to a standardized disability scale: combining the restrictions in the Activities of Daily Living (ADL) and in the Instrumental Activities of Daily Living (IADL),[8] the *AGGIR* scale defines 6 groups of dependence, 4 of which granting eligibility for APA. For each potential beneficiary, a personalized assessment of needs is organized at the house of the individual: a team made of nurses and social workers evaluates what types of activities the beneficiary requires assistance with and at what frequency.

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[7]The idea that dependent elderly should be "maintained at home" is a guideline of dependence policies in France as in most countries. This can be explained by budgetary reasons, but also because aging in place is the option that is generally preferred by individuals and their families (Colombo *et al.*, 2011). Nonetheless, in France public schemes exist also for individuals receiving institutional care, but they do not work the same. As we focus primarily on community-dwelling individuals, we describe only LTC schemes available to this population (they represent 60% of LTC policy beneficiaries in France).

[8]Conventionally, seven activities are listed as ADL: bathing or showering, personal hygiene and grooming, toilet hygiene, dressing, serving one's food and drink, self-feeding, getting in and out of the bed, sitting and getting up (Katz *et al.*, 1970). IADL correspond to the Instrumental Activities of Daily Living: they designate activities that are not essential to the survival of an individual but that need to be performed on a daily basis for an individual to live in the community (Lawton and Brody, 1969).

As to regard handicap schemes, in 2006 a new benefit, the *Prestation de compensation du handicap* (PCH), was created to progressively replace ACTP for individuals below age 60.[9] PCH works similarly to APA, but co-payment schedule and disability conditions for eligibility differ. Eligibility is granted if the individual cannot perform *at all* one or more of a list of 19 essential activities (physical mobility, personal care, administrative tasks, communication or basic social relationships), or when the person cannot perform *without major difficulties* two or more of these activities. The applicant must be aged less than 60, or show that her disabilities were anterior to her 60th birthday.

Departmental Councils, which are the entities in charge of LTC policies,[10] may also subsidizes means-tested domestic help to individuals aged less than 60 who did not get access to PCH, and to individuals aged 65 or over who could not obtain APA. Finally, pension funds may grant their retired affiliates aged 65 or more who do not meet the disability criteria to get access to APA with a subsidy on home care services.

Content of the schemes

APA can be used to finance housing adaptation or some technical assistance devices; the bulk of transfers (93% in 2014, Amar *et al.* (2016)) is however used to pay for professional home care services. This is also true for PCH, albeit specific credits, not fungible with those intended to human care subsidies, are open for technical assistance devices, housing adaptation, transportation or animal assistance. PCH-financed human care, which amounts to 92% of PCH spending (Amar *et al.*, 2016), is mainly provided by professional workers or, in some cases, by relatives, as APA and PCH can be used to financially compensate or even employ informal caregivers under restrictive conditions. Contrary to APA though, PCH cannot be used to pay for domestic help: PCH-financed professional caregivers must deliver personal care, monitoring or IADL support other than housekeeping.

Benefits and co-payments

When used to pay for professional care, all schemes except for ACTP work as an hourly subsidy on the price of care services: on each hour for which she is entitled to public support, the beneficiary must pay an out-of-pocket price that depends on the home care provider price and on the individual co-payment rate.[11] With APA, PCH and domestic help programs, beneficiaries are required to pay a financial participation equal to a certain share, set by a national co-payment schedule, of either the actual price charged by their care provider or a

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[9]ACTP has not been granted to new recipients since 2006, but still benefits surviving recipients.

[10]LTC schemes in France are not part of the social insurance system (*Sécurité sociale*), but are considered as social transfers. Although they are defined at the national level, they are organized at the departmental level (by *Conseils départementaux*).

[11]See Chapters 2 and 3 of this thesis for more information on the APA co-payment schedule.

lump-sum tariff.[12] In practice, the co-payment rate of PCH beneficiaries is zero except for those with high assets, while the co-payment rate set by APA varies from 0 to 90% depending on the beneficiary's income.

For APA, PCH and departments' or pension funds' domestic help, the maximum number of hours eligible for the subsidy is set at the moment of the needs assessment visit. For APA, the volume eligible to a subsidy must lay below the dependence group-specific ceiling, which is higher for individuals with more severe disability. Ceilings also apply for domestic help subsidized by pension funds and means-tested domestic help schemes financed by Departmental Councils. On the contrary, the pre-set ceiling for human care subsidized by PCH is not binding.

2.3   Comparing handicap and dependence schemes

We will not dig further into the differences between the schemes.[13] The three important points to bear in mind are: first, there exist public subsidies to foster home care utilization by individuals with ADL/IADL restrictions. Second, home care subsidies are not the same if you are 60 or over, or if you are under this age threshold. Third, an *a priori* assessment of the effects of this institutional distinction is hard to make, because of the many differences in eligibility rules, conditions, contents and ceilings.

As a consequence, deriving precise predictions on the relative advantages of handicap schemes over dependence policies is especially difficult to achieve for two main reasons. First, eligibility criteria in terms of disability are fairly different for APA and PCH and eligibility decisions are not processed by the same entities. Second, documenting the differences in the out-of-pocket price of care between an APA recipient and a PCH beneficiary is made difficult by the substantial leeway that Departmental Councils retain in defining the APA and PCH policy parameters, and by the local variations in the characteristics of home care supply. Nonetheless, we may tentatively predict two things: first, an elderly dependent is expected to get better access to domestic help than a handicapped adult, all other things being equal, given that PCH does not subsidize this type of care. On the contrary, the use of personal care and monitoring should benefit from higher subsidies with PCH than with APA, except for low-income individuals.

Rather than relying on ad hoc case studies, our paper proposes to use quantitative methods to assess whether LTC utilization is, overall, affected by the discontinuity of public policies at age 60. We will compare individuals with ADL or IADL restrictions, below and above

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[12]For PCH, lump-sum tariffs are used when beneficiaries receive care from an over-the-counter worker or from a home care structure that is not "authorized" (*prestataire agréé non autorisé*). These tariffs are defined at the national level. For APA, Departmental Councils are free to choose how they want to apply the co-payment schedule and to set their level of lump-sum tariffs.

[13]Further details can be found in Appendix 1.A.

age 60. Those individuals are not necessarily recipients of or even eligible for a subsidy. This way, we intend to capture the aggregation of different potential effects: the institutional difference between handicap and dependence policies may induce individuals 60 or older to be more likely to be eligible for and to claim home care subsidies (or the reverse); then, conditional on receiving the subsidy, belonging to one population rather to the other may induce differential care utilization because of differential generosity or content of the subsidy. Empirically, this will amount to estimating an Intention To Treat (ITT) effect.

3 Data and descriptive statistics

3.1 HSM survey

We first use the French Disability and Health Survey on Households (*Enquête Handicap–Santé–Ménages*, or HSM). The survey was conducted by the French National Institute of Statistics (Insee) and the Statistical Direction of the Ministry of Health and Social Affairs (Drees) in 2008, and is representative of the French population living in the community.[14] This dataset contains detailed information about the restrictions in the ADL/IADL experienced by the respondents and their socio-demographic characteristics and family setting. It also includes information about the nature of home care provided (informal or formal care, activities the individual is assisted with), as well as about caregivers.

Since the survey sample includes both individuals below age 60 and "elderly" respondents, it allows us to compare the care arrangements in the sub-populations on the two sides of the age 60 threshold.[15] Furthermore, individuals affected by disabilities and health problems were over-sampled in the survey design, enabling to work on handicap and dependence questions with reasonable sample sizes.[16]

3.2 Sample selection

Our population of interest includes all individuals that potentially require assistance to perform the tasks of everyday life. We drop individuals that can perform alone the entire set of ADL and IADL with no difficulties. We retain only individuals aged 50 to 74 to study what happens around the threshold of age 60. From an epidemiological point of view, the prevalence of functional limitations tends to increase for individuals in their fifties (Cambois

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[14]The institutionalized population (living in a nursing homes, handicap centers, rehabilitation centers and psychiatric hospitals) was the target of a companion survey, *Handicap–Santé–Institutions* (HSI, 2009).

[15]This is an important advantage of HSM over administrative datasets or elderly–specific surveys. As underlined by Colvez and Villebrun (2003), assessing the inconveniences of institutional age barriers cannot be done with administrative data that are collected on the beneficiaries of a given public transfer.

[16]HSM sample was drawn using the results of a preliminary survey, *Enquête Vie quotidienne et santé* (VQS). See Appendix 1.B for additional information on the sampling design and the implications for inference.

et al., 2013), but the prevalence of severe activity restrictions markedly increases only after age 80, when severe cognitive limitations come along severe difficulties to perform some basic physical activities (Dos Santos and Makdessi, 2010). We end up with a sample of 3,121 individuals.[17]

Individuals with ADL or IADL restrictions represent 10.9% of the 16.8 millions people living at home aged 50 to 74. Among individuals who are aged 50 to 60, the proportion of those with ADL or IADL restrictions is lower than 10%; this proportion rises steadily from 10% to 15% between age 60 and 65, and reaches 25% before just before age 75.

3.3 Formal and informal care use

Definition of outcomes

We focus on two types of home care: domestic help, personal care and other assistance with ADL/IADL provided by *professional workers* of the socio–medical sector, and care provided by *relatives.* HSM provides information on the types of tasks performed by all the caregivers declared by a respondent. We consider that an individual receives informal care if at least one of her relatives assists her with the activities of daily living. If the individual "only" gets material and financial help or psychological support from her family, we consider she does not receive informal care.[18]

Regarding professional care, it is important to distinguish between *cure* and *care*: an individual who has a temporary health problem may receive the frequent visits of medical and para-medical professionals (doctors, nurses, physiotherapists, etc.), and will be recorded in HSM as receiving professional care. However, this type of formal care does not relate to LTC schemes: in France, medical services are paid by public and private health insurances or out-of-pocket, and cannot be financed through home care programs.[19] Thus, an individual is said to receive formal *care* if she is assisted by a professional worker with ADL and IADL; she is considered as *not* receiving formal care if she receives *only* frequent *cure*,[20] without any informal or formal *care.*

The dataset contains also information on the frequency of caregivers' interventions and the average hours of care received by each formal or informal caregiver. However, volume of care is often missing for informal caregivers in the survey.[21] In order to retain in our sample

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[17]The initial sample of individuals aged 50 to 74 unable to perform alone at least one ADL or IADL was made of 3,132 individuals. We dropped 11 individuals for which some information was missing. See Appendix 1.B.

[18]On the other hand, (the few) relatives who are declared as paid caregivers are considered as providing *informal* care.

[19]In addition, nursing care and some personal care are provided to the disabled by nurses. Although they may be regarded as LTC, these services are considered as health care and paid by health insurances.

[20]For details on the way we defined "frequent cure", see Appendix 1.C.

[21]This is not a specific weakness of HSM: informal caregivers are often reluctant or simply unable to estimate the number of hours they spend assisting their relatives (Paraponaris *et al.*, 2012), and similarly individuals

those individuals co-residing with their spouse, parents, children or other relatives, who are often not responding to questions about volume of care provided, we chose to study informal care utilization at the extensive margin only. Both our informal care and formal care utilization variables are thus binary.

Home care utilization around the age 60 threshold

Figure 1.2 (Panel A) displays care utilization rates as estimated for the two sub-populations of interest. Predominance of informal care is visible in the two groups (about 60% of our population of interest is helped by relatives). This pattern is also observed in most other OECD countries (Fujisawa and Colombo, 2009). Yet the 50–59 year-old are less likely to receive any LTC, by about 7 percentage points. They more frequently receive the assistance of informal caregivers only (49% *versus* 42% for individuals 60 and older). On the contrary, they are much less likely to receive professional home care: while 31% of the 60–74 years old receive the assistance of a professional LTC worker at home, it is only the case of 18% of the individuals in the younger sub-population. A χ^2 test leads to reject that the distribution of LTC arrangements is the same in the two sub-populations ($p < 0.001$).

[Figure 1.2 to be found on the following page.]

Among those receiving professional home care, individuals aged 60 and older are less likely to have been receiving formal LTC for less than 5 years (40%, against 50%). Among those receiving informal assistance with the activities of daily living, individuals aged 60–74 are less likely to have been provided help for less than a year (4% against 8%) and more likely to have been helped for more than 5 years (65% against 60%). However, these figures take into account the financial help and psychological support that may be provided by relatives: assistance with ADL and IADL may be more recent. In addition, for both formal and informal care, we cannot reject that the conditional distribution of the age of assistance is the same in the two sub-populations.

The comparison of Panels B and C of Figure 1.2 shows that care arrangements are substantially different for women and men. Men and women are equally likely to receive professional and informal care before age 60; however, the utilization rate of professional care becomes much higher for women than for men after age 60 (35% versus 24%). Men are much more likely to be provided informal care without any professional home care, especially when they are 60 or more. Demographics may partly explain this pattern, as elderly

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who receive help from their relatives are not necessarily able or willing to "count". It is especially problematic for spouses and, more generally, co–residing relatives, for who the frontier between regular domestic work and assistance to a disabled relative may be blurred. For that reason, the designers of HSM survey filtered the questions asked about co–residing caregivers: for those relatives, frequency and volume of care are not asked.

women are less likely to have a partner at home or children (Gaymu *et al.*, 2008); yet gender differences in terms of caregiving implication are also likely to play a role.

These figures highlight the necessity to control for differences in the demographic and socio-economic composition of each subpopulation to identify the effect of LTC policies on care arrangements separately from that of other determinants of LTC policies; they also provide a rationale for investigating into potential differential effects by gender.

Figure 1.2 – Home care use among disabled individuals, population aged 50–74.
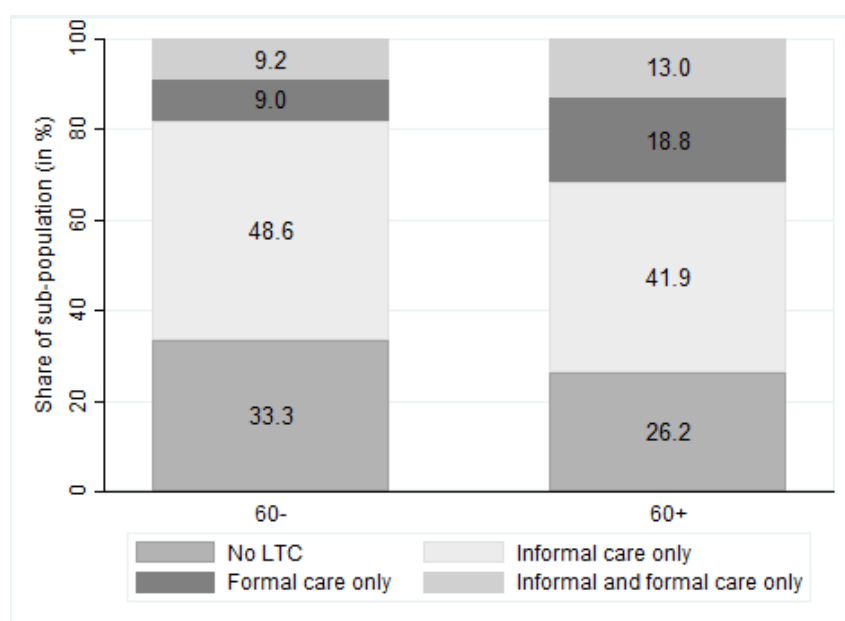
Panel A: Individuals aged 50–74.
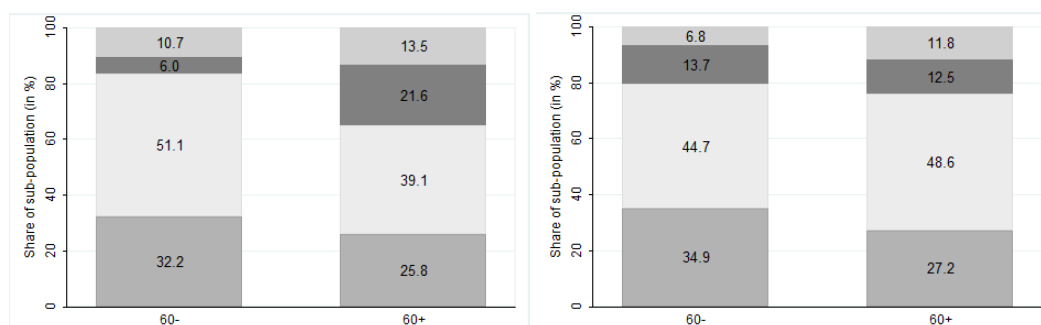
Panel B: Women aged 50–74.   *Panel C: Men aged 50–74.*

POPULATION: French population aged 50 to 74, having difficulties to perform alone one or more ADL or IADL and living in the community (N=3,121 individuals). Statistics are computed using survey weights.
SOURCE: Insee–Drees, HSM 2008.

To get a more precise idea of how LTC utilization evolves around the age 60 threshold, Figures 1.3 to 1.5 display population-average LTC utilization rates by civil age. On each graph, we add two fitted lines to capture an age trend in LTC utilization: to allow this trend to differ before and after the age 60 threshold, we regress LTC utilization first on individuals below age 60 and second on individuals above age 60.[22]

The probability to receive home care, either formal or informal, tends to increase with age. However, there seems to be a break in the trend at age 60 in all Figures. In addition, we notice a "negative jump" at 60 in the probability to receive informal care (Figure 1.4, Panel A): although the probability to receive assistance from relatives increases with age, individuals just above the age 60 threshold are less likely to receive informal care than individuals just below the threshold. We do not observe a positive jump in the probability to receive formal home care at age 60 (Figure 1.4, Panel B).

[Figures 1.4 and 1.5 to be found on pages 71 to 73]

Figure 1.3 – Care utilization around the discontinuity: Proportion of individuals receiving some home care (formal or informal).
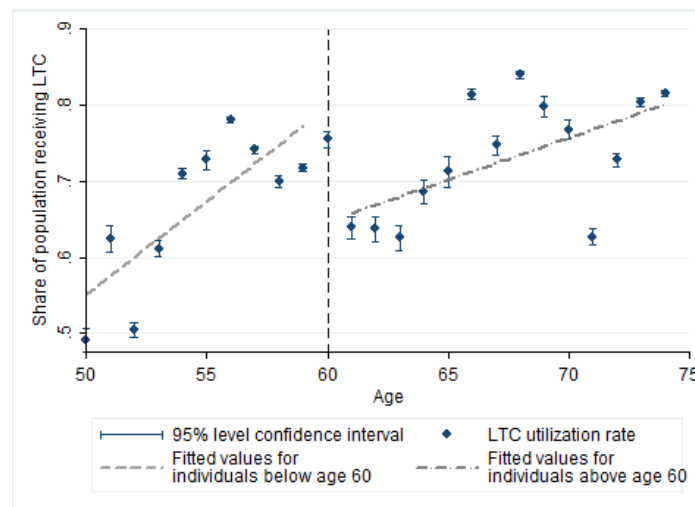
SAMPLE: French population aged 50 to 74, having difficulties to perform alone one or more ADL or IADL and living in the community (N=3,121 individuals).
NOTES: Dots represent average care utilization rate by civil age and include varying numbers of individuals. Linear trends in age are fitted using individual observations (either below or above age 60) and survey weights.
SOURCE: Insee–Drees, HSM 2008.

Systematic differences in population-average LTC utilization rates by age should be interpreted with caution: they may hide systematic differences in the individual determinants of LTC utilization across the age distribution.

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[22]The fitted lines are obtained by taking into account survey weights. We exclude age 60 when fitting the line on individuals 60^+, to account for the possibility that effective access to dependence schemes may take some time.

Figure 1.4 – Care utilization around the discontinuity: Proportion of individuals receiving informal or formal home care.

Panel A (top): Share of individuals receiving informal care.
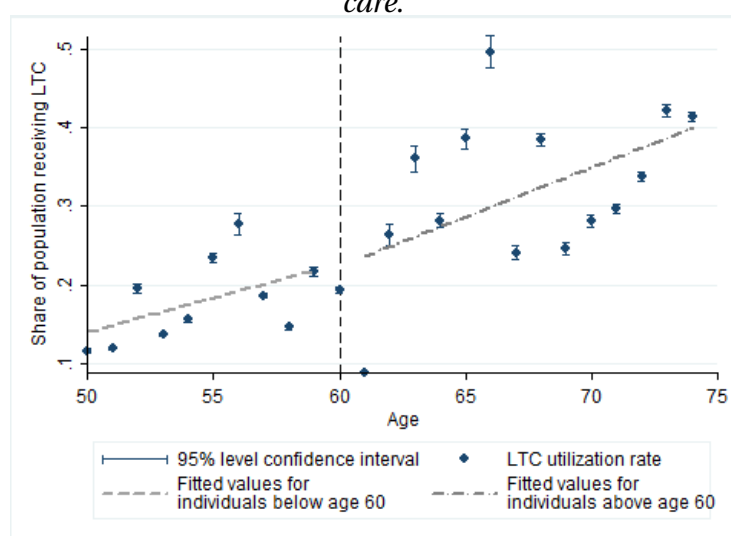
Panel B (bottom): Share of individuals receiving formal care.

NOTES: SAMPLE: French population aged 50 to 74, having difficulties to perform alone one or more ADL or IADL and living in the community (N = 3,121 individuals).
NOTES: Dots represent average care utilization rate by civil age and include varying numbers of individuals. Linear trends in age are fitted using individual observations (either below or above age 60) and survey weights.
SOURCE: Insee–Drees, HSM 2008.

Figure 1.5 – Care utilization around the discontinuity: Proportion of individuals receiving both formal and informal home care.
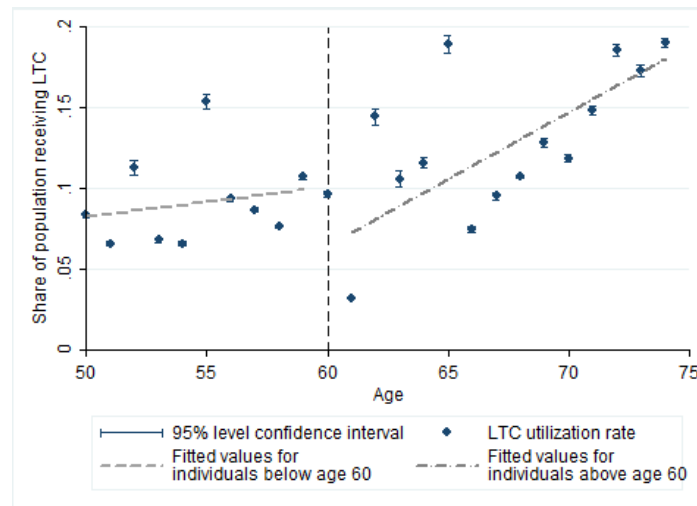
SAMPLE: French population aged 50 to 74, having difficulties to perform alone one or more ADL or IADL and living in the community (N = 3,121 individuals).
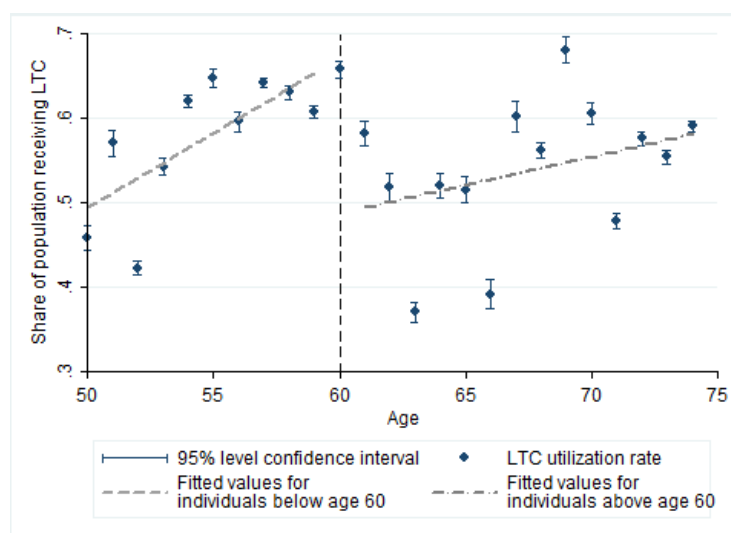NOTES: Dots represent average care utilization rate by civil age and include varying numbers of individuals. Linear trends in age are fitted using individual observations (either below or above age 60) and survey weights.
SOURCE: Insee–Drees, HSM 2008.

3.4 Socio-demographic and family characteristics

HSM provides a rich set of individual characteristics likely to correlate with both age and care settings. Based on previous literature, the covariates we retain are of three types: health and disability variables, socio-demographic characteristics (including gender) and family resources.

Severity of disability is likely to affect the demand for paid home care services and the propensity of relatives to provide some assistance. We compute a dummy equal to 1 if the individual has ADL restrictions, the number of ADL and the number of IADL the individual has difficulties to perform alone. More precisely, following Arnault (2015), we distinguish between non-cognitive and cognitive IADL and compute two separate indexes. Are considered as "cognitive IADL" using a telephone, completing routine administrative processes, taking medication[23] and finding route. This allows to control more accurately for differences in the type of disabilities on both sides of the age 60 threshold, as Dos Santos and Makdessi (2010) have shown that severe cognitive limitations are rare before 60 but becomes much more frequent for individuals aged 60 to 79.

Although the various ADL and IADL may not induce the same need for compensation, the total numbers of restrictions in ADL and of restrictions in IADL is likely to provide a good indicator of the severity of an individual's disability.[24] To better account for potential heterogeneity in care needs, we control also for physical, sensory and cognitive functional limitations (Cambois and Robine, 2003). Lastly, we include a dummy equal to 1 if the individual has absolute restrictions in one of the 3 "essential" ADL: feeding oneself when the food is ready, going to the restroom, and sitting and getting up. As shown by epidemiological longitudinal studies, these ADLs tend to be chronologically the last ones to be affected in the disablement process (Edjolo et al., 2016). They induce an intensive demand for LTC services. We additionally take into account the self-assessed health status, coded in three levels and a dummy for having declared any chronic condition.

A second range of individual characteristics include the level of education and the monthly household income per consumption unit, as well as dummies for retirement and employment status. To take into account potential differences in the local supply of professional home care services, area of residence is included, coded in 5 categories.[25] As

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[23]Barberger-Gateau et al. (1993) find that these 3 IADLs are strong predictors of one-year incident dementia. The IADL "having difficulties in taking a means of transportation" is also a predictor but since such difficulties may also arise due to physical limitations, we exclude them from our index of cognitive limitations.

[24]We do not consider the possibility of the possible endogeneity of restrictions in ADL and IADL. As pointed out by Cambois and Robine (2003), restrictions in everyday life activities may arise because of a misappropriate compensation of functional limitations. Stabile et al. (2006); Rapp et al. (2011); Barnay and Juin (2016) find that increased availability of (publicly-financed) home care has a positive effect on the physical and mental health, which may in turn affect activity restrictions.

[25]These 5 categories are: living in a rural area, living in a urban area with less than 20,000 inhabitants, living

handicap and dependence policies are implemented at the local level in France, we include a dummy for each department (*département*).[26] We also include a dummy for living oversea, as public schemes and the organization of professional LTC, as well as family and social norms, may differ from the situation in metropolitan France.

We then include some family characteristics that reflect the presence of potential care-givers and could explain differences in home care utilization. Having children is expected to increase the likelihood of receiving informal care; so is the proportion of daughters, as girls are more likely to assist their parents with day-to-day the activities (Horowitz, 1985; Bonnet *et al.*, 2013).[27] We also control for the fact of having any siblings alive, and we add a dummy equal to one if individual has at least one sister. Having a partner alive may increase informal care utilization while decreasing formal home care utilization.

Table 1.2 presents summary statistics on the individual and family characteristics of the two sub-populations of interest. Among the 60+, we find a higher proportion of women than in the subgroup aged less than 60, which is consistent with the lower life expectancy of men. While functional limitations are barely more prevalent in the eldest sub-population, the number of IADL individuals have difficulty to perform increases with age. Surprisingly, the share of individuals with ADL restrictions is higher among individuals aged less than 60. To interpret this fact, remember that we retain in our sample only individuals with IADL and ADL restrictions (living in the community). The higher prevalence of ADL restrictions among the youngest group would certainly not hold in the general population. It is probably due to the fact that the individuals with more severe health conditions and disability levels are less likely to age in place or have a reduced life-expectancy.[28] As expected, the share of individuals with absolute restrictions in one of the 3 essential ADL is very low in our sam-

in a urban area with more than 20,000 inhabitants and less then 100,000, living in a urban area with more than 100,000 inhabitants but not in Paris, living in Paris.

[26]Field observations (Billaud *et al.*, 2012) and a quantitative survey on local governments (*Enquête Territoire*, LEDa-LEGOS and CES (2012)) surveyed French metropolitan *Conseils départementaux* in 2012 to collect information on the implementation of the APA policy on their territory. These studies have shown that access to APA, evaluation of needs and computation of the co-payment vary from one department to the other. Although the main parameters of the APA subsidy are defined at the national level, local governments retain substantial leeway in its attribution and calculus, affecting the insurance and distributive properties of the policy (Bourreau-Dubois and Gramain, 2014; Bourreau-Dubois *et al.*, 2015). Similarly, practices of assessment and complementary fundings for PCH may vary from a department to another. Moreover, regulation of home care services is also organized at the local level, and local authorities' decisions have a direct influence on the price level of the available services (Hege *et al.*, 2014). As a consequence, department of residence is likely not only to influence formal home care utilization, but also to affect the effective differences between handicap and dependence schemes.

[27]Note that the gender of children may not play at the extensive margin: Fontaine (2010) shows that daughters provide on average more hours of care to their elderly parents, but represent just a little more than half of caregivers. Our definition of assistance in the activities of daily living include punctual help with home improvements and administrative tasks that sons are more likely to perform, while daughters provide more personal care and regular domestic work (Pennec, 2009).

[28]Given that our data are cross-sectional, this counter-intuitive pattern may also reflect the lower mortality from chronic conditions and disabling diseases observed in younger generations due to medical progress.

ple: most individuals with such a low functional status are supposedly living in a specialized institution.

Education levels reflect generational effects: the French born in the 1950s were more likely to complete primary and secondary education than those born ten or fifteen years earlier. Income distribution is more concentrated among the 60–74 years-old: this is consistent with the fact that most individuals after 60 receive pension benefits, which are less unequally distributed than salaries and social allowances in the active age population (Insee *et al.*, 2013).[29] No marked difference shows up in the area of residence — except for the fact that oversea departments tend to be older.

In terms of family characteristics, the two sub-populations are similar: about 2/3 of individuals have a partner alive, and more than 85% have at least a child alive. Individuals who are less than 60 have yet a higher probability to have brothers and sisters alive.

[Table 1.2 to be found on the following page]

3.5 Individual information on LTC benefits

One shortcoming of HSM is that information on LTC benefits is of poor quality. Considering the entire population of individuals aged 60 and older, the number of individuals reporting APA benefit is estimated to be 330,000, twice less than what administrative records show. Underreporting of PCH benefits is also observed, while the survey indicates slightly more ACTP beneficiaries than administrative records do (Appendix 1.A). As we may not exclude that the institutional threshold at age 60 also affects the probability to misreport LTC benefits, we will not attempt to relate self-reported declaration of LTC benefits with LTC utilization.

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[29]Educational attainment and income may also have been influenced by individual disability, especially in the 50–59 years-old group, for which disability is more likely to have affected the labor market participation.

Table 1.2 – Population descriptive statistics.

	Individuals less than 60 [1]	Individuals 60 and older [2]	Difference $60^+ - 60^-$ [3]
Average age	54.7	67.7	+12.9***
Woman	61.2%	70.1%	+8.9***
Self-declared health status			
Health status: bad	55.6%	51.1%	-4.5$^{n.s.}$
Health status: average	30.2%	35.8%	+5.6*
Health status: good	14.1%	13.2%	-0.9$^{n.s.}$
Has a chronic condition	87.4%	89.5%	+2.1$^{n.s.}$
Functional limitations and activity restrictions			
Has physical functional limitations	81.3%	87.0%	+5.7*
Has sensory functional limitations	46.6%	49.4%	+2.8$^{n.s.}$
Has cognitive functional limitations	51.2%	54.1%	+2.9$^{n.s.}$
Has ADL restrictions	37.2%	32.7%	-4.5*
Has absolute restrictions in 1 of the 3 key ADLs	2.6%	3.1%	+0.5$^{n.s.}$
Average number of non-cognitive IADL	1.9	2.3	+0.3***
Average number of cognitive IADL	0.6	0.7	+0.1**
Average number of ADL restrictions	0.9	0.8	-0.1$^{n.s.}$
Education level			
No degree	34.0%	37.2%	+3.2$^{n.s.}$
Primary education degree	21.7%	32.9%	+11.2***
Secondary education degree	37.7%	21.4%	-16.3***
College or university degree	6.6%	8.4%	+1.8$^{n.s.}$
Monthly household income (per c.u.)			
Income quartile 1 (poorest)	24.9%	18.5%	-6.4**
Income quartile 2	20.9%	28.3%	+7.4***
Income quartile 3	23.6%	26.4%	-2.8$^{n.s.}$
Income quartile 4 (richest)	30.4%	26.8%	-3.6$^{n.s.}$
Work status			
Is employed	25.9%	2.8%	-23.1***
Is retired	5.7%	84.0%	+78.2***
Area of residence			
Lives in a rural area	25.0%	23.9%	-0.1$^{n.s.}$
Lives in a small urban area	18.7%	17.9%	-0.8$^{n.s.}$
Lives in a medium urban area	12.4%	14.7%	+2.3$^{n.s.}$
Lives in a large urban area	30.4%	30.5%	0.1$^{n.s.}$
Lives in Paris	13.5%	13.1%	-0.4$^{n.s.}$
Lives oversea	2.7%	3.6%	+0.9$^{n.s.}$
Family characteristics			
Has a partner	65.4%	61.8%	-3.5$^{n.s.}$
Has at least a child alive	85.6%	86.6%	+1.0$^{n.s.}$
Number of children	2.3	2.5	+0.2$^{n.s.}$
Proportion of girls	40.7%	42.4%	+1.6$^{n.s.}$
Has any brother or sister alive	91.8%	80.4%	-11.4***
Has a sister alive	76.2%	65.1%	-11.0***
N (sample)	1,393	1,728	-

NOTES: For statistics displayed in percentages in Columns [1] and [2], the differences in Column [3] are expressed in percentage points. Statistics computed on the baseline sample (3,121 individuals), using survey weights. $^{n.s.}$ p≥0.10, * p<0.10, ** p<0.05, *** p<0.01. The Student test of differences between the two sub-populations takes into account the sampling design.

4 Empirical strategy

4.1 Empirical specification

Home care utilization

As a starting point, we disregard the distinction between formal and informal care. We define Y_i^* a continuous variable of home care use for individual i, including both professional care and the care provided by relatives. We assume that Y_i^* is a linear function of some individual characteristics Z_i, of the institutional environment and of an idiosyncratic factor u_i, according to the following Equation:

$$Y_i^* = \alpha + \beta.60_i^+ + Z_i'\theta + u_i \tag{1.1}$$

where 60_i^+ is a dummy equal to one if individual i is aged 60 and older and α is a constant. Conditional on an unconfoundedness assumption and the model being well-specified, coefficient β in Equation (1.1) captures the impact of belonging to the perimeter of dependence policies rather than of handicap schemes. If β were positive, this would mean that the institutional barrier in LTC policies causes the dependent elderly to be more likely to receive home care than the handicapped adults.

Formal and informal care utilization

If informal care utilization and formal care consumption result from simultaneous decisions,[30] estimating Equation (1.1) by a Probit with formal (alternatively, informal) care utilization as the dependent variable will give incorrect standard errors. To achieve correct inference given our nonlinear econometric model, it is necessary to estimate the impact of the institutional age threshold on formal and informal care utilization in a simultaneous equation setting. We estimate the following model:[31]

$$\begin{cases} Y_I^* = \alpha_I + \beta_I.60^+ + Z'\theta_I + u_I \\ Y_F^* = \alpha_F + \beta_F.60^+ + Z'\theta_F + u_F \end{cases} \tag{1.2}$$

Coefficients have the same interpretation as in Equation (1.1) but are now equation-

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[30]To model the provision of informal care and professional care services utilization, previous literature has made use of family decision models, with two different conceptual choices: either a unique family utility function is assumed (Stern, 1995; Stabile *et al.*, 2006); or it is supposed that the disabled individual and her relatives have different, potentially diverging preferences (Pezzin and Schone, 1999; Van Houtven and Norton, 2004; Bolin *et al.*, 2008). The second approach has been shown to be more consistent with empirical observations (Pezzin and Schone, 1999).

[31]We drop the subscript i to make notations easier.

specific; they are thus indexed by I (respectively by F) in the equation of determination of informal (resp. formal) care utilization. The coefficient of correlation between the error terms u_I and u_F, denoted ρ, can differ from zero: unobserved determinants of informal care and formal care use may correlate.

4.2 Identification assumption

For our estimate of β (resp. β_j, $j = $ I, F) to be consistent, we have to assume that $E[u|Z, 60^+]$ (resp. $E[u_j|Z, 60^+]$, $j = $ I, F) is constant. This is the most standard assumption of unconfoundedness: it imposes that there is no endogeneity bias, no reverse causality and no omitted variable.

Concerns about endogeneity and reverse causality of our dummy of interst, 60^+, are easy to dimiss, as civil age is arguably exogenous. Omitted variable bias is a more serious threat to identification here. In the set of covariates Z, we include the individual characteristics presented in Table 1.2 as well as departmental fixed effects.

We may yet wonder whether there are some unobserved determinants of LTC use correlating with age. Household wealth and housing assets, for example, are not observed, while they correlate with age in the general population (Insee, 2016). Preferences for LTC may also vary with age or be generational. To decrease the risk of omitted variable bias, we allow LTC use to depend on age independently from the institutional age threshold in LTC schemes. Empirically, we include age effects, through a linear trend in our baseline specifications. To give more flexibility to the model, we allow the trend in age to be different before and after the threshold of age 60. In practical terms, the set of covariates Z_i we include in the model writes as:

$$Z_i = \left((Age_i - 60), 60_i^+ .(Age_i - 60), X_i \right)$$

where X_i is the set of covariates other than age. If LTC use truly depends on age (in a linear way) conditional on the observable characteristics X_i, our specification will ensure that we do not confound the effect of the institutional threshold at age 60 with that of age itself.

4.3 Estimation method

Observational scheme

Since our variables of formal and informal care use are binary, we have the following observational scheme, for $y = Y, Y_I, Y_F$:

$$y = \begin{cases} 1 & \text{if} \quad y^* > 0 \\ 0 & \text{else} \end{cases}$$

We estimate Equation (1.1) by Maximum Likelihood running a univariate probit, assuming u follows a normal distribution with zero conditional mean. Similarly, System (1.2) is estimated by a bivariate probit, with the assumption that $(u_\mathrm{I}, u_\mathrm{F})$ follows a bivariate normal distribution. To ease the interpretation of results, we provide the average partial effects rather than the raw coefficients from the Probit.

Unweighted *versus* weighted regressions

The debate about the role of sampling weights in uncovering causal relationships is a longstanding one (Angrist and Pischke, 2009) and is all the more relevant here as the cross–sectional variation in survey weights in HSM is high. When the theoretical grounds for running weighted regressions are not clearly applying, Solon *et al.* (2015) advise to report both weighted and unweighted estimates and discuss their potential differences.[32] In all specifications we have tested, standard errors are extremely high when we take into account the survey sampling design; this may reflect the unaccounted for clustered structure of the error terms (Dickens, 1990). In particular, clustering on age, as we believe is warranted given our model, cannot be achieved when we take into account the weights and the stratified structure of the sample.[33] We thus choose to report only estimates from the unweighted regressions, bearing in mind that they are consistent only if there is no unmodeled heterogeneity. When deriving the average partial or marginal effects, we plug back in the survey weights, in order to obtain the *population* average effects and not the *sample* average effects.

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[32] Solon *et al.* (2015) discusses three reasons why an applied economist would run weighted regressions. First, weights may allow to correct for heteroscedasticity; in practice yet, the increase in precision thereby achieved highly depends on the structure of the error term. Second, weights may correct for endogenous sampling — an issue that we do not face while using HSM data. Finally, in the case of heterogeneous effects, weighted regression may help to identify unbiased average partial effects. In the general case though, it will not make up for not modeling adequately heterogeneity of effects.

[33] In Stata, we add the prefix `svy` to the `probit` or `biprobit` regression commands; the prefix does not support the option `vce(cluster varname)`.

5 Results

5.1 Baseline results

Table 1.3 presents the results from univariate probit estimations of Equation (1.1).[34] Specification (1) regresses the probability of receiving any care (be it informal or formal care) on the dummy "being 60 and older" and all covariates but age. The coefficient is positive and significantly different from zero at the 5% level. When adding a linear age trend, in Column (2), the coefficient decreases and statistical significance vanishes. We find a similar result when allowing the age trend in LTC utilization to be different before and after age 60 (Column (3)).

Table 1.3 – Home care utilization: Estimation results.

	(1)	(2)	(3)	(4)	(5)	(6)
			Outcome: $P(Y=1)$			
60^+	0.033**	0.003	0.015	0.030*	-0.008	-0.001
	(0.015)	(0.020)	(0.019)	(0.015)	(0.021)	(0.018)
(Age - 60)		0.003	-0.002		0.003	-0.002
		(0.002)	(0.003)		(0.002)	(0.003)
60^+.(Age - 60)			0.006*			0.007*
			(0.004)			(0.004)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Sample (ages included)	50–74	50–74	50–74	50–74 w/o age 60	50–74 w/o age 60	50–74 w/o age 60
Observations	3100	3100	3100	2964	2964	2964
Clusters	25	25	25	24	24	24
AIC	2434.0	2432.3	2430.3	2309.9	2308.1	2305.6
BIC	2579.0	2577.3	2575.3	2447.8	2445.9	2443.4

NOTES: Standard errors in parentheses, clustered on age; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.01$. Population-average partial effects (APE) for binary variables are computed using the finite-difference method. Average marginal effects (AME) for continuous variables are computed using the delta method. Unweighted estimations by a Probit model, data from HSM 2008. Specifications include department fixed effects. 21 individuals had to be withdrawn from the baseline sample, as no within–department variations in the outcome variable was observed for these observations.

Akaike's information criterion (AIC) and Bayesian information criterion (BIC) are reported (Akaike, 1998; Schwarz, 1978). Both AIC and BIC indicate that the best fit of the

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[34]The sample used in estimations of Table 1.3 is slightly smaller than our baseline sample: it contains 3,100 individuals instead of 3,121. This is because within a few departments, either all observations are receiving care, or all individuals receive no assistance at home. Such a pattern is mainly due to the sampling design of the survey: in order to minimize collection costs, not all the departments were equally intensively surveyed. As this technical selection appears to be essentially random, we chose to run our estimations on the entire sample of 3,121 individuals when estimating System (1.2) to maximize the precision of our results, and to use the sub-sample of 3,100 individuals when estimating Equation (1.1).

model to the data is obtained when an age effect is included with different slopes on both sides of the discontinuity (Column (3)).[35] This is our preferred specification.[36]

Columns (4) to (6) of Table 1.3 replicates Columns (1) to (3) on the sample excluding individuals who are aged 60 at the time of the survey. Applying for and being granted LTC benefits may take time: time to get aware of one's eligibility to the program, time to gather information and prepare an application, and time for the administration to process the application and implement the transfer or subsidy.[37] The effects of the change in accessible public schemes may not be detectable when individuals turn 60, but only later on. We thus check the robustness of our results to the exclusion of those individuals who are located just at the institutional discontinuity. The results are qualitatively similar: when we do not control by age itself, being 60 or more is associated with a higher probability to receive home care, but this effect vanishes when we control (linearly) for age.

Given the very small and statistically non-significant coefficient we find for the 60^+ dummy, we cannot reject that the age threshold in LTC policies has no effect on the probability of receiving some home care.

We now turn to the estimation of the bivariate model of Equation (1.2). Specifications (1) to (3) of Table 1.4 are similar to the first three specifications of Table 1.3, but we consider now several outcomes: we estimate the effect of being considered a dependent elderly rather than a handicapped adult on (i) the probability to receive informal care, (ii) the probability to use formal care, and (iii) the probability of joint utilization.

As shown by Column (1), if we do not control by age itself, the model suggests that being a dependent elderly rather than a handicapped adult is associated with a lower probability to receive informal care and a — much — higher probability to receive formal home care. The magnitude of the effect on professional care is high (+11pp.) given that the population-average utilization rate of formal care is about 25%.

However, when we include age trends in LTC utilization, the point estimates decrease in absolute value and statistical precision diminishes. In our favorite specification (Column (3)), we find that being a dependent elderly rather than a handicapped adult is associated

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[35]As these information criteria relates negatively to the log-likelihood, a smaller AIC (alternatively, a smaller BIC) points out to a better model. These statistics balance the gain in likelihood with the increase in the number of parameters to be estimated: when an additional control adds very little in terms of likelihood, AIC and BIC decrease. By construction, AIC gives less penalty to additional controls.

[36]We have also tested specifications including quadratic and cubic age effects. The fit of the model increases only slightly when we include higher order polynomial terms in age. The coefficient of the 60^+ dummy remains positive but practically negligible. Statistical precision decreases dramatically, as age polynomials strongly correlate with the 60^+ dummy.

[37]In the case of APA, field observations show that several months may go by between the date an individual sends her application file and the moment she eventually receives notification of acceptance.

Table 1.4 – Informal care and formal care utilization: Estimation results.

| Outcomes | Average partial effect of being 60^+ | | | |
	(1)	(2)	(3)	(4)
$Pr(Y_I = 1)$	-0.054***	-0.036	-0.029	-0.046**
	(0.016)	(0.022)	(0.022)	(0.023)
$Pr(Y_F = 1)$	0.111***	0.037*	0.036*	0.037
	(0.020)	(0.021)	(0.020)	(0.027)
$Pr(Y_I = 1, Y_F = 1)$	0.043***	0.010	0.012	0.007
	(0.010)	(0.011)	(0.011)	(0.013)
ρ	-0.437***	-0.438***	-0.438***	-0.428***
	(-8.62)	(-8.39)	(-8.39)	(-8.02)
Age effects	None	Linear; common slope	Linear; different slopes	Linear; different slopes
Other controls	Yes	Yes	Yes	Yes
Sample (ages included)	50–74	50–74	50–74	50–74 w/o age 60
Observations	3121	3121	3121	2985
Clusters	25	25	25	24
AIC	5923.5	5901.1	5900.7	5635.0
BIC	6074.6	6052.3	6051.8	5779.0

NOTES: Standard errors in parentheses, clustered on age; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.01$. Population-average partial effects (APE) for binary variables are computed using finite-difference method. Unweighted estimations by a bivariate Probit model, data from HSM 2008. Specifications include department fixed effects.

with a 3.6pp. higher probability to use formal care (statistically significant at the 10% level). The point estimate suggests a negative effect on the probability to be provided informal assistance with the activities of daily living (−2.9pp.), but the effect is not statistically significant at conventional levels. When we exclude those individuals just at the discontinuity (aged 60 in 2008), in Column (4), the negative effect on the informal care utilization rate becomes statistically significant. Overall, our estimates suggests that being 60 and older would cause the probability of receiving help from professionals to increase and the odd to be assisted by relatives to decrease, leaving the utilization rate of home care unchanged.

The correlation between the error terms u_I and u_F, ρ, is estimated to be negative, highly significant in statistical terms and practically important. This implies that the unobserved factors that increase the propensity to use professional home care services are negatively correlated with those factors that increase the propensity to receive informal care.

5.2 Results on covariates

Overall, results obtained on covariates are consistent with previous works on the determinants of home care utilization. They are displayed in Tables 1.5 and 1.6.

[Tables 1.5 and 1.6 to be found on the following pages.]

Being a woman increases the propensity to use formal care, consistent with Katz *et al.* (2000). Declaring a good health status has, paradoxically, a positive effect on professional care utilization, but this effect holds for a given functional status. Having ADL restrictions seems to decrease formal care utilization, but the probability to receive some professional care increases with the number of ADLs affected. The effect is opposite for informal care utilization. Having cognitive limitations increases professional care utilization.

The area of residence has only limited effects on care utilization rates, possibly because much of the territorial variation in care provision patterns is absorbed by the departmental dummies. These dummies (not reported in results tables) are jointly significant, confirming the existence of inter-departmental differences. Having a tertiary education increases the use of formal care, which may reflect different social norms towards paid domestic help. Belonging to the top income quartile also has a strong and statistically significant effect on the probability to use formal care. Being employed has an effect on informal care utilization (5% level), maybe because of the time constraints it imposes on caregivers or because individuals who are working in spite of their disability are less able to rely on family solidarity.

Consistently with past literature, informal care provision is positively associated with having daughters or sisters (Bonsang, 2009; Horowitz, 1985), having a partner alive, or having a child or a parent co-residing. Interestingly, the effects of these same variables on the propensity to use formal care are usually of the opposite sign.

Table 1.5 – Informal care and formal care utilization as simultaneous decisions: Results on covariates (1/2)

	Average partial or marginal effects		
	Univariate Probit	Bivariate Probit	
Outcome:	Home care	Informal care	Formal care
	(1)	(2)	(3)
60^+	0.015	-0.029	0.036*
	(0.019)	(0.022)	(0.020)
Woman	0.007	0.008	0.051**
	(0.015)	(0.019)	(0.017)
Self-assessed health: bad	0.012	0.016	-0.014
	(0.013)	(0.019)	(0.020)
Self-assessed health: fair	Ref.	Ref.	Ref.
Self-assessed health: good	0.032	0.000	0.063**
	(0.026)	(0.034)	(0.030)
Has a chronic condition	0.043	0.057*	-0.004
	(0.033)	(0.033)	(0.029)
Has ADL restrictions	0.077**	0.118***	-0.028
	(0.027)	(0.028)	(0.022)
Has restrictions with most	-0.126	-0.072	0.135**
essential ADLs	(0.091)	(0.059)	(0.043)
Has physical functional limitations	0.053**	0.053*	0.017
	(0.027)	(0.028)	(0.029)
Has cognitive functional limitations	0.008	-0.018	0.043**
	(0.018)	(0.021)	(0.015)
Has sensory functional limitations	-0.028*	-0.004	-0.003
	(0.017)	(0.017)	(0.013)
Number of ADLs	-0.005	-0.015	0.007
restrictions	(0.012)	(0.010)	(0.006)
Number of non-cognitive IADLs	0.098***	0.077***	0.055***
restrictions	(0.007)	(0.006)	(0.005)
Number of cognitive IADLs	0.020**	0.015	0.002
restrictions	(0.008)	(0.012)	(0.009)
Lives in a rural area	-0.010	0.030	0.014
	(0.025)	(0.026)	(0.017)
Lives in a small urban area	-0.015	-0.013	-0.016
	(0.039)	(0.036)	(0.031)
Lives in a medium–size urban area	Ref.	Ref.	Ref.
Lives in a large urban area	-0.006	0.040	-0.044**
	(0.029)	(0.026)	(0.021)
Lives in the Paris region	-0.021	-0.058	0.059
	(0.092)	(0.103)	(0.078)

End of covariates in following table

Table 1.6 – Informal care and formal care utilization as simultaneous decisions: Results on covariates (2/2)

	Average partial or marginal effects		
	Univariate Probit	*Bivariate Probit*	
Outcome:	Home care	Informal care	Formal care
	(1)	(2)	(3)
Beginning of covariates in previous table			
Diploma: none	-0.005	0.010	-0.025
	(0.020)	(0.019)	(0.020)
Diploma: primary education	*Ref.*	*Ref.*	*Ref.*
Diploma: secondary education	-0.021	-0.013	0.021
	(0.023)	(0.025)	(0.023)
Diploma: higher education	0.067**	-0.034	0.160***
	(0.027)	(0.033)	(0.034)
Income quartile: 1st (poorest)	0.040*	0.023	0.001
	(0.022)	(0.019)	(0.018)
Income quartile: 2nd	*Ref.*	*Ref.*	*Ref.*
Income quartile: 3rd	0.004	0.020	-0.005
	(0.014)	(0.014)	(0.015)
Income quartile: 4th (richest)	0.050**	0.012	0.090***
	(0.021)	(0.022)	(0.017)
Works	-0.031	-0.045	-0.032
	(0.034)	(0.035)	(0.030)
Has a partner	0.110***	0.244***	-0.147***
	(0.021)	(0.018)	(0.011)
Has children alive	-0.092***	-0.055**	-0.036
	(0.020)	(0.025)	(0.027)
Number of children alive	0.011**	0.018**	-0.006
	(0.005)	(0.006)	(0.006)
Proportion of daughters among children	0.000	0.048**	-0.062***
	(0.022)	(0.023)	(0.018)
Has any brother or sister	-0.013	0.009	-0.007
	(0.028)	(0.029)	(0.026)
Has a sister alive	0.016	0.057**	-0.034*
	(0.025)	(0.024)	(0.019)
ρ	–	-0.438***	
		(-8.39)	
Age effects	Linear, different trends		
Observations	3121	3036	
Clusters	25	25	
AIC	2430.3	5900.7	
BIC	2575	6051.8	

NOTES: Standard errors in parentheses, clustered on age; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.01$. Average partial effects (APE) for binary variables are computed using finite-difference method. Average marginal effects (AME) for continuous variables are computed using delta method. Estimation by a univariate or bivariate Probit model, data from HSM 2008. The specification includes departmental fixed effects (F–test of joint significance: $p < 0.01$).

5.3   Heterogeneity analysis

We test whether the effects of the institutional age thresholds differ by gender and disability level. In Table 1.7, Column (1) replicates our preferred specification from the baseline univariate Probit and bivariate Probit estimations. Column (2) (resp. Column (3)) replicates the analysis on the sub-sample of women (resp. men). Column (4) (resp. Column (5)) run the same estimations on the sub-sample of individuals with ADL restrictions (resp. with no ADL restriction).[38]

[Table 1.7 to be found on the following page.]

Men are found to be more likely to receive some home care when they are dependent elderly (Panel A of Table 1.7, Column (3)). The probability to receive informal home care is about 6pp. higher for men when they are 60 and older; in addition, those are 7pp. more likely to be helped by professionals (Panel B). On the contrary, women seem much less affected by the age 60 threshold: the bivariate probit estimation (Panel B, Column (2)) suggests that being a dependent woman decreases the probability to receive informal home care relative to a handicapped woman, but the univariate probit does not find any significant effect of the age 60 threshold on the probability to receive any home care.[39]

When testing heterogeneity by disability level, we find that the probability to receive some assistance in the activities of daily living is higher for individuals aged 60 and older among the sub-population with ADL restrictions (i-e with severe disability) (Column (4), Panel A). The probabilities of receiving care from relatives and from professional caregivers increase substantially (+6pp and +8pp). On the contrary, among individuals with a more moderate disability level (IADL restrictions only), falling into the perimeter of dependence policies decreases the probability to receive professional assistance. These results suggest that becoming eligible for APA — as individuals with ADL restrictions are expected to be when they are 60 or more — increases the access to professional care for individuals with severe disability.

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[38]Running sub-sample estimations rather than adding an interaction term to the baseline specification induces a loss of statistical power. However, the inclusion of interaction terms in probit models raise estimation issues (Ai and Norton, 2003). In addition, running sub-sample regressions allows to better take into account potential heterogeneity in the effects of the covariates.

[39]Had we not controlled for age effects, our estimates might have captured generational effects — for example, a woman born in the 1930s may have been more reluctant to have a professional worker coming at her house than a woman born in the 1950s.

Table 1.7 – Informal care and formal care utilization:: Heterogeneity of effects by gender and disability level.

	Average partial effect of being 60^+				
	All	*Women*	*Men*	*ADL restrictions*	*No ADL restrictions*
	(1)	(2)	(3)	(4)	(5)
Panel A: Univariate probit estimation					
$Pr(Y_I = 1 \text{ or } Y_F = 1)$	0.015	-0.010	0.103**	0.094**	-0.032
	(0.019)	(0.025)	(0.035)	(0.029)	(0.031)
Observations	3100	1955	997	1145	1761
Clusters	25	25	25	25	25
AIC	2430.3	1540.3	777.5	620.5	1679.4
BIC	2575.3	1674.1	895.2	741.5	1810.8
Panel B: Bivariate probit estimation					
$Pr(Y_I = 1)$	-0.029	-0.075**	0.062**	0.063**	-0.091**
	(0.022)	(0.033)	(0.024)	(0.031)	(0.036)
$Pr(Y_F = 1)$	0.036*	0.027	0.071**	0.082**	-0.011
	(0.020)	(0.035)	(0.033)	(0.033)	(0.043)
$Pr(Y_I = 1, Y_F = 1)$	0.012	-0.008	0.050**	0.081**	-0.027
	(0.011)	(0.017)	(0.019)	(0.027)	(0.020)
Observations	3121	2001	1120	1337	1784
Clusters	25	25	25	25	25
AIC	5900.7	3806.2	1804.0	2149.2	3464.0
BIC	6051.8	3946.3	1929.5	2279.2	3601.2
Age effects	Linear, different slopes				
Other controls	Yes				

NOTES: Standard errors in parentheses, clustered on age; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.01$. Population-average partial effects (APE) for binary variables are computed using finite-difference method. Unweighted estimations by a univariate probit (Panel A) or a bivariate Probit model (Panel B), data from HSM 2008. Specifications include department fixed effects. The sample sizes of Columns (2) and (3) (resp. (4) and (5)) do not sum up to the size of the entire sample (Column (1)): in some sub-samples, there is no variation in the outcome variable within a department, due to the sampling design. Observations from those departments are dropped from the estimation.

6 Dicussion

6.1 Robustness of the identification strategy

As discussed in Section 4.2, we include linear controls for age on each side of the age 60 threshold to capture some unobservable trends in home care use that would correlate with age.

The idea behind the inclusion of age effects bears resemblance with the identification philosophy of the Regression Discontinuity Design (RDD) approach (Lee and Lemieux, 2010). As the institutional threshold at age 60 provides an exogenous source of variation in benefit coverage around that age, an RDD approach would offer the potential for an identification based on a quasi-experimental setting. Identification would rely on the relatively weak assumption that home care use is a smooth function of age, continuous at age 60. Using a parametric implementation (Lee *et al.*, 2004), we would be able to estimate the effect of the age 60 threshold by regressing our outcomes on the 60+ dummy while controlling for age through polynomial terms. In such a setting, the inclusion of control variables other than age would essentially affects statistical precision.

There are yet several reasons to doubt that an "authentic" RDD approach would, in our context, sustain the level of proof it normally ensures. Firstly, RDD identification is all the more credible as the number of observations near the threshold is high. Our survey data leave use with a relatively small sample size. In addition, the number of individuals in the sample who are at the right of age 60 is particularly low (Figure 1.D.1, Appendix 1.D).[40] To obtain sufficient statistical precision, we would need to include in the estimation sample individuals relatively far away from the threshold, thus increasing the risk of bias in the estimator of β (Imbens and Lemieux, 2008). Secondly, given that the treatment status is entirely determined by age, clustering on age is warranted. Low statistical precision is further accentuated by the fact that age is measured in years and not in months. Thirdly, RDD identification requires that no other institutional discontinuity potentially affecting the use of LTC takes place right at age 60. Individuals aged 60 in 2008 had their minimum retirement age precisely at age 60 and the probability to retire in the general population exhibits a spike at this age (Blanchet and Mahieu, 2004). Although we rule out several channels through which retirement could affect LTC use in our population of interest,[41] the fact that age 60 is conventionally seen as the kick-off of "old-age" in France may have an effect of the use of LTC and on the involvement of the relatives, above and beyond LTC policies.

Although it leaves us with a stronger unconfoundedness assumption, we have deemed

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[40]This is due both to the complex design of the survey and to the demographic structure of the French population: the cohorts aged 63 to 68 in 2008 were born during the WWII (Figure 1.D.2, Appendix 1.D).

[41]For the full discussion, see Appendix 1.E.

the classical regression approach to be more robust given the data limitations and the institutional context. This implies that, even though we include age effects in the list of controls, we do not claim that our identification strategy is as compelling as a quasi-experimental, RDD-type identification would be.

We have tested whether our estimates are robust to the inclusion of non-linear trends in age and to the restriction of our sample to individuals closer to age 60. The signs of the point estimates do not change when we include quadratic and cubic polynomials in age as covariates, although the precision becomes much lower (as we add controls that are highly correlated with our dummy of interest). When we replicate our estimations on the samples of individuals aged 50 to 69, or even 55 to 64, results become inconclusive: given the much reduced number of observations, standard errors increase substantially.[42]

6.2 Interpretation of the results

Our results suggest that belonging to the institutional perimeter of dependence policies, as opposed to standing below the threshold of age 60, tends to increase formal care utilization and decrease the probability to be helped by relatives, for individuals who do not live in a specialized institution on a permanent basis. Due to relatively small sample sizes, statistical precision is low, making it difficult to quantify the effects on formal care and informal care utilization propensities. Yet, one salient feature is that effects are heterogeneous: on average, men and individuals with ADL restrictions appear *more* likely to benefit from informal care when they are elderly dependent. Only individuals with ADL restrictions (on top of IADL restrictions) have a higher utilization rate of professional home care when they are dependent elderly.

One interpretation is that, on average, the elderly with moderate to severe activity restrictions are more likely to receive APA than they would be to receive PCH, were they younger than 60.[43] The fact that APA allows individuals 60 and older with ADL restrictions to benefit from some subsidized domestic help might contribute to the observed increase in formal care utilization among individuals with ADL restrictions. It may indeed be the case that individuals who are reluctant to being provided *personal care* by professional caregivers accept more easily professional *domestic help*. As PCH cannot be used to pay for domestic

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[42] Results are available on demand. Restricting the sample in terms of the age range reduces the number of clusters, which may threaten the validity of inference as we cluster our standard errors on age.

[43] Such an interpretation seems consistent with earlier results presented in Tenand (2016). Exploiting HSM information on self-reported benefits, we found that the probability to report benefiting from home care subsidies is practically and statistically significantly higher among individuals aged 60 and older, even when we control for functional limitations, activity restrictions, socio-demographic characteristics and family resources. If the self-reported LTC beneficiaries were a random draw from the true population of LTC beneficiaries, then these results would suggest that the institutional at age 60 makes individuals in the perimeter of dependence policies *more* likely to benefit from a public scheme. Yet, again, we cannot rule out that under-reporting of LTC benefits correlates with the features of LTC schemes we are interested in.

help, individuals below age 60 have to rely on their family for house chores, unless they pay out-of-pocket the full price for professional domestic help or can benefit from means-tested domestic help provided by the departments.

We tested this assumption by replicating our probit estimation on six different outcomes, indicating whether individuals received (i) domestic help, (ii) monitoring, or (iii) personal care, provided either by professionals or by relatives.[44][45] Focusing on individuals with ADL restrictions, we find a positive point estimate for the effect of the age 60 threshold on the probability to receive professional domestic help (+3.7pp), but it is not statistically significant at the 10% level. On the contrary, the probability to be provided with domestic help by relatives increases by 8.4pp. The probability to be provided monitoring by either relatives or professionals does not change. When we look at the rate of personal care utilization, we find that being a dependent elderly increases the probability to be provided such care by professionals (+8pp, $p < 0.05$).

Although it contradicts our earlier assumption, this last effect may reflect another difference in the schemes accessible to disabled individuals depending on their age. Indeed, another type of care providers may intervene with disabled individuals: the "At-Home Nursing Care Services" (*Services de soins infirmiers à domicile*, SSIAD). These services have an ambiguous status: they are financed on the public health care insurance budget and are meant to provide individuals with chronic conditions with at-home nursing care. Yet certain caregivers of SSIADs are also given the task to provide patients with personal care; under that regard, SSIADs can be considered as part of the disability-compensating policies. Until 2004, SSIADs were accessible only for individuals 60 and older; this officially changed then, but it took time for the services to actually open "slots" for the handicapped adults.[46] The fact that an individual 60 or older experiences a lower constraint on the supply of care by SSIADs may explain why the use of professional personal care is higher after 60. In addition, our estimates suggest that the effect of the age 60 threshold on personal care use is higher for those with income higher than the top income quartile, i-e for individuals with a non-negligible co-payment on APA. As SSIADs are paid by the national health insurance, they basically come at a zero out-of-pocket cost for the patients, whatever their income, provided their GP has issued a prescription for at-home personal care. The relative cost of SSIAD is therefore lower for richer individuals, who are provided an incentive to substitute APA-subsidized care for SSIAD services.

Our estimates also suggest that, for women, there is some crowding-out of informal care provision by (a slightly increased) formal home care utilization after age 60. This is consistent

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[44]Appendix 1.C provides the description of these categories.

[45]We ran univariate probits for each of the six outcomes.

[46]In 2008, when the survey was conducted, less than 4,000 slots were available to the handicapped adults, while 93,000 dependent elderly were able to be served by SSIADs (Bertrand, 2010; Drees, 2016*b*).

with Fontaine (2012) who uses the HSM sample of individuals aged 60 and older and finds that publicly-funded formal home care provided to the 60+ has a small crowding-out effect on informal care provision.[47] When focusing on men, our estimates rather suggest some form of complementarity between informal care and (unskilled) formal care.

Note that, contrary to Fontaine (2012) who study the volumes of care, we only look at the extensive margin of home care provision. The fact that our outcomes are care utilization *rates* and not volumes is an important point to bear in mind when drawing implications from our results. It is well possible that we would observe different patterns, were we to study the intensive margin. Indeed, the co-payment schedule associated with PCH is on average more generous than the cost-sharing rule of APA. Recent works using French data have confirmed that the consumption of formal care is price-elastic not only at the extensive margin (Arrighi *et al.*, 2015), but also at the intensive margin (Bourreau-Dubois, Gramain, Lim and Xing, 2014; Hege, 2016; Roquebert and Tenand, 2017). Differences in cost-sharing rules and amounts of care to be subsidized may affect the volume of publicly-funded professional care consumed; in turn, this may lead the relatives of dependent elderly and handicapped adults to adjust the assistance with ADL and IADL they provide.

6.3 Data limitations

Despite its attractive features, the HSM survey presents some limitations for the purpose of our study. Our identification strategy hinges on the absence of omitted variable bias. We have included a set of covariates relating to family composition and characteristics but they may be insufficient to capture the full relevant heterogeneity in family structures. HSM contains rich additional information on the respondents' relatives (e.g. place of residence[48] or marital status of children, age of relatives); yet this information is available only for individuals who declared they do not need assistance in the activities of daily living. The proportion

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[47]Activities performed by caregivers are also found to change in reaction to increased formal care consumption subsidized by APA: relatives perform less household chores and personal care (Fontaine, 2012).

[48]From a theoretical point of view, when relatives live closer, informal care can be provided at a lesser cost (Hoerger *et al.*, 1996). Empirically, Stern (1995) and Charles and Sevak (2005) have shown that geographical distance from children is an important determinant of informal care provision to the elderly; this variable may also have an (indirect) effect on formal home care utilization. Moreover, co-residence is likely to correlate with home care public subsidies: using US panel data, Hoerger *et al.* (1996) show that Medicaid home health care subsidies increase the probability for a dependent elderly to live independently, relative to living in an inter-generational household. Omitting relatives' residence from the controls may thus bias the estimates. On the other hand, residence of relatives may well be endogenous to informal and formal care utilization: a relative may choose to live close to her parent in order to provide assistance more frequently if she observes her parent is feeling tired or low. Even in the case the individual receives the services of professional caregivers only, relatives may decide to live close, or not to move away, in order to assist the impaired individual with paperwork or exert some surveillance. Many articles on LTC arrangements have chosen to work on a sample of elderly living alone (see Bonsang (2009) and Arnault (2015)), thereby avoiding the endogeneity issue raised by the co-residence status. Some empirical results suggest that the endoegeneity bias is limited (Bolin *et al.*, 2008; Charles and Sevak, 2005; Stern, 1995).

of such individuals being significantly lower in our sub-sample of individuals aged 50–59 than in the older sub-sample, we chose not to exclude these individuals from our sample of interest. As the perception of the need for assistance may be influenced by the public schemes an individual has access to, and therefore by the age 60 threshold, we suspect that the sample selection would have been endogenous, had we kept only individuals with self-assessed needs of assistance.

The absence of a longitudinal dimension comes with several limitations. First, it makes it necessary to rule out cohort effects for identification. Second, it prevents from including individual fixed effects in the specifications, which would reduce the risk of omitted variable bias. Third, it makes it practically impossible to identify and take into account the specific case of the "aging handicapped " (*personnes handicapées vieillissantes*). Individuals who were granted a handicap benefit (PCH or ACTP) before they turned 60 can choose to remain in the regime of the "handicap policies" or to shift to the dependence policies. Given this derogation, the dummy for being 60 and older indicates whether the individual has access to the dependence schemes, but does not necessarily mean that the individual has no access to the handicap schemes. The impossibility to identify the "aging handicapped " may lead to under-estimate the impact of the differences between the two schemes; yet, given that less than 20% (15%) of ACTP (PCH) beneficiaries were 60 or older in 2008 (Drees, 2008*a*), the under-estimation should be limited.[49]

Finally, the absence of a follow-up wave does not allow us to take into account differential institutionalization rates, which would translate into differential sample selection on both sides of age 60. Yet the age 60 threshold itself may affect the probability to live in the community.

6.4   Differential institutionalization rates?

Existing studies, based on US data for the most, mainly suggest that home care subsidies impact institutionalization patterns. Ettner (1994); Pezzin *et al.* (1996) and Guo *et al.* (2015) find a significant, negative impact of more generous public home care programs on the probability to enter a nursing home.[50] Differences in reimbursement rates for elderly nursing homes and for handicapped adults specialized institutions could also induce differential se-

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[49] Given the low quality of data on LTC benefits in surveys in general, and in HSM in particular (cf. Appendix 1.A), relying on whether an individual who is less than 60 declares receiving PCH or ACTP is not a reliable way of identifying the "aging handicapped " in the sample. The section of the questionnaire documenting the chronic conditions and major health events include questions about the year in which the health issue emerged or the health event happened. However, such questions do not provide information precise enough to infer the age of the onset of functional limitations and activity restrictions.

[50] Earlier works by Hoerger *et al.* (1996) and Christianson (1988) concluded to the absence of such an effect (for individuals aged 65 or more). The approach of Ettner (1994) and Pezzin *et al.* (1996) is however more credible since these papers model living arrangements jointly with formal and informal care provision.

lection, as looser Medicaid eligibility rules and greater reimbursement for nursing home care were shown to increase institutionalization rates (Hoerger *et al.*, 1996). As pointed out by Weber (2011) and Ramos-Gorand and Rapegno (2016), in France, out-of-pocket payments in elderly dependent nursing homes (*EPHAD*) are on average far higher than the amounts paid by residents of handicap centers.[51]

Differential financial incentives to institutionalization may be counterbalanced by the characteristics of the supply. Availability of beds for handicapped adults and dependent elderly needs not be the same, as suppliers may adjust to the differences in LTC schemes and in national and local regulations. Ramos-Gorand and Rapegno (2016) document that nursing homes are more homogeneously distributed on the territory than handicap centers, mainly because the latter are less numerous while tending to be larger. Institutions for the handicapped tend to welcome specific sub-populations, as each handicap center needs to receive a certification to host individuals with a given type of disabilities. There is no such requirement for nursing homes, although a substantial share of EHPADs declare having refused to host patients with dementia or requiring intensive medical care (Ramos-Gorand and Rapegno, 2016). Overall, depending on one's type of disability, health status and area of residence, access to an institution may be more or less difficult when being a dependent adult rather than a handicapped adult.

HSM was conducted together with a companion survey, HSI, which collected information on individuals living in an institution permanently. Because of differing methodologies and questionnaires, merging the two surveys is not possible. However, a small dataset with basic individual information on individuals surveyed in HSI and on those interviewed in HSM is available. It contains age, sex, self-assessed health (coded in 5 levels), a dummy for chronic disease, as well as a categorical variable on functional limitations.

Figure 1.6 represents the proportion of the French population living in an institution by civil age. Linear fits of the relationship between institutionalization and age suggest that the trend changes after age 60: while the institutionalization rate tends to decrease for individuals in their 50s, it increases after age 60. In addition, if we exclude individuals right at age 60, we observe a positive jump in the institutionalization rate just after 60.

[Figure 1.6 to be found on the following page.]

To formally identify the effect of the age 60 threshold in LTC policies on the probability to live in an institution, we implement a RDD strategy. Given the limited list of control variables available, it is unlikely that the coefficient obtained from a simple multivariate regression of

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[51]Most of the fees in handicap centers are covered by the national Health Insurance or social benefits non recoverable on succession. On the contrary, social financial support accessible to the dependent elderly to pay for board and lodging can be deducted from their succession, and a co-payment is asked on the fees covering institutional care provision (Ramos-Gorand and Rapegno, 2016).

Figure 1.6 – Probability of living in an institution, by civil age.
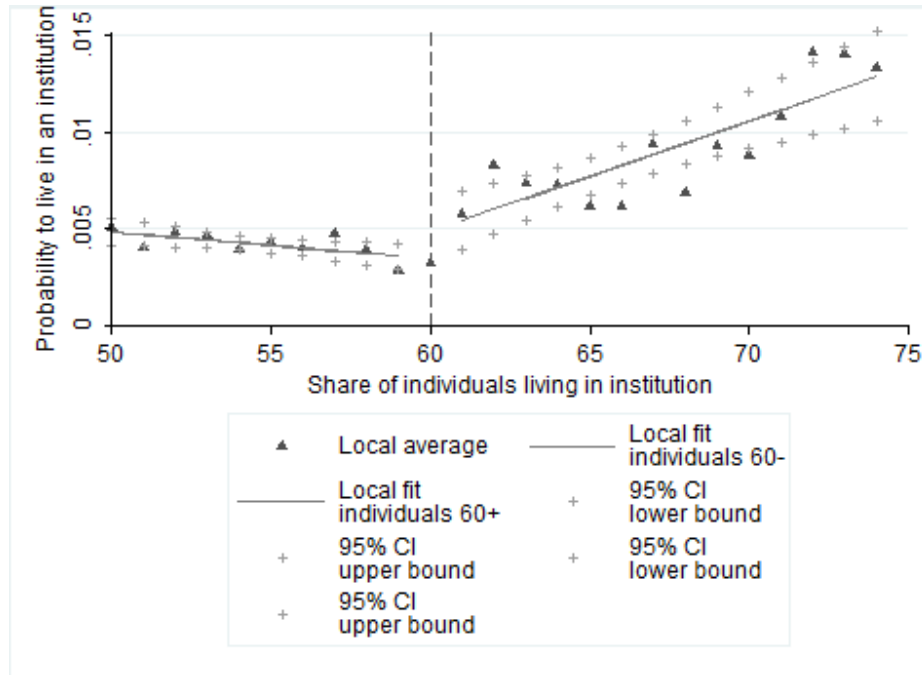
living arrangement (being institutionalized or not) on the dummy "being 60^+" will provide an unbiased estimate of the effect of the institutional threshold in LTC policies. Selecting individuals aged 50 to 74 in the matched HSM–HSI dataset, we obtain a sample of 12,784 individuals. We consider the sample size around the age 60 threshold to be reasonable enough to derive convincing evidence from a RDD strategy.[52] Following Lee *et al.* (2004), we implement a parametric approach based on the following specification:

$$I_i^* = \alpha' + \beta' 60_i^+ + \sum_{j=1}^{J} \delta_j'.(Age - 60)^j + \sum_{j=1}^{J} \mu_j'.60^+.(Age - 60)^j + Z_i'\theta' + u_i' \qquad (1.3)$$

where I_i^* is a latent variable measuring the propensity of individual i to live in institution on a permanent basis. Given that we observe a binary outcome (the individual is recorded as living either in institution or in an ordinary setting), Equation (1.3) is estimated by a univariate probit.

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[52]Moreover, differential sample selection on the two sides of the age threshold is not a threat to RDD identification anymore, as we work on a sample representative of the entire French population. In addition, the potential confounding effect of retirement is not a concern when the outcome is institutionalization: individuals who may enter a specialized institution are unlikely to be on the labor market (a further discussion and formal tests can be found in Appendix 1.F.)

With a parametric approach, RDD identification hinges on the functional form of age effects that is assumed. Empirically, we select the degree J of the polynomial terms in age by comparing the information criteria (AIC and BIC) obtained with linear, quadratic or cubic age effects. As the RDD essentially compares population averages of the outcome variable just below and just above the threshold in the forcing variable, it is important to take into account survey weights when estimating the model.

The best fit of the model (both AIC and BIC are minimized) is obtained when including cubic trend in age (J = 3 in Equation (1.3)). Probit estimates in Table 1.F.1 (Appendix 1.F) show that being 60 and older increases the probability to live in an institution by around 0.4 percentage points. The effect is statistically significant at the 1% level; in practical term, it is fairly high, as the population institutionalization rate in the French 50–74 years-old population is of 0.6%.

We assess the robustness of our result in two ways. Firstly, we exclude individuals who are 60, again considering that it may take time for individuals to change or benefit from newly accessible LTC schemes. Secondly, we exclude individuals who are 70 or more, to check that our estimates are not driven by individuals far away from the discontinuity. As presented in Table 1.F.2 (Appendix 1.F), the positive effect of being a dependent elderly on the probability to live at home keeps holding.[53]

The construction of HSM and HSI samples is key to interpreting the estimated pattern. In the HS surveys, the population living in the community includes all individuals who go back home at least *once a year*. Thus, it includes the patients of centers for the handicapped that may welcome their patients overnight during the week, but tend to allow or even encourage families to host their relatives during the weekend. On the contrary, nursing homes accessible to dependent elderly are generally conceived as permanent residences, and daycare facilities for the elderly were still scarce at the time of the survey.[54] The positive coefficient we estimate thus partly reflects the definition of "living in the community" retained in the survey sampling design.

Interestingly, the differential selection of the dependent elderly *versus* the handicapped adults in the HS surveys should not be regarded as a mere sampling bias. The fact that the 60+ are more likely to be considered as living in an institution than individuals below 60 stems from the very institutional distinction made between dependency and handicap programs we are interested in.

To fully assess disability compensation and potential horizontal inequity, it would be rel-

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[53]This effect is also found when we restrict the sample to individuals who have some functional limitations. The results are available on demand. In our baseline specification, we prefer not to do any sample selection, as the only variable on functional limitation provided in the HSM–HSI matched dataset is fairly crude.

[54]Instructions given to interviewers explicitly mention nursing homes as an example of an institutional living setting and explain that individuals living in centers for handicapped persons should be considered as living in an ordinary house.

evant to know whether individuals included in the HSM sample are actually receiving formal care from professional workers in handicap centers. As we lack such information, the effect of the institutional age discontinuities we have found on formal home care utilization rate should be read along with the fact that the individuals below 60 in our estimation sample are also more likely to receive some unobserved professional LTC.

7   Conclusion

This paper attempted to answer the following question: when you have difficulties in performing alone the activities of daily living, does it make a difference for you to be considered a "dependent elderly" rather than a "handicapped adult" by the French Welfare system? Our results suggest the answer is yes. Among individuals who live in an ordinary setting on a permanent basis, the "dependent elderly" are more likely to receive professional home care and less likely to be provided assistance with the activities of daily living by their relatives. We thus provide evidence that two sub-groups of the population with arguably equal "needs" for LTC are less likely to receive formal care due to their age. This situation contrasts with the position of the European Court of Justice, according to which age per se is not a legitimate criterion to define entitlements to disability-compensation.

Our second set of results, derived from an RDD strategy, provides original and robust evidence that the probability to be recorded as living in an institution positively jumps at age 60. On the face of it, our estimates suggest that dependence schemes are more effective in allowing disabled individuals to access formal LTC services, either at home or in institutions. Interpreting our results in terms of horizontal inequity should be made with caution for two reasons. First, we find evidence of substantial heterogeneity of effects with respect to the disability level and gender. Second, interpreting our results as evidence that the handicapped are put at disadvantage is made difficult by the fact that the French Disability and Health Survey did not survey all types of LTC services being used. The formal LTC services provided by professional workers inside the institutions in which handicapped adults can stay for the day or the week (while those aged 60 and older can hardly access those types of care without living in a nursing home on a permanent basis) do not show up anywhere in the collected data. It is thus possible that our estimates signal the substitution of formal *home* care to professional care provided *in an institution*. Presumably, our results partly capture the fact that the survey data collection was influenced by the architecture of LTC policies.

While this loophole in the survey is itself a consequence of the age threshold in LTC policies we investigated into, it translates into a limitation for our empirical analysis. Several lessons can be gleaned for future survey data collection on disability and health. First, the sampling design should be made robust to institutional differences in the treatment of vari-

ous sub-groups. In particular, the definition of living arrangements should be made as little dependent on the specific features of LTC policies as possible. Second, the content of the survey (e.g. which types of care are being asked about) should be comprehensive enough to ensure that there is no hole in the dimensions the survey aims at documenting (e.g. care arrangements). Third, questions about the types of care received should be made so that different payers (e.g. health insurance *versus* LTC schemes) can be identified. As this is challenging for respondents to report correct information when they receive multiple subsidies, one promising way to go is to push forward the matching of surveys with administrative records of social transfers and health care claims. This will also be a way to overcome the reporting bias survey data on incomes and transfers surveys are plagued with. Next, over-sampling individuals around age discontinuities would be a cost-efficient way to increase statistical power while allowing robust identification methods (e.g. RDD) to be implemented. Finally, variation in sampling probabilities with age would also be a way to smooth out the effects of demographic booms and busts on sampling sizes, which can undermine some powerful identification strategies.

Appendix

1.A LTC schemes in France: additional information and quality of self-reported benefits

1.A.1. Legislation

The institutional landscape of handicap and dependence compensating public schemes is quite complex in France. This Appendix aims at providing the key features of each scheme. As explained in Section 2, those schemes fall into two official categories: *handicap* subsidies on one hand, *dependence* or old-age subsidies on the other. Table 1.A.1 on page 101 presents the main handicap and dependence schemes for individuals living in the community:

- *Allocation compensatrice pour tierce-personne* (ACTP);

- *Prestation de compensation du handicap* (PCH);

- *Allocation personnalisée d'autonomie* (APA);

- *Prestation sociale d'aide ménagère aux personnes handicapées* (means-tested domestic help to handicapped individuals);

- *Prestation sociale d'aide ménagère aux personnes âgées* (means-tested domestic help to the elderly);

- *Prestation d'aide ménagère aux personnes âgées des caisses de retraite* (domestic help to the elderly provided by pension funds).

These different transfers are mutually exclusive. Only means-tested domestic help to the handicapped may be granted as a complement to PCH.

In this presentation, we deal exclusively with the component of these schemes that subsidizes human care utilization. Depending on the scheme considered, departments, Local Houses for Handicapped Persons (MDPH) or general practitioners proceed to an assessment of needs of applicants. For all schemes but ACTP, a maximum number of hours eligible to the subsidy, $\overline{h}_i$, is defined for each recipient i. For APA and PCH, the maximum amount of transfer for individual i, A_i, is defined as $A_i = \overline{h}_i \times t$, where t is the tariff of reimbursement. In the case of APA, this tariff is set at the local level, by *Conseils départementaux* and varies with the type of caregiver (employed over-the-couner or through home care services). In the general case, the price charged by the care provider exceeds the tariff of reimbursement.

In the case of APA, if A_i exceeds the dependence group (GIR)-specific ceiling, $\overline{h}_i$ is reduced accordingly. Usually, amount A_i is directly transferred to PCH recipients after deduction of the co-payment, while for APA, the subsidy is usually paid on an hourly basis, directly

to the home care provider. For ACTP, the amount of transfer is defined according to individual needs in terms of human care, but no control of effective spending is made.

ACTP, PCH and APA can also be used to pay relatives providing care with the activities of daily living, under some strict conditions. For individuals receiving PCH, relatives other than children, parents and partner can be employed as over-the-counter workers. The salary paid is eligible to the social security contributions and income tax rebates applied to over-the-counter home care employees; in addition, PCH beneficiaries may then receive a subsidy on the hourly price paid to their relative. Children, parents and partners who provide care on a regular basis can receive a salary only if they are not retired or full-time employed, and if the PCH recipient requires constant surveillance. For lowest degrees of disability, caregivers can receive an hourly compensation; however, the rate is very low (€3.67 per hour, while the French hourly net minimum wage is €7.51). To lower the opportunity cost of informal caregiving for close relatives, the indemnity is increased to €5.51 when the caregiver has to stop her professional activity to assist her disabled relative. In any case, the monthly indemnity is capped at 940 euros per month (about €200 less than the monthly net minimum salary).[55]

For individuals receiving APA, the transfer may be used to employ a relative as a family caregiver, except for one's partner. The reimbursement tariff, TR, which is applied to compute amount A_i, is the same as for regular over-the-counter home care providers.

In the case of APA and PCH, employing a relative as a family caregiver reduces the number of hours of formal care eligible to a subsidy, since the maximum number of subsidized hours allocated through the assessment of needs include both informal and formal care hours.

On the contrary, domestic help subsidies from departments or pension funds cannot be used to compensate a family caregiver. Means-tested domestic help given by departments is even conditional on not having any close relative able to perform domestic tasks for the individual ("subsidiarity principle").

On the supply side, home care services are regulated by local authorities. As regulations of home care services provided to the handicapped and to the elderly dependent differ, regulated prices of the services offered to the two sub-populations can differ as well. However, centrally available individual-level statistical information on both reimbursement tariffs and home care services' prices is poor, making it impossible to assess out-of-pocket payment differentials between handicapped and dependent beneficiaries.

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[55]In this Section, all values are of 2015.

Table 1.A.1 – Long-term care schemes for individuals living in the community

Transfer	Age eligibility	Disability criteria	Type of transfer	Means-tested	Amount and ceilings	Co-payment rate
ACTP	Under 60 OR 60 or older, with disabilities present since before 60th birthday	80% incapacity rate, with needs of assistance with ADL and IADL (evaluation by National Health Insurance workers)	Monetary transfer	Yes (income below €9,605 for singles)	Number of hours granted × hourly reimbursement price. Minimum of €441, maximum €882	No
PCH	Under 60 OR 60 or older, with disabilities present since before 60th birthday	Absolute restriction in one essential activity or two major restrictions in two essential activities (evaluation by Departmental Handicap Houses (MDPH))	In-kind transfer	No	Number of hours granted × hourly reimbursement price. Non-binding limit of 6.05 hours a day.	20% for income (from assets) above €25,978, 0% otherwise
Domestic help for the handicapped (departments)	Under 60, with needs of assistance with domestic chores and no relative around able to provide it	80% incapacity rate and unable to work (evaluation by Local Handicap Houses (MDPH) and departments)	In-kind transfer	Yes (income below €9,605 for singles)	Number of hours of assistance granted times hourly reimbursement price, up to 40 hours (for singles)	5%
APA	60 and over, with needs of assistance with ADL and IADL	Dependence groups (GIR) 1 to 4 (evaluation by departments)	In-kind transfer	No	Number of hours granted × hourly reimbursement price, with ceilings ranging from €563 for GIR 4 to €1,313 for GIR 1 (about 4 hours a day at max.)	From 0% (income below €8,870) to 90% (income above €35,342)
Domestic help for the dependent (departments)	65 or older (60 or older in some departments and if unable to work)	Needs of assistance with domestic chores and no relative around able to provide it (evaluation by departments)	In-kind transfer	No	Number of hours granted × hourly reimbursement price, up to 30 hours (for singles)	5%
Domestic help for the dependent (pension funds)	65 or older (60 or older in some departments and if unable to work)	Needs of assistance with domestic chores (evaluation by departments)	In-kind transfer	No	Number of hours granted × hourly reimbursement price, up to €3,000 per year	From 10% (income below €9,605) to 73% (income above €18,336)

NOTES: Transfers amounts and ceilings are expressed in euros per month, unless otherwise mentionned. All figures are of 2015. Income conditions are expressed in terms of net annual income for a single. These conditions are adjusted when the applicant lives in a couple. In the case of PCH, the ressources taken into account mainly consist of income derived from assets: labor income, pension benefits, social insurance and protection benefits are excluded. The co-payment rate schedule for pension-funds' domestic help is specific to each fund. Here, the schedule of the general fund (Cnav) is reported.

1.A.2. Information on LTC benefits around the age 60 threshold: HSM limitations

In 2008, at the time the HSM survey was conducted, about 850,000 million individuals living in the community benefited from the LTC benefits managed by the Departmental Councils. The majority of recipients (80%) were aged 60 and older.[56]

Table 1.A.2 – Declarations of handicap and dependence benefits in HSM 2008: Comparison with administrative records.

	PCH beneficiaries	ACTP beneficiaries	APA beneficiaries
Population below 60			
Estimation using HSM (2008)	13,000 [7,000;18,000]	59,000 [45,000;73,000]	22,000 [2,300;43,000]
Administrative records (2008)	63,766	66,850	0
Population 60 and more			
Estimation using HSM (2008)	3,000 [1,000;6,000]	27,000 [18,000;37,000]	327,000 [293,000;362,000]
Administrative records (2008)	11,488	17,808	671,000

NOTES: Administrative records (Drees, 2008*a*). Only beneficiaries living in the community are retained in the computation. Estimations using HSM data take into account survey weights; the 5% level confidence-intervals are displayed in brackets.

Table 1.A.2 compares the number of beneficiaries of each LTC scheme as estimated using the answers to HSM survey with the administrative records. Self-reported information on LTC benefits is poor in HSM; this drawback of the survey was also documented by Eghbal-Téhérani and Makdessi (2011) in the case of APA. Based on the answers to the survey, we would under-estimate by two the number of APA beneficiaries (327,000 against 671,000 beneficiaries). This is also true for PCH benefits, although not for ACTP. The poor quality of the variables relating to benefits in HSM is also suggested by the very high number of respondents who refused to answer the question or declared that they did not know (in our baseline sample, the number of such respondents is about as high as the number of individuals who declared benefiting from such a benefit).

Focusing on the administrative figures, we note that PCH was a smaller scheme than ACTP in terms of number of beneficiaries. This is no longer the case: in 2014, ACTP beneficiaries represented 19% of combined ACPT and PCH beneficiaries. This is due to the fact that ACTP benefit was no longer granted after 2005, although surviving beneficiaries are allowed to stay in the scheme. On the contrary, the PCH scheme grew larger: between 2008 and 2014, the number of beneficiaries has been multiplied by 3.

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[56]Table 1.A.1 in Section 2 provides similar figures for year 2014.

An attempt to get round the reporting errors on LTC benefits is to use the questions about potential applications to the schemes. In HSM, respondents were asked whether they applied for APA and what was the most recent decision made by the Departmental Council regarding the application. Using these additional questions, we obtain 1,078 individuals in the survey who are supposedly receiving the APA benefit at home.[57] The assumption is that individuals who were granted the APA at some point will keep receiving it until they die or enter a nursing home. The alleged APA beneficiaries (aged 60 and older) represent 513,000 individuals in the French population; a figure now reasonably close to the one provided by administrative records, although still lower. Nonetheless, we deemed the quality of this information not reliable enough to make our identification strategy rely on it.

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[57]In an ongoing study on out-of-pocket payments on *health care* incurred by the disabled, a team from Irdes (Anne Penneau, Sylvain Pichetti and Maude Espagnacq) uses this question to identify who receives APA or PCH benefits in the survey.

1.B   Sampling design and sample selection

1.B.1 Sampling design

HSM sample was drawn using the results of a preliminary survey, *Enquête Vie quotidienne et santé* (VQS). VQS collected basic information on the demographics and health conditions of over 200,000 households in 2007.[58] Respondents were grouped in 4 different categories based on their health and disability condition. This ancillary survey was used to form the sampling frame of HSM: the 4 disability groups of VQS were interacted with the French departments or regions to produce 45 different strata. The sample was stratified to oversample individuals with low functional levels and those living in some specific regions. This results in a relatively high dispersion of survey weights, with a ratio D9/D1 equals to 40 in the entire HSM sample (Bouvier, 2011).

At the level of the HSM survey, the primary sampling unit is the individual — although there might be several individuals from the same household in the final sample. To derive correct inference, we specify to our statistical software (STATA) that the sample follows a single-stage design with stratification.[59]

1.B.2 Sample selection

After having deleted all individuals who are aged less than 50 or 75 and older and individuals with no restriction in any ADL or IADL, we are left with 3,132 individuals in our sample, representing about 1.8 million individuals. 11 individuals have to be dropped because of missing information on health status and income.

Table 1.B.1 – Sample selection (baseline sample from HSM)

	Sample size	Share of previous sample	Population size	Share of previous population
Population aged 50–74	10,672	–	M16.8	–
Keeping individuals with IADL or ADL restriction	3,132	29.3%	M1.8	10.9%
Keeping individuals with full information on covariates	3,121	99.6%	M1.8	≈ 100%

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[58]More information on the design of HSM (in French) can be found at http://www.drees.sante.gouv.fr/les-enquetes-handicap-sante,4267.html.

[59]We specify: svyset ident_ind [pweight = poids_hsm], strata(stratehs), where ident_ind is the individual identifier, poids_hsm the survey weight and stratehs the stratum.

1.C Construction of home care utilization variables

HSM provides rich data on the caregivers declared by the survey respondents. Our outcome variables of formal and informal home care utilization were thus constructed using information available at the caregiver level. For each caregiver of a given respondent, we know either the profession (in the case she is a formal caregiver) or the family tie with the respondent (for an informal caregiver), as well as the types of tasks performed in assistance to the respondent.

1.C.1 Informal care

In the HSM questionnaire (module G, "family environment and help"), a specific question is asked to identify any potential relative or friend providing care to the respondent in an informal way. If the respondent declares any, she is then asked to provide a list of all her friends or relatives helping her. Then, for each of her informal caregivers, the respondent is asked to report the type of tasks her informal caregiver assists her with. The two questions are detailed in Table 1.C.1.

Thus, for every respondent in the survey, we are able to know whether a person who is not a professional caregiver assists her with the activities of daily living. In our analysis, an individual is considered as *receiving informal care* (the informal home care utilization dummy, Y_I, equals one) if she declares one or more non-professional caregiver(s) who are providing at least assistance with the tasks of daily living. An individual with no caregiver at all, or with no caregiver providing assistance with the activities of daily living, will be considered as not receiving any informal care ($Y_I = 0$). In our sample of 3,121 individuals, 2,106 (67.5%) are coded as receiving informal care ($Y_F = 1$).

1.C.2 Formal care

In HSM survey, each individual is asked about her difficulties in performing the activities of daily living (ADL and IADL), and about the utilization of human or technical assistance to perform these activities (module F, "activity restrictions"). When a respondent declares resorting to the services of a professional worker to perform at least one ADL or IADL, she is considered in the survey as "receiving some professional assistance". She is then asked to establish the list of all the professional workers who are providing her with care at her house.

The respondent is asked about the profession of each formal caregiver she has declared. As shown in Table 1.C.2, several categories were proposed to respondents. The delimitation between the different categories may be quite difficult to draw (e.g., categories 2 and 3 overlap), and it is likely that some respondents were not aware of the exact occupation of their

Table 1.C.1 – Informal caregivers in HSM survey

Original question (in French)	English translation
1) Screening of informal caregivers	
"Y-a-t-il des personnes (famille, amis,…) non professionnelles qui vous aident régulièrement pour accomplir certaines tâches de la vie quotidienne (ménage, repas, toilette, présence, …), ou qui vous aident financièrement, ou matériellement ou bien encore qui vous apportent un soutien moral en raison d'un problème de santé ou d'un handicap, et y compris les personnes qui vivent avec vous ?"	Are there any non-professional persons (family, friends,...) who are helping you to perform some tasks of daily living (house chores, meals, toilette, presence) on a regular basis, or who help you financially, or materially, or that provides you with moral support because of a health condition or a handicap, including those persons living with you?".
2) Type of assistance provided by informal caregivers	
"[prénom de l'aidant informel] vous aide-t-il (elle) pour: • les tâches de la vie quotidienne comme l'aide à la toilette, à l'habillage, l'aide aux tâches ménagères, … ; • par une aide financière ou matérielle ; • en vous apportant un soutien moral." (les réponses multiples étant autorisées)	"[name of the informal caregiver] helps you: • with the tasks of daily living, like assistance with bathing, with dressing, help with house chores, ...; • with a financial or material assistance; • by providing you with some moral support." (multiple answers are allowed)

SOURCES: HSM 2008 questionnaire. Author's own translation.

formal caregivers. Respondents were also offered the possibility to fill the profession in clear, with their answers being coded back to the pre-defined categories of professions.

For the purpose of our analysis, it is important to distinguish between those professional workers who provide *care* (i-e, assistance with the activities of daily living) and the professional workers providing some type of medical or paramedical *cure*. In France, handicap and dependence schemes are distinct from the Health insurance system. Individuals with disabilities may receive some health care at their house: diabetic individuals would receive the regular visit of a nurse, an elderly with chronic bronchitis may call home a physiotherapist, etc. Nurses may also intervene at home to assist disabled individuals with personal care activities.[60] Although in such a case they provide assistance with the activities of daily living, nursing services are not considered as home care workers, and thus cannot be subsidized through LTC schemes in France.

In order to separate cure from care, we follow Gramain (2011). Some of the professional

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[60]In France, there are two regimes under which nurses can provide care at the home of their patients: they can be either community nurses (infirmiers libéraux) or work in a at-home nursing service (*Service de soins infirmiers à domicile*, SSIAD).

categories for formal caregivers that could be reported in HSM unambiguously refer to the non-medical sector; however, some categories may include both home care workers and health care workers. We thus exploit additional information contained in HSM on the type of tasks every formal caregiver assists a respondent with, through the second question reported in Table 1.C.2.

We code an individual as "receiving *cure*" if at least one of her professional caregivers is assisting her with *personal care* activities (grooming or dressing), with going to the doctor or by taking care of health problems. We code the individual back to "not receiving cure" when all caregivers performing such tasks for a given respondent belong to the categories of domestic help workers or home care services, as these workers are legally not allowed to perform health care tasks. Our implicit assumption then is that the beneficiaries identify correctly these caregivers as non-medical workers. In a second step, we use information on the frequency of intervention to construct a dummy equal to one if the individual receives *frequent cure* at home. We consider that a given caregiver provides frequent cure when she comes more than once a day, 5 times a week or 22 times a month.[61] If an individual receives the frequent visit of a professional assisting her with personal care activities and medical visits, but does not receive any assistance to perform other activities of daily living (like moving around or doing house chores), it is most likely that she has a health condition requesting the frequent intervention of a nurse, but no disabilities whose impacts on daily life would need to be compensated for. We then consider that the professional assistance received by a respondent is *cure only* if the respondent receives the assistance of at least one frequent cure provider, without receiving any other form of assistance with the activities of daily living.

In addition, the data provide also a way to deal partially with the fact that some individuals may declare caregiving relatives with a job in the field of medicine or long-term care as *formal* caregivers, while we should regard them as *informal* caregivers. Close relatives can be paid for providing care to a disabled elderly only under specific rules and following a specific schedule. Among the so-declared professional caregivers whose profession is declared in clear by a respondent, we find individuals who are said to be "friends or relatives" of the respondent. We code back those caregivers (only 4 of them in the population of interest) as informal caregivers.[62] We end up with 887 individuals (28.4%) who receive formal home *care* ($Y_F = 1$) in our sample.[63]

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[61]In addition, we assume that the caregivers whose frequency of intervention was not reported are not frequent curers: had it been the case, we believe the respondent would have been able to give a response on the frequency of visit of the caregiver.

[62]In practice, a friend who is a home care worker may well be employed as a regular formal caregiver and subsidized as such through home care subsidy schemes. Conversely, some informal caregivers with professional medical or paramedical skills may have been declared as professional caregivers without the respondent mentioning their family or friendship ties. We believe these situations are rare enough not to affect our results.

[63]We checked that this number was not excessively sensitive to the definition used to define a "frequent" intervention.

Table 1.C.2 – Formal caregivers in HSM survey

Original question (in French)	English translation
1) Professions of formal caregivers in HSM survey	
"De qui s'agit-il ? 1. un (une) infirmière, un service de soins infirmiers ; 2. un(e) aide-soignant(e) ; 3. un autre professionnel paramédical (aide-soignante, ergothérapeute, kinésithérapeute, orthophoniste,...) ; 4. une aide à domicile, une aide ménagère, une auxiliaire de vie, garde à domicile, service de portage ; 5. un intervenant social (assistante sociale, éducateur spécialisé,...) : 6. un psychologue, psychomotricien,... ; 7. autres."	"Who is she?: 1. a nurse, a nursing care service; 2. an auxiliary nurse; 3. another paramedical professional (auxiliary nurse, occupational therapist, physiotherapist, speech therapist,...); 4. a home care worker, a domestic help worker, a home care assistant, an at-home delivery service; 5. a social worker (social caseworker, specialized teacher,...); 6. a psychologist, psycho-motricity specialist,...; 7. others."
2) Types of tasks performed by formal caregivers in HSM survey	
"Vous aide-t-il... (plusieurs réponses possibles) 1. pour les soins personnels (toilette, habillage, repas) ; 2. pour les tâches ménagères (faire le ménage, préparer les repas) ; 3. pour gérer votre budget, s'occuper des papiers et des démarches administratives ; 4. pour assurer une présence, une compagnie ; 5. en vérifiant ce que vous faites ; 6. pour aller voir le médecin, s'occuper de vos problèmes de santé ; 7. pour faire les courses, acheter les médicaments ; 8. dans d'autres activités (lecture pour les aveugles, traduction pour les sourds...)."	"Does she help you...?: 1. with personal care activities (grooming, dressing, meals); 2. with house chores (cleaning up, preparing meals); 3. to manage your budget, take care of paperwork and administrative procedures; 4. to ensure a presence, some company; 5. by cheeking what you do; 6. to go and visit the doctor, by taking care of your health problems; 7. by doing the shopping, buying your drugs; 8. with other activities (reading for the blind, translating for the deaf...)."

SOURCES: HSM 2008 questionnaire. Author's own translation.

1.C.3 Types of care received

The different schemes do not necessarily subsidize the same types of care, we create three categories to reflect the tasks performed by professional and informal caregivers. We use the questions that were asked about professional caregivers and those informal caregivers who provide an assistance with the activities of daily living.

- An individual is said to receive informal (formal) *personal care* if at least one informal (formal) caregiver helps her grooming, dressing or eating;
- An individual is said to receive informal (formal) *domestic help* if at least one informal (formal) caregiver helps her by doing house chores, preparing meals, shopping, buying medicines, filling administrative forms and managing her finances;
- An individual is said to receive informal (formal) *monitoring* if at least one informal (formal) caregiver intervenes to monitor what she does or provides her with a supporting presence.

Table 1.C.3 – Home care in HSM survey: Types of assistance provided by formal or informal caregivers.

Original question (in French)	English translation
1) Personal care	
Pour les soins personnels (toilette, habillage, repas)	For personal care (grooming, dressing, eating)
2) Domestic help	
Pour les tâches ménagères (faire le ménage, préparer les repas)	For house chores (clean the house, prepare the meals)
Pour gérer votre budget, s'occuper des papiers et des démarches administratives	To manage your finances, take care of adminsitrative procedures
Pour faire les courses, acheter les médicaments	To do the shopping, buy medications
3) Monitoring	
Pour assurer une présence, une compagnie	To provide you with a supportive presence
En vérifiant ce que vous faites	By monitoring what you do
Pour aller voir le médecin, s'occuper de vos problèmes de santé	To go and visit the doctor, take care of your health issues
Unclassified	
Dans d'autres activités (lecture pour les aveugles, traduction pour les sourds...)	In other activities (reading for the blind, translation for the deaf...)

SOURCES: HSM 2008 questionnaire. Author's own translation.

1.C.4 Data limitations on care received

The lack of precision of the regime within which professional caregivers intervene (home care *versus* medical care) imposes some limitations to the empirical analysis and caution in the interpretation of some results.

First, it is difficult to isolate those individuals who receive assistance in the activities of daily living activities exclusively from nurses. Think about the case of a nurse coming every day at the individual's house to help her grooming. If the individual does not receive any other form of professional assistance with ADL or IADL, she will be considered in our analysis as *not receiving* disability-compensating assistance. If we are interested in the care that can be subsidized by disability-compensating schemes such as APA and PCH, this seems a sound way of constructing our dependent variable of formal care utilization. Nonetheless, in our empirical strategy, we might still need some information about the availability or consumption of potential substitutes. Personal care delivered by private nurses or at home nursing services (SSIADs) may indeed partially substitute for some formal home care. Failure to account for such substitutions may be all the more a concern as supply from SSIADs for the handicapped adults was still substantially rationed in 2008, while these services have been available for the 60+ for long (cf. Section 6.2).

Substitution of nursing care for formal home care is relatively more likely for individuals who do not have access to home care subsidies or who incur a high co-payment rate on subsidized formal home care: as nursing care is paid for by the Health Insurance system, out-of-pocket payments on this type of care are generally low. Such a difference in out-pocket-costs thus provide a financial incentive to patients and their general practioners to claim at-home nursing care rather than home care for assistance with personal care. As shown by Ramos-Gorand (2015), there are substantial differences across departments in the supply of SSIADs, community nurses and home care services. Our dummy variables may partly capture these systematic differences and thus should decrease, though not erase, the potential bias in the 60+ coefficient due to the care provided by at-home nursing services being unobserved.

Yet an alternative way to interpret our results is to consider that the systematic differences in the supply and demand of at-home nursing services between the handicapped adults and the dependent elderly, holding individual characteristics constant, are also part of the age 60 barrier. Although SSIADs are formally part of the health care system, their missions connect them to long-term care policies. In this approach, we should read our estimates of the 60+ dummy as the effect of the age threshold in disability-compensating policies at large.

A second limitation due to the lack of precision on the professional care received is that it makes it impossible to *quantify* the volume of formal home care, distinctly from the volume of medical care received at home by an individual. These two issues limit our empirical

strategy. As we restrict our analysis to home care utilization rates, our results are valid at the extensive margin, but provide no information on the influence of the age 60 barrier on home care consumption at the intensive margin.

In 2018, the French Ministry of Health will release a national survey on Capacities, Helps and Resources (CARE). The survey will be matched with administrative data (APA and PCH records, national health insurance claims, etc.). It should thus contain richer information on the types of care received by disabled individuals, the benefits received and their out-of-pocket payments. Unfortunately, only individuals aged 60 and older will be surveyed. The institutional barrier at 60 has also effects on the data available on the population, as administrative and survey data collection tend to be done separately for the handicapped adults and for the dependent elderly (Colvez and Villebrun, 2003).

1.D   Density of the age distribution around the threshold

Although there is little scope for civil age manipulation in a national survey, we investigate the existence of any discontinuity in the density of age. This is a critical aspect of an RRD identification, as discontinuities in the running variable may undermine statistical precision or undermine identification altogether.
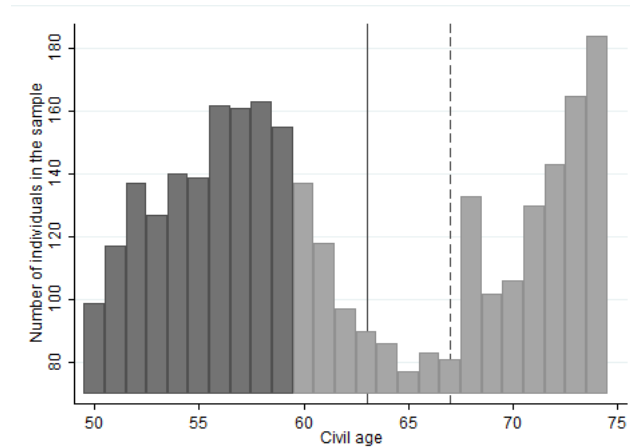
Figures 1.D.1 and 1.D.2 respectively display the *sample* and the *population* size by age of community-dwelling individuals aged 50 to 74 in 2008, with restrictions in the activities of daily living. Similarly, Figures 1.D.3 and 1.D.4 respectively represent the *sample* and the *population* size by age of the entire population aged 50 to 74 in 2008/2009.

The age distribution in the two *samples* (Figures 1.D.1 and 1.D.3) exhibits large variations. In particular, we notice a drop of the sample size between age 59 and age 60, and a "missing mass" at ages 65 to 67. *Population* size in both Figure 1.D.2 and 1.D.4 exhibits a spike at age 59, and a marked drop at age 67. Some explanation for these discontinuities dates back to World War II: individuals aged 67 in 2008 were born in 1941, a year in which the number of births fell dramatically in France. On the contrary, individuals aged 59 in 2008 were born in 1949, in the wave of the baby-boom. But the baby-boom had actually started 3 years earlier: the age pyramid of the French population at the time of the survey actually exhibits a sharp decrease in the population size between individuals born in 1946 (aged 62 or 61 in HSM, depending on their exact birthday) and individuals born in 1945 (aged 63 or 62 in the survey).[64] We actually observe a decrease in the population size around those ages. We can difficulty explain the spike at age 59, which might be possibly accounted for by some sampling design imprecision. However, what is important for a RDD identification strategy is that any discontinuity in the age density is exogenous to the outcomes of interest. We believe this is a reasonable assumption here.

HSM being cross-sectional, we have to rule out cohort effects in our identification strategy. The "WWII cohorts" may appear specific *a priori*; in terms of retirement decisions though, the cohorts born before, during and just after WWII have similar behaviors. Ruling out cohort effects in terms of care arrangements may not be such a strong assumption then.

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[64]The French legal population by age is provided by Insee: http://www.insee.fr/fr/ppp/bases-de-donnees/donnees-detaillees/bilan-demo/pyramide/pyramide.htm?lang=fr&champ=fe.

Figure 1.D.1 – Sample size in the community sample of interest, by civil age
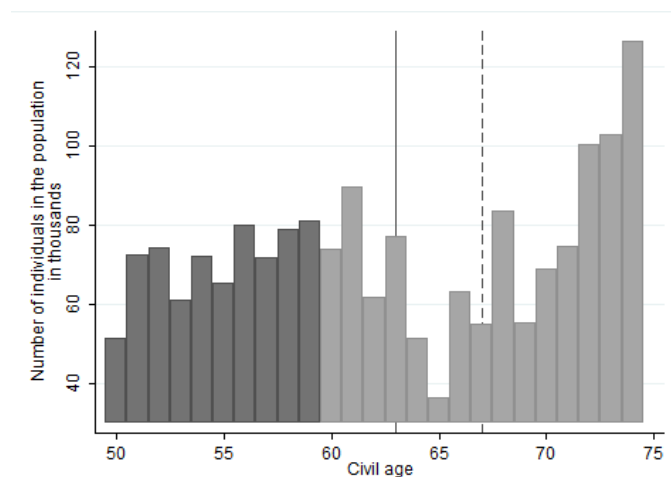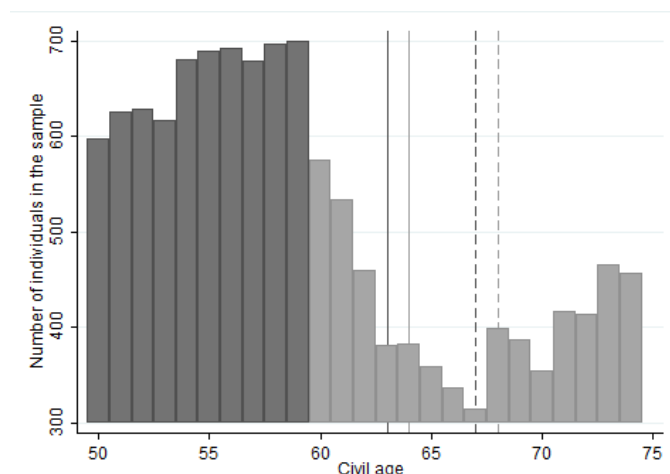

SAMPLE: Sample of the French population aged 50 to 74 in 2008, living in the community, with restrictions in the activities of daily living (N = 3,121 individuals).
SOURCE: Insee–Drees, HSM 2008.
NOTES: The dashed and solid lines respectively signal the cohorts affected by beginning of the baby-boom and by the drop in the number of births due to World War II.

Figure 1.D.2 – Population size corresponding to the community sample of interest, by civil age

SAMPLE: Sample of the French population aged 50 to 74 in 2008, living in the community, with restrictions in the activities of daily living (N = 3,121 individuals). Population size computed using survey weights.
SOURCE: Insee–Drees, HSM 2008.
NOTES: The dashed and solid lines respectively signal the cohorts affected by beginning of the baby-boom and by the drop in the number of births due to World War II.

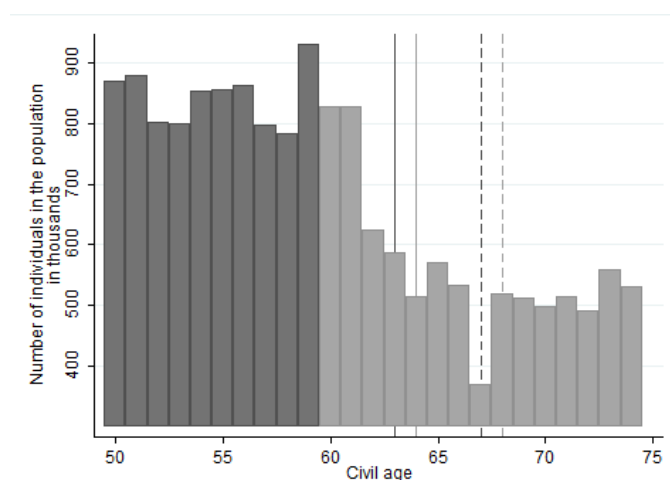Figure 1.D.3 – Sample size in the matched institution/community survey, by civil age

SAMPLE: Representative sample of the French population aged 50 to 74 in 2008 (N = 12,784 individuals).
SOURCE: Insee–Drees, HSM–HSI 2008/2009 matched sample.
NOTES: The dashed and solid lines respectively signal the cohorts affected by beginning of the baby-boom and by the drop in the number of births due to World War II.

Figure 1.D.4 – Population size in the matched institution/community survey, by civil age

SAMPLE: Representative sample of the French population aged 50 to 74 in 2008 (N = 12,784 individuals). Population size computed using survey weights.
SOURCE: Insee–Drees, HSM–HSI 2008/2009 matched sample.
NOTES: The dashed and solid lines respectively signal the cohorts affected by beginning of the baby-boom and by the drop in the number of births due to World War II.

1.E   Density of some control variables

1.E.1 Functional status around the age 60 threshold

In what follows, we display the conditional expectation of some covariates likely to have an important effect on home care arrangements, as a function of age. This may help to detect a potential differential selection of our population of interest before and after age 60, the existence of which is critical for the interpretation of our results.[65]

As differential utilization rates around the age threshold may arise because of differential epidemiological conditions, we study the evolution of the prevalence of restrictions in ADL and IADL around age 60. Figure 1.E.1 displays the average number of ADL individuals have difficulties to perform alone by civil age groups. We depicts linear fits of the observations on each side of age 60 to give a visual impression of what the potential discontinuity in the prevalence of ADL restrictions at age 60 may be (if the prevalence of ADL restrictions indeed evolves linearly with age).

The number of ADL restrictions increases with age on both sides of the institutional discontinuity of age 60, but Figure 1.E.1 suggests that this number decreases discontinuously at age 60. This finding holds even when controlling for quadratic age effects (Table 1.E.1): both Columns (1) and (2) find the coefficient of the 60^+ dummy to be negative and statistically significant in the regression of the number of ADL restrictions on our dummy of interest and linear or quadratic age effects.

As documented empirically, retirement, which usually happens between 60 and 65 in France (cf. Appendix 1.E), may also have adverse consequences on physical and mental health (Dave *et al.*, 2006; Godard, 2014). However, it is unlikely that these effects are sufficiently strong to translate into ADL restrictions: we would rather expect IADL restrictions and self–assessed health status to be affected. Yet we cannot detect any such discontinuity neither in the number of cognitive and non-cognitive IADL restrictions nor in the share of individuals declaring being in bad health (Table 1.E.1, Columns (3) to (8)).

Another assumption is that the discontinuous drop in the number of ADL restrictions at age 60 *within the population living in an ordinary setting* reflects the differential selection of the HSM sample on each side of the institutional discontinuity of age 60: as shown in Section 6.4 and Appendix 1.F, the probability to be recorded as living in an institution on

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[65]The results from this section were also used to assess the robustness of the RDD identification strategy (Imbens and Lemieux, 2008), which we have finally not retained. If some covariates exhibit a discontinuity right at the age threshold we are interested in, this may be suggestive of the covariates not being exogenous to the treatment. It may also signal that some unobserved factors correlating with the covariates, and potentially with the outcomes of interest, change discontinuously at the age threshold. If this is the case, the effect of the institutional difference between dependence and handicap schemes may be confounded with the effect of another unobserved change happening at age 60. As reminded by Imbens and Lemieux (2008) though, "a discontinuity in the conditional expectation of the covariates does not necessarily invalidate the [RDD] approach." (p. 18).

a permanent basis increases discontinuously at age 60. When focusing on individuals who live in an ordinary setting on a permanent basis, we "lose" relatively more individuals with severe activity restrictions on the right-hand side of the discontinuity than on the left-hand side, as those are more likely to live in an institution.

Figure 1.E.1 – Severity of disability around age 60: Average number of ADL individuals have difficulties to perform, by civil age
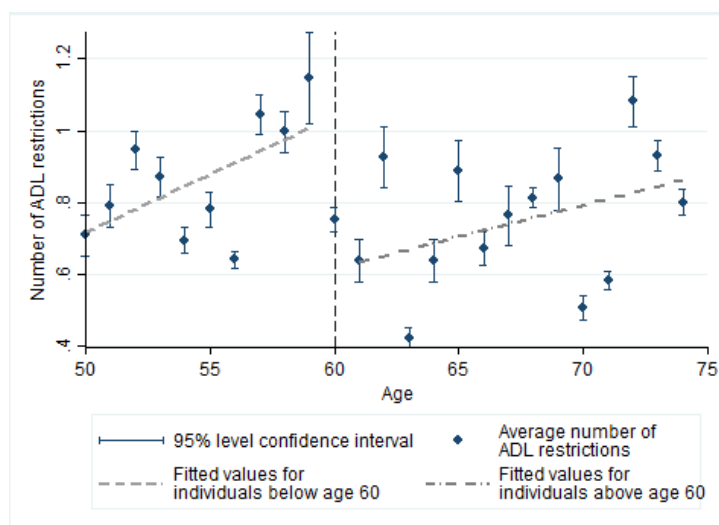
SAMPLE: French individuals aged 50 to 74, living in the community and having difficulties to perform alone at least one ADL or IADL (3,121 individuals).
SOURCE: Insee–Drees, HSM 2008.
NOTES: Dots represent average number of ADL by civil age and include varying numbers of individuals. Linear fits are obtained using individual observations and survey weights.

Table 1.E.1 – Robustness checks: Functional limitations and health around age 60.

	Dependent variable:							
	ADL restrictions		Non-cognitive IADL restrictions		Cognitive IADL restrictions		Bad or very bad health	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
60^+	-0.122**	-0.178**	0.009	0.079	-0.029	-0.025	-0.098	-0.127
	(0.052)	(0.078)	(0.054)	(0.077)	(0.060)	(0.089)	(0.061)	(0.090)
Age effects	Linear	Quadratic	Linear	Quadratic	Linear	Quadratic	Linear	Quadratic
Observations	3121	3121	3121	3121	3121	3121	3121	3121

NOTES: Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.01$. Population-average partial effects (APE) for binary variables are computed using the finite-difference method. Weighted estimations by a Probit model. Data from HSM 2008. The outcome "ADL restrictions" corresponds to the number of ADL the individual has restrictions with; the outcome "non-cognitive IADL restrictions" (resp. "cognitive IADL restrictions") corresponds to the number of non-cognitive (resp. cognitive) IADL the individual has restrictions with.

1.E.2 The age 60 threshold in the retirement legislation

The ages of 60 and 65 are common ages for retirement for French people;[66] age 60 (and to a lower extent, age 65) is associated with a positive "jump" in the probability of retirement. This pattern has been documented in the French general population (Blanchet and Mahieu, 2004), but is also visible on our sample. Figures 1.E.3 and 1.E.2 show that the probability to work decreases substantially with age before age 60 and gets close to zero after age 67. There is however no marked jump at age 60. On the contrary, the probability to be retired increases abruptly at that age, from less than 20% to about 70%. This dual pattern implies that most individuals in our population of interest had withdrawn from the labor market ahead of reaching the minimum retirement age (less than 20% of individuals aged between 55 and 59 were employed). This can be explained by the specificity of our population of interest: it is difficult for individuals with IADL or ADL restrictions to remain active on the labor market until they can claim pension benefits.

One first reason why the jump in the probability to be retired may influence the optimal mix between formal care and informal care utilization is that household resources may change discontinuously at age 60, as a consequence of the change in employment and retirement status. Columns (5) and (6) of Table 1.E.2 show that this does not happen in our population of interest: when regressing equivalized household income on the 60^+ dummy and (linear or quadratic) age effects, we cannot reject that being just older than 60 rather than being just below the institutional threshold has no effect on income.

It might still be the case one's own retirement and retirement of one's partner may induce significant changes in time allocation, and could well influence home care utilization rates. Recent evidence on French data suggests that own retirement increases home production (including cooking, doing household chores, caring for adults and children). Fitting a simultaneous equations model with both spouses' retirement decisions and hours dedicated to household chores, Stancanelli and Van Soest (2012) additionally find that partner's retirement tend to decrease men's home production (but to increase hours spent by women on house chores. Overall, household home production remains stable when the wife retires while it increases when the husband does so. Assuming these effects — which were estimated on a sample *excluding* individuals that could not participate into the labor market because of disabilities — extend to our population of interest, they would not go against our results. If anything, the effect of own retirement and of one's partner's retirement on formal care utilization would be negative.[67]

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[66]Individuals aged 60 to 67 in HSM survey were born between 1948 and 1955. Given progressive changes in retirement rules, their minimum retirement age was set between 60 and 62, and the full retirement age for these cohorts spread from age 65 to age 67 (Rabaté and Rochut, 2017).

[67]In our different specifications, the dummy variable for being retired adds no explanatory power to the model when we already control for the employment status.

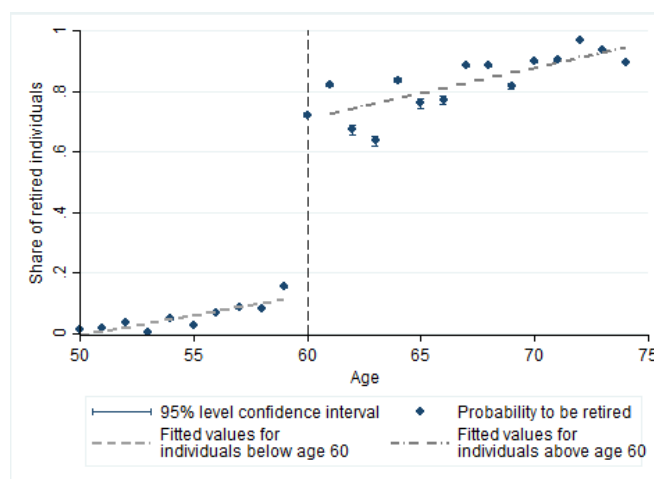Figure 1.E.2 – Work status around the age 60 threshold: Proportion of individuals working, by civil age
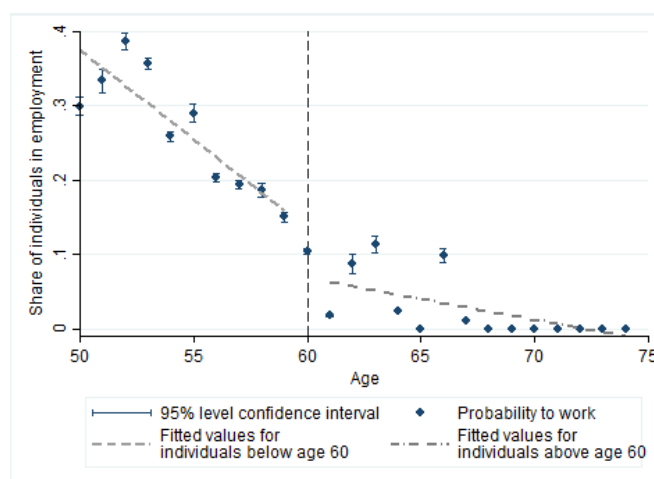
SAMPLE: French individuals aged 50 to 74, living in the community and having difficulties to perform alone at least one ADL or IADL (3,121 individuals).
SOURCE: Insee–Drees, HSM 2008.
NOTES: Dots represent average number of ADL by civil age and include varying numbers of individuals. Linear fits are obtained using individual observations and survey weights.

Figure 1.E.3 – Retirement status around the age 60 threshold: Proportion of retired individuals, by civil age.

SAMPLE: French individuals aged 50 to 74, living in the community and having difficulties to perform alone at least one ADL or IADL (3,121 individuals).
SOURCE: Insee–Drees, HSM 2008.
NOTES: Dots represent average number of non-cognitive IADL by civil age and include varying numbers of individuals. Linear fits are obtained using individual observations and survey weights.

Table 1.E.2 – Robustness checks: Work, retirement and income around age 60.

	In employment		Retired		Equivalized income	
	Dependent variable:					
	(1)	(2)	(3)	(4)	(5)	(6)
60^+	-0.028	-0.048	0.459***	0.422***	-6.215	188.167
	(0.037)	(0.056)	(0.068)	(0.096)	(84.135)	(125.929)
Age effects	Linear	Quadratic	Linear	Quadratic	Linear	Quadratic
Observations	3121	3121	3121	3121	3121	3121

NOTES: Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.01$. Population-average partial effects (APE) for binary variables are computed using the finite-difference method. Weighted estimations by a Probit model (Columns (1) to (4)) or by a linear regression model (Columns (5) and (6)). Data from HSM 2008. Equivalized income corresponds to the household equivalized income.

1.F Probability of living in an institution

1.F.1 HSM–HSI matched sample

The HSM–HSI matched sample brings together the HSM sample (cf. Appendix 1.B) and the sample of individuals included in the companion survey on the population living in an institutional setting, HSI.

The HSM–HSI matched dataset (N=39,035) is provided together with a weight variable to make the sample representative of the total French population in 2008 (64 million individuals). Although each of HSM and HSI samples were stratified, information about the strata is not reported in the matched sample. We could have imported this piece of information from each of HSM and HSI surveys and assumed that the sampling design followed a 2-stage design, the total sample being first stratified by living arrangements (strata 1: individuals living in the community; strata 2: individuals living in an institutional setting), and then stratified by either institution type (for HSI) or by regions and level (for HSM; cf. Appendix 1.B). Yet we are uncertain that this would correctly reflect the sampling design.[68] For this reason, we have preferred not to use any information about the survey structure but the survey weights when computing descriptive statistics and running the weighted estimations presented in the following subsections.[69]

To analyze the impact of the age 60 threshold on the probability to be recorded as living in an institution setting, we keep all individuals aged 50 to 74 at the time of the survey with no missing information on covariates[70] (12,784 individuals, representing 17 million individuals).

1.F.2 Impact of the age 60 threshold on the probability to live in an institution

Tables 1.F.1 and 1.F.2 present the results from regressions run on the entire sample of individuals aged 50–74. We checked that the results are robust to running the regressions on the sample of individuals with severe functional limitations only (those who are most likely to enter a specialized institution).

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[68]The sampling for HSI itself actually followed a 2-stage design: some institutions were drawn in a first stage, and then some individuals were drawn from the selected institutions in the second stage

[69]We believe this leads to over-estimate the standard errors as the survey strata, which we do not take into account, were designed to increase statistical precision.

[70]52 individuals (0.4% of the sample of interest) are discarded because of missing values.

Table 1.F.1 – Probability of living in an institution around age 60.

| | Dependent variable: Lives in an institution | | | | |
	(1)	(2)	(3)	(4)	(5)
60^+	0.004***	0.002**	0.003**	0.005**	0.005**
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
(Age - 60)		-0.000**	-0.001*	-0.003**	-0.002
		(0.000)	(0.000)	(0.001)	(0.001)
60^+.(Age - 60)		0.001***	0.001**	0.004**	0.003**
		(0.000)	(0.000)	(0.001)	(0.001)
(Age - 60)^2			0.000	0.000	0.000
			(0.000)	(0.000)	(0.000)
60^+.(Age - 60)^2			-0.000	-0.000*	-0.000
			(0.000)	(0.000)	(0.000)
(Age - 60)^3				0.000*	0.000
				(0.000)	(0.000)
60^+.(Age - 60)^3				-0.000	-0.000
				(0.000)	(0.000)
Woman					-0.001**
					(0.000)
Has a chronic disease					-0.001
					(0.001)
Self-assessed health: very bad					-0.003**
					(0.001)
Self-assessed health: bad					-0.003***
					(0.001)
Self-assessed health: fair					Ref.
Self-assessed health: good					0.002***
					(0.001)
Self-assessed health: very good					-0.000
					(0.001)
No limitations					Ref.
Mild limitations					0.009***
					(0.001)
Strong limitations					0.042***
					(0.004)
Constant	-2.637***	-2.706***	-2.763***	-2.897***	-3.207***
	(0.018)	(0.045)	(0.066)	(0.058)	(0.073)
Age effects	None	Linear	Quadratic	Cubic	Cubic
Observations	12784	12784	12784	12784	12784
AIC	1.272e+06	1.264e+06	1.264e+06	1.263e+06	1.151e+06
BIC	1.272e+06	1.264e+06	1.264e+06	1.264e+06	1.152e+06

NOTES: Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.01$. The specification of age effects allows for different trends before and after age 60. Population-average partial effects (APE) for binary variables are computed using the finite-difference method. Weighted estimations by a Probit model. Data from HSM–HSI 2008–2009.

1.F.4 Robustness checks

Estimation on alternative samples

Table 1.F.2 – Robustness checks: Probability of living in an institution around age 60 — alternative windows.

	Dependent variable: Lives in an institution					
	(1)	(2)	(3)	(4)	(5)	(6)
60^+	0.003**	0.005***	0.005**	0.004**	0.008***	0.003**
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)
Age effects	Quadratic	Quadratic	Quadratic	Cubic	Cubic	Cubic
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Window (ages included)	50–74	50–74 w/o age 60	50–69 w/o age 60	50–74	50–74 w/o age 60	50–69 w/o age 60
Observations	12784	12211	10116	12784	12211	10116
AIC	1.152e+06	1.120e+06	807186	1.151e+06	1.120e+06	806595
BIC	1.152e+06	1.120e+06	807287	1.152e+06	1.120e+06	806710

NOTES: Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.01$. The specification of age effects allows for different trends before and after age 60. Population-average partial effects (APE) for binary variables are computed using the finite-difference method. Weighted estimations by a Probit model. Data from HSM–HSI 2008–2009.

Health and functional status around the age 60 threshold

As discussed in Appendix 1.D, discontinuities in the density of covariates right at age 60 may weaken the RDD approach, if it suggests that other institutional change potentially affecting the institutionalization rate may take place at age 60. In this Appendix, we test whether we can detect any discontinuity in three key covariates: (1) having severe functional limitations, (2) having a chronic condition, and (3) having a bad or very bad self-assessed health. Such a test is achieved by regressing each of these covariates on the 60^+ dummy and on (linear or quadratic) age effects (Lee and Lemieux, 2010).

As suggested by Columns (1) and (5), the probability to suffer from severe functional limitations and of having a bad health status exhibits a discontinuity right at age 60. The point estimates are negative, statistically significant at the 5% level when we control linearly for age; statistical significance vanishes when we control for age in a quadratic way. Given that our sample is representative of the entire French population, and that the probability to retire exhibits a spike at age 60, what these estimates may pick up is a positive effect of retirement on functional status and health. When running the same regressions on the sub-sample of individuals with severe functional limitations (those who may effectively enter a specialized institution), we do not find any discontinuity in functional and health status at

age 60. This finding supports the robustness of the RDD identification of the effect of the age 60 threshold on living arrangements.

Table 1.F.3 – Robustness checks: Functional limitations and health around age 60 in the entire population (HSM–HSI).

| | Dependent variable: | | | | | |
| | Severe functional limitations | | Chronic condition | | Bad or very bad health | |
	(1)	(2)	(3)	(4)	(5)	(6)
60$^+$	-0.036**	-0.012	-0.021	-0.040	-0.043**	-0.034
	(0.014)	(0.021)	(0.029)	(0.045)	(0.015)	(0.023)
Age effects	Linear	Quadratic	Linear	Quadratic	Linear	Quadratic
Observations	12784	12784	12784	12784	12784	12784

NOTES: Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.01$. The specification of age effects allows for different trends before and after age 60. Population-average partial effects (APE) for binary variables are computed using the finite-difference method. Weighted estimations by a Probit model. Data from HSM–HSI 2008–2009.

1.G   Publication relating to this Chapter

A set of the results from this Chapter was published in *Revue française des affaires sociales* (RFAS), a French journal published by the Ministry of Health.[71]   The aim of this journal is to foster the dissemination of the results of academic works dealing with health and social policies.

Compared to the Chapter included in this thesis, the RFAS paper puts more emphasis on the institutional aspects of the French disability-compensating policies. It also provides an insight into what would be a simple economic approach to disability-compensation and to the question of the fairness of age thresholds. The empirical analysis focuses on individuals living in the community and the econometric model does not include age effects, so that we basically compare home care utilization rates among individuals aged 50–59 and among individuals aged 60–74, while controlling for differences in individual characteristics other than age.

The analysis published in RFAS suggested that the use of informal care was little affected by the age 60 threshold; in this Chapter, we present alternative results that suggest that the probability to be helped by relatives is lower for the dependent elderly. We believe this difference is due to both the refinement in the econometric analysis and a slight change in the definition of our sample of interest. Indeed, in the RFAS paper we decided to keep individuals for who we had complete information on their family composition (including age of parents and siblings, distance of the residence of the children, etc.) to include additional control variables. Some questions were not asked to those individuals who declared they did not need any assistance with the activities of daily living, and thus we dropped such individuals. In this Chapter we take a different methodological stance. If not declaring any needs for assistance correlates with benefit receipt and the age 60 threshold we are interested in, dropping individuals who declare they are in need of care may induce a non-random differential selection on both sides of the age 60 threshold. We finally deemed that this issue would probably cause a higher bias in our estimates that failing to account for additional family characteristics.

Our stronger result — that the utilization rate of formal home care is higher for the dependent elderly than for the handicapped adults — is robust to our methodological choices.

The RFAS paper also includes an analysis of the recipiency of disability-compensating benefits (APA, PCH and ACTP), based on the declarations made by the survey respondents. We find the dependent elderly are more likely to declare they benefit from a transfer. Yet, given the low reliability of information relating to benefits in HSM, we remain cautious on this set of results.

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[71]The article is made available on the academic repository Cairn.

Chapter 2

Pay more, consume less?
The price elasticity of home care for the disabled elderly in France

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This chapter was co-authored with **Quitterie Roquebert**.

Summary of the chapter

Little is known about the price sensitivity of demand for home care of the disabled elderly. We partially fill this knowledge gap by using administrative data on the beneficiaries of the main French home care subsidy program in a department and exploiting inter-individual variation in provider prices. We address the potential endogeneity of prices by taking advantage of the unequal spatial coverage of providers and instrumenting price by the number of municipalities served by a provider. We estimate a price elasticity of around –0.4 that is statistically significantly different from both 0 and –1. This less than proportionate response of consumption to price has implications for the efficiency and redistributive impact of variation in the level of co-payments in home care subsidy schemes.

Classification

JEL Classification: C24; D12; I18; J14.

Keywords: Long-term care, home care, disabled elderly, price elasticity, censored regression.

Acknowledgments for this Chapter

Publication relating to this Chapter

This Chapter was published in a similar version as:

Roquebert Q, Tenand M. "Pay less, consume more? The price elasticity of home care for the disabled elderly in France". *Health Economics.* 2017; 26: 1162—1174.

It won the 3rd prize of the International Health Economics Association (iHEA) Student Prize Committee in the 2018 edition.

Contents of the Chapter

1 Introduction

Like most developed countries, France is facing the aging of its population: due to the increase in life expectancy and the advance in age of baby-boomers, the share of the population above 75 is predicted to grow from 9.0% in 2013 to 17.2% in 2060 (Blanpain and Buisson, 2016*a*). As the rise in disability-free life expectancy falls short of the increase in life expectancy (Sieurin *et al.*, 2011), the number of the elderly needing assistance to perform the activities of daily living is expected to grow substantially. Most disabled elderly keep on living in the community rather than entering specialized institutions (Colombo *et al.*, 2011). Besides medical and nursing care, they are often provided with domestic help and personal care. Assistance may be provided by relatives (informal care) and also by professional services (formal care), whose utilization is increasing. In most countries, public policies foster the utilization of formal home care by subsidizing its consumption. These programs, however, only partially cover the cost of professional home care and the disabled elderly often bear non-negligible out-of-pocket (OOP) costs. In France, the average monthly OOP payment for home care was estimated to be €300 in 2011 (Fizzala, 2016); over one fifth of the average pension (Solard, 2015).

We address the following question: how sensitive to price are the disabled elderly when consuming professional home care? Besides concerns regarding the financial accessibility of long-term care services, OOP payments raise efficiency issues. As in the health care context, generous home care subsidies may induce over-consumption and a welfare loss, while insufficient coverage could have adverse health effects (Stabile *et al.*, 2006; Rapp *et al.*, 2015; Barnay and Juin, 2016) or induce beneficiaries to substitute home care for more expensive institutional care (Ettner, 1994; Guo *et al.*, 2015). Uncovering the impact of OOP price on home care consumption is crucial to designing an optimal subsidy policy. Such a policy would achieve ex ante insurance of uncertain LTC costs and allow ex post welfare gains through the transfer of resources towards the beneficiaries of the scheme. It would also limit ex post moral hazard arising if formal care substitutes for other consumption goods (Zeckhauser, 1970; Nyman, 1999; Cutler and Zeckhauser, 2000; Bakx, Chernichovsky, Paolucci, Schokkaert, Trottmann, Wasem and Schut, 2015). Our paper brings evidence on this empirical question by estimating the price elasticity of the demand for non-medical home care services of the disabled elderly, at the intensive margin.

We focus on the French home care scheme targeted to the disabled elderly, the APA (*Allocation personnalisée d'autonomie*) policy, which counted 738,000 community-dwelling beneficiaries in 2014 and amounted to a spending of 3.1 billion euros in 2013 (0.15% of GDP).[1] Administrative records of the scheme provide detailed information on home care consump-

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[1] Drees (2013, 2014). The APA program also has a component for the elderly living in nursing homes.

tion and OOP payments of APA beneficiaries but they are available only at the local level. We use an original dataset made of the individual records we collected for the beneficiaries of a given Departmental Council (*Conseil départemental*). We exploit inter-individual variations in provider prices to identify consumer price elasticity. Price endogeneity may arise if APA beneficiaries non-randomly choose their home care provider. To address this issue, we exploit the unequal spatial coverage by providers in the department. We fit a censored regression model to deal with observational issues and control for disposable income and other individual characteristics likely to affect the consumption of home care.

Our results indicate a negative price elasticity, with point estimates ranging from −0.5 to −0.1. According to our favoured estimation, an increase of 10% of the hourly OOP price would reduce total hours consumed by 4% on average, or 70 minutes per month for a beneficiary consuming the median monthly volume of 18 hours. Although confidence intervals are relatively large, we statistically reject a price elasticity of both 0 and −1 in most specifications.

Our paper provides one of the very first estimates of the price elasticity of the demand for home care services of the disabled elderly. Despite the growing concern about the financing of long-term care, the impact of OOP payments on the consumption of home care has been little investigated in the economic literature. A few papers tested for the effect of benefiting from subsidies on the utilization of paid home care (Coughlin *et al.*, 1992; Ettner, 1994; Pezzin *et al.*, 1996; Stabile *et al.*, 2006; Rapp *et al.*, 2011; Fontaine, 2012); because of data limitations, they were not able to quantify the price sensitivity. To our knowledge, the only existing studies addressing this gap in the literature exploit French data. Using national survey data, Hege (2016) makes assumptions on unobserved OOP prices and estimates a price elasticity of −0.16. Bourreau-Dubois, Gramain, Lim and Xing (2014) use APA records from a department to observe exact home care prices, as we do, and estimate an elasticity of −0.55. We use a different, original dataset and propose an instrumental variable strategy to deal with potential price endogeneity.

Our results entail important policy implications, as home care subsidy schemes are expanding with population aging. Home care consumption is found to be price sensitive through both substitution and income effects, meaning that home care support programs taking the form of unit subsidies on the price of care induce gross efficiency loss. Moreover, since consumption of home care reacts less than proportionately to a price change, home care subsidies should be regarded as a tool to reduce OOP spending on long-term care and achieve redistribution of consumer surplus from taxpayers to the disabled elderly.

The Chapter proceeds as follows. Section 2 presents the APA scheme and how it affects the demand for home care. Sections 3 and 4 present the data and the empirical strategy. The results and their discussion are reported in Section 5; Section 6 concludes.

2   Institutional context and demand for home care

2.1   The APA program

The French APA program aims at fostering the utilization of professional care services by the elderly requiring assistance in the activities of daily living (household chores, meal preparation or personal hygiene). The APA policy is established at the national level and implemented at the departmental level.[2] To be eligible, an individual must be at least 60 years-old and recognized as disabled. This second condition requires a specific assessment from a team managed by the Departmental Council, called the evaluation team, made of medical professionals (nurses, doctors) and/or social workers. The evaluation team visits each APA applicant to evaluate her needs of assistance using a national standardized scale. The applicant is thus assigned a disability group (*Groupe Iso-Ressources*, or GIR). Individuals found to be moderately (GIR–4) to extremely disabled (GIR–1) are eligible for APA, while the least severely disabled (GIR–5 or –6) are not.

The evaluation team then establishes a "personalized care plan". This document lists the activities for which the individual needs assistance and sets the number of hours necessary to their realization. It gives the maximum number of hours eligible for APA subsidies of each beneficiary, called the care plan volume.[3] Up to the care plan volume, the OOP price of each hour of care is lowered by the APA subsidy. The beneficiary is free to consume hours beyond the care plan volume but there are no more subsidies.

2.2   Computation rules of APA subsidies

For subsidized hours, the APA beneficiary is charged an hourly OOP price that depends on both the provider price and a co-payment rate, increasing with disposable income. For low-income individuals (below €739 per month at the end of 2014) the co-payment rate is zero, while it reaches 90% for the richest beneficiaries (monthly income above €2,945). In between the two, the co-payment rate is an increasing linear function of disposable income.[4]

If the provider chosen by the beneficiary is authorized, then the hourly OOP price is given by applying the co-payment rate to the regulated price charged by the provider.[5] For

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[2]Metropolitan France is divided into 95 departments.

[3]The monetary valuation of the care plan volume must not exceed a legal ceiling, which depends on the disability level. At the end of 2014, the ceiling was €1,313 (resp. €563) per month for GIR–1 (resp. GIR–4). Appendix 2.D provides more elements on the set up of the care plan volume.

[4]The schedule of APA co-payments was substantially reformed in 2016. We describe the pre-reform schedule.

[5]49 metropolitan Departmental Councils out of the 73 that answered a national survey conducted in 2012 applied this computation rule (LEDa-LEGOS and CES, 2012; Bourreau-Dubois *et al.*, 2015). Authorized providers are generally priced by the Departmental Councils.

"non–authorized" providers,[6] the co-payment rate is applied to a lump–sum price to get the OOP price. This distinction has important implications for what can be known of beneficiaries' OOP payments, since Departmental Councils usually keep track only of the prices of authorized providers.

2.3 Modeling demand for home care with APA

We write the Marshallian demand for professional home care assuming a heterogeneity-only model (Moffitt, 1986):

$$h_i^* = g(CP_i, \hat{I}_i; X_i) + v_i \tag{2.1}$$

where h_i^* is the number of hours of home care consumed by individual i and $g(.)$ denotes the demand function. Care consumption depends on the consumer (or OOP) price for one hour of home care, CP_i, on the total disposable income available for consumption $\hat{I}_i$, and on individual socio-demographic characteristics, X_i. v_i is an individual preference shifter.

With APA, up to the care plan volume denoted $\bar{h}_i$, the hours consumed are subsidized. The consumer price is $CP_i = c(I_i)p_i$, where p_i is the provider price for individual i and the co-payment rate c_i is a function of individual i's monetary disposable income: $c_i = c(I_i)$, with $c(.)$ a linear function.

Beyond the care plan volume $\bar{h}_i$, the consumer price equals the full provider price as there is no APA subsidy any more. The budget constraint is:

$$\begin{cases} I_i = c_i p_i h_i^* + Y_i & \text{if} \quad h_i^* \leq \bar{h}_i \\ I_i = c_i p_i \bar{h}_i + p_i(h_i^* - \bar{h}_i) + Y_i \iff I_i + (1 - c_i)p_i \bar{h}_i = p_i h_i^* + Y_i & \text{if} \quad h_i^* > \bar{h}_i \end{cases}$$

where Y denotes the composite good, with price set to 1. The APA program creates a kink in the budget constraint of the beneficiary (Figure 2.1 on the following page).

As shown by the previous system, when deciding upon an increase in home care consumption beyond $\bar{h}_i$, the individual should take into account not only her monetary disposable income I_i but also the subsidies received on the first $\bar{h}_i$ hours of care she has consumed. Denoting $\tilde{I}_i = I_i + (1 - c_i)p_i \bar{h}_i$ the "virtual" income of individual i (Moffitt, 1986, 1990), we rewrite the demand function specified in Equation (2.1) as follows:

$$\begin{cases} h_i^* = g(c_i p_i, I_i; X_i) + v_i & \text{if } h_i^* < \bar{h}_i \\ g(p_i, \tilde{I}_i; X_i) + v_i \leq \bar{h}_i \leq g(c_i p_i, I_i; X_i) + v_i & \text{if } h_i^* = \bar{h}_i \\ h_i^* = g(p_i, \tilde{I}_i; X_i) + v_i & \text{if } h_i^* > \bar{h}_i \end{cases}$$

---

[6]It can be either a non-authorized structure (*service agréé non-autorisé*) or an over-the-counter worker (*gré-à-gré* or *mandataire*). See Appendix 2.E for more details on the French home care sector.

Figure 2.1 – Budget constraint for home care under the APA program
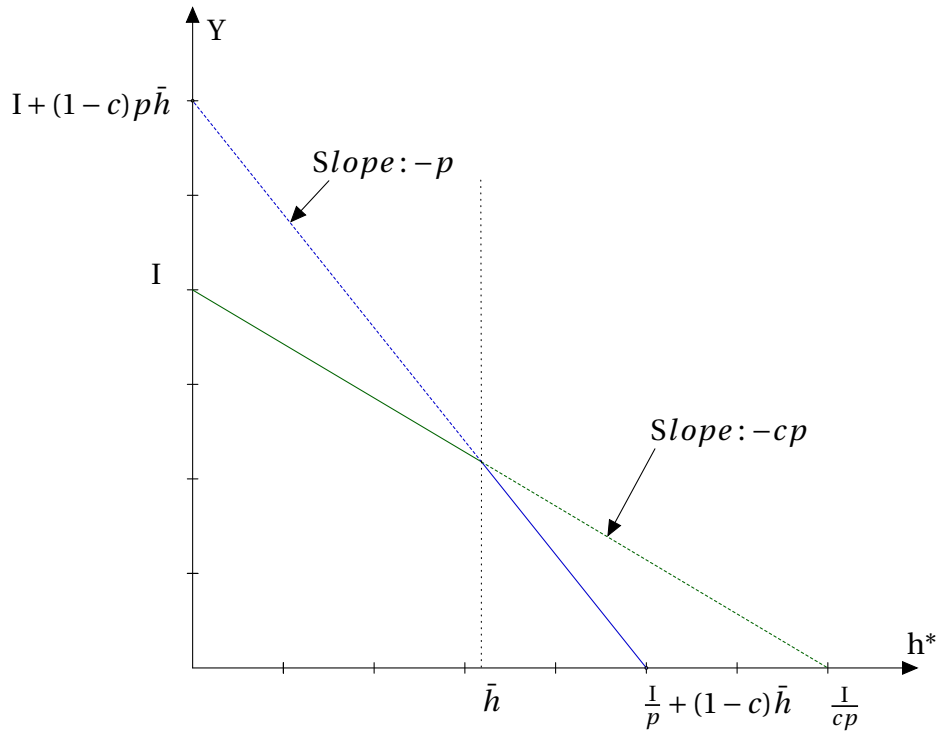
The objective of the paper is to obtain an empirical estimate of the following quantity, which is the point price elasticity:

$$\frac{\mathrm{d}g(\mathrm{CP},\hat{\mathrm{I}};\mathrm{X})}{\mathrm{dCP}} \frac{\mathrm{CP}}{g(\mathrm{CP},\hat{\mathrm{I}};\mathrm{X})}$$

3   Data

3.1   Administrative data from a Departmental Council

In France, there is no national survey or administrative data set that provides precise information on both the OOP payments and the formal home care use of the disabled elderly.[7] We collected data from one Departmental Council that uses the most frequent APA subsidy computation rule. We selected a department with demographic characteristics close to the national averages, although its population has higher than average incomes (Appendix 2.A).

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[7]This will no longer be the case as of the Summer 2018, when a new survey (CARE) collected by the French Ministry of Health is released. The CARE survey precisely aims at filling the informational gap relating to the out-of-pocket payments on formal care use incurred by the disabled elderly.

Data were collected for every month in 2012–2014. Since within year variation in provider prices is negligible, we only use data for the month of October,[8] when home care consumption is less likely to be affected by temporary shocks (like holidays and visits from children).

3.2   Sample selection

To ensure clean identification, we focus on APA beneficiaries served by an authorized home care provider for which the provider price is observed: we exclude 23% of beneficiaries of the initial sample as they receive care from other providers. We also exclude beneficiaries with missing information on subsidized consumption around the month of interest, so as to limit the risk that unobserved shocks (temporary absences or hospitalizations) could bias the estimates.

In addition, we exclude beneficiaries whose co-payment rate is zero: their OOP price on subsidized hours is zero. We also exclude beneficiaries whose co-payment is equal to 90%: the relationship between their disposable income and their co-payment rate is not linear and this makes identification more complex. We end up with 8,190 individuals, or about 2,700 per year, representing 51% of the initial sample.[9]

3.3   Descriptive statistics

Columns [3] and [4] of Table 2.1 describe our estimation sample for October 2014.[10] The typical individual is a woman, in her mid-80s and living alone. Six APA beneficiaries out of ten do not consume their full care plan volume; price sensitivity is one possible candidate to explain part of this high figure.

Columns [1] and [2] present the same statistics for two larger populations we selected our final sample from (all APA beneficiaries / all beneficiaries with an authorized provider). The last two columns indicate whether our sample and the larger samples differ in statistical terms. Differences are significant in terms of income and disability level, translating into differences in co-payment rate and care plan volume and value.[11]

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[8]Averaging consumption and OOP prices on an annual basis would hamper identification by blurring the true empirical relationship between price and consumption.

[9]Appendix 2.A provides more details.

[10]We present the data of October 2014 to draw a better picture of the population of interest. Table 2.A.3 in Appendix 2.A replicates these statistics for the pooled sample.

[11]Implications for the external validity of the analysis will be discussed in Section 5.

Table 2.1 – Descriptive statistics for estimation sample and all program beneficiaries (October 2014)

Variable	All benefi-ciaries Mean [1]	Beneficiaries with an authorized provider Mean [2]	Estimation sample Mean [3]	Estimation sample Std-dev. [4]	Differences between samples P-value [1] − [3]	Differences between samples P-value [2] − [3]
Care plan volume [a]	*n.a.*	21.9	20.5	10.7	*n.c.*	0.00
Care plan monetary value [b]	*n.a.*	€471.7	€455.5	€238.3	*n.c.*	0.00
Hours effectively subsidized [c]	*n.a.*	*n.a.*	17.7	10.9	*n.c.*	*n.c.*
Amount of effective subsidies [d]	*n.a.*	*n.a.*	€300.8	€201.4	*n.c.*	*n.c.*
[c] inferior to [a]	*n.a.*	*n.a.*	59.8%	-	*n.c.*	*n.c.*
Ratio [c]/[a]	*n.c.*	*n.c.*	85.0%	20.7 pp.	*n.c.*	*n.c.*
Ratio [d]/[b]	*n.c.*	*n.c.*	65.1%	22.2 pp.	*n.c.*	*n.c.*
Individualized income	€1,324.5	€1,264.6	€1,315.8	€422.5	0.00	0.00
Co-payment rate	24.4%	22.3%	23.7%	17.3pp.	0.01	0.00
Authorized provider price	*n.a.*	€22.2	€22.2	€1.3	*n.c.*	0.04
Hourly OOP price	*n.a.*	€4.9	€5.2	€3.8	*n.c.*	0.00
Total OOP payments on subsidized hours	*n.a.*	€84.5	€91.3	€98.6	*n.c.*	0.00
Age	*n.a.*	84.1	84.2	7.4	*n.c.*	0.29
Women	76.7%	73.8%	74.0%	-	0.03	0.76
Disability level 1 (most severe)	1.5%	1.3%	1.2%	-		
Disability level 2	14.5%	13.8%	12.5%	-		
Disability level 3	21.2%	21.0%	19.6%	-	0.00	0.00
Disability level 4 (least severe)	62.8%	63.9%	66.7%	-		
	100%	*100%*	*100%*			
Living with a spouse	32.1%	31.0%	33.8%	-		
Living alone	66.6%	67.5%	65.6%	-	0.00	0.00
Spouse in institution	1.3%	1.6%	0.6%	-		
	100%	*100%*	*100%*			
Number of individuals	5,486	4,199	2,862		-	-
Number of households	*n.a.*	*n.a.*	2,785		-	-

SAMPLES: [1]: sample of all at-home APA beneficiaries of the department; [2]: sample of beneficiaries who receive care, but not necessarily exclusively, from an authorized provider; [3] and [4]: estimation sample.

NOTES: "pp." stands for percentage points, "*n.a.*" for "not available", "*n.c.*" for "not computable" (available information is insufficient). Information on care plan volume, effective consumption and provider price is not available when the beneficiary receives care from a non-authorized provider. Care plan volume and effective home care consumption are expressed in hours per month; income, subsidies and total OOP payments are expressed in euros per month. Data from October 2014.

TESTS: The last two columns present the p-values from the tests of difference between the estimation sample and non-selected beneficiaries. The test performed is a Student (resp. Pearson χ^2) test if variable is binary or continuous (resp. categorical). The tests compare the mean or distribution in the estimation sample with the reference sample ([1] or [2]) excluding the estimation sample.

4 Empirical strategy

4.1 A censored measure of home care consumption

APA files register the individual number of home care hours that are charged by the provider to the Departmental Council or, equivalently, the *subsidized* hours of home care. However, we do not observe the *total* volume of home care consumed by each APA beneficiary. For the beneficiaries whose recorded consumption equals their care plan volume (40% of our sample), our measure of home care consumption is then right-censored.[12]

Denote h_i the number of home care hours billed to the Departmental Council for beneficiary i. We observe:

$$\begin{cases} h_i = g(c_i p_i, \mathrm{I}_i; \mathrm{X}_i) + \nu_i & \text{if} \quad g(c_i p_i, \mathrm{I}_i; \mathrm{X}_i) + \nu_i < \bar{h}_i \\ h_i = \bar{h}_i & \text{if} \quad g(c_i p_i, \mathrm{I}_i; \mathrm{X}_i) + \nu_i \geq \bar{h}_i \end{cases} \tag{2.2}$$

Hence, the parameters of the demand function $g(.)$ can only be identified from information relating to the first segment of the budget constraint. For individuals with the maximum number of billed hours $\bar{h}_i$, the only information we can use is that their demand is at least as high as this number.[13]

4.2 Econometric specification

Since the distribution of (observed) home care consumption is slightly skewed, we assume a log-linear specification of $g(.)$, as follows:

$$ln(h_{it}^*) = \beta_0 + \beta_1 . ln(c_{it} . p_{it}^j) + \beta_2 . ln(\mathrm{I}_{it}) + \mathrm{X}_{it}' . \theta + \lambda_t + \epsilon_{it} \tag{2.3}$$

where p_{it}^j denotes the price charged by provider j chosen by individual i in year t[14] and λ_t are year fixed effects. Both price and income are included in log so that β_1 represents the consumer price elasticity and β_2 captures the income elasticity of the demand for home care

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[12]No public source, at either the departmental or the national level, provides information on home care consumption beyond the care plan volume. However, data collected on a large provider operating in a French department (and used in Chapter 3 of this thesis) show that 17% of its customers receiving APA consume strictly more than their care plan volume, with a median "over-consumption" of 1.5 hour per month (Fontaine and Gramain, 2017).

[13]Appendix 2.C provides more details.

[14]All beneficiaries with the same provider are charged the same provider price, before APA co-payment rate applies.

services. As $c(.)$ is fully linear in income in the sample,[15] Equation 2.3 can be rewritten as:

$$ln(h_{it}^*) = \gamma_0 + \beta_1.ln(p_{it}^j) + (\beta_1 + \beta_2).ln(I_{it}) + X_{it}'.\theta + \lambda_t + \epsilon_{it} \qquad (2.4)$$

Equation (2.4) makes it clear that the income variations identify the *empirical* income effect within the APA framework. With APA, any marginal increase in the disposable income has two effects. First, it increases home care consumption, provided home care is a normal good (standard income effect). Then, it induces the reassessment of the co-payment rate, which may further affect home care consumption through an increased OOP price (price effect).

As System (2.2) corresponds to the typical observational scheme underlying censored regression model, β_1 and β_2 can be estimated by Maximum Likelihood after making a parametric assumption on ϵ (Tobit model).[16] Our favoured specification though, is a more flexible version of Equation (2.4). In Equation (2.5), we take as dependent variable the log-share of the care plan volume consumed by the individual, $h_{it}^*/\bar{h}_{it}$ (call it "relative consumption") and include the care plan volume $\bar{h}_{it}$ as a control. Equation (2.4) is nested in Equation (2.5) and $\tilde{\beta}_1$ can still be interpreted as a price elasticity.[17]

$$ln(h_{it}^*/\bar{h}_{it}) = \tilde{\gamma}_0 + \tilde{\beta}_1.ln(p_{it}^j) + (\tilde{\beta}_1 + \tilde{\beta}_2).ln(I_{it}) + \tilde{\beta}_3.ln(\bar{h}_{it}) + X_{it}'.\tilde{\theta} + \tilde{\lambda}_t + \tilde{\epsilon}_{it} \qquad (2.5)$$

This specification comes with several advantages. First, it includes $\bar{h}_{it}$ as a control, which might be a proxy of the unobserved determinants of consumption.[18] Technically, relative home care consumption has a better-behaved distribution than absolute consumption, making parametric estimates more likely to be consistent.[19] Its censoring point is unique (equal to 0), which eases the implementation of the estimation.

Our baseline estimates are obtained fitting a population-average[20] censored regression estimation of Equation (2.5) assuming that:

$$\tilde{\epsilon} \quad | \quad p, I, \bar{h}, X, \tilde{\lambda} \sim \mathcal{N}(0, \tilde{\sigma}^2). \qquad (2.6)$$

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[15]The relationship between c_{it} and I_{it} depends on the year the co-payment rate was set. We control for this source of inter- and intra-individual variation in our estimations. Appendix 2.B provides more details.

[16]Appendix 2.C derives the Maximum Likelihood function.

[17]Appendix 2.B provides more details.

[18]The care plan volume is supposedly based only on the specific activity restrictions of the beneficiary; but qualitative studies have shown that the evaluation team is likely to take into account additional characteristics of the individual, such as the informal care she receives (Billaud *et al.*, 2012).

[19]See Figures 2.B.1 and 2.B.2 in Appendix 2.B.

[20]We use the unbalanced sample: selecting individuals staying in the APA program for three years would raise additional selection issues.

4.3 Identification using cross-sectional variations in prices

As suggested by Equations (2.4) and (2.5), the *consumer price* elasticity of demand is identified by the cross-sectional variation in *provider prices*. In the department, there are 28 authorized providers. Each provider price is reassessed every year. In the panel, provider prices range from €19.35 to €23.50, with an average of €21.8 and a standard-deviation of €1.3. As yearly variation in prices was small between 2012 and 2014, most of the price variation is cross-sectional.[21]

To get unbiased estimates, the provider price charged to individual i must be uncorrelated with the unobserved factors affecting her home care consumption, ϵ_i. Supply-demand simultaneity may violate this condition (Zhen *et al.*, 2014), but it should be negligible in our context. Indeed, although each provider is priced by the Departmental Council on the basis of its average production cost of two years earlier, the pricing process largely depends on administrative and political considerations (Gramain and Xing, 2012).

The risk of omitted variable biases is more difficult to dismiss. Beneficiaries may non-randomly select their provider (price) on the basis of some unobservable individual characteristics such as quality expectations, unobserved health condition or informal care provision (Billaud *et al.*, 2012). Some sources of price variations can be documented and are unlikely to be correlated with unobserved determinants of home care consumption (Appendix 2.F), but it is insufficient to rule out any price endogeneity induced by non-random provider choice. To address this potential bias, we exploit the unequal spatial coverage by authorized providers in the department.

4.4 An instrumental variable strategy

We propose to instrument the provider price by the number of municipalities in which the provider serves APA beneficiaries and estimate an IV-Tobit. To be valid, our instrument must first correlate with the price, conditional on the control variables. Second, it must be uncorrelated with the unobserved determinants of professional home care consumption.

From a practical standpoint, serving more municipalities translates into higher transportation and coordination costs for a provider. Exploiting the service files of a large French home care provider, Roquebert (2018) gives an estimate for the travel costs incurred by a given provider, for one hour of intervention. Their average value ranges between between 6% and 8% of the provider price. This share is found to vary considerably with the organization of caregivers' rounds. For authorized providers, such costs are partially incorporated in the price set by the Departmental Council (Gramain and Xing, 2012). Several public and research

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[21]On average, provider prices increased by 1.9% between October 2012 and 2013 and by 1.3% between 2013 and 2014.

reports on the French home care sector have insisted on the heterogeneity in transportation costs borne by providers and the differences in prices it induces (Aube-Martin *et al.*, 2010; Vanlerenberghe and Watrin, 2014; Branchu *et al.*, 2015; Garabige *et al.*, 2015).

In our data, as is evidenced by Figure 2.G.4, the price charged by a given provider and the number of municipalities in which it operates are positively correlated. The IV-Tobit first stage (Table 2.2) shows that a one standard-deviation increase in the number of municipalities served by the provider is associated with a 4.9% increase in its price. The F-statistic associated with this estimate exceeds 143 - a figure far higher than the conventional threshold used to assess the risk that the instrument is weak (Staiger and Stock, 1997).

Figure 2.2 – Correlation between provider price and number of municipalities served by the provider
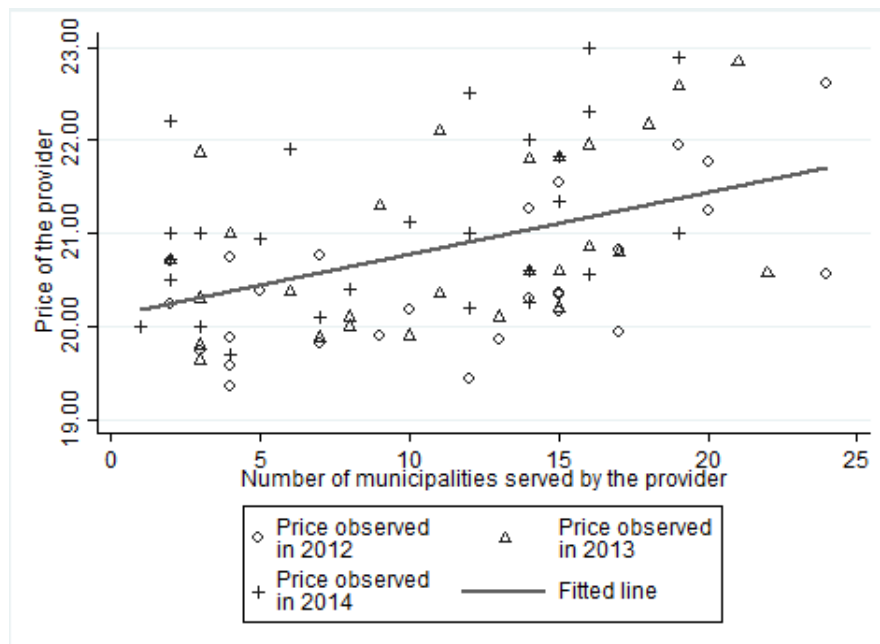
NOTES: The number of municipalities served by each provider is constructed using information on all APA beneficiaries receiving home care from an authorized provider in October 2012, 2013 and 2014 (and not just the beneficiaries retained in the estimation sample). The line is fitted using all three years of observation. To make the graphical representation more readable, we excluded the largest provider. With 199 municipalities served in October 2014, it charged the highest price over the 3 years of observation (€23.5 in 2014). The positive correlation displayed by the graph is preserved when we include the largest provider.

A potential threat to the exclusion restriction is that the instrument may correlate with individual consumption through another channel than the price charged by the provider. In particular, it would be the case if the number of hours provided by a service systematically increases its provision costs due to decreasing returns to scale. Apart from transportation and coordination costs though, the care provision process may be assumed to exhibit

roughly constant returns to scale, as most of the provision costs is made of caregivers' wages. The strong association between the price charged by a provider and its geographical area of operation is thus unlikely to be driven by the volume of care it delivers.

5 Results and discussion

5.1 Main results

Table 2.2 presents our main results, obtained on the panel data.[22] Column (1) presents Tobit estimates of Equation (2.5). Column (2) presents the estimates we obtain when the price is instrumented by the number of municipalities served by the provider.[23] We cluster the standard errors at the provider level since our "treatment" variable, p_{it}^j, essentially varies at the provider level (Moulton, 1990; Cameron and Miller, 2015).

[Table 2.2 to be found on the following page.]

When the provider price is considered as exogenous, the consumer price elasticity estimate is about -0.45. When using our instrument, the coefficient is slightly lower in absolute value. The difference between the two is not statistically significant, suggesting that the potential bias due to non-random provider selection may be limited.[24] Overall, price elasticity estimates are negative, statistically significant, confirming that the disabled elderly are sensitive to the price of professional home care. Our favoured estimation (Column (2)), which instruments the price, gives a point estimate of -0.387, or about -0.4.

The income effect in the APA framework appears negative, but negligible and statistically not different from zero. Richer APA beneficiaries do not tend to consume more formal care, all other things being equal. With $\hat{\tilde{\beta}}_1 + \hat{\tilde{\beta}}_2$ close to zero, our estimations suggest that the increase in the co-payment rate, induced by an increase in income, compensates for the standard income effect. We also derive an estimate of the standard income elasticity $\tilde{\beta}_2$. Both the Tobit and the IV-Tobit give a value of about 0.4, statistically different from zero. Although this income effect is imprecisely estimated,[25] we are able to conclude that home care is a necessity good for the disabled elderly.

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[22]The coefficients displayed give the predicted impact of a marginal (or 0/1) change in a given explanatory variable on the total, uncensored relative home care consumption.

[23]We use the parametric version of Stata command `ivtobit`. We thus assume the error terms of the first-stage and second-stage equations are jointly normally distributed.

[24]We implement a cluster Bootstrap Hausman test. We cannot reject that the provider price is exogenous ($p = 0.88$).

[25]$\hat{\tilde{\beta}}_2$ corresponds to the difference between the empirical income elasticity with APA and the price elasticity estimates; the associated standard error is high (around 0.19), due to the relatively large standard error of the price elasticity estimate.

Table 2.2 – Censored regression estimates of demand for home care hours

	Tobit	IV-Tobit
	(1)	(2)
Panel A: Second stage	Dependent variable: relative consumption $h^*/\bar{h}$ (log)	
Price (log)	-0.450**	-0.387**
	(0.181)	(0.192)
Disposable income (log)	-0.010	-0.010
	(0.008)	(0.008)
Care plan volume (log)	0.040*	0.040*
	(0.023)	(0.023)
Woman	0.029**	0.030**
	(0.014)	(0.014)
Age: 60–69	-0.124***	-0.123***
	(0.047)	(0.047)
Age: 70–79	-0.042**	-0.042**
	(0.017)	(0.017)
Age: 80–89	*Ref.*	*Ref.*
Age: 90 or older	0.051***	0.052***
	(0.015)	(0.015)
Disability group: 1 (most severe)	0.154***	0.153***
	(0.057)	(0.057)
Disability group: 2	0.027	0.027
	(0.022)	(0.022)
Disability group: 3	*Ref.*	*Ref.*
Disability group: 4 (least severe)	0.008	0.009
	(0.012)	(0.012)
Living with no spouse	0.107***	0.107***
	(0.013)	(0.013)
Spouse receives APA	0.036	0.037
	(0.034)	(0.034)
Spouse in institution	0.170*	0.170*
	(0.095)	(0.094)
Living with non-APA spouse	*Ref.*	*Ref.*
Constant	1.225**	1.032*
	(0.556)	(0.592)
Panel B: First stage	Dependent variable: provider price p (log)	
Number of municipalities (std.)		0.049***
		(0.004)
F statistic		143.98
Observations	8190	8190
Censored observations	39.6%	39.6%
Number of clusters	28	28
AIC	11454	-22049
BIC	11644	-21860

NOTES: Standard errors in parentheses, clustered at the provider level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Pooled data from October 2012, 2013 and 2014. Estimation of a Tobit or IV-Tobit model by Maximum Likelihood. In the first stage (Panel B), the log-provider price is regressed on the standardized number of municipalities served by the provider. All specifications include year fixed effects, dummies for the year in which the co-payment rate was computed as well as dummies for the year the latest plan was decided upon (in the first and second stages for the IV-Tobit estimation).

Individuals with a higher care plan volume tend to consume a larger share of their care plan. For a given disability level, a higher care plan volume could be explained by a lower provision of informal care. Alternatively, a higher care plan may also have a stronger prescriptive effect.

As expected, the highly-disabled individuals consume relatively more than the beneficiaries with mild to moderate disability, all other factors being equal. Even when controlling for the disability level, age retains a significant effect on the consumption on home care services. Being a woman increases the consumption of professional home care relative to the care plan volume, by a small but statistically significant amount. Living alone (spouse in institution or no spouse) increases the amount of professional assistance received, consistently with previous works showing the importance of the co-residing spouse in providing informal care substituting partly for formal home care services.

5.2 Further results and robustness checks

We replicate the estimations on each year separately (Appendix 2.G); price elasticity estimates are found to range from -0.54 to -0.13. Precision is low but we can reject that the price elasticity is zero (except for 2014) or unity.[26] We check our results are robust to the fact that inference relies on a small number of clusters by implementing a cluster percentile-t bootstrap (Appendix 2.G). Statistical significance of the price elasticity is preserved at the 5% level on the pooled sample.

To investigate the potential heterogeneity in price sensitivity, we estimate the model interacting the price with the disability level or the income level (Table 2.3).

[Table 2.3 to be found on the following page.]

A credible IV strategy would require to find an additional instrument for each interaction term. As Table 2.2 suggests that the bias due to potential price endogeneity is limited, we fit a simple Tobit model when adding the interaction terms. We expected more severely disabled individuals to be less price sensitive, but we are not able to detect such an effect. Price sensitivity is higher for individuals whose income is above the sample median income. This result echoes Duarte (2012), who finds that higher income individuals are more price-elastic in their medical care consumption. Richer individuals may be more able to understand the health care system and cost-sharing schedules due to a higher financial literacy.

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[26] Precision in 2014 is lower, as a provider closed down.

As a robustness check, we implement an alternative identification strategy (Appendix 2.G). We estimate our equation of interest (without instrumenting the price) on the subsample of APA beneficiaries who live in a municipality where a single authorized provider is found to operate. In a context in which price selection is arguably limited, we find a price elasticity estimate around –0.5 — not statistically different from our main result.

Table 2.3 – Price elasticity of home care by severity of disability and income

	Dependent variable: relative consumption h^*/h (log)		
	(1)	(2)	(3)
Price (log)	-0.450**	-0.323	-0.446**
	(0.181)	(0.236)	(0.178)
Price (log) × disability group 4 (least severe)		-0.190	
		(0.270)	
Price (log) × income above median			-0.019***
			(0.006)
Disposable income (log)	-0.010	-0.010	0.011
	(0.008)	(0.008)	(0.010)
Observations	8190	8190	8190
Censored observations	39.6%	39.6%	39.6%
Number of clusters	28	28	28
AIC	11454	11453	11439
BIC	11643	11642	11629

NOTES: Standard errors in parentheses, clustered at the provider level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Pooled data from October 2012, 2013 and 2014. Estimation of Tobit model by Maximum Likelihood. All specifications include as controls the care plan volume, socio-demographic characteristics, year fixed effects, dummies for the year in which the co-payment rate was computed as well as dummies for the year the latest plan was decided upon.

5.3 Discussion

Our results confirm that the consumption of home care of the disabled elderly is sensitive to the price they pay. Decisions relating to formal home care consumption are influenced by a trade-off between the OOP price of an extra hour and its marginal value. Such a pecuniary trade-off has been documented at the extensive margin, as the take-up of APA benefits is affected by the average subsidy rate in the department (Arrighi *et al.*, 2015). Originally, we find evidence that the price elasticity of the demand for home care is seemingly lower than unity at the intensive margin: the adjustment of consumption is proportionally lower than a given change in price. This implies a positive price elasticity of OOP expenditures: a *decrease* in the OOP price should lead to a *decrease* in total OOP payments.

The price sensitivity we obtain is of an order of magnitude similar to the estimates found for health care demand. Although the magnitude of the −0.2 estimate derived from the Rand Health Insurance Experiment (Manning *et al.*, 1987; Keeler and Rolph, 1988) is subject to discussion (Aron-Dine *et al.*, 2013), a large literature has confirmed that medical spending is price-elastic, with price sensitivity varying with the type of care (Duarte, 2012; Fukushima *et al.*, 2016). Our paper provides interesting evidence that, at the intensive margin, home care consumption is closer to acute care than to elective care in terms of price sensitivity.

Uncovering the welfare effects of home care subsidies yet requires to assess the extent to which the adjustment of home care use to a change in the relative price of care is due to income effects as opposed to substitution effects. Nyman (1999) has suggested that the transfer of income achieved through an insurance scheme offering a price reduction on health care may increase the willingness-to-pay for care, thus the surplus associated with care use. However, any further increase in care consumption due to the change in relative prices alone induces a loss in allocative efficiency, as the willingness-to-pay for care falls short of its relative costs at the margin. Transposing this framework to our analysis, we decompose our estimated price effects into substitution and income effects. A back-of-the-envelope computation suggests the price elasticity of the *hicksian* demand to be close to our estimated price elasticity of the *marshallian* demand, around 0.3-0.4 in absolute value.[27] Providing insurance against long-term care expenses through subsidies on the price of care thus comes with some gross efficiency loss. Providing full estimates of the welfare gains or losses associated with the APA program would however require richer data and more extensive modeling, and is beyond the scope of this Chapter.

The interpretation and implications of our results are contingent on several assumptions and limitations. Our OOP price measure does not take into account possible tax reductions on home care services, unobserved in the APA records. Without sufficient information to simulate them, we implicitly assume APA beneficiaries to be sensitive to the "spot" price (Geoffard, 2000). We also assume that APA recipients react in the same way to variations in the co-payment rate and in the provider price. If salience differs (Chetty *et al.*, 2009), implications of our results for the design of the co-payment schedule are less straightforward.

In our administrative data, information on family characteristics is poor. Receiving more informal care has been found to decrease formal care use, both at the extensive and intensive margins (Van Houtven and Norton, 2004; Bonsang, 2009). Omitting informal care provision could bias the estimates of our entire set of coefficients. This is all the more of a concern as the share of (self-declared) APA beneficiaries who declare receiving some informal help is higher in the department than in the rest of France.[28] As a robustness check, we include as

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[27]See Appendix 2.H for details.
[28]Over four-fifths in the department, against 75% in metropolitan France (Insee-Drees, 2014).

a control whether the individual receives formal home care during the weekend and public holidays (Table 2.G.9, Appendix 2.G). We hypothesize that individuals not receiving professional home care over the weekend are more likely to receive assistance from their relatives. Receiving formal care during the weekend is associated with more hours consumed during working days; reassuringly though, it does not significantly affect the price elasticity estimate.

Finally, external validity of our results should be qualified. Without data covering the entire population eligible to APA, the potential bias induced by the differential take-up of APA subsidies (Chauveaud and Warin, 2005) cannot be dealt with. Our sample is not nationally representative and we focus on APA recipients who consume home care from authorized services. As the department is slightly richer than France as a whole, and price sensitivity being greater for richer beneficiaries, our estimates may be an upper bound (in absolute value). Yet the department is reasonably close to "average France" in terms of other socio-demographic characteristics and most APA beneficiaries in France receive care from authorized providers (Couvert, 2017; Hege *et al.*, 2014). Finally, our results are in line with the two available estimates (Bourreau-Dubois, Gramain, Lim and Xing, 2014; Hege, 2016), which rely on different estimation strategies and data.

6   Conclusion

This paper estimates the consumer price elasticity of the demand for professional home care services of the disabled elderly benefiting from the French APA program. Our results suggest this parameter is about −0.4, with point estimates statistically different from zero and unity in absolute value.

Our findings pave the way for several policy implications. The income elasticity of the structural demand for home care, holding the co-payment rate constant, is found to be positive, suggesting that the ex post transfer of income from the taxpayers to the disabled elderly enabled by the APA scheme results in some welfare gains. However, formal home care displays some substitutability with other consumption goods, reducing the efficiency of a long-term care scheme offering a price payoff rather than a lump-sum payment. From a more dynamic perspective, that LTC use adjusts to the price of care may make home care subsidy programs conducive to positive health effects for beneficiaries, if higher use of LTC improves their health status. Given the relatively low price elasticity of demand, the generosity of home care subsidies may also be seen as a tool achieving redistribution of consumer surplus from taxpayers to the disabled elderly. Finally, as differences in income between APA beneficiaries are found to little correlate with differences in care use, the design of the APA co-payment schedule seems to ensure that the use of professional home care by the disabled

elderly little depends on individual socio-economic status.

While remaining cautious regarding the external validity of the results, our estimates can be used to discuss the effects of potential reforms of home care subsidies. The decrease of co-payment rates enacted by the 2016 APA reform, higher for low- and middle-income recipients, should reduce overall OOP expenses on professional home care of current APA recipients, while having a limited volume effect.[29]

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[29]This prediction abstracts from the increase in the national ceilings on care plan volumes that was also decided by the 2016 APA reform. Chapter 3 assesses the effects of the full set of the measures of the reform.

Appendix

2.A   Additional information on the data

2.A.1. Comparison of the department studied with metropolitan France

Table 2.A.1 compares the department studied to metropolitan France. We use either administrative sources ([A]: Insee *et al.* (2013); [B]: Insee (2014); [D]: Drees (2013)) or survey data ([C]: Insee-Drees (2014)).

Column [1] gives descriptive statistics on metropolitan France while Column [2] focuses on the department studied. Column [2] reports intervals around the true department value to preserve its anonymity. Bounds are computed so that 20% of the French departments closest to the department of interest (weighting by the size of the departmental population aged 60 or more) have a value lying in the interval.[30] If the department is located in the bottom quintile, we report as a lower bound the minimum value observed across French departments for the variable; similarly, when the department ranks in the top quintile, the upper bound we report is the maximum value observed in metropolitan France.

The third column tests the significance of the differences between the first two columns. For statistics computed using exhaustive administrative sources ([A], [B] and [D]), we test whether the department *population* can be considered as a random draw from the French metropolitan population. When using survey data ([C]), the tests of difference compare the *sample* of the respondents of the department with the respondents of the rest of France.

Although differences are quasi-systematic in statistical terms, the selected department has socio-demographic characteristics close to that of France overall. Our selected department is however richer than the rest of France: it has a higher share of households subject to the income tax and a lower poverty rate in the 75+ population, although the median taxable income in the department is only slightly higher than in France. Albeit the prevalence of functional limitations in the 60+ population is similar in the department and in the rest of France, the rate of APA beneficiaries is slightly higher in our department. This possibly reflects local variations in the way the APA policy is implemented (Billaud *et al.*, 2012).

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[30]Insee *et al.* (2013) directly provides the deciles of the taxable income distribution in the metropolitan French population aged 75 or more. The department is found to be richer than the 40% least wealthy departments, but poorer than the 40% richest departments. We use the 4th and 6th deciles of the national distribution to bound the median taxable income observed in the department studied.

Table 2.A.1 – Descriptive statistics for department studied and metropolitan France

Variable	Metropolitan France [1]	Department [2]	Difference (p. value) [1] − [2]	Source -
General population				
Households subject to income tax	58.2%	[61.9%–75.1%]	0.00	[A]
60+ population/total population	24.4%	[23.8%–26.3%]	0.00	[B]
Elderly population (60+)				
Average age	71.8	[71.3–71.7]	0.00	
Health status (functional limitations)				
Level 1 (least severe)	64.9%	[63.9%–66.2%]		
Level 2	21.4%	[20.1%–21.0%]	0.48	[C]
Level 3	7.7%	[7.2%–7.8%]		
Level 4 (most severe)	6.0%	[6.3%–7.0%]		
	100%	*100%*		
Poverty rate in 75+ population	8.9%	[6.9%–7.9%]	0.00	[A]
Median taxable income (75+ households)	€19,536	[€17,380–€22,050]	*n.c.*	
Rate of APA beneficiaries	7.8%	[8.1%–9.1%]	0.00	[D]
At–home recipients/all APA beneficiaries	58.7%	[56.1%–60.6%]	0.00	
At-home APA beneficiaries				
Woman	73.7%	[71.7%–72.8%]	0.00	
Age groups				
Age 60-74	12.7%	[11.2%–12.7%]		
Age 75-79	13.6%	[13.8%–14.6%]	*n.c.*	[D]
Age 80-84	23.9%	[23.5%–24.4%]		
Age 85+	49.7%	[49.2%–51.0%]		
	100%	*100%*		
Living arrangements				
Living alone	55.3%	[54.7%–56.9%]		
Living with her spouse	30.4%	[27.7%–32.7%]	0.88	[C]
Living with a relative other than her spouse	14.3%	[9.5%–12.5%]		
	100%	*100%*		
Disability level				
Disability level 1 (most severe)	2.4%	[1.7%–2.1%]		
Disability level 2	16.8%	[14.1%–15.6%]	*n.c.*	[D]
Disability level 3	22.1%	[20.0%–21.7%]		
Disability level 4 (least severe)	58.8%	[60.5%–64.5%]		
	100%	*100%*		
Amount of effective subsidies	€361.1	[€329.1–€350.5]	*n.c.*	

SOURCES: [A]: Insee *et al.* (2013); [B]: Insee (2014); [C]: Insee-Drees (2014) – APA benefit is self-declared. Rate of spousal co-residence may be underestimated; [D]: Drees (2013)– Administrative files on APA beneficiaries in 2013, all French departments. Decomposition by sex and age (resp. by disability level) not available in 21 (resp. in 5) departments.

NOTES: Column [2] reports intervals around the true department value to preserve its anonymity. Bounds are computed so that 20% of the French departments closest to the department of interest (weighting by the size of the departmental population aged 60 or more) have a value lying in the interval.

TESTS: *n.c.* stands for "not computable". Test performed is a Student (resp. a Pearson χ^2) test for binary (resp. categorical) variables.

2.A.2. Sample selection

This Appendix aims at documenting the selection steps the data from October 2014 have gone through. We follow the same steps to construct the samples of October 2012 and 2013. The percentages of individuals selected at each step are very similar to what is found for 2014 and are available upon request.

The initial number of beneficiaries is considered to be 5,486.[31] Table 4.A.2 sums up the selection steps.

Table 2.A.2 – Sample selection steps

	All	Recipients with an authorized provider *at least*				
		All	Recipients effectively consuming care in the month			
			All	"Stable" recipients		
				All	Recipients consuming *only from one* authorized provider	
					All	Recipients with $0 < c_i < 90\%$
	(1)	(2)	(3)	(4)	(5)	(6)
Number	5,486	4,475	4,199	3,527	3,327	2,862
% of previous step	-	81.6%	93.8%	84.0%	94.3%	86.1 %
% of initial sample	100%	81.6%	76.5%	64.3%	60.6%	52.2%

NOTES: "Stable" APA recipients in October 2014 are defined as those for which information is available also for the months of September and November 2014. For additional 63 individuals (not in the numbers here above), the administrative files contain no information on the co-payment rate or or the consumption of home care hours, or are inconsistent with national APA legislation.

To observe precisely both the out-of-pocket price and the number of hours that are effectively consumed and subsidized, we retain the beneficiaries receiving care from an authorized provider. They represent the majority of APA recipients in the department (more than 4/5).

Among them, about 6% have no actual consumption of home care recorded in the files. This might be explained by temporary absences (like hospitalizations) or disruptions (e.g. visits from relatives, who replace temporarily professional home care services by providing informal care). As the outcome of interest is missing, we drop these observations. Another 15% of APA recipients with an authorized provider have missing information on subsidized care consumption for the preceding or the following month. We choose to drop them to

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[31]For October 2014, administrative records indicate that 5,549 beneficiaries were receiving APA; but for 61 individuals, essential information on subsidized hours, co-payment rate or on matrimonial status was missing or inconsistent. These individuals are presumably former APA recipients not yet erased from the files. For 2 additional individuals, the monetary value of the care plan was beyond the national legal ceiling, signaling a probable error in the records. We dropped these 63 observations from our sample.

avoid potential unobservable shocks likely to bias our estimations. The remaining individuals can be regarded as "stable".

Among beneficiaries actually receiving care from an authorized provider at least, less than 6% receive care from a secondary provider.[32] As we generally do not observe care consumption from the secondary provider nor its price,[33] we drop multiple-provider individuals.

Beneficiaries with income below a certain threshold have a 0% co-payment rate: their OOP price is zero. Our log-log specification cannot be estimated on these observations. In addition, so as to make the relationship between the consumer price and the provider price fully linear in disposable income (see Appendix 2.B), we retain only those individuals with a co-payment rate strictly below 90%. These two income groups represent respectively 12.7% and 1.3% of the remaining 3,327 beneficiaries.

We end up with a sample that represents 52% of total at-home APA recipients of the department.

A Heckman-type model would allow to take into account the selection of our sample on both observable and unobservable factors affecting the demand for home care. But we do not have any good instrument at hand to construct an estimator that would not entirely rely on a parametric assumption. We choose to estimate our parameters of interest directly on the selected sample. Such a choice imposes to remain cautious about the external validity of our estimates, as discussed in Section 5.3 of the paper.

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[32]The majority of these beneficiaries receive additional care from an over-the-counter worker (see Section 2.E for more details on the different types of home care providers). Over-the-counter workers are generally cheaper and more flexible than home care structures. 7 individuals receive home care from a second authorized provider. Theoretically, there might be a third case: beneficiaries could also complement the care provided by an authorized structure with care provided by a non-authorized structure. Our files do not allow us to identify such cases; we believe they are marginal, as care provision by non-authorized structures is rare (only 6% of beneficiaries with no authorized provider receive home care from a non-authorized structure).

[33]Even if we had all necessary information, dealing with the simultaneity of consumption decisions would have made our empirical strategy considerably more complex.

2.A.3. Imputation of couples of APA beneficiaries

The data we collected indicate when a beneficiary lives with a partner, but we do not directly know whether the partner also receives APA. Having an APA-recipient spouse may correlate with one's own home care consumption; failing to control for such a characteristic may bias our estimates.

To identify potential couples in our sample, we checked whether each individual could be matched with another recipient of the opposite sex, recorded as living with a spouse, with exactly the same income[34] and residing in the same municipality. If two individuals match, we assume they belong to the same household: our estimations will control for the fact of having a spouse receiving APA.

The matching procedure may fail for individuals whose co-payment rate is 0%. The reported disposable income is the same for all such individuals, be they actual spouses or not. The same pitfall applies for individuals whose co-payment rate is 90%. In these cases, the Departmental Council simply records the lower or upper income threshold of the APA co-payment schedule. In October 2014, only 16 individuals were not matched for this reason. But all our estimations rely on the sample of individuals with a co-payment rate strictly between 0 and 90%, for whom the matching procedure is systematically successful.

2.A.4. Descriptive statistics on the pooled sample

Table 2.A.3 replicates Columns (3) and (4) of Table 2.1 of the paper, by presenting the descriptive statistics on the pooled sample (and not on the 2014 sample only).

The pooled sample we derive our baseline estimates from is an unbalanced panel. In this sample, 26% of beneficiaries are present all three waves; another 26% are present only in two waves; finally, 48% are only present in one wave.[35] Focusing on the sample of beneficiaries in October 2014, we see that the longer the individual has been receiving APA, the older she is; this translates into a higher proportion of women, who have a longer life-expectancy, and a lower proportion of beneficiaries with a spouse alive among the beneficiaries present in two or three waves. Those beneficiaries tend to be more disabled; they have, on average, a higher care plan volume and a higher number of hours subsidized by the APA scheme (consumption relative to the care plan volume being also higher). On the contrary, we do not see any difference in average provider and OOP prices, nor in income.

When using the unbalanced sample, we do not select a specific population — the new entrants into the APA scheme —; the shortcoming of such a choice, however, is that the in-

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[34]The APA co-payment schedule takes into account the household income. See Appendix 2.B.

[35]This does not mean that the typical APA recipient benefits from the scheme less than one year. For individuals observed only in 2012, for example, we do not know whether they were receiving APA one year or two years before. Average duration of APA benefits is estimated to be around 4 years (Debout, 2010).

Table 2.A.3 – Descriptive statistics on the pooled sample (2012–2014)

Variable	Mean [1]	Std-dev. [2]
Care plan volume [a]	20.9	10.7
Care plan monetary value [b]	€456.1	€235.8
Hours effectively subsidized [c]	18.1	10.8
Amount of effective subsidies [d]	€303.1	€199.2
[c] inferior to [a]	60.4%	-
Ratio [c]/[a]	85.6%	19.8pp.
Ratio [d]/[b]	65.5%	21.7pp.
Individualized income	€1,301.5	€415.6
co-payment rate	23.8%	17.2pp.
Provider price	€21.8	€1.3
OOP price	€5.2	€3.8
Total OOP payments on subsidized hours	€91.6	€95.2
Age	84.0	7.3
Woman	73.2%	-
Disability level 1	1.2%	-
Disability level 2	12.8%	-
Disability level 3	20.2%	-
Disability level 4	65.8%	-
	100%	
Lives with a spouse	33.8%	-
Lives alone	65.6%	-
Spouse in institution	0.6%	-
	100%	
Number of individuals	8,190	-

NOTES: "pp." stands for percentage points. Care plan volume and effective home care consumption are expressed in hours per month; income, subsidies and total OOP payments are expressed in euros per month. Sample from October 2012, 2013 and 2014.

dividuals who have been present in several waves weigh more in the estimation than single-observation individuals. The cross-sectional estimates presented in Appendix 2.G (Tables 2.G.1 to 2.G.3) show that the magnitude of the price elasticity estimate does not change substantially when replicating our estimations using the sample of beneficiaries present in October of either 2012, 2013 or 2014.

2.B   Specifications

2.B.1.   Addressing income and co-payment rate issues in the empirical specifications

In Section 4.2 of the paper, when taking the absolute consumption as the dependent variable, our econometric specification is stated as follows:

$$ln(h_{it}^*) = \gamma_0 + \beta_1.ln(p_{it}^j) + (\beta_1 + \beta_2).ln(I_{it}) + X'_{it}.\theta + \lambda_t + \epsilon_{it} \tag{2.7}$$

To ensure a clean identification of the parameters, two features of the data must be taken into account. First, the disposable income recorded in the data at time t is not the current value of income but the income when the co-payment rate was computed or last revised, denoted I_{it}^{obs}. We express disposable income at time t as: $I_{it} = \rho_{it}I_{it}^{obs}$, with ρ_{it} the rate of increase of individual disposable income between time t and the year i's last co-payment rate was computed. As the rate of increase in disposable income ρ_{it} is not directly observable, we include a dummy $\mathbb{1}_{it}^d$ equal to one when i's co-payment rate (observed in t) was last revised in year d. Dummy coefficients should capture the rate of increase in income between years d and t.[36] In our data, most co-payment rates were last computed between 2010 and 2014; for a few observations though, the latest computation of the co-payment rate is older ($d = 2002,...,2014$).

Second, the co-payment rate is set to be strictly proportional to the disposable income at the time the latest personalized care plan was defined, I_{it}^{obs}, according to the following function:

$$c_{it} = \frac{0.9}{2MTP_{it}^D}I_{it}^{obs}$$

where MTP_{it}^D is the value of a particular disability allowance (*Majoration pour Tierce-Personne*) the year the co-payment rate was last computed for individual i observed at time t. For a given observed income, the co-payment might differ according to the year d when the co-payment rate was last computed. Year dummies $\mathbb{1}_{it}^d$, $d = 2002,...,2014$ thus additionally control for inter-individual and intra-individual variation in this parameter.

For 2% of our sample, the relationship between the income and the co-payment rate does not respect the legal formula used to compute the co-payment rate. After a careful examination of the data, we hypothesize that most of these errors occurred when the co-payment

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[36]We implicitly assume the rate of increase in disposable income to be identical for two individuals observed a given year, whose personalized plans were decided upon the same year d. Retirees' income is mostly made of pension benefits (Deloffre, 2009), which are reevaluated every year following the inflation rate. It remains a strong assumption given the heterogeneity in income composition across the income distribution.

rate was computed; conversely, we assume the values of income are well recorded, and the co-payment rate registered in the data is the value that is effectively applied to compute the APA subsidy. We add a dummy variable $\mathbb{1}_{it}^e$ signaling whether the observation is affected by such a calculation error. The full equation to be estimated is then:

$$ln(h_{it}^*) = \gamma_0 + \beta_1.ln(p_{it}^j) + (\beta_1 + \beta_2).ln(\mathrm{I}_{it}^{obs}) + \sum_{d=2002}^{2014} \xi^d.\mathbb{1}_{it}^d + \zeta.\mathbb{1}_{it}^e + \mathrm{X}_{it}'.\theta + \epsilon_{it} \qquad (2.8)$$

Finally, note that our econometric specification includes *disposable* income and not income *per se*. In the APA scheme, disposable income is defined as the individualized income[37] minus an amount equal to $0.67 \times \mathrm{MTP}_{it}^{\mathrm{D}}$ (€739 per month for an individual whose income and co-payment rate was last reassessed in 2014). It roughly equals the old-age minimum income allowance. This amount may be regarded as the minimum income that will ensure the individual can satisfy her basic consumption needs: the individual trades off home care consumption for other consumption goods only when deciding upon the allocation of the part of her income in excess of the minimum income allowance.

2.B.2. Specification with relative consumption

When using the specification with relative consumption, we consider as the dependent variable the share of the care plan that is effectively consumed by the individual, $h_{it}^*/\bar{h}_{it}$ (this is the ratio we call the "relative consumption").

Empirically, we take the log of the ratio and estimate the following specification:

$$ln\big(h_{it}^*/\bar{h}_{it}\big) = \tilde{\gamma}_0 + \tilde{\beta}_1.ln(p_{it}^j) + (\tilde{\beta}_1 + \tilde{\beta}_2)ln(\mathrm{I}_{it}^{obs}) + \beta_3.ln(\bar{h}_{it})$$
$$+ \sum_{d=2002}^{2014} \tilde{\xi^d}.\mathbb{1}_{it}^d + \tilde{\zeta}.\mathbb{1}_{it}^e + \mathrm{X}_{it}'.\tilde{\theta} + \tilde{\lambda}_t + \tilde{\epsilon}_{it} \qquad (2.9)$$

The dependent variable is still censored when individuals fully consume their care plan volume (exact volume or more), but the censoring point now equals $ln(h_{it}^*/\bar{h}_{it}) = ln(1) = 0$. It is the same for all beneficiaries, whatever the volume of the care plan. Equation (2.9) is

---

[37] Individualized income equals the individual's monetary income when the beneficiary has no spouse alive; it is equal to the household monetary income divided by 1.7 when the beneficiary has a spouse alive. The consumption unit attributed to the second adult of the household follows the Oxford (or "old OECD") scale (OECD, 2013*a*). Compared to the OECD-modified scale, which is nowadays the most frequently used in France, the use of the Oxford scale to compute APA individualized income implies that the economies of scale in a household with a disabled elderly are lower than in other households.

equivalent to:

$$ln(h_{it}^*) - ln(\bar{h_{it}}) = \tilde{\gamma}_0 + \tilde{\beta}_1.ln(p_{it}^j) + (\tilde{\beta}_1 + \tilde{\beta}_2)ln(I_{it}^{obs}) + \tilde{\beta}_3.ln(\bar{h_{it}})$$

$$+ \sum_{d=2002}^{2014} \tilde{\xi}^d.\mathbb{1}_{it}^d + \tilde{\zeta}.\mathbb{1}_{it}^e + X'_{it}.\tilde{\theta} + \tilde{\lambda}_t + \tilde{\epsilon}_{it}$$

$$ln(h_i^*) = \tilde{\gamma}_0 + \tilde{\beta}_1.ln(p_{it}^j) + (\tilde{\beta}_1 + \tilde{\beta}_2)ln(I_{it}^{obs}) + (\tilde{\beta}_3 + 1).ln(\bar{h_{it}})$$

$$+ \sum_{d=2002}^{2014} \tilde{\xi}^d.\mathbb{1}_{it}^d + \tilde{\zeta}.\mathbb{1}_{it}^e + X'_{it}.\tilde{\theta} + \tilde{\lambda}_t + \tilde{\epsilon}_{it} \tag{2.10}$$

In Equation (2.9), $\tilde{\beta}_1$ can thus be interpreted as the price elasticity of demand. The equation presented in the previous section, Equation (2.8), is nested in this equation. It would be equivalent to Equation (2.10) if we imposed the constraint that $\tilde{\beta}_3 = -1$.

The specification with relative consumption comes with several advantages. First, it includes the care plan volume as a control, which might be a proxy of the unobserved determinants of consumption. Second, relative consumption is a better-behaved outcome than absolute consumption: its distribution is closer to a normal (Figures 2.B.1 and 2.B.2) and the consistency of Tobit estimates requires the normality of the error term. Finally, it enables us to overcome the limitation of having an individual-specific censoring point: it eases the implementation of the estimations.

[Figures 2.B.1 and 2.B.2 to be found on the following page]

Figure 2.B.1 – Distribution of absolute home care consumption, by disability level
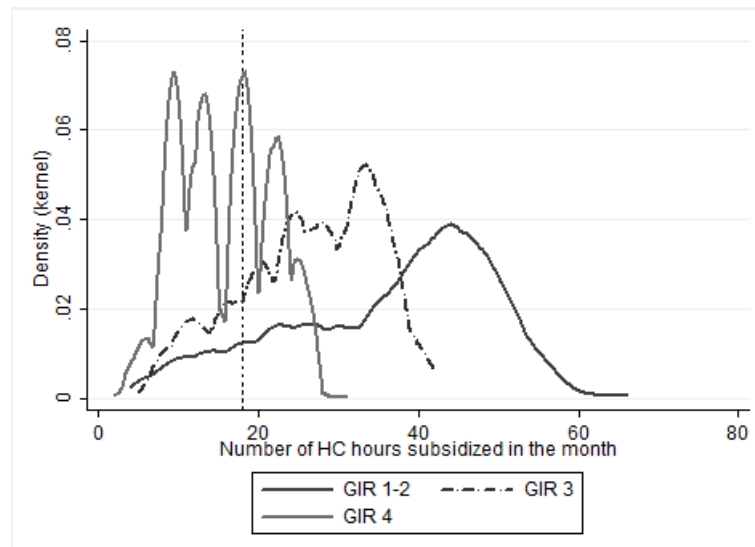
SAMPLE: Estimation sample (data from October 2012, 2013 and 2014; 8,190 individuals). Sub-sample size: N=1,145 in GIR 1 or 2 (most severe disability levels); N=1,655 in GIR 3; N=5,390 in GIR 4 (least severe disability level).
NOTES: The "GIR" corresponds to the official disability level of APA beneficiaries. The dashed vertical line indicates the pooled sample median value of home care consumption.

Figure 2.B.2 – Distribution of relative home care consumption, by disability level
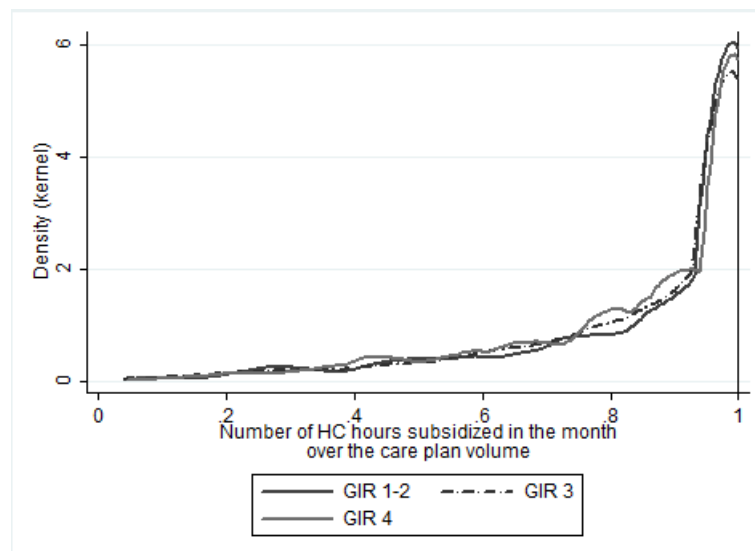
SAMPLE: Estimation sample (data from October 2012, 2013 and 2014; 8,190 individuals). Sub-sample size: N=1,145 in GIR 1 or 2 (most severe disability levels); N=1,655 in GIR 3; N=5,390 in GIR 4 (least severe disability level).
NOTES: Relative home care consumption designates the ratio $h_i / \bar{h}_i$. The "GIR" corresponds to the official disability level of APA beneficiaries. The solid vertical line at 1 indicates the censoring point of relative consumption.

2.C   Maximum likelihood estimation

The objective of this appendix is twofold. First, it provides the expression of the likelihood function we maximize to derive our baseline estimates (Tobit estimation). Second, it shows that, within the framework proposed by Moffitt (1986), the censoring of the measure of consumption at the kink and beyond does not prevent the identification of the sample average price elasticity of demand, conditional on some assumptions on the stability of individual preferences.

To keep notations simple and concise, we ignore the time dimension (subscript t and year dummies are not included) and consider home care consumption in level when deriving the likelihood function (while we include its log in the empirical specification).

2.C.1. General setting

The demand for home care with the kinked budget constraint generated by APA writes:

$$
\begin{cases}
h_i^* = g(c_i p_i, I_i; X_i) + v_i & \text{if } h_i^* < \bar{h}_i \\
g(p_i, \tilde{I}_i; X_i) + v_i \leq \bar{h}_i \leq g(c_i p_i, I_i; X_i) + v_i & \text{if } h_i^* = \bar{h}_i \\
h_i^* = g(p_i, \tilde{I}_i; X_i) + v_i & \text{if } h_i^* > \bar{h}_i
\end{cases}
\tag{2.11}
$$

with v_i an individual preference shifter. We denote:

ψ a set of parameters characterizing the function $g(.)$;

κ a set of parameters characterizing the distribution of the error term v;

S_1 the left-hand side segment of the budget constraint: $i \in S_1 \iff h_i^* < \bar{h}_i$;

S_2 the right-hand side segment of the budget constraint: $i \in S_2 \iff h_i^* > \bar{h}_i$;

K the kink of the budget constraint: $i \in K \iff h_i^* = \bar{h}_i$.

2.C.2. Observational scheme with censoring

With h_i the consumption in the data and h_i^* the true consumption, our observational scheme is:

$$
h_i =
\begin{cases}
h_i^* & \text{if } h_i^* < \bar{h}_i \\
\bar{h}_i & \text{if } h_i^* \geq \bar{h}_i
\end{cases}
\tag{2.12}
$$

From Systems 2.11 and 2.12, we know that:

1. For all individuals i such that $h_i < \bar{h}_i$, we know that $h_i = h_i^*$; thus we have $h_i^* < \bar{h}_i$ ($i \in S_1$):

$$
h_i = g(c_i p_i, I_i; X_i) + v_i < \bar{h}_i
$$

2. For individuals i such that $h_i = \bar{h}_i$, we know that $h_i^* \geq \bar{h}_i$; these individuals can be split in two different sub-groups:

   (a) Individuals i such that $h_i^* = \bar{h}_i$ ($i \in K$); then:

   $$\begin{cases} g(c_i p_i, I_i; X_i) + \nu_i \geq \bar{h}_i \\ g(p_i, \tilde{I}_i; X_i) + \nu_i \leq \bar{h}_i \end{cases}$$

   (b) Individuals i such that $h_i^* > \bar{h}_i$ ($i \in S_2$); then:

   $$\begin{cases} g(c_i p_i, I_i; X_i) + \nu_i > \bar{h}_i \\ g(p_i, \tilde{I}_i; X_i) + \nu_i > \bar{h}_i \end{cases}$$

Thus, all censored observations ($i \in S_2$ or $i \in K$) have in common the fact that:

$$g(c_i p_i, I_i; X_i) + \nu_i \geq \bar{h}_i$$

We can thus write:

$$h_i = \begin{cases} g(c_i p_i, I_i; X_i) + \nu_i & \text{if } g(c_i p_i, I_i; X_i) + \nu_i < \bar{h}_i \\ \bar{h}_i & \text{if } g(c_i p_i, I_i; X_i) + \nu_i \geq \bar{h}_i \end{cases} \tag{2.13}$$

which corresponds to the usual censored regression model setting.

The individual contributions to the likelihood function are derived from this setting. Denote $f(.|c_i, p_i, I_i, \bar{h}_i, X_i)$ the conditional density function of ν and $F(.|c_i, p_i, I_i, \bar{h}_i, X_i)$ its conditional cumulative distribution function. Then the likelihood function writes:

$$L(\psi, \kappa) = \prod_{i=1}^{n} \left[f\big(h_i - g(c_i p_i, I_i; X_i)|c_i, p_i, I_i, \bar{h}_i, X_i\big) \right]^{\mathbb{1}[h_i < \bar{h}_i]}$$
$$\times \left[\left(1 - F\big(\bar{h}_i - g(c_i p_i, I_i; X_i)|c_i, p_i, I_i, \bar{h}_i, X_i\big)\right) \right]^{\mathbb{1}[h_i = \bar{h}_i]}$$

In our setting, the censoring of the dependent variable exactly at the kink prevents us from distinguishing between the individuals who consume exactly at the kink and those who actually locate on the right-hand side segment of the budget constraint. Interestingly, it does not prevent the identification of our parameters of interest (which relate to function $g(.)$), although it comes at a cost in terms of precision. Assuming some stability of individual preferences,[38] we can interpret the price elasticity estimated using information relating to the left-hand side of the kink as the price sensitivity of demand along the entire budget constraint.

---

[38] Moffitt (1986) assumes the functional form of $g(.)$ is invariant to changes in consumer price and income.

Weaker assumptions on individual preferences would not undermine the identification of the price sensitivity for the selected sample of APA beneficiaries consuming less than their care plan volume. However, if the underlying data generating process actually changes at the kink, censored regression methods would not adequately correct for the bias induced by the non-observability of the individuals consuming at the kink or beyond.

2.C.3. Likelihood of our sample

As explained in Section 4.2 of the paper, we assumed the following specification for the demand for home care:[39]

$$ln(h_i^*) = \gamma_0 + \beta_1.ln(p_i^j) + (\beta_1 + \beta_2).ln(I_i) + X_i'.\theta + \epsilon_i$$

We assume a normal distribution for the idiosyncratic shock ϵ:

$$\epsilon \mid p, I, X \sim \mathcal{N}(0, \sigma^2)$$

Our likelihood function thus writes:

$$L(\beta, \gamma, \theta, \sigma) = \prod_{i=1}^{n} \left[\frac{1}{\sigma} \phi \left(\frac{ln(h_i) - \gamma_0 - \beta_1.ln(p_i^j) - (\beta_1 + \beta_2).ln(I_i) - X_i'.\theta}{\sigma} \right) \right]^{\mathbb{1}_{[h_i < \bar{h}_i]}}$$
$$\times \left[\left(1 - \Phi \left(\frac{ln(\bar{h}_i) - \gamma_0 - \beta_1.ln(p_i^j) - (\beta_1 + \beta_2).ln(I_i) - X_i'.\theta}{\sigma} \right) \right) \right]^{\mathbb{1}_{[h_i = \bar{h}_i]}}$$

where $\phi(.)$ (resp. $\Phi(.)$) the conditional density (resp. cumulative distribution) function of a standardized normal variable.

When using the specification with the relative consumption, we have:

$$ln(h_i^*/\bar{h}_i) = \tilde{\gamma}_0 + \tilde{\beta_1}.ln(p_i^j) + (\tilde{\beta_1} + \tilde{\beta_2}).ln(I_i) + \tilde{\beta}_3.ln(\bar{h}_i) + X_i'.\tilde{\theta} + \tilde{\epsilon}_i$$

Similarly, we assume a normal distribution for the idiosyncratic shock $\tilde{\epsilon}$:

$$\tilde{\epsilon} \mid p, I, X, \bar{h} \sim \mathcal{N}(0, \tilde{\sigma}^2)$$

---

[39]Again, for the sake simplicity, we do not include in the expressions provided in this Appendix the full set of dummies we actually include in our specifications to control for both the unobserved increase in income and the legal relationship between the co-payment rate and disposable income (see Appendix 2.B).

The likelihood function writes:

$$\tilde{L}(\tilde{\beta}, \tilde{\gamma}, \tilde{\theta}, \tilde{\sigma}) = \prod_{i=1}^{n} \left[\frac{1}{\tilde{\sigma}} \phi \Big(\frac{ln(h_i^*/\bar{h}_i) - \tilde{\gamma}_0 - \tilde{\beta}_1.ln(p_i^j) - (\tilde{\beta}_1 + \tilde{\beta}_2).ln(I_i) - \tilde{\beta}_3.ln(\bar{h}_i) - X_i'.\tilde{\theta}}{\tilde{\sigma}} \Big) \right]^{\mathbb{1}_{[h_i/\bar{h}_i<1]}}$$

$$\times \left[\Big(1 - \Phi \Big(\frac{ln(h_i^*/\bar{h}_i) - \tilde{\gamma}_0 - \tilde{\beta}_1.ln(p_i^j) - (\tilde{\beta}_1 + \tilde{\beta}_2).ln(I_i) - \tilde{\beta}_3.ln(\bar{h}_i) - X_i'.\tilde{\theta}}{\tilde{\sigma}} \Big) \Big) \right]^{\mathbb{1}_{[h_i/\bar{h}_i=1]}}$$

Consistent estimators of β_1, β_2 and θ (respectively of $\tilde{\beta}_1$, $\tilde{\beta}_2$, $\tilde{\beta}_3$ and $\tilde{\theta}$) can be derived as the arguments of the maximization of the log-likelihood function, provided it is concave.[40]

In order to derive the likelihood function when taking the log-absolute consumption as the dependent variable, we must assume the censoring point $\bar{h}_i$ does not depend on the error term, ϵ_i. In other words, the individual censoring point is assumed to be exogenous, conditional on the observable variables. This assumption is discussed in the next Section and is not needed when we take the log-relative consumption as the dependent variable.

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[40]Similarly, though with a little more work, we could derive the likelihood function of the IV-Tobit model. In the version we estimate (using Stata command `ivtobit`), the error terms of the first-stage and second-stage equations are assumed to be jointly normally distributed.

2.D   Determinants of the care plan volume and censoring

When taking the log-*absolute* consumption as the dependent variable, the Maximum Likelihood function (Appendix 2.C) is derived assuming the individual censoring point, defined by $\bar{h}_i$, is exogenous conditional on explanatory variables. In addition, consistency of estimates relies on the additional assumption that the provider price p_{ij} is exogenous. When estimating Equation (2.7) (Appendix 2.B), one particular concern is that the provider price and the care plan volume are correlated even conditional on the control variables.

These two assumptions — exogeneity of the censoring point and no systematic conditional relationship between the care plan volume and the provider price — are relaxed when we take the log-*relative* consumption as the dependent variable. This Appendix nonetheless discusses the plausibility of these assumptions, by presenting elements on the establishing of the care plan volume and additional empirical material.

When setting the care plan volume $\bar{h}_i$, the evaluation team supposedly takes into account the needs of the beneficiary in terms of assistance with the activities of daily living. By law, the care plan volume should depend on the administrative disability group. Gender and age (which we control for) may influence the care plan volume, as they correlate with unobserved health problems and housekeeping skills. Additionally, even tough matrimonial status and family structure are not supposed to influence the care plan volume, anecdotal evidence suggests that the evaluation team takes into account the possible assistance regularly provided by relatives when establishing the care plan.

Additionally, $\bar{h}_i$ could directly relate to the price of the chosen provider in a specific case: when the evaluation team sets the personalized care plan, it has to check that the monetary equivalent of the care plan volume is below the legal ceiling associated with the disability level of the beneficiary. In the case care is provided by an authorized provider, the monetary equivalent of the care plan equals the number of hours granted by the evaluation team times the provider price. If the monetary equivalent of the care plan volume is higher than the legal ceiling, the adjustment will go through a reduction in $\bar{h}_i$ or the choice of a cheaper provider. This may be a source of price endogeneity in both (absolute and relative consumption) specifications.[41]

Empirically, once controlling for income, gender, age, disability group, matrimonial status and professional care received on weekends, we find a small positive correlation between the (OOP or provider) price and the volume of the care plan, but the effect is not statistically significant.[42] Then, a probit estimation of the probability to be censored, $\mathbb{P}(h_i = \bar{h}_i)$, shows

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[41]Yet it should remain limited: for 7% of our sample at most, the monetary equivalent of their care plan volume would exceed their legal ceiling if they choose the most expensive provider operating in their municipality.

[42]In the panel analysis, we include fixed effects and cluster at the individual level. Table of results is not included but is available upon request.

that the probability to be censored slightly correlates with the price. A €1 increase in the provider price is predicted to increase the probability to be censored by 2 pp. (as a reminder, the sample censoring rate is around 40% and the standard-deviation in provider prices is of €1.3).

Although they are statistically significant, these effects are small in practical terms. In addition, they fade out when we restrict our attention to beneficiaries living in a municipality where only one provider is operating. This suggests that the strategic choice of a provider (price) to comply with the legal ceiling is empirically negligible in this sub-sample (see Appendix 2.G) — although we cannot rule out that there might be a relatively higher share of beneficiaries contracting with over-the-counter workers or non-authorized providers in municipalities where a single authorized provider operates.

The probability to be censored is higher for individuals with no partner at home, possibly because individuals living with a partner benefit from economies of scale in home care utilization, especially when the spouse is also benefiting from APA[43], and from informal help provided by their spouse, when she is has no disability herself. Consuming the care plan volume totally is also more likely for individuals who are entitled to subsidies on formal care served during the weekends.

Individual observable characteristics explain about 50% of the variations observed in the care plan volume. This leaves a large share of the variations unexplained. Ethnographic work suggests that unobserved informal care or health status can influence the evaluation team in the set up of the care plan volume (Billaud *et al.*, 2012).

As we do not have any good instrument to test the endogenity of the care plan volume in our dataset, we have to rely on the assumption that it is reasonably exogenous when estimating the specification with log-absolute consumption as the dependent variable. This is one of the reasons why we favour the specification with the relative consumption (Equation (2.5), Appendix 2.B).

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[43]These economies of scale are not supposed to be factored in by the evaluation team when setting the care plan volume. This is consistent with the fact that APA is meant to be a personal subsidy: legal ceilings do not depend on whether a beneficiary has a partner also receiving APA.

2.E   The home care sector in France

2.E.1. Three main types of home care providers

Home care to the disabled elderly can be provided by three types of providers:

(1) Authorized structures (*services autorisés*), which must receive a special authorization granted by the Departmental Council to enter the market; their price is fixed by the Departmental Council.

(2) Non-authorized structures (*services agréés non autorisés*) are allowed to provide home care services to APA beneficiaries under lighter conditions than authorized structures; they are free to set their price (with some restrictions on yearly price evolution being set at the departmental level).

(3) Over-the-counter workers (*gré-à-gré* ou *mandataire*): the beneficiary directly contracts with a home care worker. The beneficiary is free to set her employee's hourly wage provided she complies with general labor law.

There is no regulation for over-the-counter workers. Both authorized and non-authorized structures have to meet quality standards, though requirements are higher for authorized structures. The existence of differences in quality between *authorized* providers is less clear-cut. From a theoretical prospective though, the uncertainties regarding the quality of services in the home care sector lead to rule out vertical differentiation through prices (Messaoudi, 2012).

In our empirical analysis, we focus on authorized providers: technically, we are able to compute the exact OOP price of their customers receiving APA as these services are priced by the Departmental Council. Although they provide only partial information, available data suggest that the majority of professional care provided within the APA program is delivered by such authorized structures.

Using administrative data on APA beneficiaries from 45 departments from 2011 (*Remontées individuelles*), Couvert (2017) documents that 79% of APA beneficiaries whose care plan includes human assistance[44] receive professional care from caregivers that are employed by home care structures. Given that the share of beneficiaries receiving care from over-the-counter workers increases as the care plan volume gets close to the disability-specific ceiling, this means that 79% is an upper-bound for the share of professional care hours that are provided by home care *structures*. Although we have not been able to reconstruct a lower-bound, the different figures available suggest that these structures provide the majority of

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[44]For 8% of beneficiaries, care plans only include technical assistance devices and punctual measures for housing adaptation. The remaining 92% have human care in their care plan.

professional care included in APA care plan volumes.[45]

Getting now to the distinction between authorized providers and non-authorized home care structures, using a survey conducted on the French departments (LEDa-LEGOS and CES, 2012), Hege *et al.* (2014) document that in over 45% of (responding) departments, more than two thirds of APA home care hours are provided by authorized services. Care provided by authorized structures represent less than one third of APA hours in only 15% of departments.

It must be highlighted however that focusing on beneficiaries served exclusively by an (authorized) home care structure induces more sample selection among individuals with a care plan volume high relative to their disability-specific national ceiling. As documented by Couvert (2017), in all disability groups, the share of individuals using a mix of providers or only over-the-counter caregivers increases steadily as the number of subsidized hours granted increases. As the national ceiling is more frequently hit for individuals in GIR 1, this means that focusing on beneficiaries receiving care only from home care structures induces relatively more selection among GIR 1. Using our data, we study the determinants of the choice of a provider type. We find that individuals receiving care from an authorized provider are on average less rich than the overall population of APA beneficiaries; they tend to be younger, less disabled and live more often alone[46]

2.E.2. The different status for authorized providers

Authorized providers can be either public, for-profit or non-profit. Historically, in France, non-profit organizations were important providers of home care and they remain predominant in most rural areas. In our department, 5 authorized providers are non-profit, providing care to about 54% of our estimation sample in October 2014. 20 municipal services are providing care to APA recipients (about 43% of the 2014 sample). For-profit structures represent a small share of the authorized home care providers (3 in the department), as they provide home care only to 3% of our 2014 sample.[47]

Theoretically, an APA beneficiary is free to choose her provider. In practice, the spatial coverage by the different types of authorized services is unequal over the territory. In some municipalities, several providers are found to operate, while there is only one provider in others (see Section 2.G). In our department, among the beneficiaries living in a municipality

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[45]Combining the proportion of beneficiaries in each GIR and the average care plan volume in each GIR, we find that GIR–1 and –2 represent roughly 20% of all APA beneficiaries but 50% of the hours included in care plan volumes. Given that 60% and 69% of beneficiaries from GIR–1 and –2 respectively receive care exclusively from home care structures (Couvert, 2017), we may take the value of 2/3 as a reasonable conservative estimate of the share of all professional hours included in care plan volumes that are to be provided by home care structures.

[46]Results available upon request.

[47]Proportions are similar in the pooled sample. The small market share of for-profit services among authorized providers is not a specific feature of the department studied.

where several authorized providers serve APA recipients, more than 50% can choose between the three types (public/ non-profit/ for-profit) of authorized providers. These beneficiaries live in relatively large municipalities: the supply mix is more diversified when there is an important market for home care services, while small municipalities are generally *de facto* served by a unique, non-profit structure. Conversely, the typical supply mix in medium-size municipalities is the combination of non-profit and public authorized providers. Finally, a for-profit provider is never found to be the only authorized service operating in a given municipality.

2.F   Explaining variations in provider prices

2.F.1. Components of costs in the home care sector

In this section, we explain why customers may exogenously face different provider prices, by detailing the components of prices in the home care sector.

Authorized providers are priced by the Departmental Council. The hourly price of each provider, for one given year, should be set on the basis of the overall average hourly production cost of the provider, of two years before. The various components of production costs are described in qualitative studies, either in academic works (Gramain and Xing, 2012) or in public reports.[48] By order of importance (top-down), production costs can be decomposed as follows:

- Workforce costs (80% of total charges): wages paid to professional caregivers and, for a small part (around 10% of total charges), to the supervising staff. The wage of a caregiver depends on her qualification, according to collective labour agreements. We expect that the larger the proportion of skilled caregivers, the higher the production cost and the price. Wages are also augmented if employees work on Sunday or on public holidays, in accordance with general labour legislation.

- Operating costs (10–15% of total charges): those include rents for the service's offices and other running expenses.

- Transportation costs (5–10% of total charges)[49] correspond to the compensation for the costs borne by employees to go to the consumer's home. This item is likely to vary largely across services according to their geographical area of intervention.

- Contrary to the health care sector, technological progress and capital costs are negligible in the home care sector.

We represent the relationship between the provider price and several providers' characteristics graphically.[50] We distinguish between non-public (mainly non-profit) providers and public providers. The latest are likely to receive grants or advantages (e.g., a free office) from local municipalities that reduce operating costs. Such advantages are taken into account in the pricing process done by the Departmental Council and lower down the regulated price of

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[48]There is, though, no national, comprehensive benchmark study on the costs of home care services. Public reports regularly deplore the lack of information on costs as a major shortcoming preventing from understanding the functioning of the sector (Vanlerenberghe and Watrin, 2014; Poletti, 2012).

[49]This item only includes the compensation of employees for the monetary costs associated with transport. Roquebert (2018) additionally takes into account the unproductive hours spent on transports by the employees that are paid by the provider.

[50]We explore here other characteristics than the number of served municipalities, that we use as an instrument for the price. The empirical relationship between the two variables is documented by Figure 2 in the paper.

public providers. In the graphical representation, we exclude the largest provider of the department, a nationwide non-profit organization, which has systematically the highest values for the variables we are here interested in (see Appendix 2.G).

In Figure 2.F.1, provider prices are plotted against the number of APA beneficiaries served by the service. Graphically, the more customers the provider has, the higher its price. Having more customers might be associated with more municipalities to serve (see discussion in Section 4.4 of the paper) or more unproductive hours.[51] This graph should be interpreted cautiously though: we only know the number of APA recipients served by each home care provider, instead of the total number of customers (including non-APA beneficiaries, like other elderly or disabled individuals) served in the department.

Figure 2.F.2 shows the relationship between the provider price and the share of hours they serve on Sundays or on public holidays. Public providers have a very low share of such hours, as most public services do not operate on weekends and holidays. A higher share of hours made on holidays is associated with a higher price among public structures, which is consistent with the financial compensation of employees for working on public holidays.

[Table 2.F.2 to be found on the following page]

Figure 2.F.1 – Provider price according to the number of APA beneficiaries served by the provider, by legal status
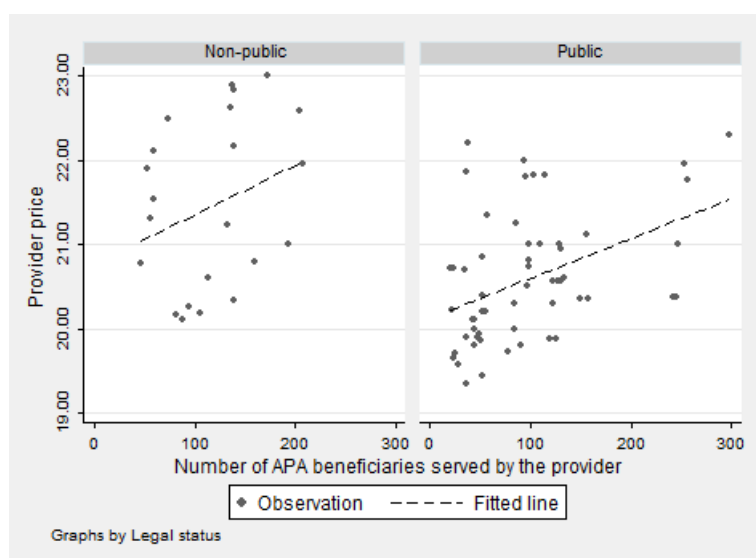
SAMPLE: Authorized providers of the department serving at least one APA beneficiary in October 2012, 2013 or 2014.
NOTES: The largest provider, which serves 43% of the APA beneficiaries receiving care from an authorized provider in the department in 2014, is not included.

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[51]Unproductive hours (meetings, training) may become relatively more numerous when a service gets relatively large.

Figure 2.F.2 – Provider price according to the share of hours served on Sundays and public holidays, by legal status
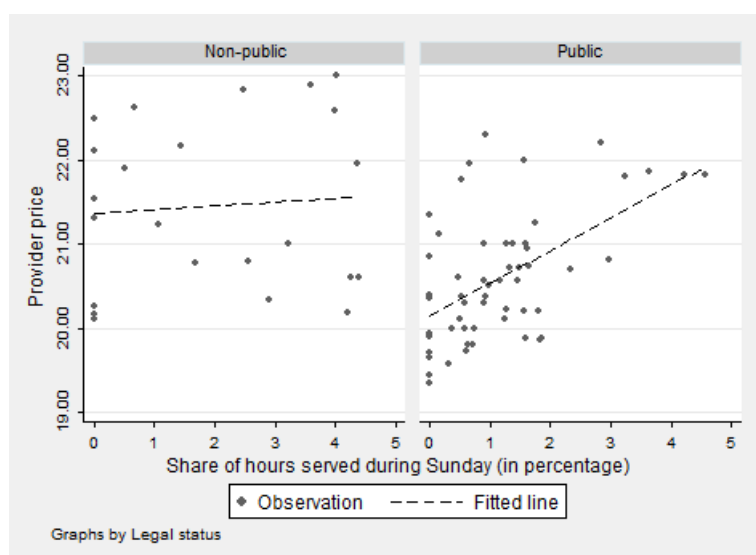
SAMPLE: Authorized providers of the department serving at least one APA beneficiary in October 2012, 2013 or 2014.
NOTES: The largest provider, which has 1.80% of its home care hours provided on Sundays and holidays in 2014, is not included.

2.F.2. Correlations between individual characteristics and provider price

We also investigate the importance of the observable characteristics on the choice of a given level of provider price. Table 2.F.1 presents the individual characteristics associated with the choice of a "low-price" authorized provider, defined as a provider charging a price strictly below the average price charged by the authorized providers operating in the beneficiary's municipality (in a given month). We estimate the probability of choosing a "low-price" provider by a Probit on the sub-sample of individuals who live in a municipality where several authorized providers serve APA recipients. Beyond a slight age effect, only the disability level is found to have a significant impact. The least severely disabled are more likely to choose a "low-price" provider, possibly reflecting that they perceive home care as less necessary and are thus ex ante more sensitive to its price. Income is not found to have any impact on this choice, nor is matrimonial status (Fisher tests reject the joint significance of both the set of income quartile dummies and the set of matrimonial status dummies).[52]

[Table 2.F.1 to be found on the following page]

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[52]Although we do not find any evidence that beneficiaries who are able to choose between different authorized providers choose a price level according to their income, it might still be the case that there is systematic correlation between income and provider price in the sample, as about 30% of beneficiaries are suspected not to be able to choose between different providers (Appendix 2.G). When we take our estimation sample and regress the provider price on income and all the socio-demographic variables we include in our estimations as well as year dummies, we find a negative partial correlation between income and provider price. Although it is statistically significant, it is fairly small: a one standard-deviation increase in disposable income is predicted to decrease provider price by 0.01 standard-deviation. This is small enough not to undermine the separate identification of the price and empirical income elasticities.

Table 2.F.1 – Individual characteristics associated with the choice of a low provider price

	Dependent variable: chooses a "low-price" provider
	(1)
Income quartile: 1	-0.010
	(0.025)
Income quartile: 2	Ref.
Income quartile: 3	-0.003
	(0.028)
Income quartile: 4	-0.006
	(0.029)
Woman	-0.030
	(0.019)
aAge: 60–69	-0.050
	(0.054)
Age: 70–79	-0.040*
	(0.021)
Age: 80–89	Ref.
Age: 90 or more	-0.029
	(0.021)
Disability level: 1 (most severe)	-0.102
	(0.113)
Disability level: 2	-0.024
	(0.036)
Disability level: 3	Ref.
Disability level: 4 (least severe)	0.068***
	(0.022)
Lives with no spouse	-0.000
	(0.021)
Spouse receives APA	0.004
	(0.051)
Lives with non–APA spouse	Ref.
Spouse in institution	-0.098
	(0.110)
Observations	5701
Number of clusters	82

NOTES: Standard errors in parentheses, clustered at the municipality level; $^{*}p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Estimation of a Probit model by Maximum Likelihood. Average partial effects (APE) are displayed. "Low-price" providers are charging a price below the average price of authorized providers within a given municipality (in one given month: October 2012, 2013 or 2014); the estimation uses the sample of beneficiaries served by only an authorized provider living in a municipality where at least two different prices are offered by authorized providers. Data pooled from October 2012, October 2013 and October 2014. Specifications include year fixed effects.

2.G   Robustness checks

2.G.1. Additional results: absolute or relative consumption

In this section, we present the results obtained on the pooled sample and by year, fitting several specifications. Table 2.G.1 presents the estimates of the first specification, when the dependent variable is the absolute consumption (Equation (2.7), Appendix 2.B). Tables 2.G.2 and Table 2.G.3 present the results obtained with the second specification, when the dependent variable is the relative consumption, either assuming the provider price is exogenous (Table 2.G.2) or instrumenting it (Table 2.G.3). In all three tables, Column (1) gives the estimate obtained on the pooled sample, while Columns (2) to (4) display the estimates obtained on October 2012, 2013 or 2014.

Whatever the specification, estimates on 2014 are of a lower precision, essentially because there is one provider less (one provider closed down in 2014). The point estimates are also systematically lower (in absolute value) in 2014 than in the other two years, although the difference from one year to the other is never statistically significant.

When the dependent variable is the absolute consumption, the coefficients associated with the price lie between -0.7 and -1.0: they are higher than those obtained with the relative consumption (between -0.3 and -0.7 with no instrumentation, -0.1 and -0.5 when the IV strategy is implemented). It might be explained by the fact that the care plan volume, which may be a proxy for some unobserved determinants of professional care consumption, is not taken into account in the specification with absolute consumption as the dependent variable.

With the absolute consumption, the income effect within the APA scheme is suggested to be negative. When taking the relative consumption as the dependent variable, and including the care plan volume as a control, point estimates are lower in absolute value (presumably because the omitted variable bias is reduced); the effect of income within the APA scheme is no longer significant. The IV-strategy only little affects point estimates. Except for 2014, we can systematically reject that the price elasticity is zero.

Overall, these results confirm that the price elasticity is significantly different from zero and inferior to one in absolute value. The -0.4 point estimate we finally retain is the one that is the most likely to be unbiased (care plan volume as a control & IV strategy) and the most precise (pooled data with both intra– and inter- individual price variations). Yet we must acknowledge the relatively low precision of our results: the 95%-level confidence interval derived from our favoured specification indicates a price elasticity between -0.01 and -0.76.

Table 2.G.1 – Censored regression estimates of demand for home care hours (absolute consumption)

	(1) 2012–14	(2) 2012	(3) 2013	(4) 2014
Dependent variable: absolute consumption h^* (log)				
Price (log)	-0.793***	-0.977***	-0.721**	-0.709**
	(0.248)	(0.260)	(0.297)	(0.290)
Disposable income (log)	-0.039***	-0.033***	-0.039***	-0.048***
	(0.010)	(0.012)	(0.015)	(0.019)
Other controls	Yes	Yes	Yes	Yes
Observations	8190	2571	2757	2862
Censored observations	36.6%	40.4%	38.2%	40.2%
Number of clusters	28	28	28	27

NOTES: Standard errors in parentheses, clustered at the provider level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Data from October 2012, 2013 and 2014. Estimation of a Tobit model by Maximum Likelihood. All specifications include as controls socio-demographic variables, dummies for the year the latest plan was decided upon and dummies for the year in which the co-payment rate was computed. Column (1) additionally includes year fixed effects.

Table 2.G.2 – Censored regression estimates of demand for home care hours (relative consumption)

	(1) 2012–14	(2) 2012	(3) 2013	(4) 2014
Dependent variable: relative consumption $h^*/\bar{h}$ (log)				
Price (log)	-0.450**	-0.670***	-0.376	-0.300
	(0.181)	(0.180)	(0.236)	(0.238)
Disposable income (log)	-0.010	-0.003	-0.014	-0.014
	(0.008)	(0.009)	(0.009)	(0.016)
Care plan volume (log)	0.040*	0.054*	0.019	0.041
	(0.023)	(0.030)	(0.027)	(0.033)
Other controls	Yes	Yes	Yes	Yes
Observations	8190	2571	2757	2862
Censored observations	36.6%	40.4%	38.2%	40.2%
Number of clusters	28	28	28	27

NOTES: Standard errors in parentheses, clustered at the provider level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Data from October 2012, 2013 and 2014. Estimation of a Tobit model by Maximum Likelihood. All specifications include as controls socio-demographic variables, dummies for the year the latest plan was decided upon and dummies for the year in which the co-payment rate was computed. Column (1) additionally includes year fixed effects.

Table 2.G.3 – Censored regression estimates of demand for home care hours (relative consumption, IV)

	(1) 2012-14	(2) 2012	(3) 2013	(4) 2014
Panel A: Second Stage	Dependent variable: relative consumption $h^*/\bar{h}$ (log)			
Price (log)	-0.387**	-0.537**	-0.460**	-0.134
	(0.192)	(0.209)	(0.214)	(0.245)
Disposable income (log)	-0.010	-0.003	-0.014	-0.014
	(0.008)	(0.009)	(0.008)	(0.016)
Care plan volume (log)	0.040*	0.054*	0.019	0.042
	(0.023)	(0.030)	(0.028)	(0.033)
Panel B: First Stage	Dependent variable: provider price p (log)			
Number of municipalities (std.)	0.049***	0.050***	0.046***	0.050***
	(0.004)	(0.004)	(0.004)	(0.004)
Other controls	Yes	Yes	Yes	Yes
Observations	8190	2571	2757	2862
Censored observations	36.6%	40.4%	38.2%	40.2%
Number of clusters	28	28	28	27

NOTES: Standard errors in parentheses, clustered at the provider level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Data from October 2012, 2013 and 2014. Estimation of an IV-Tobit model by Maximum Likelihood. Price is instrumented by the number of municipalities served by the provider. In the first stage (Panel B), the log-provider price is regressed on the standardized number of municipalities served by the provider. All specifications, for both Panel A and Panel B, include as controls socio-demographic variables, dummies for the year the latest plan was decided upon and dummies for the year in which the co-payment rate was computed. Column (1) additionally includes year fixed effects.

2.G.2. Clustering and Bootstrap inference

Level of clustering

In the paper, we denote $\tilde{\epsilon}_{it}$ the error term in our favoured specification (Equation (5)). As we cluster at the provider level j, we actually implicitly assume the following structure for the error term $\tilde{\epsilon}$:

$$\tilde{\epsilon}_{ijt} = \tilde{\tilde{\xi}}_i + \tilde{v}_j + \tilde{\zeta}_{ijt}$$

with $\tilde{\tilde{\xi}}_i$ capturing the unobserved individual heterogeneity, and $\tilde{v}_j$ the provider level time-invariant unobserved heterogeneity. For two individuals i and i' that are served by the same provider j (assume for the sake of simplicity that t is not varying), $corr(\tilde{\epsilon}_{ijt}, \tilde{\epsilon}_{i'jt}) \neq 0$ as long as there are unobserved shocks taking place at the provider level.

For a given individual observed at t and t', error terms will be necessarily correlated if there is some individual time-invariant unobserved heterogeneity.[53] As standard with panel data, we would need to cluster at the individual level. Yet, as almost all APA beneficiaries keep the same provider j over time, the latter way of clustering (at the individual level) is essentially nested in the former clustering option (at the provider level). We believe that within-individual correlation of errors is more important than within-provider shock correlation; we nonetheless choose to cluster at the most aggregate level. In our specific setting, in which our main explanatory variable varies at the provider-year level, clustering at the provider level is of due caution as the provider price does not change within one cluster cross-sectionally (Moulton, 1990; Cameron and Miller, 2015).

Inference with few clusters

With clustered standard errors, inference relies on asymptotic properties that kick in as the number of clusters tends to infinity. The "few-cluster issue" was documented notably by Cameron *et al.* (2008): in an OLS setting, Wald hypothesis tests based on the standard cluster-robust estimate of the variance matrix tend to over-reject the null. Rejection rates increase when clusters are of unequal sizes (Imbens and Kolesár, 2015).

In our department, there are relatively few authorized providers (28 in 2012 and 2013, 27 in 2014 as one provider closed down).[54] and there is one very large authorized provider (Figure 2.G.1). This service is a local branch of a long-standing nationwide non-profit home care service; it serves 37% of the APA beneficiaries in our sample. With only 28 clusters, including one being considerably larger than the others, we face the risk that standard cluster-robust inference is biased.

In order to assess the robustness of the inference on the estimates presented in the pa-

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[53]Note that we are not able to include individual fixed-effects in the type 1-Tobit model, as there is no parametric solution to the incidental parameter problem (Lancaster, 2000).

[54]This is not a feature specific to our department though (LEDa-LEGOS and CES, 2012).

Figure 2.G.1 – Distribution of the size of authorized providers (October 2014)
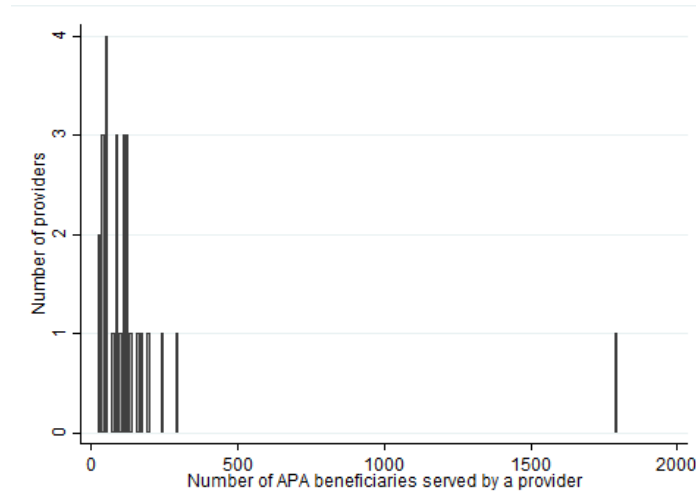
NOTES: Size of a provider is measured by the number of APA beneficiaries it serves. Data from October 2014, 27 authorized providers (one authorized provider closed down in 2014).

per, we use a bootstrap procedure. By bootstrapping the Wald t-statistic associated with the price elasticity estimate $\hat{\bar{\beta}}_1$, we may improve small-sample inference by attaining asymptotic refinement (Cameron and Miller, 2015).

We start by estimating our equation on the original sample (by Tobit or IV-Tobit).[55] We retrieve the point estimate of the price elasticity, $\hat{\bar{\beta}}_1$ and its standard error, $se(\hat{\bar{\beta}}_1)$, and we compute the original sample Wald t-statistic $t = \hat{\bar{\beta}}_1 / se(\hat{\bar{\beta}}_1)$. We then implement a percentile pair cluster bootstrap, by repeating 1,000 times the following steps:

1. We form 28 "pair" clusters of observations by re-sampling with replacement 28 times from the original clustered sample.

2. For each bootstrap sample $b = 1, ..., 1000$, we estimate $\hat{\bar{\beta}}_1^b$ (by Tobit or IV-Tobit), and the associated cluster-robust standard error $se(\hat{\bar{\beta}}_1^b)$.

3. For each bootstrap sample b, we compute the Wald t-statistic centered in $\hat{\bar{\beta}}_1$:

$$t_b = \frac{\hat{\bar{\beta}}_1^b - \hat{\bar{\beta}}_1}{se(\hat{\bar{\beta}}_1^b)}, \quad b = 1, ..., 1000$$

---

[55]Here, as well as in the subsequent bootstrap replications, we do not use Stata's `ivtobit` command, through which standard errors are derived using the observed information matrix (oim). Instead, we first regress the (log) provider price on the instrument and the other exogenous controls (clustering at the provider level) and derive a prediction of the log of the provider price. We run the second step by regressing the (log) relative consumption on the *predicted* log-provider price and the other controls, again clustering at the provider level. It gives the inputs we use in the bootstrap procedure.

We then use the empirical distribution of the bootstrap t-statistics t_b to derive the critical values to be used in lieu of the critical values derived from a standard normal or T distribution. We compare the t-statistic associated with the price elasticity coefficient obtained in the observed sample to the symmetrical critical values derived from the bootstrapped t-statistic distribution. The percentile-t p-value for the symmetric two-sided Wald test of H0: "$\tilde{\beta}_1 = 0$" is computed as the proportion of times the absolute value of the boostrapped t-statistic is greater than the absolute value of the observed sample t-statistic; that is to say, the proportion of times that $|t_b| > |t|$, $b = 1, ..., 1000$

Issues may arise when using pair cluster resampling with dummy control variables: some of the bootstrap samples may have little or even no variation in the control variables. The computation of t_b in those samples is not possible; using the bootstrap t-statistics that were actually computed is not an option either, as completed replications cannot be assumed to be random.[56] In order to avoid failure to complete the target number of cluster bootstrap replications, we drop from our original sample the 8 individuals whose co-payment rate was last reassessed prior to 2011.[57]

Table 2.G.4 displays the price elasticity estimates and compares standard inference with bootstrap inference. Columns (1) to (3) display the estimates obtained using a Tobit model to estimate our specification with relative consumption, while Columns (4) to (6) are derived from an IV-Tobit estimation. Columns (1) and (3) display the original consumer price elasticity estimates obtained by either Tobit or IV-Tobit estimations, while Columns (2) and (5) display the same estimates obtained on the sample on which the pair cluster bootstrap can be completed. Comparing (1) and (2) first, then (4) and (5), we see that dropping the 8 aforementioned individuals has virtually no effect on the point estimate.

[Table 2.G.4 to be found on the following page]

The Tobit estimation of the specification with the relative consumption produces a t-stat equal to -2.50. The 25th lowest value of the bootstrap t-statistics is -1.87, while its 975th is equal to 1.90. Using a symmetric Wald test, we find that the absolute value of the original t-stat is larger than $|t_b|$ a little less than 99% of times (p-value of 0.018, Column (3) of Table 2.G.4). Bootstrap inference thus indicates that we can reject the hypothesis that the price elasticity is zero at the 5% level.

Similarly, the IV-Tobit estimation of the specification with relative consumption produces a t-stat equal to -1.93. The 25th lowest value of the bootstrap t-statistics is -1.73, while its 975th is equal to 1.38. Using a symmetric Wald test, we reject the hypothesis that the relative consumption of home care is price inelastic, again at the 5% level.

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[56]Wild cluster bootstrap has been documented as leading to more robust inference in the case of few clusters, as well as helping in the case that right-hand side dummy variables induce incomplete replications (Cameron and Miller, 2015). To our knowledge though, wild cluster bootstrap has not been extended to nonlinear models.

[57]Our specifications with absolute and relative consumptions include a dummy for the year in which the co-payment rate was assessed, as justified in Appendix 2.B.

Table 2.G.4 – Bootstrap inference.

		Tobit			*IV-Tobit*	
	Dependent variable: relative consumption $h^*/\bar{h}$ (log)					
	(1)	(2)	(3)	(4)	(5)	(6)
Price (log)	-0.450**	-0.451**	-0.451**	-0.387**	-0.388**	-0.386**
(se)	(0.181)	(0.180)	-	(0.192)	(0.192)	-
p-value	*0.013*	*0.012*	*0.018*	*0.044*	*0.044*	*0.014*
Disposable income (log)	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010
(se)	(0.007)	(0.007)	-	(0.007)	(0.007)	-
p-value	*0.184*	*0.184*	*0.163*	*0.186*	*0.186*	*0.165*
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Sample	All	co-payment reassessed no earlier than 2011		All	co-payment reassessed no earlier than 2011	
Observations	8190	8182	8182	8190	8182	8182
Censored observations	39.6%	39.6%	39.6%	39.6%	39.6%	39.6%
Inference	Default	Default	Bootstrap	Default	Default	Bootstrap
Number of clusters	28	28	28	28	28	28

NOTES: Standard errors in parentheses, the provider level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Data pooled from October 2012, 2013 and 2014. Estimation of a Tobit or IV-Tobit model by Maximum Likelihood (Stata commands `tobit` for Columns (1) to (3), and `ivtobit` for Columns (4) and (5)). In Columns (3) and (6), inference is obtained using a bootstrap procedure. Difference in the point estimates between Columns (5) and (6) is due to the fact that in Column (6) we implement manually the IV strategy in two separate steps, rather than using the `ivtobit` command, to make the Bootstrap procedure consistent.
SAMPLES: In Columns (2), (3), (5) and (6), individuals whose co-payment rate was reassessed prior to 2011 are not included in the sample (8 individuals).
BOOTSTRAP INFERENCE: We implement a pair cluster percentile bootstrap of the t-statistics (1,000 replications). The percentile-t p-value for the symmetric two-sided Wald test of H0: $\tilde{\beta}_1 = 0$, is computed as the proportion of times the absolute value of the boostrap t-statistic is greater than the absolute value of the observed sample t-statistic.

Figures 2.G.2 and 2.G.3 display the empirical distribution of the bootstrap t-statistics obtained following either the Tobit or the IV-Tobit estimation of the consumer price elasticity. We display a normal distribution with mean and variance equal to the mean and variance of the empirical distribution of the bootstrap t-statistics, and the normal distribution with mean 0 and variance 1 as a benchmark. Despite the sample containing one very large cluster, we observe a quite smooth distribution of t-statistics in both Figures. All replications are complete and the tails of the distribution do not seem excessively fat, making us confident in the quality of our bootstrap and in the statistical power of the deriving Wald test on the price elasticity estimate.

Figure 2.G.2 – Percentile-t bootstrap quality: Distribution of bootstrap t-statistics (Tobit estimation)
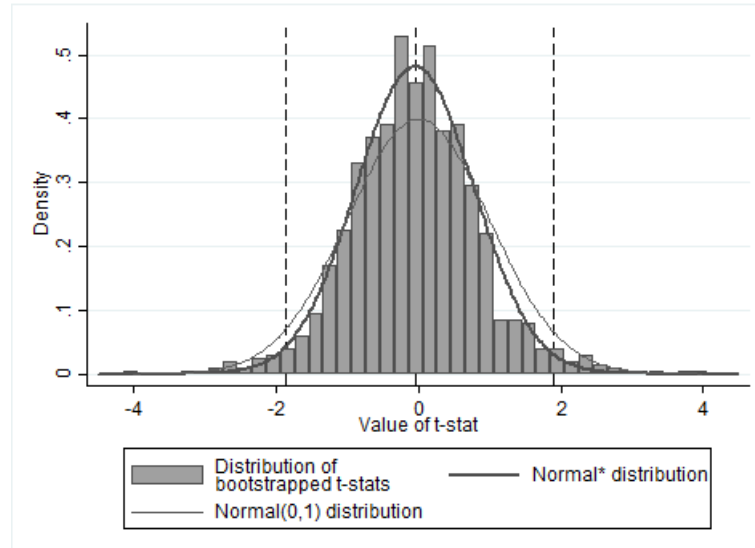
NOTES: t-stats from percentile bootstrap-t (1,000 replications). Output from Tobit estimation on relative consumption (Column (3) of Table 2.G.4) on sample of 8,182 individuals. *The first normal distribution displayed has a mean and variance equal to the mean and variance of the distribution of bootstrap t-stats. Dashed vertical lines represent the 25th and 975th ordered elements and the mean of the bootstrap t-stat distribution.

Figure 2.G.3 – Percentile-t bootstrap quality: Distribution of bootstrap t-statistics (IV-Tobit estimation)
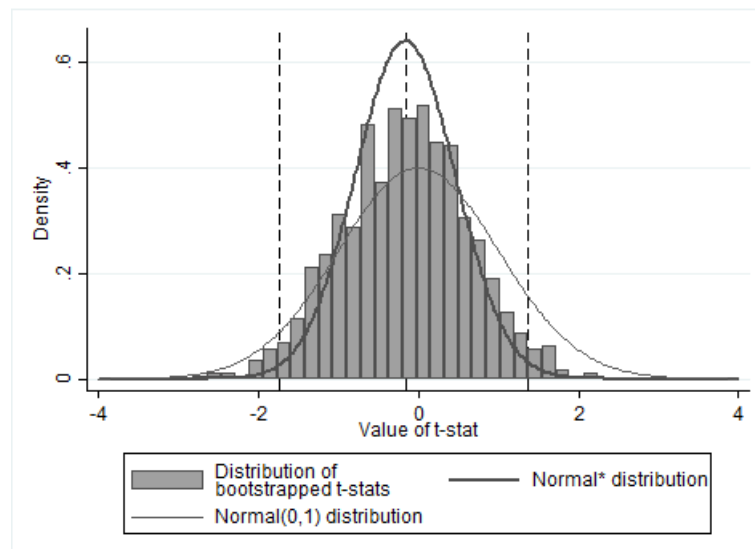
NOTES: t-stats from percentile bootstrap-t (1,000 replications). Output from manual IV-Tobit estimation on relative consumption (Column (6) of Table 2.G.4) on sample of 8,182 individuals. *The first normal distribution displayed has a mean and variance equal to the mean and variance of the distribution of bootstrap t-stats. Dashed vertical lines represent the 25th and 975th ordered elements and the mean of the bootstrap t-stat distribution.

2.G.3. Alternative identification strategy: using single-provider areas

Single-provider and multiple-provider areas

According to their geographical location in the department, beneficiaries may not be systematically able to choose between several providers of the department. We divide our sample into two sub-populations (Figure 2.G.4): on the one side, beneficiaries living in a municipality where a single provider is found to operate, or single-provider area (denoted "SPA"; areas in plain color). On the other side, individuals living in a municipality where two or more authorized providers have customers, or multiple-provider area (denoted "non-SPA"; dotted areas).[58]

Figure 2.G.4 – Distribution of providers in the department - Schematic representation
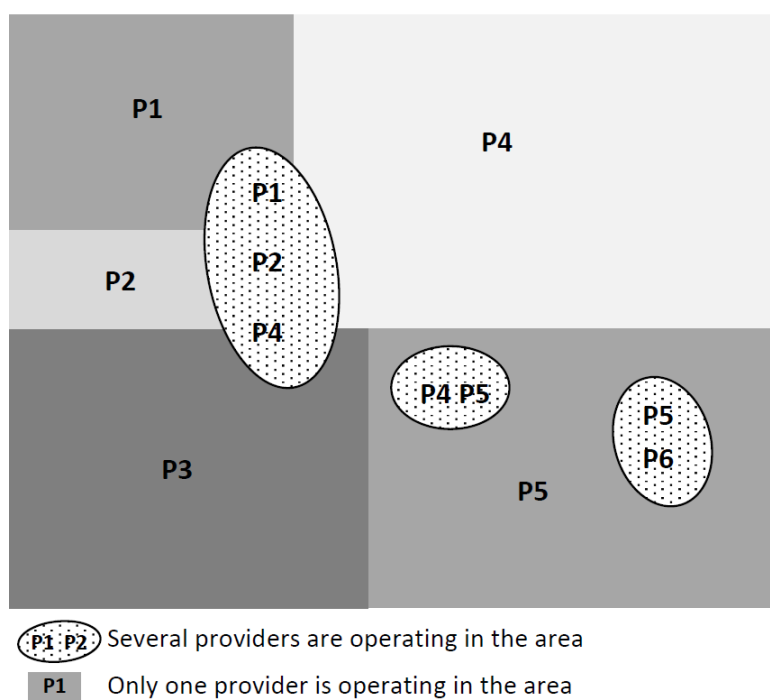
NOTES: We provide only a schematic representation to preserve the anonymity of the department. Different shades of plain grey indicate different areas served by a unique authorized service (single-provider areas, or SPA), each being served by a different provider with a given price level. The dotted areas correspond to multiple-provider (non-SPA) municipalities.

As displayed in Table 2.G.5, 79% of the municipalities represented in our sample belong to an SPA; 35% of beneficiaries included in the estimation sample live in this type of areas. The remaining beneficiaries live in a municipality where two or more authorized providers have customers. This partition interestingly reflects the spatial concentration of the APA

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[58]To identify the two types of areas, we use the full population of APA beneficiaries in the department, not only the APA beneficiaries of our estimation sample.

population: 65% of the beneficiaries in our sample live in 21% of the department municipalities. Consistently, non-SPA municipalities are more often urban centers than SPA municipalities.

Table 2.G.5 – Single-provider areas and multiple-provider areas (October 2014)

	Municipalities		Beneficiaries		Average price
	Number	*Frequencies*	*Number*	*Frequencies*	
SPA	220	78.9%	995	34.8%	€22.7
Non-SPA	59	21.1%	1,867	65.2%	€22.0
Total	279	100%	2,862	100%	-

NOTES: Estimation sample from October 2014. Average provider price per type of area is not weighted by the number of customers of the providers.

The spatial distribution of professional care provision is consistent with the fact that transportation costs are an important factor in the provision decision of home care services (cf. Section 4.4 of the paper). Providing services all over the department would be costly for a relatively small service. Typically, municipalities where only one provider is found to operate are served by non-profit home care services. In urban centers, the supply proposed by non-profit services may be complemented with municipal home care services, or even, in the largest municipalities, with one of the few for-profit authorized services found in the department (cf. Appendix 2.E).

Table 2.G.6 presents the descriptive statistics computed on the two sub-samples of APA beneficiaries, depending on the type of area in which they live. The two sub-samples are similar in terms of their socio-demographic characteristics albeit non-SPA residents are richer on average. This is consistent with the fact that non-SPA residents tend to locate in urban centers. The under-consumption rate is higher among non-SPA beneficiaries, but the average number of hours effectively subsidized is similar in both types of areas. This goes against the concern that SPA beneficiaries may experience rationing in the provision of professional care. Although subsidized consumption *relative* to the care plan volume is slightly higher for SPA beneficiaries on average (86% *versus* 84%), the overall distribution of relative consumption is fairly similar in the two sub-samples. Overall, except for the income level, the two populations little differ in terms of outcome and explaining variables.

Price elasticity estimates using SPA and non-SPA beneficiaries

Arguably, SPA beneficiaries have limited choice if they resort to an authorized provider. As a consequence, they are not able to choose their price p_i^j. Note that home care price endogeneity due to residential mobility is suggested to be negligible: the overall residential mobility of the elderly is very low (Laferrère, 2008) and when moves occur, they are mainly

Table 2.G.6 – Descriptive statistics on the two sub-samples (SPA/non-SPA, October 2014)

Variable	SPA [1]	Non-SPA [2]	Difference (p-value) [1] - [2]
Care plan volume [a]	20.1	20.8	0.06
Care plan monetary value [b]	€456.8	€454.8	0.83
Hours effectively subsidized [c]	17.5	17.8	0.38
Amount of effective subsidies [d]	€311.7	€294.9	0.03
[c] inferior to [a]	57.2%	61.2%	0.03
Individualized income	€1,272	€1,339	0.00
co-payment rate	21.9%	24.6%	0.00
Provider price	€22.8	€21.8	0.00
Hourly out-of-pocket price	€5.0	€5.4	0.01
Total OOP payments on subsidized hours	€86.0	€94.2	0.03
Age	84.4	84.0	0.18
Women	72.5%	74.7%	0.18
Disability level 1 (most severe)	1.5%	1.0 %	
Disability level 2	12.2%	12.6%	0.54
Disability level 3	20.7%	19.1%	
Disability level 4 (least severe)	65.6%	67.3%	
	100%	*100%*	
Living with a spouse	34.7%	33.3%	
Living alone	64.7%	66.1%	0.81
Spouse in institution	0.6%	0.6%	
	100%	*100%*	
Number of individuals	995	1867	-
Number of households	965	1820	-

NOTES: Estimation sample from October 2014. Descriptive statistics are computed on the sub-sample of APA beneficiaries living in single-provider municipalities (SPA) in Column (1) and those living in multiple-provider municipalities (non-SPA) in Column (2). Compared to Table 2.G.5, average provider price in each sub-sample is weighted by the number of beneficiaries in the sample. TESTS: Last column presents the p-values associated with the tests of difference between SPA and non-SPA beneficiaries. Test performed is a Student (resp. a Pearson χ^2) for binary or continuous (resp. categorical) variables.

explained by family motives or the need for adapted residences. Price endogeneity should thus be limited in the SPA sub-sample; on the contrary, we suspect it may arise in the non-SPA sample. Comparing the price elasticity estimates obtained on the two sub-samples may thus provide a test of price endogeneity in the estimation sample.

The estimation is run using the specification with the relative consumption, the outcome being $h_{it}^*/\bar{h}_{it}$. Results are displayed in Table 2.G.7.[59] As presented in the paper, the price elasticity is of -0.45 when estimated on the whole sample, significantly different from zero at the 5% level. Restricting the sample to individuals who are assumed to have no provider choice, the point estimate slightly changes to -0.52. Because of reduced sample size and

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[59]We only display the price and income coefficients as the effects of controls are similar to the estimates obtained with the full estimation sample (displayed in Table II of the paper).

price variations, precision is lower but the estimate is still significantly different from zero at the 10% level.

The point estimate is higher when we run the estimation on the sub-population of individuals who can choose between different providers, with a point value of -0.63. The difference between the two sub-sample estimates might potentially be explained by both an omitted variable bias affecting the choice of the provider price and some differences in the characteristics of the individuals of the two samples. However, the difference is not statistically significant even at the 10% level. Overall, this alternative estimation strategy (relying on SPA beneficiaries only) confirms our main results: the consumption of home care by the disabled elderly is price-elastic, with a point estimate inferior to one in absolute value and a magnitude seemingly around -0.5 or -0.4.

Table 2.G.7 – Censored regression estimates of demand for home care hours (SPA/non-SPA)

	Dependent variable: relative consumption $h^*/\bar{h}$ (log)		
Sample:	All	SPA	Non-SPA
	(1)	(2)	(3)
Price (log)	-0.450**	-0.522*	-0.626**
	(0.181)	(0.305)	(0.258)
Disposable income (log)	-0.010	0.001	-0.013
	(0.008)	(0.010)	(0.009)
Care plan volume (log)	0.040*	0.039***	0.049*
	(0.023)	(0.014)	(0.029)
Other controls	Yes	Yes	Yes
Observations	8190	2489	5701
Censored observations	39.6%	40.7%	39.1%
Number of clusters	28	18	28
AIC	11454	3277.318	8144
BIC	11643	3376.252	8324

NOTES: Standard errors in parentheses, clustered at the provider level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Pooled data from October 2012, 2013, 2014. Estimation of a Tobit model by Maximum Likelihood. All specifications include as controls socio-demographic variables, dummies for the year the latest plan was decided upon, dummies for the year in which the co-payment rate was computed and year fixed effects. SPA stands for "single-provider area" beneficiaries, non-SPA for "multiple-provider area" beneficiaries.

This alternative identification strategy has several drawbacks. First, focusing on SPA beneficiaries induces additional intra-departmental selection. We find the non-SPA to be richer than SPA beneficiaries. If richer individuals are more price-elastic, as suggested by Table III in the main text, the price elasticity obtained on the SPA sub-sample would then be a lower bound (in absolute value) for the average price elasticity of our estimation sample. But we may additionally suspect that the two sub-samples differ in terms of unobservable determinants of professional care consumption. Using the specification with relative consumption, we tested the effect of including a dummy equal to one for SPA beneficiaries (Table 2.G.8): living in a SPA is found to positively affect home care relative consumption, *ceteris paribus*. The inclusion of the SPA dummy affects the price elasticity estimate (although not statistically significantly). This might suggest that SPA beneficiaries behave differently than non-SPA in terms of care consumption decisions.

[Table 2.G.8 to be found on the following page]

One might fear that authorized providers operating as monopolies may set their price in accordance with the price elasticity of demand. In SPA municipalities, provider prices could be higher where the price sensitivity of APA beneficiaries is lower, inducing a potential downward bias (in absolute value) in our point elasticity estimate. Given that the authorized providers operating in an SPA are systematically non-profit structures and that they are priced by the Departmental Council, there is limited scope for consumer surplus extraction by monopolist providers.

A more serious issue *a priori* is that SPA and non-SPA sub-samples are constructed using the available information of our sample. We construct the non-SPA sample by observing the municipalities in which there are beneficiaries served by at least two different authorized providers.[60] It might be the case, especially in very small municipalities, that there are few beneficiaries living in a municipality and they happen to all choose the same provider. In this case, we will infer that there is only one provider operating; we do not have any other way to infer from the data whether the individuals were able to choose between different providers. Although such cases are scarce,[61] we should remain cautious when interpreting the price elasticity estimated on the SPA sample.

Finally, when focusing on SPA beneficiaries, we loose 10 clusters (corresponding to authorized providers who are only found to operate jointly with other providers in the municipalities where they are present). This may undermine the validity of inference in the SPA sub-sample.

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[60]We do not have direct information on the supply and geographical coverage by the different providers.

[61]8% municipalities turn out to have a unique APA beneficiary, hosting 1% of the department's beneficiaries. More largely, beneficiaries living in municipalities with 5 or less APA recipients represent around 10% of total beneficiaries.

Table 2.G.8 – Censored regression estimates of demand for home care hours, controlling for the type of area of residence

	Dependent variable: relative consumption $h^*/\bar{h}$ (log)	
	(1)	(2)
Price (log)	-0.450**	-0.613***
	(0.181)	(0.202)
Disposable income (log)	-0.010	-0.008
	(0.008)	(0.007)
Lives in a SPA		0.064***
		(0.023)
Other controls	Yes	Yes
Observations	8190	8190
Censored observations	36.9%	36.9%
Number of clusters	28	28
AIC	11454	11431
BIC	11644	11621

NOTES: Standard errors in parentheses, clustered at the provider level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Pooled data from October 2012, 2013 and 2014. Estimation of a Tobit model by Maximum Likelihood. Specifications include as controls socio-demographic variables, dummies for the year the latest plan was decided upon, dummies for the year in which the co-payment rate was computed and year fixed effects. SPA stands for "single-provider area", non-SPA for "multiple-provider area" beneficiaries.

2.G.4. Additional results: sensitivity to the inclusion of care received on weekends

As we do not directly observe the informal care received by the individuals, we include as a control in our estimation the formal home care the individual possibly receives during the weekend and public holidays (Table 2.G.9).

As in our baseline estimations, the latent dependent variable is the number of hours consumed between Monday and Saturday, except for public holidays, divided by the care plan volume open for business days. Consistently, the care plan volume taken into account to compute relative consumption only includes the hours that were prescribed to be consumed over the week. APA beneficiaries may also be entitled to subsidies for a few hours of care to be received during weekends and public holidays, which are set separately in the personalized care plan. Although weekend hours are charged the same price, they are not fungible with week hours. Only 7.5% of our estimation sample has weekend hours included in her personalized care plan, for a median volume of about 5 hours a month.[62] We did not include the home care hours received on weekends as a control in our baseline specifications because of a simultaneity concern.

We hypothesize that, for given disability and socio-demographic characteristics, individuals not receiving professional home care over the weekend are more likely to receive assistance from their relatives. We find that receiving formal care during the weekend is associated with more hours consumed during working days; reassuringly though, it does not significantly affect the price elasticity estimate.

[Table 2.G.9 to be found on the following page]

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[62]As beneficiaries with weekend care plan volume tend to be more severely disabled, their week care plan volume, $\bar{h}_{it}$, is on average higher than the week care plan volume of the rest of beneficiaries. Among these beneficiaries, APA hours prescribed on weekends amount only to 15% of the week care plan volume on average.

Table 2.G.9 – Inclusion of home care received on weekends

	(1)	(2)	(3)
Dependent variable: relative consumption during the week $h_i^*/\bar{h}_i$ (log)			
Price (log)	-0.392**	-0.452**	-0.392**
	(0.193)	(0.195)	(0.196)
Consumes care on weekends		0.227***	-0.054
		(0.020)	(0.054)
Number of hours received on weekends			0.080***
			(0.017)
Observations	8,190	8,190	8,190
Censored observations	39.6%	39.6%	39.6%
Number of clusters	28	28	28
AIC	-22073.724	-22168.783	-22215.301
BIC	-21884.435	-21979.495	-22026.013

NOTES: Standard errors in parentheses, clustered at the provider level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Pooled data from October 2012, 2013 and 2014 (population-average model). Estimation of an IV-Tobit model by Maximum Likelihood. Provider price is instrumented by the number of municipalities served by the provider. All specifications, in both the first and second stages, include as controls the care plan volume, socio-demographic variables, dummies for the year the latest plan was decided upon, dummies for the year in which the co-payment rate was computed and year fixed effects.

2.G.5. Robustness check: estimation by a truncated regression model

As a further robustness check, we estimate the price sensitivity of the demand for home care using a truncated regression model. We make as if we did not observe all individuals who consume beyond their care plan volume.

A first estimation attempt based on our preferred specification (Equation (2.5)) was made. Unfortunately, the maximum likelihood is found to have discontinuous regions with missing values and no estimate could be derived.[63] As an alternative, we took the relative consumption, $h_i/\bar{h}_i$ (without taking the log), as the dependent variable. Convergence is achieved. As shown in Table 2.G.10, the truncated regression model gives a price coefficient very close to what the censored regression model does. As we exploit less information when fitting a truncation model (on about 40% of the sample), the precision is much lower. Although the coefficient on income is higher in when using a truncated regression model, this comparison gives credit to the econometric specification of the model. It gives empirical support to the theoretical discussion presented in Appendix 2.C: under an assumption of stability of preferences and constant price elasticity along the demand curve, we are able identify the sample average price elasticity by using information on the individuals that locate on the left-hand side of the kink in the budget constraint.

Table 2.G.10 – Consumer price elasticity estimations: Comparing truncated and censored regression models.

	Dependent variable: relative consumption ($h/\bar{h}$)	
	(1)	(2)
	Truncated reg.	Censored reg.
Price (log)	-0.304	-0.275**
	(0.449)	(0.111)
Disposable income (log)	-0.076***	-0.007*
	(0.027)	(0.004)
Observations	4947	8190
Clusters	28.000	28.000

NOTES: Standard errors in parentheses, clustered at the provider level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Pooled data from October 2012, 2013 and 2014. Estimation of a Truncated regression model and a Tobit model by Maximum Likelihood. Specifications include as controls socio-demographic variables, dummies for the year the latest plan was decided upon, dummies for the year in which the co-payment rate was computed and year fixed effects. The dependent variable is the relative consumption, not in ratio.

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[63]The maximum likelihood function of a truncated regression model is a ratio; as the algorithms behind the `truncreg` command in Stata use analytic derivatives, we hypothesize that the estimation failure is due to the fact that the denominator of the maximum likelihood function (the cumulative distribution function of a Normal) gets too close to zero when taking the log-relative consumption as the dependent variable.

2.H   Deriving the price elasticity of the hicksian demand

Using the Slutsky equation, we can show that:

$$|\epsilon_h^{\text{M}}| = |\epsilon_h^{\text{H}}| + s_h \mu_h^{\text{I}}$$

where ϵ_h^{M} is the price elasticity of the marshallian demand for home care, ϵ_h^{H} is the price elasticity of the hicksian demand, μ_h^{I} is the income elasticity of the marshallian demand and s_h is the share of (individual) income allocated to home care spending.

From our estimations, we take:

$$|\epsilon_h^{\text{M}}| = |\hat{\beta_1}|$$

$$\mu_h^{\text{I}} = \hat{\beta_2}$$

From external data, we estimate s_h to be around 12% on average for APA beneficiaries (see Chapter 3 of this thesis).

With our preferred estimates, derived from the IV-Tobit estimation (reported in Table 2.2, Section 5), this results in:

$$|\epsilon_h^{\text{H}}| = 0.35$$

The relatively low values of both the income elasticity and the budget share alocated to home care spending that we have plugged in the formula explain that we end up with the price elasticities of the hicksian and marshallian demands being close to each other.

Chapter 3

Equity in the French home care subsidy program: An ex ante evaluation of the 2016 APA reform

Summary of the chapter

While public long-term care (LTC) expenditure is growing across OECD countries, the extent to which LTC systems ensure an equitable allocation and a fair financing of care services has been little documented. Our paper sheds light on the equity in home care use and in associated out-of-pocket (OOP) payments in the context of the largest French home care subsidy program targeted to the disabled elderly (APA). We use original data from a home care provider, with unique individual-level information on both APA-subsidized and unsubsidized care for a sample of APA beneficiaries. We then conduct a simulation-based ex ante evaluation of the 2016 APA reform, whose aim was to increase public effort towards certain beneficiaries. We predict that the reform will improve coverage against the high OOP payments that were incurred by the most severely disabled prior to the reform and decrease vertical inequity in care use. Behavioral reactions are predicted to increase care use but also OOP payments for the income-poor beneficiaries, leading to an increase in the vertical inequity in the contributions made to the scheme. Evidence of limited income-related horizontal inequity in use is found both before and after the reform.

Classification

JEL Classification: D12; I14; I38; J14.

Keywords: Disability; Home care; Socio-economic inequalities; Equity; Policy analysis; Simulations.

Acknowledgments for this chapter

Contents of the Chapter

1 Introduction

With population aging, old-age disability and the financing of long-term care (LTC) services for the elderly have turned into pressing issues in developed countries (Economic Policy Committee, 2015). Despite their growing macroeconomic importance, the extent to which LTC systems achieve insurance against old-age disability risk, affordability of LTC services and redistribution between different segments of the population in OECD countries is still largely undocumented. In particular, while there exists a large international literature documenting how health care systems fare in terms of equity (Wagstaff and van Doorslaer, 2000*a*; van Doorslaer and van Ourti, 2011), these studies generally have left LTC services aside.

Equity assessments require careful empirical analysis, based on explicit definitions of which variations in care use and in financial contributions are to be considered as fair. As it reflects value judgments, any equity principle can be disputed. As many countries discuss potential reforms of their LTC systems, either to broaden coverage or curb increasing public spending, it is critical to expand the body of empirical evidence on the performance of the existing public LTC schemes with respect to well-defined and popular, if not consensual, normative stances.

Several dimensions of equity may be considered when assessing how LTC systems perform. Equity can be defined with respect to the *use* of LTC services — whether different groups of the population have a different consumption of care; or with respect to the *financial contribution* to the costs of LTC — whether different groups contribute to the financing of LTC by differing amounts (Lachaud and Rochaix, 1995). For each of these dimensions, inequity may result from a situation of either *horizontal* inequity — individuals with the same legitimate needs for care, or the same contributory capacity, use LTC services or contribute to their costs differently; or *vertical* inequity — individuals with different levels of needs, or contributory capacities, do not make a relative use of LTC or pay for these services in a way that is deemed appropriate (Rochaix and Tubeuf, 2009).[1]

The public debate regarding equity in LTC tends to focus on the issue of the costs left to the responsibility of the disabled elderly and of their family. Vertical inequity in the financing of LTC costs is presumed to induce socio-economic horizontal inequity in the use of LTC services. In most OECD countries, the coverage of LTC costs by public schemes, especially when care is provided at home, is only partial (Fizzala, 2016; Muir, 2017). Countries either offer means-tested programs or levy income- or assets-related co-payments, inducing transfers of resources along the income or wealth distribution among the disabled elderly. Depending

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[1] Put it differently, there is horizontal equity when the likes are treated alike, and vertical equity when unlike individuals are treated differently to an extent that is deemed appropriate.

on the cost-sharing rules and the price sensitivity of the demand for home care services, the design of public schemes may in turn affect how the use of LTC services varies with income.

A recent empirical literature has tested whether public LTC systems achieve socioeconomic horizontal equity in LTC use, i.e. whether allocation of care is made according to needs. While García-Gómez *et al.* (2015) find evidence of pro-rich horizontal inequity in the use of some home care services in Spain, Tenand *et al.* (2018) [Chapter 4 of this thesis] find the Dutch income-poor to use more, or more expensive, LTC services than the richer disabled elderly, even conditional on the needs assessed within the public LTC insurance. Exploiting the SHARE survey, Carrieri *et al.* (2017) and Ilinca *et al.* (2017) find that the distribution of professional home care consumption correlates with income or wealth when controlling for arguably legitimate "needs" for LTC in some European countries, but not in all. For most European countries, the scope of the results is limited by low statistical precision.

In line with this young literature, the aim of this paper is to shed light on how the French LTC system rates in terms of equity, focusing on the disabled elderly who live in the community. In France, about 5% of the population aged 60 and older benefit from public home care subsidies. These schemes represent a spending of B€3.8 (Drees, 2014), or 2.9% of public expenditures in France. The largest programme, the *Allocation personnalisée d'autonomie* (APA), offers universal benefits, allowing the disabled elderly to pay mostly for non-medical professional home care. However, APA beneficiaries are requested to make income-dependent co-payments on the cost of the LTC they use. Created in 2002, the at-home APA scheme was substantially reformed in 2016, so as to make the public coverage more generous by increasing the transfers of resources achieved by the program towards the poorest and middle-class beneficiaries, as well as the most severely disabled.

We use an original dataset made from the customer files of a home care provider operating in one French department. It contains detailed cross-sectional information on the consumption of formal care by APA beneficiaries who were customers of the provider in October 2014 (N=1,616). The unique feature of these data is that they provide precise individual-level information on the amount of APA subsidies received and the volume of care consumed, including the formal care use that did *not* benefit from APA public support.

We first use these real-world data to document (i) how the use of professional home care services varies along the income distribution and as disability gets more severe, and (ii) how the OOP payments incurred by APA beneficiaries evolve along these same two dimensions, before the 2016 reform. Contrary to the distributional analysis conducted by the Ministry of Health (Fizzala, 2016), we do not need to rely on assumptions regarding the home care demand behavior of APA beneficiaries and the local implementation of the APA program by the Departmental Councils given that our data allow us to observe total home care use and to compute OOP payments.

Second, we define some normative stances taken from the egalitarian tradition and accordingly assess how equitable the pre-reform APA scheme was. In a final step, we propose a simulation of the effects of the 2016 APA reform. We use recent estimates of the price and income elasticity of the demand for home care of the disabled elderly to simulate the post-reform formal care use at the individual level. We keep the empirical analysis voluntarily very simple: it basically relies on the comparison of the use of LTC services and the associated OOP payments across income quintiles and across administrative disability groups.

Together with the companion study by Hege (2018), we provide the first empirical normative analyses of the APA policy. Our exploratory study intends to demonstrate the interest and practical challenges associated with using simulation techniques to provide an ex ante evaluation of a reform of home care subsidies. Such an exercise proves useful to anticipate the effects of reforms of LTC that may have a differential impact on care use and co-payments across socio-economic and disability groups. In the absence of any individual level data that would make an ex post evaluation possible, our analysis provides suggestive evidence that the 2016 APA reform should reduce vertical inequity in the use of home care, while providing better coverage against the financial risk associated with severe disability. Vertical inequity in OOP payments and horizontal inequity in use are however predicted to increase.

The rest of the paper proceeds as follows. Section 2 describes the APA program and its 2016 reform. Section 3 presents our data, while the outcomes and the normative stances we base our empirical analysis on are described in Section 4. Results are presented in Sections 5 (pre-reform situation) and 6 (post-reform situation). Section 7 discusses the limitations of the paper and concludes.

2 The French APA programme and its redistributive features

2.1 Background: the home care APA programme

With 740,000 beneficiaries living in the community, APA covers almost 90% of the 60+ who benefit from a home care subsidy (Amar *et al.*, 2016).[2] [3] To be eligible for APA, an individual must be aged 60 or older and have moderate to major difficulties to perform some activities of daily living, like getting up from bed, grooming or eating. A team made of social workers and nurses pays a visit to the house of every applicant and assesses her disability level. The disability grid used in France defines 6 disability levels, or GIR (*Groupes Iso-Ressources*): if the individual is assigned to groups 1 (most severe disability) to 4 (moderate

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[2]These figures do not take into account tax rebates that may be granted on LTC expenditures; as of 2014, the rebates would reduce OOP payments for taxable beneficiaries only.

[3]APA can also benefit individuals who would like to enter a nursing home. We restrict our attention to the home care component of the scheme, covering 60% of APA beneficiaries (Amar *et al.*, 2016).

disability), she can receive APA. Groups 5 and 6 (better functional status) are not eligible.

The evaluation team then conducts a complete assessment of needs to list the interventions required by a beneficiary. APA can pay for domestic help, personal care and assistance with IADL and ADL activities.[4] The scheme works as an hourly subsidy on the unit price of care.[5] The maximum number of subsidized hours is set individually, consistently with the needs assessment, and is called the "personalized care plan". APA beneficiaries are free to consume home care beyond that point, but they have to bear the full cost of it.

The APA subsidy is computed on the basis of the equivalized spousal income. Until 2016, the legal co-payment rate was linearly increasing with income, with a zero co-payment rate for individuals earning up to €740 a month (approximately the minimum living allowance for the elderly) and a maximum rate of 90% for individuals with income beyond €2,945.

Although the general rules of APA are defined at the national level, the program is implemented at the departmental level. The central government transfers financial resources to the Departmental Councils so that they can finance the implementation of the APA scheme on their territory. Yet the allocation of resources is made prospectively and explicitly meant to cover only part of the costs of the scheme. The Departmental Councils bear (at the margin) the financial risk associated with an ageing, unhealthy population and with the decisions made by the evaluation teams at the moment of their needs assessments.

2.2 Redistributive features of the APA programme prior to the 2016 reform

By granting its beneficiaries additional financial resources to face the costs of LTC, the APA policy operates redistribution from those paying for the scheme to the disabled elderly. More precisely, as APA works as an hourly subsidy, the decrease in the home care price that it creates induces a transfer of income from the taxpayers to the APA beneficiaries.

Ex ante, before consumption decisions are actually made, this can be seen from the budget set of APA beneficiaries. Denote h_i the home care consumption of individual i and Y_i her consumption of the numeraire composite good. I_i is her income, p is the provider price of home care and p_i^s is the APA-subsidized price of care (which depends on I_i). Finally, $\bar{h}_i$ is her care plan volume. Figure 3.1 illustrates that the budget set of APA beneficiary (b) is made larger by the APA scheme relative to that of a non-disabled individual otherwise identical.[6]

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[4]APA may finance technical devices, meals-on-wheels and housing adaptation, but the bulk of APA spending pays for human care (Amar *et al.*, 2016; Couvert, 2017). Nursing care is delivered by providers paid by public and private health insurances.

[5]APA-funded care is mainly provided by services (as opposed to over-the-counter workers), most of them being non-profit or public structures.

[6]We use the term "redistribution" to designate the income transfers that are made possible by the APA scheme, between different groups of the population (defined by their disability level or income). This term does not imply that the redistribution operated by the scheme necessarily aims at reducing socio-economic

Figure 3.1 – Budget set with APA.
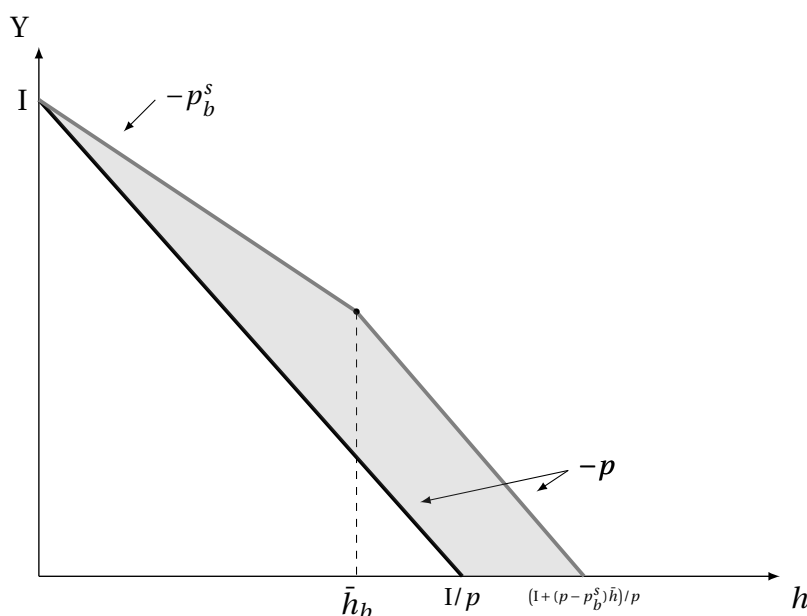
NOTES: The black line represents the budget constraint of an individual that is not eligible for APA. The piece-wise linear budget constraint of beneficiary (b) is represented by gray lines. The gray-shaded area is the extension in the budget set induced by APA.

In addition, two features of the at-home APA scheme shape the redistribution of resources *among* APA beneficiaries, meaning that beneficiaries with specific characteristics may ex ante expect to enjoy larger income transfers.

The care plan volume formally sets how the costs of LTC should be split between the part benefiting from public support within the APA policy, and the part left to individual responsibility (possibly supplemented by other forms of public support or private insurance). Under the APA rules, the care plan volume should increase with the amount of assistance an individual requires to perform the activities of daily living (*Code de l'Action Sociale et des Familles*, Article L232–6). This allows the redistribution of resources operated by APA to be more important for those who are more severely disabled. Ex ante, this is represented on Figure 3.2 by the larger budget set incurred by a more disabled individual, relative to a beneficiary less disabled but otherwise similar. Yet departmental-level budgetary constraints weighing on the evaluation teams and the explicit limits imposed by the disability-specific national ceilings[7] limit the additional transfers towards the most severely disabled APA beneficiaries.

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inequalities; it also arises because of an insurance motive.

[7]The national GIR-specific ceilings imposed on care plan volumes were set at relatively low levels until 2015 (HCFEA, 2017). See Appendix 3.C.

Figure 3.2 – Budget set with APA, depending on the beneficiary's disability level (pre-reform situation).
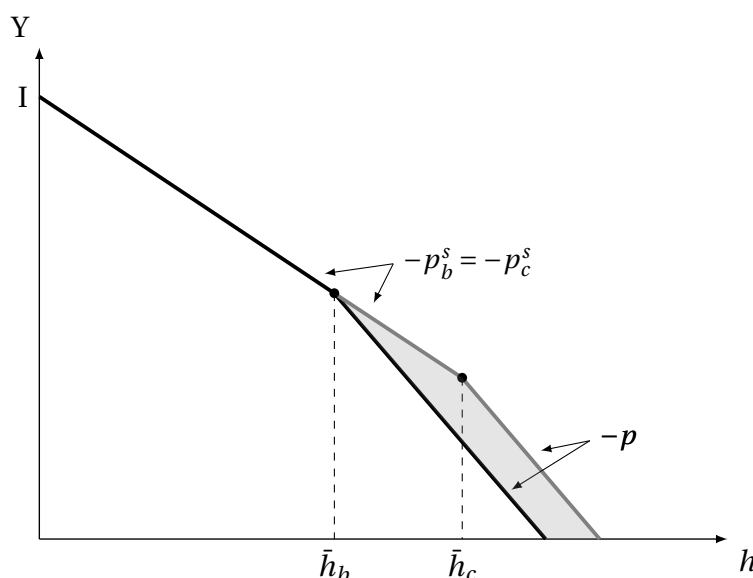
NOTES: The black lines represent the budget constraint of APA beneficiary (b). The gray lines represent the budget constraint of APA beneficiary (c), who is more severely disabled than (b). The gray-shaded area is the extension in the budget set induced by the care plan volume being increasing in the disability level.

The second feature of the program that intends to achieve redistribution within the population of APA beneficiaries is its co-payment. The national schedule must be used by Departmental Councils to define the amount of their participation to the individual costs of home care. Departmental Councils however retain significant leeway in the implementation of APA (Billaud *et al.*, 2012; Gramain, Hege and Roquebert, 2015). In particular, they are free to choose how to use the national co-payment schedule to derive the effective subsidies paid to beneficiaries.

By computing and comparing the APA subsidy and OOP payments incurred by beneficiaries under the various rules departments are found to choose between, Bourreau-Dubois and Gramain (2014) have shown that the choices made by the Departmental Councils affect the way the APA scheme redistributes resources from the rich beneficiaries to the poorer ones. Whatever the choices made by the department however, an APA beneficiary with a lower income enjoys a larger budget set than an otherwise similar but richer beneficiary (Figure 3.3). For a given level of care use, OOP payments on home care are expected to increase with the contributory capacity of APA beneficiaries.

Figure 3.3 – Budget set with APA, depending on the beneficiary's income.
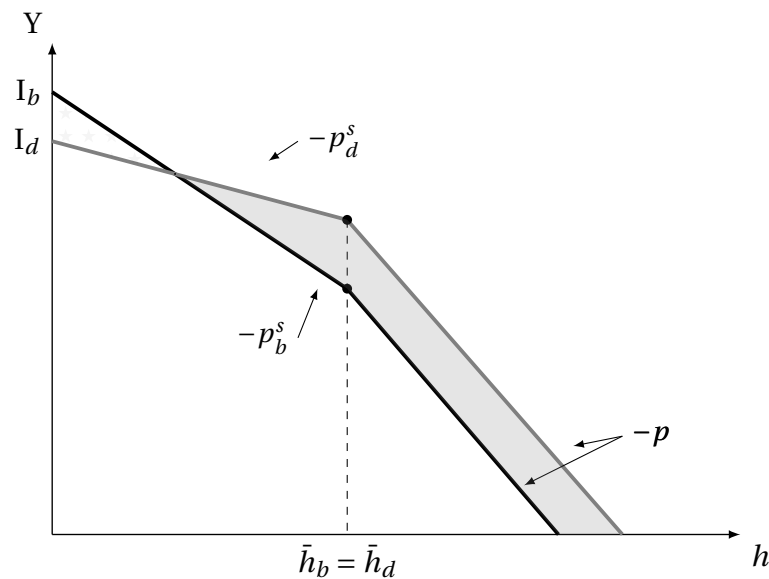
NOTES: The black lines represent the budget constraint of APA beneficiary (b). The gray lines represent the budget constraint of APA beneficiary (d), who has a lower income than (b). The gray-shaded area is the extension in the budget set induced by the income-dependent co-payment. The area filled with gray stars corresponds to the reduction in the budget set induced by the lower income of beneficiary (d).

2.3   Policy objectives of the scheme

The design of the APA scheme presumably pursues some efficiency goals. By increasing the number of hours that benefit from public financing, a higher care plan volume enables more pooling of the financial risk associated with intensive LTC use. Following Nyman (1999, 2006), the welfare gain associated with providing LTC insurance will be all the higher as the disabled elderly value the implicit income transfer associated with an insurance scheme offering partial reimbursement of the care consumed. Ex post, if individual preferences exhibit less substitutability between home care and other consumption goods as disability gets more severe, increasing the care plan volume with the disability level may allow to achieve higher welfare gains (through the income effect) with limited efficiency loss (due to the substitution effect induced by the price distortion). Moreover, decreasing the co-payments rate for the poorest would improve the efficiency of APA in the case substitutability is higher at the margin for the income-rich.

It however seems that the APA design also aims at addressing equity concerns. It is possible to interpret the care plan as a tool ensuring that the allocation of publicly-subsidized formal home care is made according to the disability level. The income-dependent co-payment schedule may result from an efficiency-equity trade-off, in which the concern that a high marginal cost of care may reduce the use of home care for lower-income beneficiaries pre-

vails over moral hazard considerations. Imposing a co-payment increasing with income is also a way to make the out-of-pocket contribution to the scheme all the higher as income is high, thereby possibly ensuring some vertical equity in financing.

The design of the at-home APA scheme thus seems to meet concerns for both equity in the use of LTC and equity in the financial contributions made to the scheme. This shows also from the motivations of the 2016 APA reform, whose aim was not only to increase public support towards the disabled elderly but also to rebalance the intended redistribution of resources towards specific categories of beneficiaries, as explained below.

2.4 The 2016 APA reform

Five years after the national debate on old-age disability and LTC policies in 2010–2011, France passed a law that brought important changes to the at-home APA scheme.[8] The motivations behind the reform were that the APA scheme offered insufficient coverage against the financial risk associated with home care costs, especially for the most disabled. In addition, it was considered that the poorest beneficiaries incurred a subsidized price of home care that was still too high given their limited financial resources. Finally, the reform aimed at addressing the recurrent claim that the middle-class elderly are relatively disfavored by LTC policies in France.

The reform thus implemented four important modifications. First, the legal co-payment rate became a function of both income and the care plan volume: this would make the out-of-pocket cost of home care lower for more severely disabled individuals. Second, holding the disability level fixed, the relationship between income and the co-payment rate was changed, following an inverted U-shape: the decrease was higher for middle-class beneficiaries. Third, the income threshold below which the legal co-payment is zero was raised from €740 to 800€. For individuals earning an income between these two values, the OOP price of every subsidized hour of care decreased (assuming no change in the prices charged by home care providers). The fourth change consisted in the increase of the GIR-specific national ceilings on care plan volume: the ceilings for the least disabled (GIR 3 and 4) increased by 18%, while the ceilings for beneficiaries of GIR 2 and 1 increased by 22% and 31% respectively.

The concerns behind the reform were supported by some empirical elements. Pre-reform statistics from the French Ministry of Health showed that severely disabled APA beneficiaries (GIR 1 and 2) were more likely to have their care plan volume constrained by their GIR-specific national ceiling ("*saturation du plan d'aide*", Bérardier (2012)) than the least severely disabled. Under the assumption that APA beneficiaries do not consume unsubsidized care and that the Departmental Councils apply the legal co-payment schedule

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[8] *Loi 2015–1776 du 28 décembre 2015 relative à l'adaptation de la société au vieillissement.*

to the price effectively charged by providers, the effort rate in the pre-reform situation was predicted to increase with income.[9] As no national or local administrative records would however allow to assess to what extent APA beneficiaries would consume beyond their care plan volume,[10] the French Ministry of Health used a microsimulation model dedicated to public LTC schemes to explore this question (Fizzala, 2016). Under the alternative assumption that beneficiaries whose care plan volume hits their GIR-specific national ceiling consume some unsubsidized care (call it scenario B), effort rates are found to *decrease* with income.

Additionally, Fizzala (2016) simulated the OOP payments under the assumption that Departmental Councils use a lump-sum tariff instead of the price charged by home care providers to compute the APA unit subsidy (call it scenario C). Effort rates prior to the reform are again predicted to be high, on average, for the very low-income (about 40% for beneficiaries in GIR 1 or 2 with monthly income lower around €800) and *decreasing* with income (Fizzala, 2016). Under both scenarios B and C, the effort rate of the most severely disabled (GIR 1 or 2) was predicted to exceed 20% even for beneficiaries in the top income decile.[11]

Those microsimulation results rely on two sets of assumptions: (i) hypothesis on the beneficiaries' behavior in terms of home care demand, and (ii) assumptions on the Departmental Councils' choices regarding the implementation of the APA program. Such assumptions may affect the assessment of equity in the use and in the financing of home care within the APA program in the pre-reform situation.[12] We propose to overcome these shortcomings by using original observational data.

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[9]We define the effort rate as the ratio of total OOP payments on home care to income.

[10]The administrative records of the Ministry of Health (*Remontées individuelles* 2007; 2011) or the departmental datasets used by Bourreau-Dubois, Gramain, Lim and Xing (2014) and Roquebert and Tenand (2017) [Chapter 2 of this thesis] only contain a censored measured of home care consumption, equal to the number of hours effectively subsidized by the Departmental Councils.

[11]The case for the relative disadvantage of the middle-class in the pre-reform situation is less clear. It appears when we consider the tax *rebate* on out-of-pocket home care spending that existed until it was transformed into a tax credit in 2017. By construction, among individuals with a relatively high home care consumption, the rebate was higher for high-income beneficiaries, who pay more taxes.

[12]In particular, the microsimulation exercise did not consider the case in which beneficiaries other than those with a "saturated" care plan may consume unsubsidized care. This could further increase the negative income-gradient in the effort rate on home care spending.

3   Data and descriptive statistics

3.1   Customer files of a home care provider

We use data extracted from the customer files of one French home care provider.[13] The department in which this home care provider operates is relatively rich and rural and has an oligopolistic home care supply: 4 providers operate in the department,[14] with only 2 covering the entire territory.[15] These providers are not directly priced by the Departmental Council, although the evolution of their prices is legally monitored. The service we focus on has a non-profit status and is the largest to operate in the department.

The dataset contains information on the professional care delivered to the house of each beneficiary, whether it is subsidized by APA or paid entirely out-of-pocket by the individual. Care use is recorded on a monthly basis. The data relate to the month of October 2014 and provide a sample of 1,616 APA beneficiaries.

The customer files contain additional variables such as the administrative disability level, the provider price of care, the APA co-payment rate, the APA care plan volume, age and gender, and a dummy indicating whether the individual lives in a rural area.

3.2   Measures of home care use

We distinguish between different measures of formal home care consumption. First, the number of hours of professional home care that are consumed by a given individual and subsidized by APA, which we call "subsidized consumption"; second, the number of hours an individual may consume beyond her care plan volume, which we call "unsubsidized consumption"; third, "total consumption", equal to the sum of subsidized and unsubsidized consumption.[16]

In a given month, the customer files of the home care provider contain information only on the APA beneficiaries that have been provided some care over the month by the provider.

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[13]These files were collected as part of the MODAPA project. For confidentiality reasons, the name of the service and its location cannot be disclosed.

[14]This figure includes home care structures (public, for-profit and not-for-profit organizations) but it does not take into account over-the-counter workers. APA beneficiaries are allowed to contract directly with a professional caregiver, although they more frequently receive care from a home care structure.

[15]The home care market may vary substantially from one department to the other, depending on the regulatory decisions made by Departmental Councils. Studying a department of a similar size, Roquebert and Tenand (2017) [Chapter 2 of this thesis] document the existence of 28 authorized services (not taking into account "non-authorized" structures), while Bourreau-Dubois, Gramain, Lim and Xing (2014) count only 15 authorized providers (with delimited perimeters of intervention) in a much more populated department. Such a variability was also documented in an ad hoc survey (LEDa-LEGOS and CES, 2012).

[16]Information on the care plan volume can be considered as highly reliable, as the provider bills APA-subsidized hours directly to the Departmental Council, which can be expected to track any reporting error.

Our data do not allow us to observe whether some beneficiaries forgo entirely home care consumption over the month.[17] [18]

In the department our data come from, the Departmental Council distinguishes between hours of professional home care that are to be received on weekdays (Monday to Saturday) and hours to be received on Sundays and non-labor days (call them weekend hours). As weekend hours are charged at a higher price than weekday hours, they appear separately in the care plan set by the evaluation team. If an APA beneficiary reaches the volume of *weekend* hours prescribed in her care plan, she has to pay the full price of the *weekend* hours if she wants to use additional care on weekends, whether she has reached the volume of *weekday* hours prescribed in her care plan or not, and symmetrically (there is no fungibility).[19]

In our sample, less than 13% of beneficiaries are prescribed or consume weekend hours. In the analysis, we add together both types of hours. Since weekend hours have a higher monetary value, we check the robustness of our results to the weighting of the two types of hours by their relative prices (Appendix 3.A).

3.3 Information on income and disability status

Although this dataset provides precious, unique information of the use of home care that is not subsidized by APA, it has two important limitations with respect to our research questions.

First, information on the administrative disability status (GIR) turns out to be recorded with error by the service. This is visible in the service's files, as the monetary value of the care plan of some customers is higher than the GIR-specific national ceiling set for APA transfers. Our assumption is that the service correctly noted down the GIR of each of its customers when she first joined the service, but does not systematically update this information if the disability group of the customer gets re-assessed by the Departmental Council.[20] In the case the individual care plan value was found to be inconsistent with the recorded GIR, we coded upward the disability level so that the care plan value systematically lies below the GIR-specific ceiling imposed on subsidized hours. Adjustment of the disability group was made for 6% of the sample. Although some recording errors may have been left unde-

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[17]Additional 46 APA beneficiaries were found in the files, with a recorded consumption of home care for the month of zero. Given that we cannot exclude that these observations are individuals not yet erased from the files, we drop them from the sample. We erased one additional individual due to her entry date in the service being missing.

[18]However the measure of unsubsidized consumption can take the value of zero, as APA beneficiaries do not necessarily consume professional care hours beyond their care plan volume.

[19]Unsubsidized consumption is then defined as the number of weekday hours consumed beyond the number of weekday hours included in the personalized care plan, plus the number of weekend hours consumed beyond the number of weekend hours set in the care plan.

[20]This is all the more likely as not updating the disability status in the customer files entails no consequences for either the beneficiary or the service.

tected,[21] examination of the data makes us confident that potential mis-categorization of individuals in disability groups should be limited (cf. descriptive statistics below).

A second drawback of our dataset is that we do not observe income directly. However, we have individual information on the APA co-payment rate, which is computed on the basis of an extensive definition of income (which roughly covers all taxable income, including capital income and pensions earned by the household). We are able to impute income using the co-payment schedule. The income definition we refer to in the analysis is thus the measure used by the Departmental Council to levy the beneficiaries' financial participation. In the case the individual has a spouse alive and living in the same household,[22] the household income is divided by 1.7 before the co-payment schedule is applied.[23]

For individuals at the very bottom (top) of the income distribution, the imputed income is however an upper (lower) bound for income. 11% of the sample have a zero co-payment rate, implying that their equivalized household income is *at most* equal to €738 a month. Given that there is a minimum living allowance for the elderly, we conjecture that the large majority of these individuals have indeed an income close to €738.[24] At the other end of the income distribution, only 5 individuals have a co-payment of 90%, meaning that we can successfully reconstruct the income of almost all richest beneficiaries.[25]

3.4 Descriptive statistics

Table 3.1 provides descriptive statistics on the sample. The age and gender composition matches the usual profile of the elderly disabled population. The majority of APA beneficiaries are women, aged more than 80. Over 4/5 of them live in a rural area. APA beneficiaries in our sample perceive on average €1,218 of equivalized income.[26]

[Table 3.1 to be found on page 207.]

The majority of APA beneficiaries served by the provider are moderately disabled (GIR 3 and 4). In the department as a whole, in 2013, about 16% of APA beneficiaries were severely

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[21] See Appendix 3.A for explanations.

[22] The presence of other members in the household does not seem to be taken into account in the computation of APA equivalized income. In any case, only 14% of self-declared APA beneficiaries reside with someone else than a spouse (Insee-Drees, 2014).

[23] See Appendix 3.C for discussion of the implicit economies of scale associated with this scaling factor.

[24] The minimum living allowance for a single elderly was of €791 a month in 2014. If we equivalize the minimum living allowance for an elderly couple using the scale used in the APA scheme, we obtain a minimum monthly income of €723, thus fairly close to an imputed value of €738. The first decile of household income per consumption unit among elderly households (head of the fiscal unit being 75 or older) was equal to €903 in 2013 (Insee *et al.*, 2013), thus comfortably higher than the minimum imputed value for income in our sample. Yet, given that the old-age living allowance can be recovered from inheritance, there may be some non-negligible take-up among those eligible; this makes it likely that some individuals in our sample earn less than the minimum imputed value for income.

[25] See Appendix 3.A for further details on our data imputations.

[26] This figure is in line with the average pension benefit (Solard, 2015).

disabled (GIR 1 and 2), while it is the case for 10% of our sample. On the contrary, the least severely disabled (GIR 4) are over-represented in our sample relative to the departmental figure and, even more so, relative to the national proportion of beneficiaries in GIR 4 (58.8%) (Drees, 2013). We expect the relatively low proportion of severely disabled beneficiaries found in our sample to reflect the fact that the most disabled APA beneficiaries do not opt for relatively expensive authorized providers, and in particular not for the service our data come from.[27]

On average, the APA beneficiaries in our sample are entitled to 20.8 subsidized hours per month. The average number of hours effectively subsidized is however lower (18.6). We also observe that the total number of hours consumed is higher (19.4 hours per month). About 25% of individuals consume hours beyond their care plan volume, but unsubsidized hours represent on average less than one hour a month.

The hourly price charged by the provider for weekday home care ranges between €19.6 and €22.15.[28] Although the average APA co-payment rate is about one-fifth, the share of the cost of home care that is paid out-of-pocket reaches 1/3 on average. This is due both to the fact that some beneficiaries consume unsubsidized hours and to the choice made by the Departmental Council to apply the legal co-payment rate to a lump-sum tariff rather than to the price actually charged by the provider.[29]

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[27]Using data from a different department, Roquebert and Tenand (2017) [Chapter 2 of this thesis] document that the APA beneficiaries opting for an authorized structure have on average less severe disabilities. This is due to the fact that disabled individual APA beneficiaries with a severely deteriorated functional status are more likely to receive care from over-the-counter workers: in such a case, the unit price of care is lower than when care is provided through a home care structure, the beneficiary can afford more hours with a given budget and the evaluation team can grant more subsidized hours before hitting the ceiling. This is confirmed by Couvert (2017): using 2011 national data on APA beneficiaries and their care plan, she documents that beneficiaries whose care plan is close to their GIR-specific ceiling are less likely to receive care from an authorized provider. As individuals in GIR 1 and 2 are more likely to have their care plan hitting the national ceiling, this translates into the most severely disabled being more likely to receive care from other types of services. This effect offsets the legal provision that Departmental Councils should foster the matching of the most severely disabled beneficiaries with authorized providers (*Article L232–6 du Code de l'action sociale et des familles*).

[28]The provider charges a different price for customers that joined the service in different years: the earlier the customer joined the provider, the less expensive the price of care.

[29]Section 4 and Appendix 3.C provide explanations about the computation of the individual APA subsidy and of OOP payments on home care in this department.

Table 3.1 – Descriptive statistics on the sample.

	Average	Std-dev.
Home care use (in hours)		
Total consumption	19.4	14.4
Subsidized consumption [a]	18.6	13.1
Unsubsidized consumption [b]	0.8	3.1
Share with [b] > 0	25.0%	–
Ratio [b]/([a]+[b])	2.6%	6.8
Care plan volume [c]	20.8	13.5
Ratio ([a]+[b])/[c]	92.5%	23.9
Home care price and APA		
APA co-payment rate	19.6%	17.2
Share with zero APA co-payment rate	11.0%	–
Provider price of care (weekday hours)	€20.9	€0.5
Hourly OOP on subsidized hours (total)	€6.8	€3.1
Public cost (APA transfer) [d]	€265.3	204.3
Total cost [e]	€409.2	€306.5
Ratio [d]/[e]	66.0%	15.0
Demographic & and socio-economic characteristics		
Man	28.0%	–
Age 60–69	5.6%	23.1
Age 70–79	19.9%	39.9
Age 80–84	23.0%	42.1
Age 85–89	30.6%	46.1
Age 90+	20.8%	40.6
Disability group: 1	2.7%	16.3
Disability group: 2	8.3%	27.6
Disability group: 3	15.3%	36.1
Disability group: 4	73.6%	44.1
Income	1218.8	421.3
Lives in a rural area	83.0%	–
Observations	1616	

NOTES: Consumption of care and care plan volume are expressed in hours per month. They include both weekend and weekday care hours. Income is expressed in euros per month; it corresponds to the equivalized household income as computed within the APA scheme. Provider price is the price charged by the provider for one hour of care provided between Monday and Saturday.

4   Empirical approach

Our empirical analysis proceeds in three steps. In a first descriptive step, we assess the degree of income-related and disability-related inequality in the use of home care and in the OOP payments using our observational data. Given our limited sample size, individuals are simply grouped either by income quintile or by their administrative disability group. We compute and compare the average of the number of hours consumed, or OOP payments incurred, across the different groups.

Second, we propose some normative stances and draw implications in terms of equity in the APA scheme in the pre-reform situation. We additionally discuss some aspects of efficiency. Finally, we assess how the 2016 reform has affected the extent to which the APA scheme ensures equity and coverage against severe disability.

4.1   Differential home care use by income

We start by comparing the total volume of home care consumed in the month across income quintiles. Socio-economic inequalities in the use of LTC services are not necessarily a policy concern: if we assume that one of the goals of the at-home APA scheme is to ensure income-related *horizontal equity* in use (equal care for equal needs), *inequalities* in LTC use would be acceptable if they merely reflect systematic differences in the "needs" for LTC across the income distribution, i.e. legitimate determinants of LTC use.

Any empirical assessment of the degree of horizontal inequity in use requires a normative stance regarding what is defined a need. In the context of the APA program, one possible measure of "needs" is the care plan decided upon by the evaluation team of the Departmental Council. Yet this interpretation raises two concerns. First, given that the decision upon the care plan is made by the Departmental Council, which is the marginal payer for APA, the care plan volume should not be seen only as a device to ensure that the allocation of public spending is made according to needs, but also as a tool regulating the local level of spending. Second, if the APA reform led to an increase in the care plan relatively higher for some beneficiaries, our measure of needs would not be robust to the policy change we are interested in.[30]

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[30]The implicit assumptions we have to make so that we can interpret the care plan volume $\tilde{h}_i$ as a measure of needs is that (i) *relative* inequalities matters and (ii) relative differences in care plan volumes are relevant to measure differential needs. But the existence of GIR-specific national ceilings and the non-negligible rate of care plans that hit these ceilings makes this second assumption fragile. Consider two beneficiaries, one whose care plan volume equal her GIR-specific ceiling and another one with a care plan volume equal to half of this same ceiling. In order to infer that the legitimate needs for care of the first beneficiary is twice as high as the care needs of the second beneficiary, we have to assume a specific behavior of the evaluation teams in setting care plan volumes. This would indeed requires that evaluation teams allocates the "saturated" care plans to the individuals with the very worst functional status; and then set the care plans of individuals with better

The other candidate as a need variable is the administrative disability group itself. It comes with two disadvantages — that there may be some measurement error and that it only counts 4 categories; yet, as it derives from an explicit grid (*grille AGGIR*), we take it as being a conceptually more robust measure of needs. Following Wagstaff *et al.* (1991), we test for income-related horizontal inequity by estimating the following linear regression:

$$h_i = \pi_0 + \sum_{j=1, j\neq 3}^{5} \pi_1^j \mathbb{1}_{[q_i=j]} + \sum_{k=1, k\neq 3}^{4} \pi_2^k \mathbb{1}_{[d_i=k]} + \sum_{j=1, j\neq 3}^{5} \sum_{k=1, k\neq 3}^{4} \pi_3^{jk} \mathbb{1}_{[q_i=j]} \times \mathbb{1}_{[d_i=k]} + \epsilon_i \qquad (3.1)$$

where: h_i is total number of home care hours consumed, $q_i = j$ with $j = 1,...,5$ if individual i is in the jth income quintile, $d_i = k$ with $k = 1,...,4$ if individual i is classified in GIR k. ϵ_i is an error term. We take income quintile 3 and GIR 3 as reference categories. If, within each disability group, individuals use on average the same amount of home care across income quintiles, we would have:

$$\text{H0}: \quad \pi_1^j = 0, \quad j = 1,2,4,5 \quad and \quad \pi_3^{jk} = 0, \quad j = 1,2,4,5; k = 1,2,4 \qquad (3.2)$$

Failing to reject the null means that we are not able to find evidence of income-related inequality in use.

4.2 Differential contributions by income

The second outcome we look at is how OOP vary with income. In normative terms, we postulate that having effort rates that are increasing in income is a necessary condition for APA to ensure vertical equity in the contributions to the scheme.[31]

Given the rules adopted by the department our data come from, the monthly OOP payments, OOP_i for APA beneficiary i who is a customer of the home care provider we are considering, are equal to:

$$\text{OOP}_i = \begin{cases} \big((c_i t) + (p_i - t)\big) h_i & \text{if} \quad h_i \leq \bar{h}_i \\ \big((c_i t) + (p_i - t)\big) \bar{h}_i + p_i(h_i - \bar{h}_i) & \text{if} \quad h_i > \bar{h}_i \end{cases}$$

where c_i is the APA legal co-payment rate, a function of income with values ranging from 0 to 0.9.[32] t is the tariff set by the Departmental Council to compute APA subsidies, which is equal to €17.59 for weekday hours, systematically lower than the price charged by the provider to individual i, p_i.

The formula enlightens three important things. First, for any additional hour consumed up to the care plan volume, OOP payments increase by an amount equal to $(c_i t) + (p_i - t)$.

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functional status as a proportion of this benchmark.

[31] This reflects the stance that a fair social scheme should ensure the progressivity of contributions (Wagstaff and van Doorslaer, 2000*a*).

[32] See Appendix 3.C for details on the computation of OOP payments.

This amount increases with income, but at a smaller rate than the slope of the legal APA co-payment rate.[33] Second, the OOP formula shows that even individuals with income so low that they have a legal APA co-payment rate equal to zero ($c_i = 0$) bear positive OOP payments even on the hours subsidized by the APA scheme.[34] Finally, any additional hour consumed beyond the care plan volume increases OOP payments by a higher amount, equal to p_i. Unsubsidized care is all the more expensive relative to subsidized care as the APA unit subsidy is high and thus income is low.

4.3 Differential use by disability level

The third outcome we document is how home care use varies across disability groups. For a LTC system to ensure vertical equity in use, individuals with more needs for care should be able to consume more care, by a proportion that is considered as fair. Rather than assuming a precise norm here, we postulate that, prior to the reform, APA did not ensure that the most severely disabled beneficiaries consumed sufficiently more than those with moderate disability. We this assume that APA did not allow to reach a situation of vertical equity in the use of home care, which is an interpretation consistent with the criticisms that were addressed to the scheme. We then focus on assessing whether the 2016 reform has induced the most severely disabled to increase their home care use *relatively more* than those with more moderate disability.

Relatively small differences in the use of care across disability levels may also reveal some inefficiency in the APA design. It may result from the most disabled being little income-elastic in their home care consumption, or healthier beneficiaries being much more price-elastic. If this is the case, a home care subsidy scheme may prove an inefficient way of providing insurance against old-age disability.

4.4 Differential contributions by disability level

The fourth and final outcome we study is how OOP payments and effort rates vary across disability groups. The APA creates a direct link between the volume of care consumed and the OOP payments incurred, even at the margin. We thus expect OOP payments and effort rates to increase as disability becomes more severe. Comparing the OOP payments borne by beneficiaries in GIR 1 with those with better functional status provides information on the degree of coverage against severe disability that is provided by APA. Departing from an equity analysis, we thereby provide some indication of the degree of risk-sharing induced by APA and how the 2016 reform has improved this efficiency aspect of the scheme.

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[33]See Appendix 3.C for further details.

[34]For such individuals, the APA-subsidized unit price of weekday care equals ($p_i - t$), or about €3.5.

Table 3.2 summarizes the indicators that we study.

Table 3.2 – Indicators used in the empirical analysis and their interpretation.

	[1] Use	[2] OOP payments or effort rates
[a] By income quintile	Horizontal inequity in use	Vertical equity in financing
[b] By disability group	Vertical equity in use	Extent of coverage

5   Results for the pre-reform situation

Table 3.3 provides the sample averages by income quintile and disability group of the relevant outcomes, as observed in our 2014 data.

Table 3.3 – Differential use and contributions by income and disability levels.

	Average use (1)	Share with unsubsidized use (2)	Average OOP payments (3)	Average effort rate (4)
Panel A: Differences across income quintiles				
Income quintile: 1	21.0 [19.5,22.6]	0.276 [0.228,0.323]	88.2 [72.9,103.5]	0.115 [0.104,0.126]
Income quintile: 2	19.0 [17.5,20.6]	0.245 [0.197,0.292]	104.0 [88.7,119.3]	0.110 [0.099,0.121]
Income quintile: 3	18.2 [16.6,19.8]	0.217 [0.169,0.265]	121.5 [106.2,136.8]	0.108 [0.097,0.119]
Income quintile: 4	18.6 [17.0,20.1]	0.263 [0.215,0.311]	155.9 [140.6,171.3]	0.114 [0.102,0.125]
Income quintile: 5	20.0 [18.4,21.5]	0.302 [0.255,0.350]	249.1 [233.8,264.4]	0.129 [0.118,0.141]
Panel B: Differences across disability groups				
Disability group: 1	63.1 [60.6,65.7]	0.727 [0.603,0.852]	470.6 [434.7,506.5]	0.390 [0.369,0.411]
Disability group: 2	41.8 [40.3,43.2]	0.522 [0.451,0.594]	326.2 [305.7,346.8]	0.263 [0.251,0.275]
Disability group: 3	28.2 [27.1,29.3]	0.347 [0.294,0.399]	218.6 [203.5,233.7]	0.173 [0.164,0.182]
Disability group: 4	13.4 [12.9,13.9]	0.196 [0.172,0.220]	95.6 [88.7,102.5]	0.076 [0.072,0.080]

NOTES: APA beneficiaries customers of the anonymous home care provider in October 2014 (N= 1,616). Care use is expressed in hours in the month and adds together weekday and weekend hours of care, be it APA-subsidized or not. Beneficiaries with unsubsidized care are those consuming beyond their care plan volume. OOP payments are expressed in euros per month. 5% confidence intervals are displayed in brackets.

5.1 Results on differential use by income

From Column (1) of Panel A (Table 3.3), we observe a U-shaped relationship between income and actual use of care. Beneficiaries in the middle of the income distribution are less likely to consume unsubsidized care, but the relatively large standard deviation makes differences between quintiles not statistically significant (even at the 10% level).

In order to assess whether there is a systematic correlation between income and home care use when we control for the disability group (care needs), we estimate Equation (3.1). Results are reported in Table 3.B.1 (Appendix 3.B). A Fisher test of joint significance does not allow to reject H0 (cf. formula (3.2)) even at the 10% level. However, the t-tests on individual coefficients reveal that beneficiaries in the 4$^{\text{th}}$ income quintile are predicted to consume significantly less than those in the third quintile when in GIR 3 (at the 5% level).[35] Individuals in the upper middle-class seemed to receive relatively too little care. These results suggest that, prior to the reform, the APA scheme was not too far from a situation of income-related horizontal equity in use, although it did not completely achieve it.

5.2 Results on differential contributions by income

From Table 3.3 – Panel A, Column (3) shows a positive income-gradient in the average OOP payments: the contributions borne by beneficiaries were on average of €88 in the month for those in the bottom income quintile, while being almost three times higher for beneficiaries in the top income quintile. The differences between the bottom 4 income quintiles are fairly small, reflecting the facts that (i) the legal co-payment rate increases at a relatively small pace between the bottom of the income distribution and the fourth quintile (where it does not exceed 30%), and (ii) the existence of a fixed component of the subsidized price of care ($p - t$), independent from income, which presses down on the income-gradient attached with the co-payment schedule.

Column (4) reveals that the effort rate on home care spending is on average of 11% in the bottom 80% of the income distribution, and reaches 13% in the top income quintile. Given that the imputed income is an upper bound for the true income for about 45% of beneficiaries in the bottom income quintile, their true average effort rate can be expected to be higher. Vertical equity in the contributions made to the APA scheme was thus not achieved in the pre-reform situation.

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[35]Among interaction terms, only the coefficient of the interaction term between the dummy for the fourth income quintile and fourth disability group is statistically significantly different from 0 at conventional levels.

5.3 Results on differential use by disability level

We now focus on Panel B of Table 3.3. Column (1) shows that the more severely disabled indeed receive more home care than beneficiaries with better functional status. The share of those consuming home care beyond their care plan volume is however substantially higher among the most disabled: more than 50% of beneficiaries in GIR 1 or 2 consume unsubsidized care, while it is the case of less than 20% of GIR 4 beneficiaries.

In microeconomic terms, the fact that the most disabled beneficiaries choose to locate beyond the kink of their budget constraint, despite the much higher OOP price of care there, is consistent with them having high preferences for care, a low price elasticity or high income elasticity in their demand for home care. This would make a case for achieving welfare gains by increasing the public effort towards the most severely disabled, as the 2016 reform did.

5.4 Results on differential contributions by disability level

From Column (3) of Table 3.3, Panel B, we see that OOP payments are relatively high for individuals in GIR 1 and 2, translating into effort rates close to 40% on average for GIR 1 beneficiaries. High OOP payments are partly due to the more frequent unsubsidized consumption as disability becomes more severe; for GIR 1 and 2, the average is pulled up by very high effort rates for some beneficiaries (cf. the box plots presented in Figure 3.B.3, Panel B, Appendix 3.B). About 25% of beneficiaries in GIR 3 had an effort rate in excess of 20%, while this is the case for only 1% of GIR 4 beneficiaries.[36]

Prior to the reform, APA thus offered fairly limited coverage against the financial risk associated with the risk of severe old-age disability for community-dwelling beneficiaries.

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[36]We can compare the average OOP payments by GIR with the simulated values presented in Fizzala (2016) (Table 2 , scenario "H2"). We find lower OOP payments across all disability levels, even though the price charged by our home care provider is relatively high and the decision of the department to compute APA subsidies based on a lump-sum tariff is unfavorable to APA beneficiaries. This reveals that either (i) the care "needs" Fizzala (2016) relies on, following a methodology proposed by Bérardier and Debout (2011), are over-estimated, or (ii) the assumption that individuals would consume all their "needs" does not reflect the true behavioral reactions of beneficiaries. We believe that this latter assumption is indeed inconsistent with plausible values of the price elasticity of home care demand by APA beneficiaries. Of course, the discrepancy can also be explained by the fact that the most disabled beneficiaries of each GIR are likely to be under-represented in our sample.

6   Simulated impacts of the 2016 APA reform

6.1   The potential impact of the reform on inequalities in care use and in OOP payments

The impacts of the 2016 reform on the use of home care and OOP payments borne by APA beneficiaries will depend on two empirical elements, which are: how the demand for formal care of the disabled elderly will adjust to a decrease in the price of care they have to pay out-of-pocket; and how the departmental evaluation teams will adjust care plan volumes following the increase in the national ceilings.

If APA beneficiaries are not price-sensitive,[37] their consumption of home care should not adjust to the APA reform. The 2016 reform would then translate unambiguously into a reduction of OOP payments, higher for the very low-income and middle-class beneficiaries as well as for the most severely disabled. If APA beneficiaries react to the decrease in the OOP price of care induced by the reform, its effects on total OOP is a priori unclear: if the upward-adjustment of formal care consumption is proportionately higher than the downward-adjustment of the unit price of care, total OOP payments may actually *increase* with the reform.

Several studies have provided reduced-form evidence that the use of professional home care services is price elastic, based on North-American or European data (Pezzin *et al.*, 1996; Stabile *et al.*, 2006; Rapp *et al.*, 2011; Fontaine, 2012). Exploiting French data, a couple of recent papers (Bourreau-Dubois, Gramain, Lim and Xing, 2014; Hege, 2016; Roquebert and Tenand, 2017) [Chapter 2 of this thesis] have directly estimated the price elasticity of the demand for home care of APA beneficiaries. With point estimates ranging from -0.16 to -0.55, they point to a statistically significant price sensitivity, yet much below unity in absolute value. Exploiting a reform of the co-payment schedule in the Netherlands, Non (2017) also finds evidence that home care use is price-sensitive.

Would the price elasticity be constant along the income distribution, it would be sufficient for the modifications in the APA schedule to impact differential home care use across income quintiles: given that richer individuals were slightly more likely to consume unsubsidized hours than the poor in our sample, the relative change in the marginal OOP price of care induced by the reform should vary along the income distribution. In addition, Hege (2016) and Roquebert and Tenand (2017) [Chapter 2 of this thesis] find the price elasticity of professional home care to be higher (in absolute value) for richer APA beneficiaries. The heterogeneity in the price sensitivity along the income distribution is a second reason why the reform may have impacted how home care use — and in turn, OOP payments — vary

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[37]And that we abstract from the income effects potentially induced by the increase in care plan volumes.

with income.

The second crucial element that will affect the outcomes of the reform in terms of both coverage and equity is how the increase in the GIR-specific national ceilings will translate into increases in individual care plan volumes. If the evaluation teams of Departmental Councils react to the reform by increasing the care plan volume of a beneficiary, this will decrease her OOP payments if she was consuming unsubsidized care prior to the reform. For those who were consuming exactly the number of hours for which they were entitled to receive a subsidy, the increase in the care plan volume will create a sharp decrease in the marginal price of care (as it will go from the provider price to the APA-subsidized price). Final impacts on home care use and OOP payments across the distributions of income and disability groups will depend not only on how the different groups are affected by an upward-adjustment of their care plan volume, but also on how the pre-reform consumption of beneficiaries was set relative to their post-reform care plan volume (Fontaine and Gramain, 2017).

Assessing these different effects and how they combine is thus an essentially empirical question.

6.2   Simulation approach

No administrative or survey data on home care consumption by APA beneficiaries in the post-reform period are available. We propose to use our data and available estimates of the price elasticity of home care demand to simulate the impact of the reform on APA beneficiaries' consumption.

Appendix 3.D provides a detailed presentation of the methodology of the simulation. We construct the budget constraint in the context of both the pre-reform and the post-reform APA scheme using the pre- and post-reform co-payment schedules (see Appendix 3.C). We then predict the change in the marginal price of care and any potential income effect to simulate the change in home care consumption. Several important assumptions are made. First, we assume that the evaluation teams of the Departmental Council will react to the reform by increasing the care plan volume for all beneficiaries of a given disability group in a uniform way. Second, using the estimates from Roquebert and Tenand (2017) [Chapter 2 of this thesis], we assume a price elasticity and an income elasticity of home care consumption of -0.4 and 0.4 respectively, constant across the income distribution.[38]

The quality of the results obtained from the simulations is contingent on the assumptions made. The validity of some of our hypothesis is however difficult to assess. In particular, the price and income elasticities are assumed to be the same for weekday hours and weekend hours of care. It is likely though that they are considered as two different goods by the dis-

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[38]Although richer beneficiaries seem to more be price-elastic, available evidence makes it hard to assess by how much.

abled elderly; however, no specific study of the demand of care on weekends can provide us with quantitative elements we could inject in our simulation. More importantly, there are limited empirical elements available to anticipate the reaction of evaluation teams. Ethnographic observations made in several French departments suggest that the adjustment of evaluation teams is likely to depend on the department: there is considerable variation from one Department Council to the other in terms of the background of evaluation team members and the way they perceive their task, of the financial margin of maneuver available to the department, and to the degree of control exerted by the hierarchy on the individual decisions made by the evaluation team (Billaud *et al.*, 2012; Gramain, Billaud and Xing, 2015*a*).[39]

6.3 Simulation results

Descriptive statistics on the simulated changes in prices, care use and OOP payments due to the reform are provided in Table 3.4 (on the following page). Given our assumptions, we predict a decrease in the APA co-payment rate by about 30% on average, leading to a change in the marginal price of care for weekday hours of 40%. We can compare the average values of consumption as simulated for the post-reform situation and to the pre-reform, observed consumption values. On average, total consumption is predicted to increase by 12.2%, while the consumption of subsidized hours would increase by only slightly less (11.6%). The share of beneficiaries consuming unsubsidized hours is predicted to double; the average number of unsubsidized hours for individuals consuming beyond their care plan volume however remains roughly the same. The lower standard deviation (2.1 against 3.1) is consistent with the reform allowing the individuals for which the pre-reform legal ceilings were much below their actual use of professional care (mostly beneficiaries in GIR 1 and 2) to benefit from subsidies on a higher number of hours.[40]

[Table 3.4 to be found on the following page.]

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[39]With the new co-payment schedule, the decision made by the evaluation team on the care plan volume does not only affect the number of hours for which the beneficiary can perceive a subsidy, but also the subsidy rate on these hours. If the evaluation team derives a specific utility from granting a beneficiary with the highest possible APA transfer (due to some form of altruism or professional ethos), the reform provides the team with an additional incentive to increase the care plan volume. Conversely, if we consider the fact that most Departmental Councils are heavily budget-constrained, the reform will increase the incentive for departments to closely monitor care plan volumes.

[40]Complementary descriptive statistics on unsubsidized care use before and after the reform are provided in Table 3.D.7, Appendix 3.D.

Table 3.4 – Descriptive statistics on simulated post-reform home care consumption.

	Average	Std-dev.
Increase in care plan volume		
Change in care plan volume	18.7%	2.3
Post-reform care plan volume	24.9	16.8
Change in marginal price & virtual income		
Change in APA co-payment rate	-29.9%	25.7
Post-reform co-payment rate	16.2%	16.6
Change in marginal price (weekday)	-40.9%	33.3
Change in marginal price (weekend)	-4.6%	16.0
Change in virtual income	-10.2%	13.6
Post-reform consumption		
Change in total consumption	12.2%	9.2
Post-reform total consumption	21.8	15.9
Change in subsidized consumption	11.6%	7.4
Post-reform subsidized consumption	21.0	15.2
Change in unsubsidized consumption	21.6%	113.0
Post-reform unsubsidized consumption	0.8	2.3
Observations	1616	

NOTES: Consumption of care and care plan volume are expressed in hours per month. Unless specified differently, consumption includes both weekend and weekday care hours. Changes in income and prices and post-reform consumption are simulated.

We now present how simulated home care use and OOP payments vary with income and disability level. As displayed in Figure 3.4, the increase in total care consumption is roughly of the same magnitude in the bottom 4 income quintiles; the increase is less marked for the 20% richest, probably because of the limited decrease in the legal co-payment rate experienced by those beneficiaries. The simulated data reveal that the average unsubsidized consumption should increase for beneficiaries in income quintiles 1 to 4, but decrease in the top income quintile.[41] This can be explained both by the richest benefiting after the reform from APA subsidies on hours that they would previously pay entirely out-of-pocket, and by the fact that the more modest beneficiaries experience strong price effects.

[Figure 3.4 to be found on the following page.]

We re-estimate Equation (3.1) to test for horizontal inequity in use, with simulated home care use as the outcome. Again, the F-test fails to reject that all coefficients on income quintiles and interacted terms are zero, but t-tests indicate that a few coefficients are individually statistically significant.[42] In particular, beneficiaries at the very bottom of the income distribution and in the fourth quintile are predicted to consume significantly less than other

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[41]These descriptive statistics are presented in Table 3.D.7, Appendix 3.D.
[42]Results are presented in Column (2) of Table 3.B.1, Appendix 3.B.

beneficiaries, except when they belong to GIR 4. The reform has thus not allowed to reach a situation of horizontal equity in use.
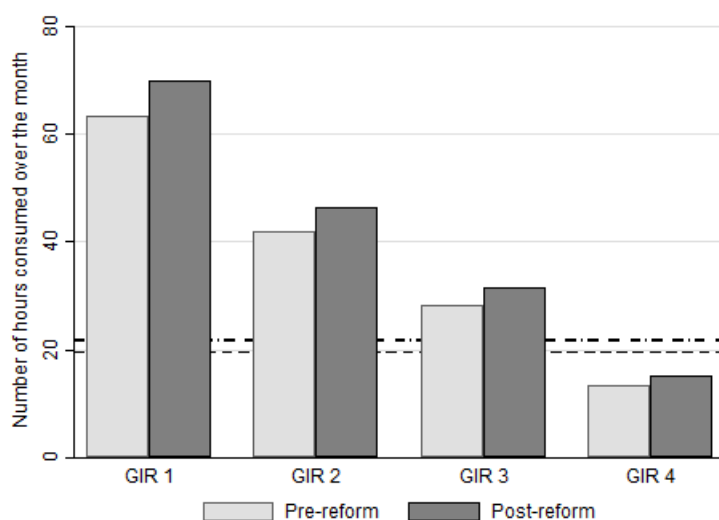
Figure 3.4 – Use of formal home care, by income quintile: Pre- and post-reform comparison.
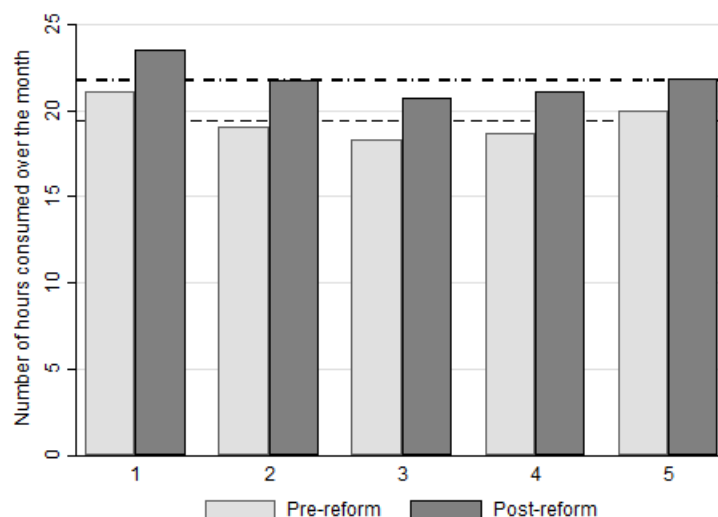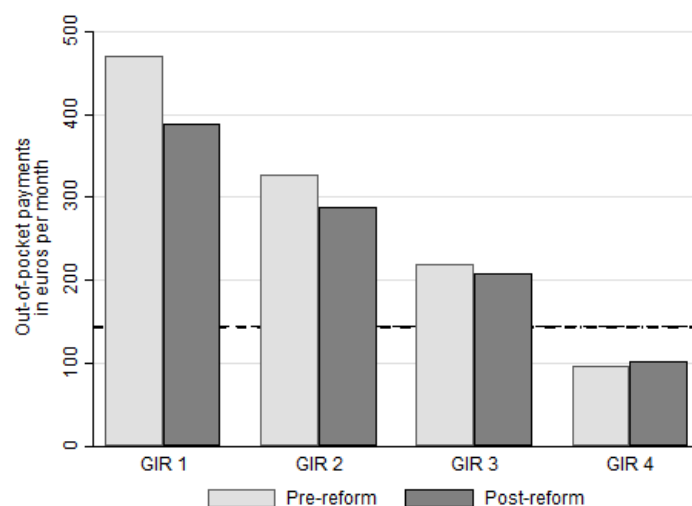

NOTES: APA beneficiaries customers of the anonymous home care provider in October 2014 (N=1,616) and own simulations of post-reform outcomes. The dashed horizontal line represents the sample average use in the pre-reform situation. The dash-dotted thicker horizontal line represents the sample average use in the post-reform situation.

As shown by Figure 3.5 (Panel A), the reform has increased the contributions made to the scheme for beneficiaries in the bottom two income quintiles, while the average OOP payments decreased in the top of the income distribution due to the lower use of unsubsidized care. The reform would lead the average effort rate to be similar in the poorest and richest quintiles (around 12.5%), while being lower (11% or less) in the middle of the income distribution.

[Figure 3.5 to be found on the following page.]

If vertical equity in financing is to be judged by the progressivity of OOP payments, then the APA reform is predicted to accentuate vertical inequity in financing. This conclusion is contingent on the substantial increase in the care use that we predict for individuals in the bottom of the income distribution and it heavily relies on the assumption of constant price and income elasticities of home care demand. If low-income individuals turn out to be less sensitive to a decrease in the OOP price of care, then we may not observe an increase in the effort rate on home care for the poorest.

Figure 3.5 – Contributions to the APA scheme, by income quintile: Pre- and post-reform comparison.
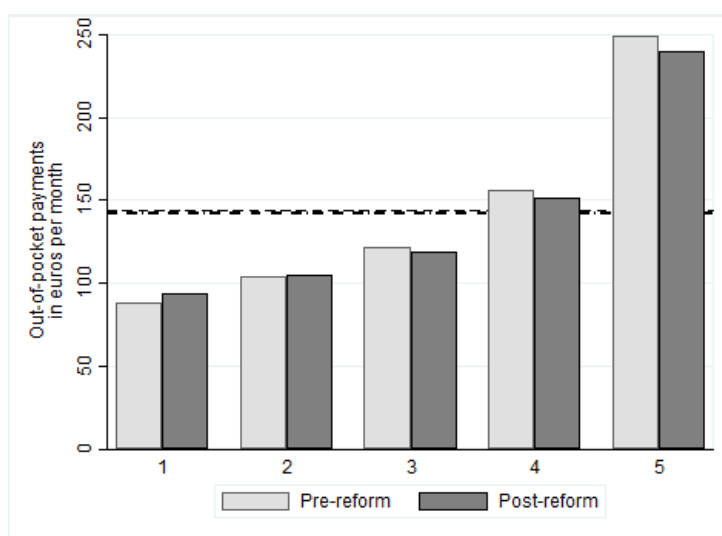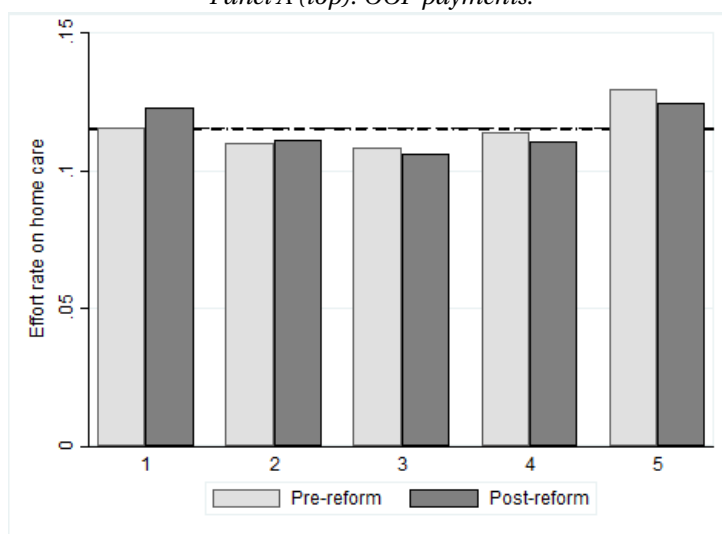
Panel A (top): OOP payments.

Panel B (bottom): Effort rate on home care.

NOTES: APA beneficiaries customers of the anonymous home care provider in October 2014 (N=1,616) and own simulations of post-reform outcomes. The dashed horizontal line represents the sample average OOP payments (Panel A) or the sample average effort rate (Panel B) in the pre-reform situation. The dash-dotted thicker horizontal line represents the sample average OOP payments (Panel A) or the sample average effort rate (Panel B) in the post-reform situation.

We now turn to comparing disability groups. The increase in home care use following the reform is predicted to be all the higher as disability is more severe (Figure 3.6), suggesting that the reform would decrease vertical inequity in use.

The share of those consuming unsubsidized care is predicted to decrease in GIR 1 and 2, due to the relatively high increase in the care plan volumes for these groups. For GIR 3 and 4, the proportion of those consuming beyond their care plan is expected to increase, but the average unsubsidized consumption among them is predicted to fall. This means that, if the increase in national ceilings translates in increases in care plans following our assumption, the situations of beneficiaries with moderate disabilities having to consume a substantial number of unsubsidized hours should become much rarer.

Figure 3.6 – Use of formal home care, by disability level: Pre- and post-reform comparison.

NOTES: APA beneficiaries customers of the anonymous home care provider in October 2014 (N=1,616) and own simulations of post-reform outcomes. The dashed horizontal line represents the sample average use in the pre-reform situation. The dash-dotted thicker horizontal line represents the sample average use in the post-reform situation.

Finally, Figure 3.7 shows that the OOP payments and effort rates on home care have decreased for GIR 1 to 3 (and substantially so for the most severely disabled), while they are predicted to remain roughly unchanged for beneficiaries in GIR 4. While the full welfare gains to the reform cannot be assessed without further information and assumptions on preferences, we can yet infer that the 2016 reform has improved coverage against the risk of severe disability. We thus tentatively predict efficiency gains from a higher ex ante risk sharing.

[Figure 3.7 to be found on the following page.]

Figure 3.7 – Contributions to the APA scheme, by disability level: Pre- and post-reform comparison.
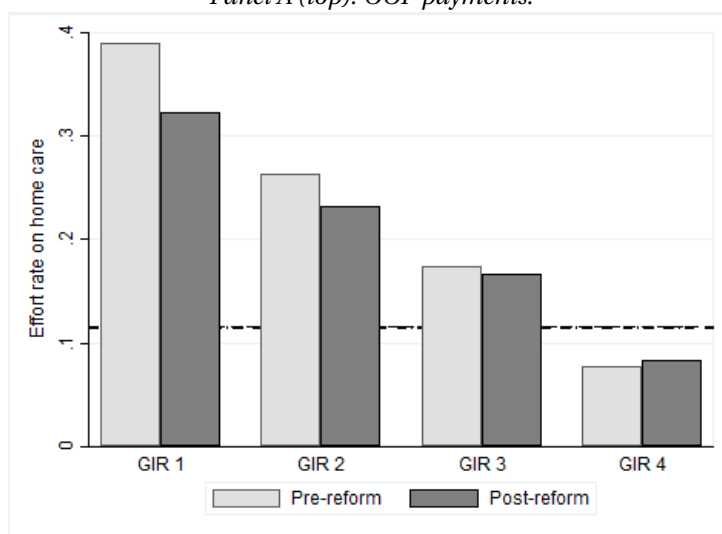
Panel A (top): OOP payments.

Panel B (bottom): Effort rate on home care.

NOTES: APA beneficiaries customers of the anonymous home care provider in October 2014 (N=1,616) and own simulations of post-reform outcomes. The dashed horizontal line represents the sample average OOP payments (Panel A) or the sample average effort rate (Panel B) in the pre-reform situation. The dash-dotted thicker horizontal line represents the sample average OOP payments (Panel A) or the sample average effort rate (Panel B) in the post-reform situation.

7 Discussion

7.1 Limitations

While we believe our simulation offers a valuable ex ante evaluation of the APA reform in the absence of any data available for ex post evaluation, we acknowledge that our results rely on relatively strong assumptions. First, our results do not reflect the substantial uncertainty around the parameters and assumptions we are using in the simulation. Several empirical elements on the demand of home care by the disabled elderly have been produced in the recent years, but further evidence is needed to make simulation exercises more robust. Second, we have adopted a fairly simple simulation method to predict post-reform care use. Given the non-linearity of the budget constraint induced by APA, a more sophisticated method may be warranted. As for now, our simulated outcomes fail to reproduce the significant bunching at the kink (the level of the care plan volume), which we expect from the microeconomic consumer theory and that we observe in our 2014 data (Figure 3.D.2, Appendix 3.D).

There are certainly ways to improve and enrich the simulation that we have not explored yet, both in technical terms and with respect to scenarios. In particular, we could distinguish between the mechanical effects of the reform and the ones further induced by the behavioral reactions of APA beneficiaries. Given that the reaction of the departmental evaluation teams to the increase in national ceilings is extremely speculative, it would be of interest to test different hypothesis for the adjustment of care plan volumes. Our current implicit assumption is that the evaluation team fully integrates the budgetary constraints weighing on the Departmental Council and sets the care plan volumes *proportionately* to individual needs. Another possible decision model would consider that the evaluation teams first decide upon the volume of care a given APA beneficiary requires, and then "censor" the care plan volume if it lies above the GIR-specific national ceiling.[43] In such a case, if we consider that the underlying "norm" that the evaluation team members implement when they set a care plan volume, in terms of how much an individual requires of professional assistance, is left unchanged by the reform (Fontaine and Gramain, 2017), then we would expect only the care plan volumes that were hitting the national ceilings to be adjusted upward. As pointed out in Fontaine and Gramain (2017), APA beneficiaries in such a situation (and who were actually consuming at least their care plan volume) represent only 15% of the sample. The scenario we have simulated might thus over-estimate the overall increase in home care use induced by the reform.

In a companion analysis conducted within the MODAPA research project, Hege (2018)

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[43]This is the decision model that is suggested by the APA legislation.

has used the same data to propose an assessment of the redistribution induced by the APA scheme and simulate the effects of the 2016 reform. Although they address the same broad questions, our two studies differ in the choice of the outcomes of interest and the simulation assumptions. Hege (2018) focuses on the distribution of APA spending and of disposable income (net of APA benefits) across income deciles. His assessment of horizontal equity in home care use relies on the assumption that the care plan is a relevant individual measure of relative needs for care, whereas we have retained the administrative disability group. He simulates the change in care use based on the price elasticity estimated in Hege (2016), which varies with the subsidized price of care and thus with income. In spite of these methodological differences, our two studies deliver similar messages, in particular regarding the unintended marked decrease in out-of-pocket payments and associated increase in APA transfers at the top of the income distribution.

The scope of our analysis should not be over-stated. We focus on the APA policy and ignore other public support provided to the disabled elderly. The tax rebates on OOP payments on home care that were available until 2016 achieved substantial redistribution of resources towards the middle-class and richest beneficiaries, presumably increasing the vertical inequity in out-of-pocket financing in the French home care subsidy system. The conversion of the rebate into a tax credit in 2017[44] is expected to have reshuffled the decks, as it can now benefit equally the large taxpayers and the modest households (HCFEA, 2017). Neither do we assess how the taxes and contributions that finance the APA spending spread out.[45]

In addition, the external validity of our study is limited by the nature of the data we use. Our sample is not necessarily representative of the total population of at-home APA beneficiaries in France. In particular, the department which the data come from is richer than average metropolitan France (Insee *et al.*, 2013). Given the significant leeway the departments retain in the implementation of the APA policy, we should be careful in extrapolating our conclusions. As discussed earlier, the fact the Department Council applies the APA legal co-payment schedule to a lump-sum tariff decreases the vertical redistribution relative to what is embedded in the national legislation. In terms of socio-economic differences in LTC use and OOP payments, we adopt an unfavorable scenario perspective. Moreover, within the department our data come from, we do not observe APA beneficiaries who do not choose our specific provider. Our sample may not be representative of the at-home APA beneficiary population in terms of income and disability level.

Finally, we focus on the at-home APA scheme and leave aside the elderly who reside in institution (about 40% of the disabled elderly nationwide). In France, the elderly and their family are free to choose whether they want to stay home or enter a nursing home; depending

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[44] *Loi 2016–1917 du 29 décembre 2016 de finances pour 2017.*

[45] The assessment of the progressivity of the mix of taxes that fund APA spending would require a careful analysis. Yet the fact that some of these taxes are regressive may prevent overall funding from being progressive.

on their choice, their disability group and APA benefit are assessed either within the at-home APA program or within the in-institution scheme. Given this peculiarity and the differences in co-payments across living arrangements, we expect the decision to stay in the community to depend on socio-economic status. There is however little ground to predict how this would affect our conclusions in terms of equity.

7.2   Concluding remarks

This paper provides an exploratory study of the distribution of the use of home care and OOP payments across the income distribution and disability levels, for the disabled elderly benefiting from the French APA program. Our original data allow us to document the use of unsubsidized home care by APA beneficiaries and the full OOP payments that they incur, once the local decision regarding the computation rules of APA benefits and the unsubsidized care use are taken into account. In addition to these descriptive results, we assess whether equity in home care use and equity in the contributions made to the scheme are achieved within the at-home APA policy, based on egalitarian normative stances. As a last step, we dig into the "anatomy of APA" to propose a simulation of the 2016 reform of the scheme and compare inequalities in the use of formal care and in the OOP payments before and after the reform.

We predict that the 2016 APA reform would increase home care consumption across all disability groups and income levels. Effects on total OOP payments are more ambiguous: those may actually increase in the bottom of the income distribution, due to a strong predicted increase in home care use. Some limited income-related horizontal inequity in use was detected prior to the reform and should keep holding afterwards. Vertical inequity in OOP financing is even predicted to accentuate with the reform. On the other hand, we predict that the reform-induced increase in home care use will be all the higher as disability is more severe. Assuming there was vertical inequity in home care use prior to 2016, the reform should decrease it. OOP payments are predicted to decrease substantially for the most severely disabled, meaning that the reform should increase the degree of coverage of the financial risk associated not only with old-age disability, but also with the most severe functional losses, provided individuals are able to stay in the community.

Given the limitations of our data, we remain cautious about the scope of our conclusions. The opportunity to replicate the analysis on more comprehensive data should be considered. The upcoming release of a new survey on disability and LTC use by the 60+ living either in the community or in institution by the French Ministry of Health should open the way for a more comprehensive analysis.[46] The data were collected a few months before the 2016 reform was

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[46]The CARE survey, which is expected to be made available in 2018, will contain information on income and publicly-financed home care use matched from administrative sources.

enacted. As no follow-up wave is scheduled, only an ex ante evaluation of the reform can be considered. Another option would be to use the individual-level administrative registers of APA beneficiaries that the Ministry of Health intends to collect. The data would cover all French APA beneficiaries in 2017 and the APA subsidies they have received over the previous years. A mandate for improved collection of individual-level information relating to the APA and other LTC schemes was enacted by the 2016 APA reform. However, such data will only contain information on APA-subsidized care; we will have to rely on assumptions on the consumption of unsubsidized care if we are to assess the effects of the reform on the full LTC use and OOP payments.

Appendix

3.A Data issues

3.A.1 Imputation of the administrative disability group

As explained in Section 3.3, reported disability group (GIR) is found to be inconsistent with the values of national ceilings for a number of observations. We adjust the GIR following the rule described in Section 3.3. There may however remain measurement errors on the GIR.

There are theoretically two reasons for that. First, within a given reported disability group, we have no way to detect whether individuals with a relatively small care plan volume (relative to the national ceiling corresponding to this disability level) have their GIR correctly coded. However, if an APA beneficiary is granted a re-assessment of the administrative disability group, this is generally because the care plan volume cannot be adjusted upwards sufficiently without hitting her initial GIR-specific ceiling.

The second reason for which we might fail to adjust upward the disability level is that we have to refer to the 2014 values of the national ceilings. Yet the national ceilings that are binding for a given beneficiary are those who were in place when her needs assessment was last conducted.[47] Imagine the case of an individual who is recorded as a GIR 2, while her most recent need assessment would place her in GIR 1 (most severe disability level). The monetary value of her care plan volume (correctly recorded in the data) is supposed to be €1,110. Say the reassessment was done in 2012, so that the maximum value for a care plan of GIR 2 that year was €1,104. As we refer to the value of 2014 (which indicates a maximum of €1,125), we fail to detect that this individual is actually a GIR 1. Again, we believe that this issue is practically negligible: re-assessment of needs are meant to be conducted every two years, and the two-year difference in the value of national ceilings is less than €25.

3.A.2 Imputation of income

As explained in Section 3.3, the income of APA beneficiaries is not directly recorded in the provider's files. However, we know the APA legal co-payment rate for each APA beneficiary; we thus use the APA co-payment schedule to impute individual income.

The co-payment rate is linearly increasing with income, with lower and upper bounds. For the 11% individuals who have a co-payment of zero, we only know their monthly income

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[47]The values of national ceilings are reassessed yearly following the value of a disability benefit called MTP. See Appendix 3.C for further explanation.

is of or below €738, which is a value almost equal to the equivalized minimum living allowance for the elderly. In our sample, there are 5 individuals with a co-payment of 90%, for which we only know their income is equal or greater than €2,945. We impute them this value for income: given the low number of APA beneficiaries with the maximum co-payment, the expected measurement error should have little impact on our results.

The coefficient that relates the (unobserved) income to the (observed) co-payment rate depends on the year the co-payment was last computed.[48] As we do not have this information, we use the coefficient that was used when the individual joined the service. This uncertainty may cause some — limited — upward measurement error on income.

In our empirical analysis, we only group individuals by their income quintile, and do not rank them one by one: there is then no uncertainty about the fact that the 11% of individuals with a zero co-payment rate are in the bottom income quintile, and that the 5 individuals with a 90% co-payment belong to the top quintile.

When computing the effort rates (ratio of OOP payments on income), we should keep in mind that they may be under-estimated in the bottom income quintile.

What we impute is the individual income definition used by the Departmental Councils to compute their financial participation to APA beneficiaries' costs of LTC. Following the APA legislation, they have to use the equivalized "spousal" income: it is equal either to the individual income for individuals who are single, or the sum of the income of the two spouses, if the beneficiary is living with a partner, that is divded by 1.7.

This scaling implicitly uses the Oxford scale (also called "old-OECD scale") for equivalence units (OECD, 2013b). Compared to the OECD-modified scale, which is often used in France, the old-OECD scale integrates a lesser degree of economies of scale within the couple. If the spouse of the beneficiary is alive but lives in a nursing home, the household income is divided by 2, reflecting the little scope for economies of scale.

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[48]See Appendix 3.C for further explanation.

3.A.3 Sensitivity analysis: relative value of weekend hours

Hours of care provided on a weekday are not charged the same price by the provider as hours of care provided on a weekend or working holiday. Consistently, when converting the care plan volume into its monetary equivalent, the Departmental Council does not take the same unit price to value weekday hours and weekend hours.

When measuring home care use, it is not conceptually clear whether we should weigh the hours received by their monetary value. On the one hand, individuals with activity restrictions may value assistance they receive the same whatever the day they receive it. On the other hand, being prescribed care on weekends may reflect the fact that care consumption is not easily inter-temporally substitutable. Then, compared to individuals that are not being prescribed hours on weekends, individuals who have weekend hours in their care plan may attribute a higher value to these hours as they were not reallocated to weekdays.

In the baseline analysis, we weigh equally weekday and weekend hours, thereby implicitly considered they are homogeneous goods. As a sensitivity analysis, we weigh both the hours prescribed in the care plan and the hours actually consumed by the relative provider price of weekend and weekday hours. The provider charges a price 30% higher for weekend hours. Then, for an individual with $\bar{h}_{wd}$ hours of care prescribed on weekdays and $\bar{h}_{we}$ hours of care prescribed on weekends, the weighted care plan volume is equal to $\bar{h}_{wd} + 1.3 * \bar{h}_{we}$. Similarly, for an individual with h_{wd} hours of care actually consumed on weekdays and h_{we} hours of care consumed on weekends, the weighted consumption is equal to $h_{wd} + 1.3 * h_{we}$.

The results of our analysis are invariant to the inclusion of the weights. This can be explained by the fact that only 12.7% (resp. 12.2%) of the beneficiaries have weekend hours prescribed (resp. consumed), representing 1.5% of the care plan volume (resp. 1.2% of total consumption).

3.B   Complementary results on the pre-reform situation

3.B.1 Distribution of care use, OOP payments and effort rates in the pre-reform situation

Figure 3.B.1 – Distribution of home care use by disability group and income quintile (pre-reform situation).
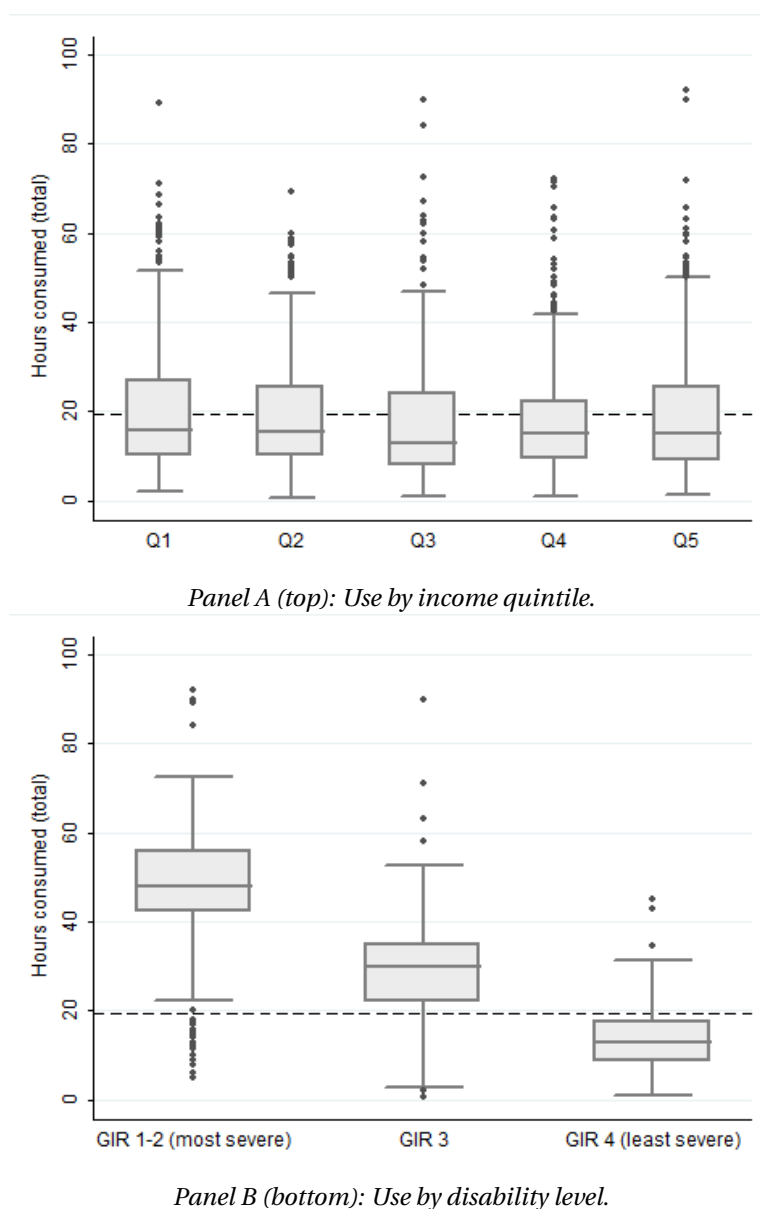
Panel A (top): Use by income quintile.

Panel B (bottom): Use by disability level.

NOTES: APA beneficiaries customers of the anonymous home care provider in October 2014 (N= 1,616). Use is expressed in hours (weekday and weekend) consumed in the month. The dashed horizontal line represents the sample average of home care use. In the bottom Panel, we group together beneficiaries of GIR 1 and GIR 2 given the low number of individuals in GIR 1 (N=22).

Reading: there are five horizontal segments defining each box plot. The second, third and fourth segments respectively indicate the lower quartile, the median and the upper quartile of the distribution of the variable. The lower segment indicates either the minimum value taken by the variable, or the difference between the lower quartile and 2/3 of the interquartile range if it is higher than the minimum. Similarly, the upper segment indicates either the maximum, or the sum of the upper quartile and 2/3 of the interquartile range if it is lower than the maximum. The dots indicate outlying values (such that there are more than 2/3 of the interquartile range away from either the lower or the upper quartile).

Figure 3.B.2 – Distribution of OOP payments by disability group and income quintile (pre-reform situation).
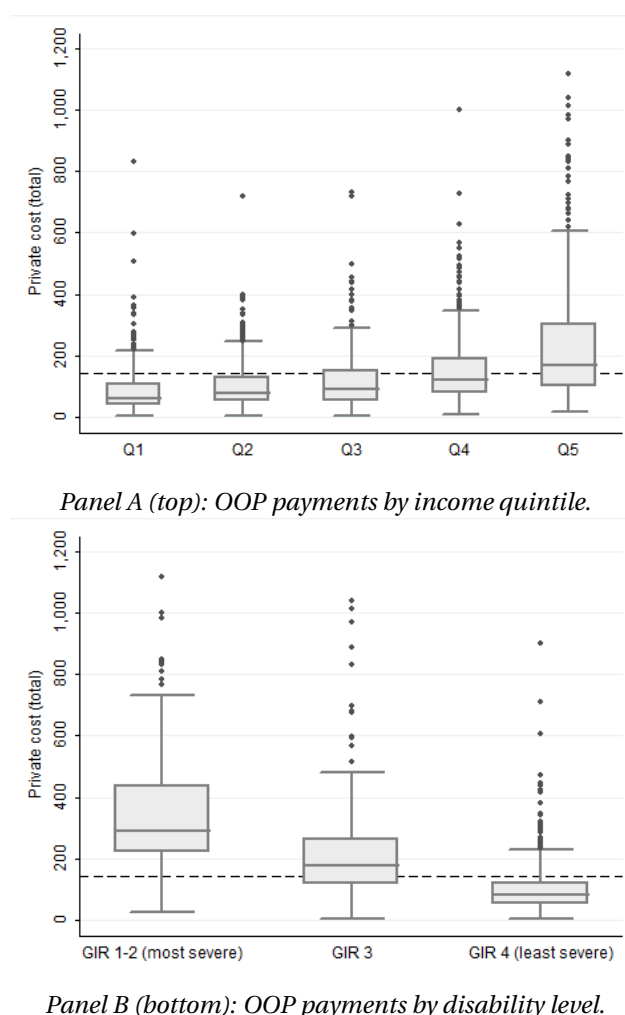
Panel A (top): OOP payments by income quintile.

Panel B (bottom): OOP payments by disability level.

NOTES: APA beneficiaries customers of the anonymous home care provider in October 2014 (N= 1,616). OOP payments are expressed in euros per month. The dashed horizontal line represents the sample average of OOP payments. In the bottom Panel, we group together beneficiaries of GIR 1 and GIR 2 given the low number of individuals in GIR 1 (N=22). For better readability, we exclude from the graph 2 individuals whose OOP payments exceed €1,200.

Figure 3.B.3 – Distribution of effort rate by disability group and income quintile (pre-reform situation).
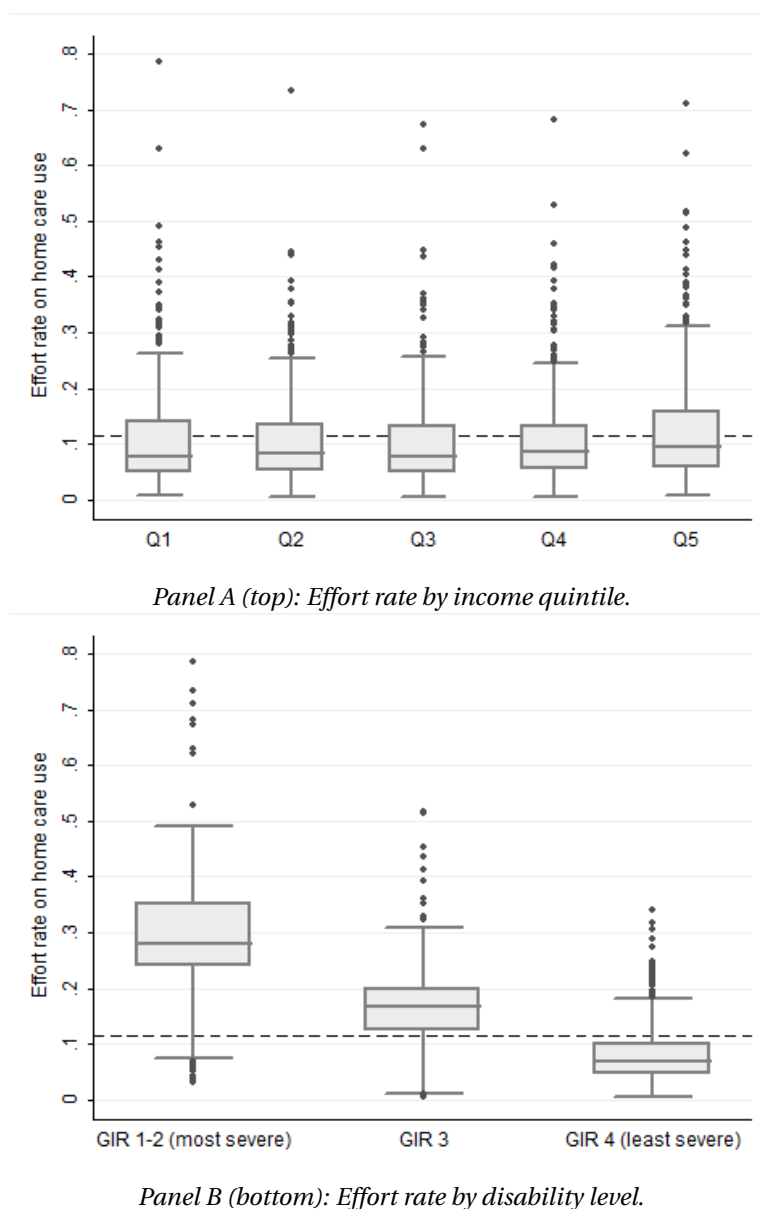
Panel A (top): Effort rate by income quintile.

Panel B (bottom): Effort rate by disability level.

NOTES: APA beneficiaries customers of the anonymous home care provider in October 2014 (N= 1,616). The effort rate equals OOP payments divided by income. The dashed horizontal line represents the sample average of the effort rate. In the bottom Panel, we group together beneficiaries of GIR 1 and GIR 2 given the low number of individuals in GIR 1 (N=22). For better readability, we exclude from the graph 2 individuals whose effort rate exceeds 80%.

3.B.2 Regression results

Table 3.B.1 – OLS regression of home care use on income quintiles and disability groups (test for income-related horizontal inequity in use).

	Outcome: home care use	
	Pre-reform	*Post-reform*
Income quintile: 1	-2.228	-3.491*
	(1.755)	(1.961)
Income quintile: 2	-1.905	-2.295
	(1.780)	(1.988)
Income quintile: 3	*Ref.*	*Ref.*
Income quintile: 4	-3.883**	-4.336**
	(1.772)	(1.979)
Income quintile: 5	-1.006	-2.310
	(1.755)	(1.961)
Disability group (GIR): 1	34.917***	39.081***
	(3.308)	(3.695)
Disability group (GIR): 2	12.392***	13.797***
	(2.317)	(2.588)
Disability group (GIR): 3	*Ref.*	*Ref.*
Disability group (GIR): 4	-17.390***	-19.592***
	(1.396)	(1.559)
Interacted term: GIR 1 × Income quintile 1	-0.819	-2.367
	(4.126)	(4.608)
Interacted term: GIR 1 × Income quintile 2	-5.595	-7.709
	(5.572)	(6.223)
Interacted term: GIR 1 × Income quintile 4	3.977	5.298
	(4.661)	(5.206)
Interacted term: GIR 1 × Income quintile 5	0.819	-0.003
	(4.655)	(5.199)
Interacted term: GIR 2 × Income quintile 1	2.123	1.529
	(3.060)	(3.417)
Interacted term: GIR 2 × Income quintile 2	0.369	0.405
	(3.023)	(3.376)
Interacted term: GIR 2 × Income quintile 4	4.386	4.588
	(3.199)	(3.573)
Interacted term: GIR 2 × Income quintile 5	-0.544	-1.083
	(3.046)	(3.402)
Interacted term: GIR 4 × Income quintile 1	3.416*	4.900**
	(1.926)	(2.151)
Interacted term: GIR 4 × Income quintile 2	2.703	3.393
	(1.944)	(2.171)
Interacted term: GIR 4 × Income quintile 4	4.531**	5.002**
	(1.934)	(2.161)
Interacted term: GIR 4 × Income quintile 5	2.094	2.911
	(1.923)	(2.147)
Constant	30.083***	34.047***
	(1.285)	(1.436)
Observations	1616	1616
R^2	0.644	0.636

NOTES: Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

3.C   The APA scheme and the 2016 reform: Additional information

3.C.1. APA disability groups and national ceilings before 2016

To be eligible for APA, individuals must be assessed as belonging to the administrative group (GIR) 1, 2, 3 or 4. GIRs and the corresponding grid (AGGIR) are a French specificity. Here is a brief description of the profiles of the different eligible groups:

- Beneficiaries in GIR 1 (most severe disability) are individuals who lost their cognitive, physical and social autonomy. They absolutely require constant supervision;

- Beneficiaries in GIR 2 require assistance in most of the activities of daily living and are of two types. They can be either individuals with deteriorated cognitive functions but with good mobility; or individuals that are bedridden but with satisfactory intellectual functioning;

- Beneficiaries in GIR 3 have good cognitive capacities, partial mobility and require assistance for personal care several times a day;

- Beneficiaries in GIR 4 (least severe disability, among eligible categories) are of two types. They can be either individuals who need assistance to get up from their bed, but that can then move around their house without assistance, while requiring punctual assistance with grooming and dressing. Or they can be individuals with no mobility limitations but who require assistance with personal care and for meal preparation.

In 2014, the monthly ceiling for the most severe disability group was of €1,312. Depending on the price of care, this amount would pay for 13 to 26 hours per week of a combination of personal care, domestic help and assistance with other ADLs/IADLs (Couvert, 2017). This can be compared with the (non-binding) ceiling of 50 hours a week set on the combination of personal care and individual guidance in the Dutch public LTC insurance for home care recipients (Tenand *et al.*, 2018) [Chapter 4 of this thesis], which can be complemented by domestic help provided by the municipalities.

For individuals in GIR 2, the number of hours of care that can be subsidized by APA is capped at around 22 hours a week; this figure is of 17 and 11 hours a week for beneficiaries in GIR 3 and GIR 4 respectively.

3.C.2 Computation rule of the APA hourly subsidy and transfer

The amount of APA transfer of a given beneficiary is equal to the APA hourly subsidy times the number of hours of care she effectively consumed up to care plan volume. To derive the individual APA hourly subsidy for each APA hour of care, each Departmental Council can choose the tariff to which apply the national APA co-payment schedule. In the department we study, the Departmental Council does not apply the APA co-payment rate to the price charged by the provider, but to a lump-sum tariff. The APA hourly subsidy is thus equal to:

$$s_i = (1 - c_i)\, t$$

where c_i is the legal APA co-payment rate (set at the national level) and t is the lump-sum tariff set by the Departmental Council.[49]

Before the 2016 reform, the legal co-payment rate c_i was a simple function of the monthly equivalized household income I_i:

$$c_i = \begin{cases} 0 & \text{if} \quad I_i \leq 0.67\mathrm{MTP}_i \\ \frac{0.9 I_i}{2\mathrm{MTP}_i} & 0.67\mathrm{MTP}_i < I_i < 2.67\mathrm{MTP}_i \\ 0.9 & \text{if} \quad I_i \geq 2.67\mathrm{MTP}_i \end{cases}$$

where MTP stands for *Majoration pour tierce-personne*, which is a disability benefit whose value is reassessed every year nationally (equal to €1,107 in April 2017). In the formula, MTP is indexed by i: the value of the MTP to be applied will be the one in the year the individual's situation was (last) assessed.[50]

The individual APA transfer will be equal to an hourly APA subsidy times the number of hours of care that are effectively consumed, up to the volume defined by the individual care plan. APA does not provide a monetary transfer: it is an in-kind benefit.

3.C.3 Computation of out-of-pocket payments

From the beneficiary's point of view, the hourly price that APA beneficiary i has to pay out-of-pocket (called her consumer price, CP_i) on the subsidized hours she consumes[51] is then equal to:

$$CP_i = p_i - s_i$$
$$= (c_i\, t) + (p_i - t)$$

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[49]For the sake of simplicity, we disregard for now the distinction made between weekend and weekday hours of home care, which are priced and reimbursed at different rates.

[50]Legally, Departmental Councils should regularly — maximum every 2 years — reassess the situation of APA beneficiaries. In practice, there is local variation in the regularity of reassessments. MTP varying by a few euros from one year to another, this has limited implications on c at the individual level.

[51]This is the subsidized price, p^s, we referred to in Section 2.2.

where p_i is the price charged by the service to individual i.

Next, for hours that are consumed beyond the care plan volume and do not benefit from a home care subsidy, the consumer price simply equals the provider price:

$$CP_i = p_i$$

Finally, we derive total OOP payments for APA beneficiary i as:

$$OOP_i = \begin{cases} \big((c_i t) + (p_i - t)\big) h_i & \text{if} \quad h_i \leq \bar{h}_i \\ \big((c_i t) + (p_i - t)\big) \bar{h}_i + p_i (h_i - \bar{h}_i) & \text{if} \quad h_i > \bar{h}_i \end{cases}$$

The APA-subsidized consumer price can be decomposed in two parts: $(c_i t)$ is the OOP payment associated with the APA co-payment rate, and $(p_i - t)$ can be seen as an hourly surcharge (independent from income). The out-of-pocket price of care on APA-subsidized hours is higher than what it would be if the Departmental Council applied the APA co-payment rate to the provider price. Indeed, as the home care provider our data come from charges prices that are strictly higher than the lump-sum tariffs set by the Departmental Council ($t < p_i$), we have:

$$c_i t + (p_i - t) = p_i - (1 - c_i) t > p_i - (1 - c_i) p_i = c p_i$$

The effective co-payment rate on every hour of care is thus:

$$OOP_i / p_i = 1 - (1 - c_i) t / p_i$$

We have disregarded here the difference between weekend and weekday hours. In practice however, the APA-subsidized price is computed separately for the two types of care, given that the two types of hours are not priced the same and cannot be traded off. OOP payments are then the sum of the OOP payments incurred on weekend hours and of the OOP payments incurred on weekday hours.

3.C.4 The 2016 APA reform

Regarding the APA scheme for individuals living in the community, the reform implemented in 2016 introduced the following changes:

1. The national ceilings on the care plan volume were increased, more so for more severe disability groups;

2. The lower income threshold was raised by 8%, to allow more low-income beneficiaries to benefit from the zero APA co-payment rate;

3. The APA co-payment schedule was substantially modified:

- Overall, it was made more generous: every beneficiary experienced a decrease or no change to her APA co-payment rate;

- The decrease in the APA legal co-payment rate was higher for individuals in the middle of the income distribution.

- While before the reform, the APA co-payment rate would depend only on income, it now depends on the disability level: the higher the care plan volume, the lower the APA co-payment rate.

Table 3.C.1 – APA care plans: National ceilings, by disability group.

	GIR 1	GIR 2	GIR 3	GIR 4
Pre-reform ceilings (April, 1st 2015)	€1,312.67	€1,125.14	€843.86	€562.57
Post-reform ceilings (April, 1st 2016)	€1,714.80	€1,376.92	€994.87	€857.40
Increase due to the reform	+31%	+22%	+18%	+18%

NOTES: Ceilings are expressed in euros per month. The GIR corresponds to the administrative disability group (GIR 1 being the group of the most severely disabled beneficiaries).

The co-payment schedule since the 2016 reform

The formula of the co-payment rate c_i is now much more complex. It depends on the care plan volume $\bar{h}_i$ and is defined as $P_i / \bar{h}_i$, where P_i is computed as:

1. If $\bar{h}_i < s_1$:
$$P_i = 0.9 \Delta_i^0 \bar{h}_i$$

2. If $\bar{h}_i \in [s_1, s_2[$:
$$P_i = 0.9 \Delta_i^0 \left(s_1 + \Delta_i^1 (\bar{h}_i - s_1)\right)$$

3. If $\bar{h}_i \geq s_2$:
$$P_i = 0.9 \Delta_i^0 \left(s_1 + \Delta_i^1 (s_2 - s_1) + \Delta_i^2 (\bar{h}_i - s_2)\right)$$

with:
- $s_1 = 0.317 \times \mathrm{MTP}_i$
- $s_2 = 0.498 \times \mathrm{MTP}_i$
- $\mathrm{I}_{inf} = 0.725 \times \mathrm{MTP}_i$
- $\mathrm{I}_{sup} = 2.67 \times \mathrm{MTP}_i$
- $\Delta_i^0 = \frac{\mathrm{I}_i - \mathrm{I}_{inf}}{\mathrm{I}_{sup} - \mathrm{I}_{inf}}$
- $\Delta_i^1 = \Delta_i^0 + 0.4 \frac{\mathrm{I}_{sup} - \mathrm{I}_i}{\mathrm{I}_{sup} - \mathrm{I}_{inf}}$
- $\Delta_i^2 = \Delta_i^0 + 0.2 \frac{\mathrm{I}_{sup} - \mathrm{I}_i}{\mathrm{I}_{sup} - \mathrm{I}_{inf}}$

As it was already the case before the reform:

- $c_i = 0$ if $I_i \leq I_{inf}$;

- $c_i = 0.9$ if $I_i \geq I_{sup}$.

The changes in the co-payment schedule induced by a reform: an illustration

We illustrate how the reform has affected the co-payment rate for different profiles of beneficiaries, depending on their income and care plan.

Figure 3.C.1 (resp. 3.C.2) shows the pre- and post-reform co-payment rate (the change in the co-payment rate induced by the reform) for beneficiaries with 3 different values of the care plan, as a function of the beneficiary's income:

- Beneficiaries with a "small care plan" have a care plan equal to 0.3 MTP, or about €300 per month. The median value of care plans for beneficiaries in GIR 4 in 2011 was of €345.[52]

- Beneficiaries with a "medium care plan" have a care plan equal to 0.4 MTP, or about €441 per month. This is a value close to the 3rd quartile of the distribution of the values of care plans for beneficiaries in GIR 4 and the 1st quartile for beneficiaries in GIR 3.

- Beneficiaries with a "high care plan" have a care plan equal to 1.1 MTP, or about €1,215 per month (this is the median care plan value for individuals in GIR 1). As a reminder, the national ceiling for individuals in GIR 1 before the reform was of 1.19 MTP; it is now of 1.553 MTP.

For those beneficiaries with a post-reform care plan set beyond the pre-reform value of the national ceiling in GIR 1 (equal to 1.33MTP), the decrease in the APA co-payment rate will be especially marked: it will equal the weighted sum of the decrease in the co-payment rate on the hours below the pre-reform national ceiling for GIR 1 (-0.15 pp at maximum) and of the decrease in the co-payment rate on the hours beyond this value (the co-payment rate will go from 1 to about 0.35 for an individual with an income close to the 6th decile of the income distribution).

[Figures 3.C.1 and 3.C.2 are displayed on the following page.]

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[52]We retrieve information on the distribution of care plan volumes in the French population of APA beneficiaries thanks to a dataset from 2011 called "Remontées individuelles APA". We only take into account the care plans including human care only. See Couvert (2017) and the figures provided with this publication.

Figure 3.C.1 – APA co-payment rate, before and after the 2016 reform, depending on income
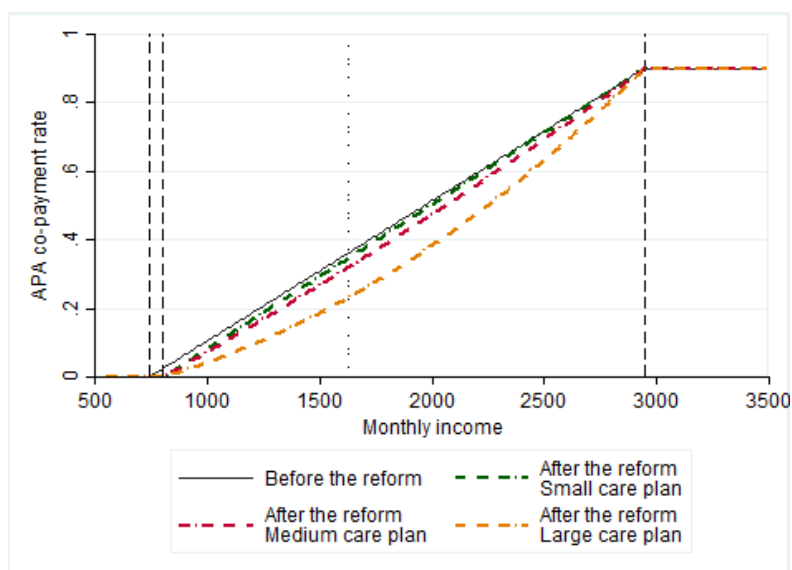
NOTES: Income is equal to the monthly equivalized household income and is expressed in euros. The three vertical dotted lines respectively indicate the pre- and post-reform lower income thresholds and the upper income threshold in the APA co-payment schedule. The vertical dotted line indicates the median taxable income per consumption unit of fiscal units whose head is 75 years or older (2013 value, Insee *et al.* (2013)).

Figure 3.C.2 – Change in the APA co-payment rate induced by the 2016 reform, depending on income.
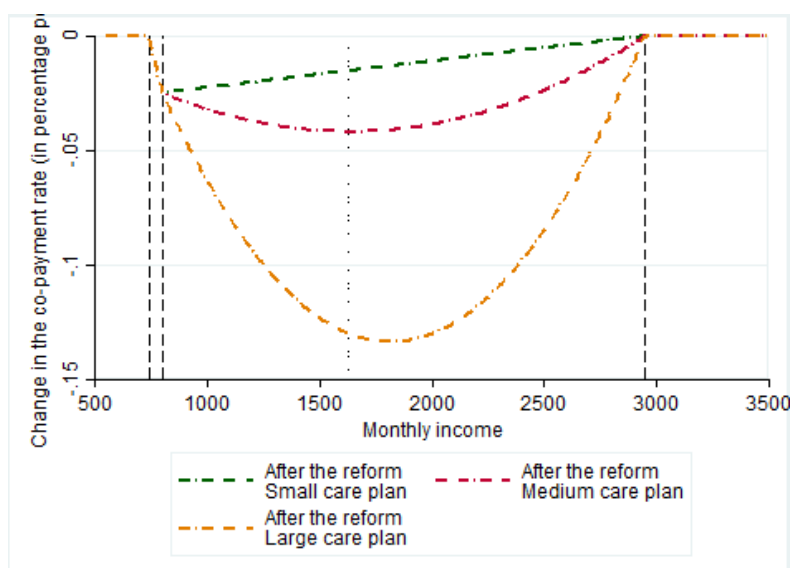
NOTES: Income is equal to the monthly equivalized household income and is expressed in euros. The three vertical dotted lines respectively indicate the pre- and post-reform lower income thresholds and the upper income threshold in the APA co-payment schedule. The vertical dotted line indicates the median taxable income per consumption unit of fiscal units whose head is 75 years or older (2013 value, Insee *et al.* (2013)).

Figure 3.C.3 (3.C.4) shows the pre- and post-reform co-payment rate (the change in the co-payment rate induced by the reform) for beneficiaries with 3 different values of income, as a function of their care plan value:[53]

- 2nd income decile: €1,120 a month;

- 4th income decile: €1,450 a month;

- 7th income decile: €2,100 a month;.

Below a care plan value equal to 0.317MTP (which is close to the median care plan value for beneficiaries in GIR 4), the decrease in the co-payment rate induded by the reform is limited, whatever the income level. This reflects the reform's ambition to target beneficiaries with moderate to severe disability.

[Figures 3.C.1 and 3.C.2 are displayed on the following page.]

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[53]We refer to the distribution of the taxable income per consumption unit of fiscal units whose head is 75 years or older (2013 value, Insee *et al.* (2013)).

Figure 3.C.3 – APA co-payment rate, before and after the 2016 reform, depending on the care plan.
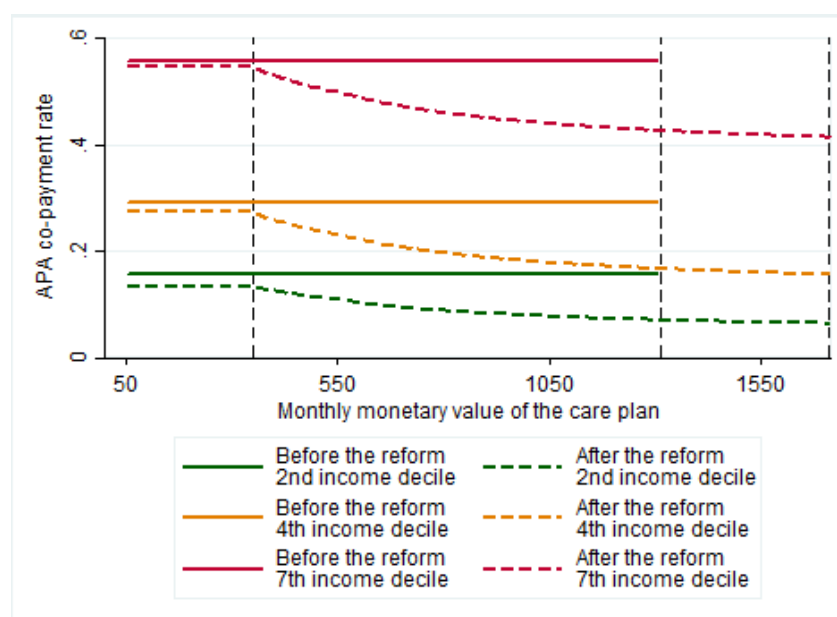
NOTES: The care plan is expressed in euros per month. The two vertical dotted lines to the right respectively indicate the national ceiling for GIR 1, before and after the reform. The vertical dotted line to the left indicates the value of 0.317MTP.

Figure 3.C.4 – Change in the APA co-payment rate induced by the 2016 reform, depending on the care plan.
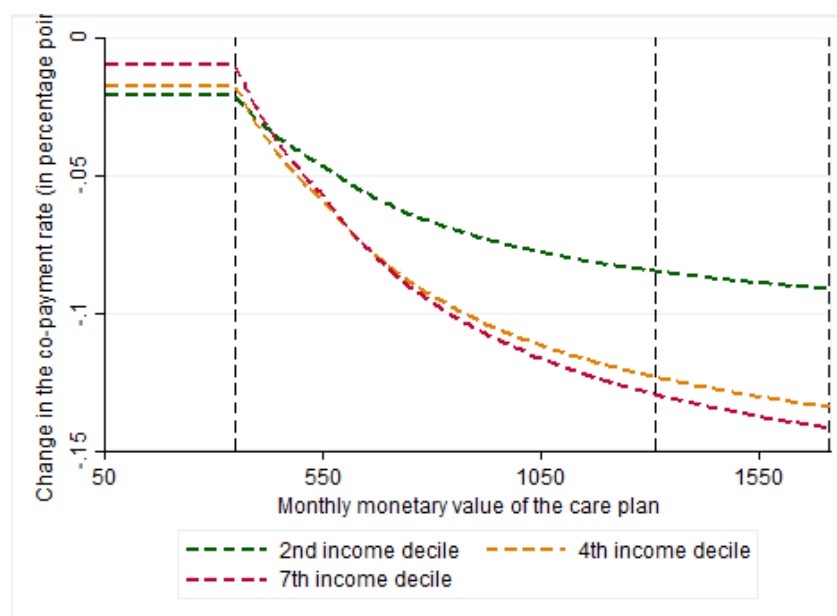
NOTES: The care plan is expressed in euros per month. The two vertical dotted lines to the right respectively indicate the national ceiling for GIR 1, before and after the reform. The vertical dotted line to the left indicates the value of 0.317MTP.

3.D   Simulation of post-reform home care consumption

3.D.1 Assumptions

Our simulation is based on a range of assumptions, regarding the way evaluation teams are predicted to adjust the care plan volume following the reform and the behavioral reactions of APA beneficiaries.

Assumptions made on the change in the care plan volume.

The reform increased the legal ceilings specific to each administrative disability group by 31% (GIR 1), 22% (GIR 2) or 18% (GIR 3 and 4). Following the reform, the evaluation teams of the Departmental Councils are supposed to progressively proceed to a new need assessment for every APA beneficiary. The objective of the reform is to allow APA beneficiaries to be granted higher care plan volumes, but the actual change in care plan volumes will eventually depend on the decisions of the departmental evaluation teams.

There are little empirical elements to predict whether evaluations teams will increase care plan volumes more for certain types of beneficiaries. We thus assume that the care plan volume of the beneficiaries of a given GIR will increase by the same factor as the GIR-specific legal ceiling increased.

Assumptions on behavioral responses of APA beneficiaries to changes in price and virtual income

1. We use the values of price and income elasticities of professional home care obtained by Roquebert and Tenand (2017) [Chapter 2 of this thesis] (price elasticity of −0.4 and income elasticity of 0.4).

2. The income and own-price elasticities of the marshallian demand for weekday and weekend care are constant. A value for the income elasticity of the demand for care is needed because some individuals may experience a change in their virtual income (Moffitt, 1990), in addition to or without a change in the marginal price of care;

3. The price and income elasticities are the same for weekday and weekend hours of care;

4. The cross-price elasticity between weekday and weekend care consumption is zero;

5. For the sake of simplicity, our simulation does not integrate the fact that the price and income elasticities taken from Roquebert and Tenand (2017) [Chapter 2 of this thesis] and used in the simulation are only point estimates, whose confidence intervals are

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relatively large. Ideally, inference at the simulation stage should reflect the uncertainty surrounding the true values of the behavioral reactions of APA beneficiaries.

6. We consider the unit price of care to be the OOP price the individual has to pay to buy an additional hour of care, given her pre-reform consumption. We neglect the fact that, for individuals close (from the left) to their pre-reform or post-reform care plan volumes, the marginal price of some hours of care may turn out to be different if they "cross" the threshold following the reform. Theoretically, this means that individuals who were consuming slightly below their care plan volume are assigned a smaller price decrease than what they are exposed to if they actually end up consuming beyond their care plan volume. Playing in the opposite direction is the fact that we should then factor in the decrease in their virtual income.

Relatively few individuals consume slightly below their care plan volume in the pre-reform period: consistent with the existence of a concave kink in the budget constraint, there is substantial bunching at the kink for weekday hours (Saez (2010); cf. Figure 3.D.2). With that respect, our simplifying simulation assumption should lead to under-estimate the actual OOP price decrease for a limited number of beneficiaries.[54]

On the other hand, our simulation method does not allow to fully integrate the non-linearity of the post-reform budget constraint of APA beneficiaries. This may lead to over-estimate the adjustment in consumption in some cases.[55] Figure 3.D.2 (Panel B) indeed suggests that our simulated data over-estimate the share of individuals consuming more than their post-reform care plan volumes.

A more sophisticated simulation technique (e.g. that relies on a calibration of individual preferences) may be warranted given the kink in the budget constraint of APA beneficiaries.

---

[54]Given that home care provision is organized on a weekly basis, APA beneficiaries may have an imperfect control over their monthly consumption of home care (Fontaine and Gramain, 2017). Another simulation option would then be to consider that individuals who locate sufficiently close to their kink in the 2014 data would actually react as if they were consuming their care plan volume.

[55]Think about the case of a beneficiary who was consuming more than her pre-reform care plan volume in 2014; thanks to the reform-induced increased in her care plan, she will experience a strong decrease in her marginal OOP price of care. But if her *pre*-reform consumption was actually fairly close to her *post*-reform care plan, the consumer theory leads to predict that she has a high probability to optimally consume no more than her post-reform care plan volume after the reform.

3.D.2 The budget constraint of APA beneficiaries: pre- and post-reform situations

Table 3.D.1 – Budget constraint and home care consumption with APA: Notations

	Pre-reform	Post-reform
	Pre- & and post-reform	
Parameters of the budget constraint		
Equivalized income	I	
Legal co-payment rate	c^0	c^1
Hourly price of weekday care	p_A	
Hourly price of weekend care	p_B	
Hourly departmental tariff of weekday care	t_A	
Hourly departmental of weekend care	t_B	
Care plan volume for weekday hours	$\bar{h}_A^0$	$\bar{h}_A^1$
Care plan volume for weekend hours	$\bar{h}_B^0$	$\bar{h}_B^1$
Composite good	Y	
Individual consumption of home care		
Consumption of home care during weekdays	h_A^0	h_A^1
Consumption of home care during weekends	h_B^0	h_B^1

For the APA beneficiaries in our sample, the pre-reform budget constraint can be written as follows:

$$
\begin{cases}
\begin{aligned}
I = \ & \left(c^0 t_A + (p_A - t_A)\right)h_A^0 \\
& + \left(c^0 t_B + (p_B - t_B)\right)h_B^0 + Y & \text{if} \quad h_A^0 \leq \bar{h}_A^0, h_B^0 \leq \bar{h}_B^0 \\
I = \ & \left(c^0 t_A + (p_A - t_A)\right)\bar{h}_A^0 + p_A\left(h_A^0 - \bar{h}_A^0\right) \\
& + \left(c^0 t_B + (p_B - t_B)\right)h_B^0 + Y & \text{if} \quad h_A^0 > \bar{h}_A^0, h_A^0 \leq \bar{h}_A^0 \\
I = \ & \left(c^0 t_A + (p_A - t_A)\right)h_A^0 \\
& + \left(c^0 t_B + (p_B - t_B)\right)\bar{h}_B^0 + p_B\left(h_B^0 - \bar{h}_B^0\right) + Y & \text{if} \quad h_A^0 \leq \bar{h}_A^0, h_B^0 > \bar{h}_B^0 \\
I = \ & \left(c^0 t_A + (p_A - t_A)\right)\bar{h}_A^0 + p_A\left(h_A^0 - \bar{h}_A^0\right) \\
& + \left(c^0 t_B + (p_B - t_B)\right)\bar{h}_B^0 + p_B\left(h_B^0 - \bar{h}_B^0\right) + Y & \text{if} \quad h_A^0 > \bar{h}_A^0, h_B^0 > \bar{h}_B^0
\end{aligned}
\end{cases}
$$

To have a graphical representation of the budget constraint and anticipate the impact of the APA reform on it, it is more convenient to rewrite the budget constraint in terms of virtual income (Moffitt, 1990) rather than of monetary income. The previous system is equivalent to:

$$
\begin{cases}
\text{I} = & \big(c^0 t_{\text{A}} + (p_{\text{A}} - t_{\text{A}})\big) h_{\text{A}}^0 \\
& + \big(c^0 t_{\text{B}} + (p_{\text{B}} - t_{\text{B}})\big) h_{\text{B}}^0 + \text{Y} \quad \text{if} \quad h_{\text{A}}^0 \leq \bar{h}_{\text{A}}^0,\, h_{\text{B}}^0 \leq \bar{h}_{\text{B}}^0 \\[4pt]
\text{I} + (1 - c^0) t_{\text{A}} \bar{h}_{\text{A}}^0 = & p_{\text{A}} h_{\text{A}}^0 \\
& + \big(c^0 t_{\text{B}} + (p_{\text{B}} - t_{\text{B}})\big) h_{\text{B}}^0 + \text{Y} \quad \text{if} \quad h_{\text{A}}^0 > \bar{h}_{\text{A}}^0,\, h_{\text{A}}^0 \leq \bar{h}_{\text{A}}^0 \\[4pt]
\text{I} + (1 - c^0) t_{\text{B}} \bar{h}_{\text{B}}^0 = & \big(c^0 t_{\text{A}} + (p_{\text{A}} - t_{\text{A}})\big) h_{\text{A}}^0 \\
& + p_{\text{B}} h_{\text{B}}^0 + \text{Y} \hphantom{mmmmmi} \quad \text{if} \quad h_{\text{A}}^0 \leq \bar{h}_{\text{A}}^0,\, h_{\text{B}}^0 > \bar{h}_{\text{B}}^0 \\[4pt]
\text{I} + (1 - c^0)\big(t_{\text{A}} \bar{h}_{\text{A}}^0 + t_{\text{B}} \bar{h}_{\text{B}}^0\big) = & p_{\text{A}} h_{\text{A}}^0 \\
& + p_{\text{B}} h_{\text{B}}^0 + \text{Y} \hphantom{mmmmmi} \quad \text{if} \quad h_{\text{A}}^0 > \bar{h}_{\text{A}}^0,\, h_{\text{B}}^0 > \bar{h}_{\text{B}}^0
\end{cases}
$$

Similarly, the post-reform budget constraint writes:

$$
\begin{cases}
\text{I} = & \big(c^1 t_{\text{A}} + (p_{\text{A}} - t_{\text{A}})\big) h_{\text{A}}^1 \\
& + \big(c^1 t_{\text{B}} + (p_{\text{B}} - t_{\text{B}})\big) h_{\text{B}}^1 + \text{Y} \quad \text{if} \quad h_{\text{A}}^1 \leq \bar{h}_{\text{A}}^1,\, h_{\text{B}}^1 \leq \bar{h}_{\text{B}}^1 \\[4pt]
\text{I} + (1 - c^1) t_{\text{A}} \bar{h}_{\text{A}}^1 = & p_{\text{A}} h_{\text{A}}^1 \\
& + \big(c^1 t_{\text{B}} + (p_{\text{B}} - t_{\text{B}})\big) h_{\text{B}}^1 + \text{Y} \quad \text{if} \quad h_{\text{A}}^1 > \bar{h}_{\text{A}}^1,\, h_{\text{A}}^1 \leq \bar{h}_{\text{A}}^1 \\[4pt]
\text{I} + (1 - c^v) t_{\text{B}} \bar{h}_{\text{B}}^1 = & \big(c^1 t_{\text{A}} + (p_{\text{A}} - t_{\text{A}})\big) h_{\text{A}}^1 \\
& + p_{\text{B}} h_{\text{B}}^1 + \text{Y} \hphantom{mmmmmi} \quad \text{if} \quad h_{\text{A}}^1 \leq \bar{h}_{\text{A}}^1,\, h_{\text{B}}^1 > \bar{h}_{\text{B}}^1 \\[4pt]
\text{I} + (1 - c^1)\big(t_{\text{A}} \bar{h}_{\text{A}}^1 + t_{\text{B}} \bar{h}_{\text{B}}^1\big) = & p_{\text{A}} h_{\text{A}}^1 \\
& + p_{\text{B}} h_{\text{B}}^1 + \text{Y} \hphantom{mmmmmi} \quad \text{if} \quad h_{\text{A}}^1 > \bar{h}_{\text{A}}^1,\, h_{\text{B}}^1 > \bar{h}_{\text{B}}^1
\end{cases}
$$

Depending on the pre-reform care plan volume and consumption and on her income, a given APA beneficiary will be subject to a more or less important decrease in her co-payment rate, and thus in the marginal price of home care. In addition, if she was consuming more than her care plan volume, she will experience an income effect induced by the fact that the subsidies perceived on hours included in the care plan increased.

To illustrate the effects, suppose there is only one type of care provided (weekday hours). We can represent the pre- and post-reform budget constraints in a 2-dimensional figure (Figure 3.D.1), with the horizontal axis displaying the consumption of care and the vertical axis the consumption of the composite good. The black lines illustrate the pre-reform situation, while the gray lines refer to the post-reform situation. Both budget constraints are kinked, but the kink moves to the right with the reform if the care plan volume is adjusted upward ($\bar{h}_{\text{A}}^1 > \bar{h}_{\text{A}}^0$). For each hour of care up to $\bar{h}_{\text{A}}^0$, the OOP price decreases because of the decrease in the legal co-payment rate ($c^1 < c^0$). Moreover, the price of each hour consumed between $\bar{h}_{\text{A}}^0$ and $\bar{h}_{\text{A}}^1$ also decreases, from p_{A} to $\big(c^1 t_{\text{A}} + (p_{\text{A}} - t_{\text{A}})\big)$, because of the increase in the number of hours entitled to a subsidy.

Figure 3.D.1 – Budget constraint of APA beneficiaries: pre- and post-reform
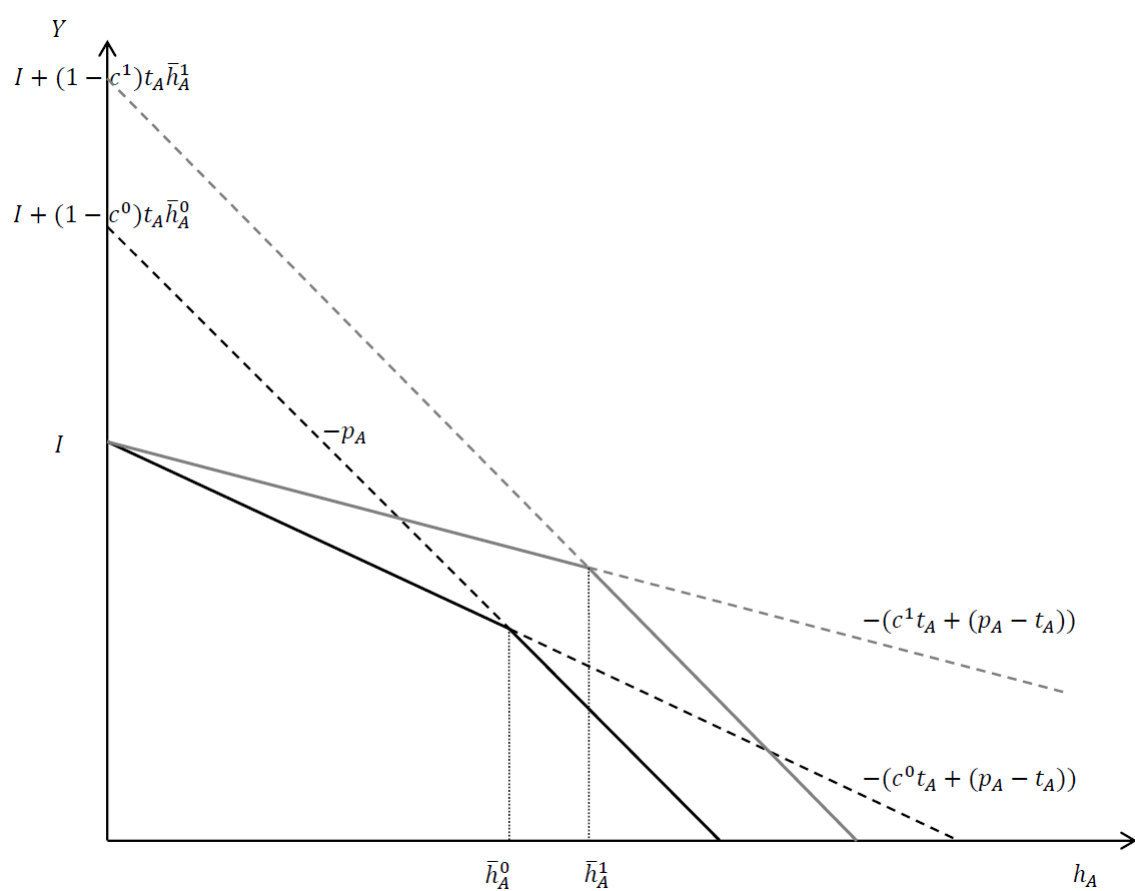
The price and income effects induced by the reform will ultimately depend on the initial position of the beneficiary on the pre-reform budget constraint. If she was consuming less than her care plan volume ($h_A^0 < \bar{h}_A^1$), she will only experience the decrease in her *marginal* price of care. If she was consuming more than her pre-reform care plan volume, but less than her post-reform care plan volume, ($h_A^0 \geq \bar{h}_A^0$ and $h_A^0 < \bar{h}_A^0$), she will also experience a decrease in her marginal price of care, of a higher magnitude, and a decrease in her virtual income. Finally, if the beneficiary was consuming more than her post-reform care plan volume, she will experience no change in her marginal price of care, but an increase in her virtual income (from $I + (1 - c^0) p_A \bar{h}_A^0$ to $I + (1 - c^1) p_A \bar{h}_A^1$).

Integrating now the difference between the care received in the weekdays and weekend care, we have 3×3 groups of beneficiaries who will experience different combinations of price and income effects. The groups and their size are displayed in Table 3.D.2.

Table 3.D.2 – Simulation of post-reform home care consumption: The different cases

	$h_A^0 < \bar{h}_A^0$	$h_A^0 \geq \bar{h}_A^0$ & $h_A^0 < \bar{h}_A^1$	$h_A^0 > \bar{h}_A^1$	*Total*
$h_B^0 < \bar{h}_B^0$	N=61 (3.7%)	N=46 (2.9%)	N=11 (0.6%)	N= 118 (7.3%)
$h_B^0 \geq \bar{h}_B^0$ & $h_B^0 < \bar{h}_B^1$	N=18 (1.1%)	N=53 (3.2%)	N=8 (0.5%)	N= 79 (4.8%)
$h_B^0 > \bar{h}_B^1$	N=610 (37.7%)	N=736 (45.5%)	N=73 (4.5%)	N=1,419 (87.8%)
Total	N=689 (42.6%)	N=835 (51.6%)	N= 92 (5.6%)	N=1,616 (100%)

NOTES: The subscript A (B) stands for weekday (weekend) hours.
NOTES: 51.6% of the sample were consuming in 2014 a volume of care higher than their pre-reform care plan volume but lower than their post-reform care plan volume.

A simple parametric illustration

Assuming APA beneficiaries maximize preferences defined over their home care consumption and the composite good, the optimal levels of home care consumption for an APA beneficiary in the pre-reform and post-reform situations could be characterized in terms of the marginal rate of substitution between home care and the composite goods, and of the parameters of the budget constraint. Nonetheless, the kinked budget constraint makes the comparative statics complex.[56] We propose to assume a simple functional form for the utility function of APA beneficiaries and highlight different cases. For the sake of simplicity, we consider only one type of home care (either care provided on weekdays or care provided on weekends) and forgo the subscript A and B.

Assume the utility function of APA beneficiaries is a Cobb-Douglas function:

$$U(h, Y) = h^\alpha Y^{1-\alpha}$$

---

[56]Due to the kink, and the translation of the kink to the right, the demand function is not continuous. The standard decomposition of a price change in an income effect and a substitution effect through the Slutsky equation cannot be done.

where $0 < \alpha < 1$ measures the relative preference for home care. Using the first order conditions of the consumer's optimization program and the fact that the budget constraint is saturated (given the monotonicity of Cobb-Douglas-type preferences), we derive the home care demand function:

$$
\begin{cases}
h^{j*} = \alpha I / \left(c^j t + (p - t) \right) & \text{if} \quad \alpha I / \left(c^j t + (p - t) \right) \leq \bar{h}^j \\
h^{j*} = \alpha \left(I + (1 - c^j) t \bar{h}^j \right) / p & \text{if} \quad \alpha \left(I + (1 - c^j) t \bar{h}^j \right) / p \geq \bar{h}^j \\
h^{j*} = \bar{h}^j & \text{if} \quad \alpha I / \left(c^j t + (p - t) \right) > \bar{h}^j, \alpha \left(I + (1 - c^j) t \bar{h}^j \right) / p < \bar{h}^j
\end{cases}
$$

where $j = 0, 1$ designates the pre-reform or post-reform situation. The optimal consumption level in the pre-reform situation depends on the beneficiary's income and (associated) co-payment rate, her care plan volume and her preferences.

Let us take the situation of a beneficiary with a monthly income of €1,300 (close to the sample average). In the pre-reform situation, her co-payment rate is of 23%; the provider charges her an hourly price of €21 (the reimbursement tariff t is set to €17.59): she thus has to pay €7.4 out-of-pocket on each subsidized hour she consumes.

Table 3.D.3 displays the optimal consumption in the pre-reform and post-reform situations for this agent, depending on her relative preference for home care and her initial care plan volume. Due to the reform, the decrease of the APA co-payment rate was much higher for individuals with a more severe disability level: the 23% pre-reform co-payment rate went down to 13% for individual (c), while the number of subsidized hours increased by 31%. Subsequently, the increase in consumption for these individuals is predicted to be high (30%, whatever the scenario on preferences).

Individuals of type (b), with moderate disability and a relatively weak preference for home care are expected to adjust quite importantly their level of consumption: given that the kink in the budget constraint for such individuals was quite low in the pre-reform situation, they found it optimal to consume no more than the number of hours for which they would perceive a subsidy. It is mainly the increase of the care plan volume that leads them to increase their care consumption, and not much the decrease in the co-payment rate on subsidized hours. For individuals who were already consuming beyond their post-reform care plan volume, the increase in consumption is predicted to be limited: the income effect driving this increase is small given that both the decrease in the co-payment rate and the increase in the number of hours that turn out to be subsidized are limited.

Table 3.D.3 – Optimal consumption in the pre-reform and post-reform situations: Numerical examples.

Preference for home care (α)	Optimal home consumption (hours/month)		Increase in consumption
	Pre-reform: h^{0*}	*Post-reform h^{1*}*	
(a) Individual with $\bar{h}^0 = 20$ (pre-reform average) and $\bar{h}^1 = 23.6$; $c^1 = 18.1\%$			
0.1	17.9 (< kink)	19.7 (< kink)	+10%
0.2	20 (= kink)	23.6 (= kink)	+18%
0.3	22.5 (> kink)	23.6 (= kink)	+5%
0.4	30.0 (> kink)	31.2 (> kink)	+4%
(b) Individual with $\bar{h}^0 = 12$ (pre-reform first quartile) and $\bar{h}^1 = 14.2$; $c^1 = 21.0\%$			
0.1	12 (= kink)	14.2 (= kink)	+18%
0.2	12 (= kink)	14.3 (< kink)	+19%
0.3	20.9 (> kink)	21.3 (> kink)	+2%
0.4	27.9 (> kink)	28.5 (> kink)	+2%
(c) Individual with $\bar{h}^0 = 39$ (pre-reform top decile) and $\bar{h}^1 = 51.1$; $c^1 = 12.9\%$			
0.1	17.4 (< kink)	22.8 (< kink)	+31%
0.2	34.8 (< kink)	45.8 (< kink)	+32%
0.3	39 (= kink)	51.1 (= kink)	+31%
0.4	39 (= kink)	51.1 (= kink)	+31%

NOTES: For the 3 cases displayed in this table, we have selected values for the pre-reform care plan volume equal to the pre-reform average value of care plan volumes, the pre-reform first quartile and the pre-reform top decile respectively. These 3 typical cases are meant to represent individuals with respectively severe, moderate and very severe disability.

Table 3.D.4 – Simulation of the change in marginal price of weekday hours

	$h_A^0 < \bar{h}_A^0$	$h_A^0 >= \bar{h}_A^0 \,\&\, h_A^0 < \bar{h}_A^1$	$h_A^0 > \bar{h}_A^1$
$h_B^0 < \bar{h}_B^0$	$\dfrac{-(c^0-c^1)t_A}{c^0 t_A+(p_A-t_A)}$	$\dfrac{-(1-c^1)t_A}{p_A}$	0
$h_B^0 >= \bar{h}_B^0 \,\&\, h_B^0 < \bar{h}_B^1$	$\dfrac{-(c^0-c^1)t_A}{c^0 t_A+(p_A-t_A)}$	$\dfrac{-(1-c^1)t_A}{p_A}$	0
$h_B^0 > \bar{h}_B^1$	$\dfrac{-(c^0-c^1)t_A}{c^0 t_A+(p_A-t_A)}$	$\dfrac{-(1-c^1)t_A}{p_A}$	0

Table 3.D.5 – Simulation of the change in marginal price of weekend hours

	$h_A^0 < \bar{h}_A^0$	$h_A^0 >= \bar{h}_A^0 \,\&\, h_A^0 < \bar{h}_A^1$	$h_A^0 > \bar{h}_A^1$
$h_B^0 < \bar{h}_B^0$	$\dfrac{-(c^0-c^1)t_B}{c^0 t_B+(p_B-t_B)}$	$\dfrac{-(c^0-c^1)t_B}{c^0 t_B+(p_B-t_B)}$	$\dfrac{-(c^0-c^1)t_B}{c^0 t_B+(p_B-t_B)}$
$h_B^0 >= \bar{h}_B^0 \,\&\, h_B^0 < \bar{h}_B^1$	$\dfrac{-(1-c^1)t_B}{p_B}$	$\dfrac{-(1-c^1)t_B}{p_B}$	$\dfrac{-(1-c^1)t_B}{p_B}$
$h_B^0 > \bar{h}_B^1$	0	0	0

Table 3.D.6 – Simulation of the change in virtual income

	$h_A^0 < \bar{h}_A^0$	$h_A^0 >= \bar{h}_A^0 \,\&\, h_A^0 < \bar{h}_A^1$	$h_A^0 \geq \bar{h}_A^1$
$h_B^0 < \bar{h}_B^0$	0	$\dfrac{-(1-c^0)t_A\bar{h}_A^0}{I+(1-c^0)t_A\bar{h}_A^0}$	$\dfrac{t_A\left((1-c^1)\bar{h}_A^1-(1-c^0)\bar{h}_A^0\right)}{(I+(1-c^0)t_A\bar{h}_A^0)}$
$h_B^0 >= \bar{h}_B^0 \,\&\, h_B^0 < \bar{h}_B^1$	$\dfrac{-(1-c^0)t_B\bar{h}_B^0}{(I+(1-c^0)t_B\bar{h}_B^0)}$	$\dfrac{-(1-c^0)(t_A\bar{h}_A^0+t_B\bar{h}_B^0)}{I+(1-c^0)(t_A\bar{h}_A^0+t_B\bar{h}_B^0)}$	$\dfrac{t_A\left((1-c^1)\bar{h}_A^1-(1-c^0)\bar{h}_A^0\right)-(1-c^0)t_B\bar{h}_B^0}{I+(1-c^0)(t_A\bar{h}_A^0+t_B\bar{h}_B^0)}$
$h_B^0 \geq \bar{h}_B^1$	$\dfrac{t_B\left((1-c^1)\bar{h}_B^1-(1-c^0)\bar{h}_B^0\right)}{(I+(1-c^0)t_B\bar{h}_B^0)}$	$\dfrac{t_B\left((1-c^1)\bar{h}_B^1-(1-c^0)\bar{h}_B^0\right)-(1-c^0)t_A\bar{h}_A^0}{I+(1-c^0)(t_A\bar{h}_A^0+t_B\bar{h}_B^0)}$	$\dfrac{t_A\left((1-c^1)\bar{h}_A^1-(1-c^0)\bar{h}_A^0\right)+t_B\left((1-c^1)\bar{h}_B^1-(1-c^0)\bar{h}_B^0\right)}{I+(1-c^0)(t_A\bar{h}_A^0+t_B\bar{h}_B^0)}$

3.D.3 Post-reform simulated home care consumption: Descriptive statistics

Table 3.D.7 – Unsubsidized consumption by income and disability levels.

	Share with unsubsidized use		Average use of unsubsidized care among those with unsubsidized care	
	Pre-reform (1)	*Post-reform* (2)	*Pre-reform* (3)	*Post-reform* (4)
Panel A: Differences across income quintiles				
Income quintile: 1	0.276 [0.228,0.323]	0.511 [0.456,0.565]	2.4 [1.3,3.5]	1.4 [0.9,1.8]
Income quintile: 2	0.245 [0.197,0.292]	0.542 [0.487,0.596]	2.5 [1.3,3.6]	1.3 [0.9,1.7]
Income quintile: 3	0.217 [0.169,0.265]	0.533 [0.478,0.587]	3.1 [1.8,4.3]	1.4 [1.0,1.9]
Income quintile: 4	0.263 [0.215,0.311]	0.548 [0.494,0.602]	2.4 [1.3,3.5]	1.1 [0.7,1.6]
Income quintile: 5	0.302 [0.255,0.350]	0.420 [0.365,0.474]	4.8 [3.8,5.9]	2.3 [1.8,2.8]
Panel B: Differences across disability groups				
Disability group: 1	0.727 [0.603,0.852]	0.205 [0.058,0.351]	5.5 [3.7,7.3]	5.8 [3.9,7.7]
Disability group: 2	0.522 [0.451,0.594]	0.343 [0.259,0.427]	4.5 [3.3,5.8]	3.9 [3.1,4.7]
Disability group: 3	0.347 [0.294,0.399]	0.548 [0.487,0.610]	4.5 [3.4,5.5]	2.6 [2.1,3.0]
Disability group: 4	0.196 [0.172,0.220]	0.533 [0.505,0.561]	1.8 [1.2,2.5]	1.0 [0.8,1.2]
Observations	1616	1616	421	825

NOTES: APA beneficiaries customers of the anonymous home care provider in October 2014 (N= 1,616) and simulated post-reform data. Care use is expressed in hours in the month. Beneficiaries with unsubsidized care are those consuming beyond their care plan volume. 5% confidence intervals are displayed in brackets.

Figure 3.D.2 – Bunching at the kink for weekday care use, before and after the reform.
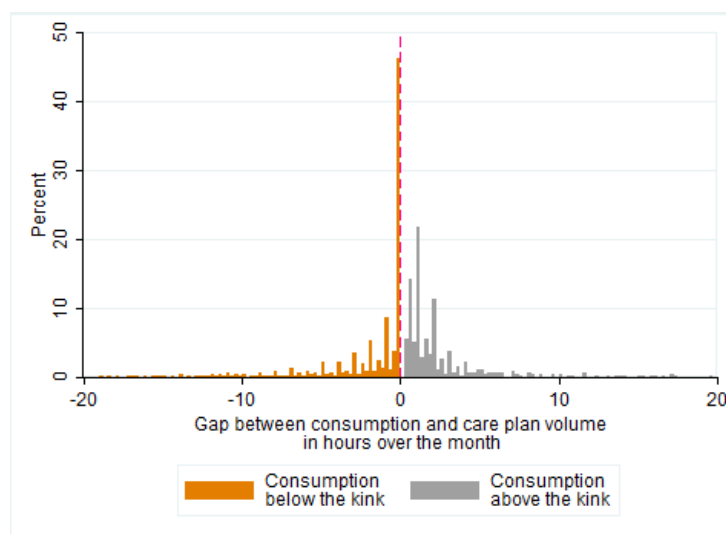
Panel A (top): Bunching in the pre-reform situation
(observational data).
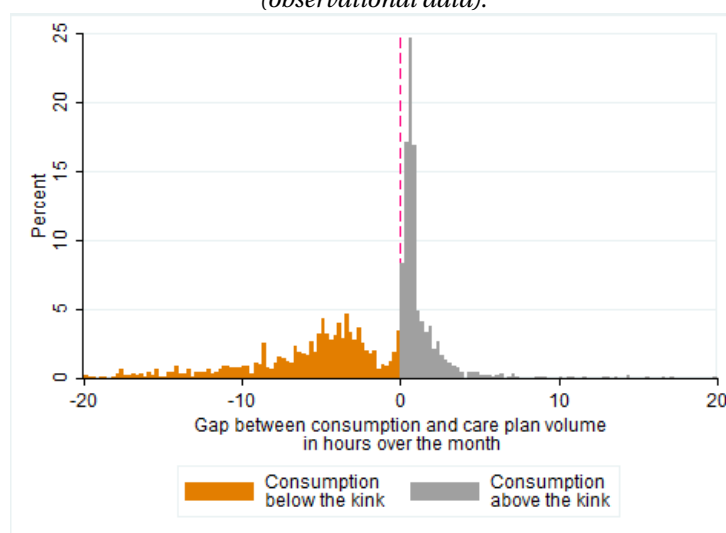
Panel B (bottom): Bunching in the post-reform situation
(simulated data).

NOTES: APA beneficiaries customers of the anonymous home care provider in October 2014 (N=1,616) and own simulations of post-reform use. Beneficiaries who locate at the level of zero on the x-axis are individuals who consume exactly their care plan volume.

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Chapter 4

Long-term care use in the Netherlands: Equal care for equal needs? An assessment using administrative data

This chapter was co-authored with **Pieter Bakx** and **Eddy van Doorslaer**.

Summary of the chapter

The Netherlands stands out for offering a generous public coverage of long-term care (LTC) services. This paper investigates whether individuals with similar "needs for LTC" receive the same amount of services in the Netherlands, irrespective of their income. While most studies of horizontal equity in care use rely on a statistically derived measure of needs, we use the eligibility assessment made by the Dutch independent central LTC assessment agency as an indicator of the legitimate needs for LTC. We exploit rich administrative data on the universe of the individuals aged 60 or more eligible for public LTC in 2012 (N=616,934). We construct measures LTC use and LTC needs as the monetary value of all institutional care and home care services the individual used, or was entitled to, in 2012, which we match with individual socio-economic and demographic information. We find substantial pro-poor concentration of LTC use, only partially offset by poorer individuals having higher needs for LTC. When eligible for institutional care, high-income individuals are more likely to use home care or cash benefits than low-income beneficiaries. Among those eligible for home care, the rich are also found to use less of additional care entitlements. Depending on the value judgment we adopt, our results may be indicative of the Dutch public LTC insurance being overly "pro-poor" or unduly unfavorable to the poor.

Classification

Acknowledgments for this chapter

Contents of the Chapter

1   Introduction

All developed countries have introduced some forms of social support for the disabled elderly, yet we observe substantial cross-country variation in the resources devoted to LTC policies: while, in 2014, public LTC spending represented less than 1% of GDP in Southern Europe countries, it exceeded 3% in Nordic countries (OECD, 2017a). Demographics and population health alone cannot explain these differences. Countries vary greatly in the way LTC systems are organized, in the coverage they offer and in the financial participation that is required from beneficiaries (Colombo *et al.*, 2011; Muir, 2017). Despite the growing importance of LTC policies, the extent to which they achieve insurance against old-age disability risk, affordability of LTC services and redistribution between different groups of the population is still largely undocumented. In particular, there is limited evidence on whether LTC systems achieve socioeconomic horizontal equity in LTC use, that is to say whether disabled individuals with similar "needs" for assistance with activities of daily living receive equivalent LTC services, irrespective of their socio-economic status.

The economic literature has produced a fair deal of theoretical and empirical assessments of equity in the context of curative health care use and financing (Fleurbaey and Schokkaert, 2011; van Doorslaer *et al.*, 2000), which offer guidance for the empirical investigation of equity in LTC systems. In particular, many such studies have tested whether allocation of care is made according to medical care needs in different OECD countries (see e.g. van Doorslaer *et al.* (2006)). Although the justification and implications of the allocation rule "to each according to her needs" in health care are controversial among economists, this social justice principle turns out to be endorsed by most health care professionals and European policy-makers (Culyer *et al.*, 1992). That this principle of social justice is equally endorsed for the allocation of LTC can be disputed. In many countries, public LTC support takes the form of means-tested social assistance, although in some other countries comprehensive social insurance schemes have been implemented to cover old-age disability. Whatever the policy objectives adopted in the different OECD countries, pinpointing inequalities and potential inequity in the use of LTC services is important for the public debate. It seems especially useful as the public opinion in Europe regularly expresses concerns about fairness in the access to LTC services, and as many countries discuss potential reforms of their LTC systems, either to broaden coverage or to curb increasing spending.

Our paper aims at documenting income-related inequalities and assessing potential horizontal inequity in the use of LTC services in the Netherlands. From an international perspective, studying inequalities in the Dutch public LTC insurance is relevant for two reasons. First, the Dutch system stands out as a model: with the second highest spending in terms of GDP of all OECD countries (4.3% of GDP in 2014 (OECD, 2017a)), the Dutch LTC system is

able to insure the elderly against catastrophic expenditures on home care and institutional care (Mot, 2010; Schut *et al.*, 2013; Bakx, Chernichovsky, Paolucci, Schokkaert, Trottmann, Wasem and Schut, 2015). As a result of its overall generosity, the system is often perceived as leaving little room for inequalities, as stated by Mot (2010) (p. 66): "While the system in the Netherlands is not completely egalitarian, it is not too far from it".[1] Yet empirical evidence is scarce and focuses on regional disparities. Given the large investment of resources made by the Netherlands in its LTC policies, it is critical to assess to what extent LTC is indeed allocated according to needs.[2]

Secondly, another distinctive feature of the Netherlands is the quality of available data on eligibility for and use of LTC services. In this paper, we exploit exhaustive administrative records providing information on the eligibility decisions issued in 2012 by the Dutch central agency CIZ, in charge of needs assessments for applicants to the public LTC insurance.

To our knowledge, only three papers have specifically focused on socio-economic inequality and horizontal inequity in LTC use.[3] García-Gómez *et al.* (2015) find professional home care use to be disproportionately concentrated among the richer elderly in Spain. As the poor tend to have more activity restrictions, this translates into pro-rich horizontal inequity. Contrary to the Dutch case, the low public support offered by the Spanish LTC system leaves substantial financial barriers to access to formal LTC services. Two recent papers (Rodrigues *et al.*, 2017; Carrieri *et al.*, 2017) exploit the SHARE survey to estimate horizontal inequity indexes in the Netherlands and other European countries. Rodrigues *et al.* (2017) compute income-related and wealth-related horizontal inequity indexes for home care use in 11 European countries. At the extensive margin, formal home care use is found to be roughly proportionately distributed along the income distribution in most countries. Carrieri *et al.* (2017) conclude that there is at most limited income-related horizontal inequity in the use of personal or nursing care at the extensive margin, in Southern Europe as in Nordic countries.

However, the analyses in these articles are limited by data availability in three ways. First, they do not include institutional care, which still represents the vast majority of LTC spending in all OECD countries (67% in the Netherlands in 2012, Statistics Netherlands (2012*a*,*b*,*c*)). Second, they only study the decision whether to use care, but ignore the

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[1] In their analysis of the recent reforms of the Dutch LTC system, Maarse and Jeurissen (2016) refers to the Netherlands as having a "highly egalitarian ... health care culture", with the term health care encompassing both curative care and LTC.

[2] This is all the more important as the Dutch public LTC insurance has been undergoing major changes since 2013 (Maarse and Jeurissen, 2016). As a further wave of reforms is being discussed, insights into inequity in use in the pre-reform situation should come in handy to policy discussion.

[3] These papers fit within a broader strand of the literature on the determinants of LTC use, which has suggested that there is an income gradient in the use of formal care in some countries but not in others (Bonsang, 2009; Bakx, de Meijer, Schut and van Doorslaer, 2015). However, these papers do not specifically investigate into socio-economic inequalities in the use of LTC nor attempt to summarize inequity using synthetic indexes.

decision about how much to use, which is likely to witness substantial inter-personal variation — home care use may be limited to two hours of care for a couple of months after surgery up to round-the-clock nursing in the last months before death — that may be correlated with socio-economic status. Third, while SHARE is a large panel survey data set, the number of observations per country is limited, thereby limiting statistical precision. We overcome these three problems by using administrative on the universe of LTC eligibility and use.[4]

Our paper contrasts with the existing literature also in the way potential horizontal inequity in use is distinguished from fair inequalities. The distinction requires incorporating a norm of vertical equity in use in the empirical framework, stating by how much individuals with different levels of "needs" for care are expected to use different levels of LTC services (van Doorslaer *et al.*, 2000; Sutton, 2002). Traditionally, the empirical economic literature has refrained from assuming an arbitrary explicit norm of vertical equity. In most existing studies, an implicit, average norm is derived by regressing care use on the variables considered to lead to fair inequalities in care use and potential confounders (Wagstaff and van Doorslaer, 2000*b*; van Doorslaer and van Ourti, 2011). Instead, we rely on an explicit equity norm. We use the monetary value of the entitlements made by the independent, central Dutch agency in charge of the eligibility decisions as the only indicator of legitimate needs for LTC. We consider the individual entitlements for LTC support to embody the norm of vertical equity prevailing in the Dutch LTC public insurance and implemented by CIZ assessors.

This paper brings two main findings. Firstly, we find the use of LTC services (in value) to be concentrated among the income-poor. The rich are more likely not to use any care or to use home care services and cash benefits rather than (more costly) institutional care. Secondly, we provide evidence that the low-income elderly tend to use more LTC (in value) than the rich even when the differences in LTC needs across the income distribution are controlled for. Regardless of which factors induce this pattern and its interpretation, the marked income gradient in the need-standardized LTC use was an unexpected feature of the Dutch LTC system.

The Chapter is organized as follows: Section 2 provides an overview of the Dutch LTC system. Sections 3 and 4 present the empirical approach and the data we rely on, as well as descriptive statistics. The baseline results are presented in Section 5, while Section 6 offers complementary results from the separate analysis of the population eligible for home care and the population eligible for institutional care. Section 7 discusses the interpretation of the results and their limitations. Section 8 concludes.

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[4]A fourth advantage of administrative data over survey data is that the former do not suffer from reporting and recall bias, which may be substantial: e.g. while social LTC insurance provides universal coverage in the Netherlands, two-thirds of the Dutch SHARE respondents report not being covered by a public LTC insurance.

2   The Dutch long-term care system

The Dutch public LTC insurance (*Algemene Wet Bijzondere Ziektekosten*, or AWBZ) has existed since 1968. It offers universal benefits and a comprehensive coverage of LTC services. In 2014, 18% of the individuals aged 65 and older received public LTC support in the Netherlands (OECD, 2017*a*; Muir, 2017), while private LTC is believed to remain marginal (Maarse and Jeurissen, 2016). Individuals can receive support either in the community or in specialized institutions. About 30% of public LTC beneficiaries aged 65 and older live in an institution, where they receive a package of services tailored to the type and severity of their disability (Table 4.1). The institutionalized elderly most often reside in two types of settings: nursing homes and residential care homes. Residential care homes allow the elderly to live in their own residential unit while receiving mostly personal care and guidance in the daily activities, while nursing home residents much more frequently receive nursing care (Mot, 2010). At home, individuals can receive nursing care, personal care, individual and group guidance and short stays in an institution. Domestic help used to be included in the public insurance scheme, but has been delegated to municipalities since 2007 and is provided under the Social Support Act (Wmo).[5]

Table 4.1 – Types of LTC services paid by the Dutch public LTC insurance

	Home care	Institutional care
Types of care	Nursing care, personal care, individual guidance, group guidance	Institutional stay
Content of prescription	Numbers of hours or half–days for each type of care	Type of institution and "packages" of services (ZZP package)
Reference period	A week	A day

NOTES: Individuals can be eligible also for individual and group therapy, or short stays in institution when they keep on living in the community. As we lack information on the actual use of these services and their prices, we do not take them into account in the empirical analysis. Such a limitation should only marginally affect our analysis, as these services are only seldom granted. Domestic help is not part of the social LTC insurance (AWBZ).

Decisions regarding eligibility for public LTC are taken by a central independent agency (*Centrum indicatiestelling zorg*, or CIZ). To claim an assessment, individuals have to fill in an application form and send it to the regional office of CIZ (CIZ, 2017). Health care workers and family members can also apply on the behalf of the disabled individual. An application contains information on the functional limitations of the applicant, her health status and background characteristics.[6] The application is reviewed by an assessor, who has also

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[5] We describe the pre-2015 system because we use data from 2012. See van Ginneken and Kroneman (2015) for details of the 2015 reform.

[6] Individuals may also specify which types of care they would like to receive; yet the documentation about

information about any previous applications and past use of public LTC. The review procedure may take different forms (desk checks, phone calls to the applicant or her health care providers, face-to-face interview, visit of a multidisciplinary staff), depending on the severity and complexity of the case. The assessor is entitled to collect additional information on the social environment and the living conditions of the applicant and might decide to conduct a home visit; she is however not supposed to inquire into the income or wealth of the applicant.

Assessors decide on the type and volume of care the individual will be entitled to receive and the period for which the decision is valid, following a list of criteria. The entitlements are expressed in hours per week for home care services, or as a type of institution and a package of services if the individual is made eligible for institutional care. Beneficiaries can ask for a reassessment whenever their health condition or personal situation evolves. The presence of relatives is taken into account during the need assessment inasmuch as the members of the household of the applicant are expected to provide some minimum personal care to their relative (Mot, 2010).

Beneficiaries can receive in-kind care, but they can also opt for cash benefits. In that case, they are entitled to receive a monetary transfer equal to about 75% of the value of the in-kind care they were made eligible for (Schut and Van Den Berg, 2010).[7] The provision of care is organized at a regional level. 32 regional purchasing agencies (*zorgkantoren*) are entrusted with buying the LTC to be provided in-kind. While publicly-funded institutions are required to be non-profits, home care providers can be for-profit. Tariffs for institutional care and price caps for home care are set at the national level.[8]

Mandatory social security contributions to the scheme represent about 2/3 of the total costs (Schut *et al.*, 2013); in 2012, about 25% came from general governments revenues while only 8% were financed privately (mainly through income-dependent co-payments) (Maarse and Jeurissen, 2016). These co-payments increase with income and with the use of LTC services when those are received in the community; yet they do not exceed the cost of care nor the user's income.[9] Furthermore, co-payments are capped at roughly €2,248 per month for institutional care. When the individual receives care at home, co-payments should not exceed €1,750 per month, with a minimum fee of about €20 for beneficiaries

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the assessment procedure shows that the preferences expressed by applicants need not be taken into account. According to Bakx *et al.* (2017), who interviewed several CIZ assessors, these preferences rarely play a role in the assessment process.

[7]The cash benefits work as a cash-for-care program: transfer of funds is conditional on the beneficiary producing invoices from registered home care providers. Relatives providing informal care can be paid by cash benefits provided they have a formal work contract with their relative as caregivers.

[8]The tariffs applied in 2012 are provided in Table 4.B.1, Appendix 4.B.

[9]Co-payments also depend marginally on wealth and include allowances for a range of circumstances. See Appendix 4.B for further details on the schedule of co-payments.

with lowest incomes.[10] Given the value of care individuals can be entitled to and the schedule of co-payments, the Dutch public LTC insurance operates transfers of resources towards LTC beneficiaries that are fairly high by international standards.

3 Empirical approach

3.1 Concentration index and concentration curve

The standard methodology to assess the existence of horizontal inequity in care use consists of two steps. The first one consists in documenting potential *inequalities* in care use. The second step involves normative judgments to distinguish between acceptable inequalities and unfair ones (Fleurbaey and Schokkaert, 2011; van Doorslaer and van Ourti, 2011; Wagstaff *et al.*, 1991; Wagstaff and van Doorslaer, 2000*a*).

Assessing income-related inequalities is traditionally done by drawing the concentration curve of the outcome of interest (Wagstaff and van Doorslaer, 2000*a*).[11] Our concentration curve plots the cumulative percentage of the monetary value of LTC use (on the vertical axis) against the cumulative percentage of the population of interest ranked by individualized income. If the concentration curve coincides with the line of equality, there is no systematic association between LTC use and individual income. If the concentration curve lies above (below) the line of equality, the poorer individuals consume on average a higher (lower) value of LTC services than the richer individuals.

We additionally compute the concentration index of LTC use (Kakwani, 1980; Kakwani *et al.*, 1997; Wagstaff *et al.*, 1991).[12] A negative concentration index indicates that, overall, there is some pro-poor inequality in LTC use: consumption is disproportionately concentrated among the less well-off. Conversely, a positive concentration index signals some pro-rich inequality.

A convenient way of expressing the concentration index for LTC use, denoted CI(y), is:

$$\text{CI}(y) = \frac{2}{\bar{y}} cov(y, r^{\text{I}}) \tag{4.1}$$

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[10]The agency in charge of computing the individual co-payments, CAK (*Centraal Administratie Kantoor*), is fully distinct from CIZ.

[11]There is a normative premise associated with this choice, which is that *relative* inequalities in the use of LTC, as opposed to *absolute* inequalities, matter.

[12]The concentration index takes values between –1 and 1. It equals twice the area between the concentration curve and the line of equality. Portions of the income distribution for which the concentration curve lies above (below) the line of equality will contribute negatively (positively) to the index. If the concentration curve crosses the line of equality, then there is pro-poor inequality in LTC use for some portions of the income distribution and pro-rich inequality at some other points. The concentration index implicitly attributes arbitrary weights to the inequality observed at different parts of the distribution (Bleichrodt and van Doorslaer, 2006). As Wagstaff and van Doorslaer (2000*a*) put it, the concentration index gives a measure of horizontal inequity "on balance".

where r_i^{I} denotes the fractional rank of individual i in the income distribution of the population of interest ($r_i^{\mathrm{I}} = i/\mathrm{N}$ if i is the i-poorest individual); y_i is a (continuous and unbounded) measure of LTC use over year 2012 for individual i, and $\bar{y}$ denotes the population average LTC use over 2012.

3.2 Horizontal inequity in LTC use

From inequality to horizontal inequity in LTC use

Not all income-related inequality in LTC use should be considered as horizontally inequitable. In particular, heterogeneity in functional status may correlate with income, and induce fair differences in LTC use along the income distribution. In empirical assessments of horizontal equity in care use, the conceptual challenge lies in the delimitation of those factors leading to fair inequalities, which are called the "need" variables.[13]

Pinpointing need factors is however not sufficient: we need a stance in terms of *how different* the use of LTC services should be for individuals with different levels of needs. In other terms, an *horizontal* equity assessment involves the incorporation of a norm of *vertical* equity in care use in the empirical analysis.[14] Rather than proposing an arbitrary ad hoc norm of vertical equity, applied economists interested in equity in health care use have proposed to infer the norm from the data (Wagstaff and van Doorslaer, 2000*a*). The typical way of proceeding is to assume that the population average relationship between need variables and care use, when controlling for potential confounders, provides a sensible norm of vertical equity in care use. One criticism addressed to this method is that horizontal equity assessment has to rely on the assumption that there is no vertical inequity in care use overall.[15]

In the context of the Dutch LTC system, the eligibility assessment rules set by the Ministry of Health and implemented by the CIZ assessors de facto define a norm of vertical equity in use: CIZ entitlements to public LTC provide a straightforward indicator of the fair extent to which two persons with different levels of "needs" should receive different levels of support. We thus take the monetary value of CIZ-assessed needs as the only need variable to be used in our empirical investigation and consider that vertical equity in LTC use is achieved when an additional euro of entitlements to publicly-subsidized care translates into an additional euro in the value of services being used.

Such an institutionalized norm of "needed care" is seldom available in other contexts: in

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[13]This word "needs" is used not to capture any deterministic relationship between an individual characteristic and the use of LTC at the individual level, but to reflect the normative nature of any equity assessment.

[14]Keep in mind that we are interested in equity in *use* and not equity in *financing*: our analysis leaves aside the question of the differential ability to pay for LTC services across the income distribution.

[15]Ruling out (average) vertical inequity is a priori a relatively strong assumption; it is carefully discussed in Sutton (2002), who proposes an alternative, data-driven method to come up with a norm of vertical equity while imposing as little arbitrary assumptions as possible.

most cases, the diagnosis and the provision of health care are done by the same agent and through a decentralized process, at the level of the individual health care providers. In such cases, there is no measure of needs that can be distinguished from the treatment decision and observed empirically; even if diagnosis were recorded and centralized, we may suspect that they would partly reflect providers' and system-wide incentives to deliver a certain type and amount of care. Given the purpose of CIZ agency, its centralized organization and its independence from the bodies in charge of the provision and financing of the LTC services, we believe that CIZ eligibility decisions are informative of national policy objectives regarding access to LTC in the Netherlands. The question we are thus asking in the paper is: "How much of the potential income-related inequalities in the use of LTC services can not be explained by differences in CIZ-assessed needs?".

The horizontal inequity index

Empirically, in order to isolate the impact of *needs* on LTC use system-wide, we follow a standard method and compare the concentration of the actual *use* of LTC services with the concentration of the legitimate *needs* for LTC (van Doorslaer and van Ourti, 2011). Consistently with our assumption that the observed CIZ eligibility decisions embody the relevant norm of vertical equity in use, we depart from the previous literature in the way we compute the concentration of needs, $C^N(y)$: we simply take it to be equal to the concentration index of CIZ-assessed needs, multiplied by the the ratio of population-average needs to population average use.[16] Denoting x_i the needs as assessed by CIZ for individual i, we define:

$$C^N(y) = \frac{\bar{x}}{\bar{y}} CI(x) = \frac{2}{\bar{y}} cov(x, r^I) \tag{4.2}$$

with $\bar{x}$ the population-average of CIZ-assessed needs. We define the horizontal inequity index of LTC use, $HI(y)$, as:

$$HI(y) = CI(y) - C^N(y) \tag{4.3}$$

Like the concentration index, the horizontal inequity index varies between -1 and +1. When positive (negative), it indicates that the rich (poor) consume LTC services disproportionately with respect to their needs.

Interpreting the magnitude of the horizontal inequity index is not straightforward. One more visual way of assessing the extent of horizontal inequity in the use of LTC services can be obtained by plotting the *need-standardized* LTC use, $\hat{y}_i^{IS}$, which is equal to:

$$\hat{y}_i^{IS} = y_i - x_i + \bar{x} \tag{4.4}$$

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[16]This is a normalization that will enable the decomposition of total inequality in the contributions of different factors (see Section 5.3).

The need-standardized use provides a measure of LTC use that "purges" the individual measure of actual use from the legitimate needs for LTC. The distribution of need-standardized LTC use across income may be interpreted as the distribution of LTC use that we would observe if differences in needs across the income distribution were neutralized.[17] If, for example, need-standardized use is much higher among the rich than among the poor, this means that the rich consume disproportionately more than the poor even when taking into account differential needs across the income distribution. Consistently, we can relate need-standardized use with our horizontal inequity index:

$$\mathrm{HI}(y) = \mathrm{CI}(\hat{y}^{\mathrm{IS}}) \tag{4.5}$$

Compared with the existing literature, the strength of our empirical investigation is that the computation of need-standardized use and of the horizontal inequity index does not rely on any econometric estimate.[18] [19]

4   Data and descriptive statistics

4.1   Exhaustive administrative information on LTC eligibility and use

We use a rich set of data sources covering the entire Dutch population at the individual level in 2012 (described in Appendix 4.A) that are linked through a unique identifier.[20] We have detailed information on the eligibility decisions made by CIZ in 2012; in particular, we know the reasons why the individual is made eligible, whether she is eligible for home care or for institutional care, and the types and amounts of services she is entitled to receive. The data contain similarly precise information on the actual use of LTC services financed by the Dutch public LTC insurance (cf. Table 4.1 in Section 2). Additional administrative records provide information on household income and assets, personal address and demographic information.

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[17]We adopt an indirect standardization approach. See O'Donnell *et al.* (2008), Chapter 5, for a discussion of the interpretations of direct and indirect standardization methods.

[18]In addition, given the very large size of our sample, which virtually matches our population of interest, statistical uncertainty regarding the population average of needs and use ($\bar{x}$ and $\bar{y}$) and the covariance either between needs and the income rank ($cov(x, r^{\mathrm{I}})$) or between use and the income rank ($cov(y, r^{\mathrm{I}})$) is extremely limited.

[19]Appendix 4.E explains how our method relates to the standard method of empirical assessment of horizontal equity we refer to.

[20]Access to the microdata and permission to merge different datasets are granted by Statistics Netherlands (CBS) under a confidentiality agreement.

4.2 Population of interest and baseline sample

We focus on the individuals who were 60 years of age or more in 2012 and who were entitled to LTC at some point during the year because of a somatic or a psycho-geriatric condition. Among those who were eligible only for institutional care in 2012, we further exclude those who were eligible for a stay in another type of specialized institution than a nursing home, a residential care home, a rehabilitation center or a palliative care facility.[21] Given that we measure needs as CIZ entitlements to public LTC, we do not take into account individuals who were not eligible for elderly care at any point in 2012. In addition not to having any needs for LTC, by definition, those individuals systematically have a zero use of elderly care services, as access to (public) LTC in the Netherlands is possible only for people made eligible by CIZ. Leaving out these individuals from our population of interest should not bias our analysis insofar as it relies on the assumption that CIZ entitlements to public support embody the legitimate LTC needs.

The population of interest is made of 618,041 individuals. Missing background information reduces the sample by less than 0.2%,[22] meaning a final sample of 616,934 individuals.

4.3 Variables of interest

The ranking variable

We focus on *income*-related inequality and horizontal inequity. Individuals are ranked by their household taxable income of year 2011,[23] which is equivalized using the square root equivalence scale.[24] The distribution of income is smooth, with virtually no mass point, making it empirically straightforward to rank individuals from the poorest to the richest.[25]

Measure of LTC use and needs

The monetary value of annual LTC use is equal to the sum of the value of in-kind services used and of the imputed value of cash benefits. To obtain the monetary value of in-kind services, we multiply quantities used by their unit price (for institutional care) or by the

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[21]Other types of institutions include psychiatric hospitals and centers for the physically handicapped. We exclude individuals eligible for LTC due to mental health problems or a physical or cognitive handicap. Those individuals have often lived for years with functional limitations and their use of LTC services may follow different patterns than those observed in the population affected by disability at an old age.

[22]Appendix 4.A provides additional details.

[23]As individuals who died in 2012 were not taxed in 2012, for all individuals we consider the taxable income and wealth of 2011.

[24]The equivalized income of an individual is then equal to her household income divided by the square root of the number of household members (OECD, 2011a).

[25]In particular, less than 500 individuals have an income equal to 0.

maximum tariff (for home care) that are set by the Dutch Healthcare Authority (NZA).[26] If individuals opt for cash rather than in-kind care, we only observe the take-up of benefits, not their amount. We exploit the official grid used to convert entitlements to in-kind LTC into a cash transfer.[27] On average, 89.5% of the value of cash benefits granted are actually used (Statistics Netherlands, 2017). We thus discount the imputed cash equivalent of entitlements to in-kind services by 10.5% to obtain the individual imputed monetary value of cash benefits.

Similarly, needs are computed as the monetary value of LTC the individual was eligible for.[28]

One issue when considering *annual* LTC use (resp. needs) is for individuals who died before the end of 2012: their use of (needs for) LTC services is right-censored by their death. We prorate the monetary value of LTC use (needs) of individuals who died in 2012 on the basis of the proportion of the year they were alive.[29]

Socio-demographic information

As we assume that CIZ eligibility decisions capture the sources of legitimate interpersonal differences in LTC use, we do not need any individual-level information other than income, care use and CIZ-assessed needs to derive a measure of income-related horizontal inequity. Yet, beyond providing valuable descriptive information on the composition of our population of interest, individual-level information on socio-demographic characteristics will also be used to shed light on the potential sources of income-related horizontal inequity. We have information on gender, age, marital status, household composition, whether the individual has a foreign background, wealth, home ownership.[30] We also know the LTC purchasing region the individual lives in.

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[26]Additional details and the grid of tariffs are reported in Appendix 4.B.

[27]See Appendix 4.B. The cash equivalent of in-kind services represents about 75% of their national price.

[28]Eligibility for home care services is granted in hours per week and is expressed as a range (e.g., the individual can receive from 6 to 7 hours of nursing care per week); we take the middle point of the range (in our example, 6.5 hours) when computing the value of LTC the individual is eligible for. In the Dutch LTC system, this midpoint is the one taken into account when entitlements to in-kind services are converted into entitlements to cash benefits.

[29]For example, for an individual who died at the end of June, we multiply the value of her actual use of (needs for) LTC services and CIZ entitlements by 2.

[30]When the household composition, family status or address has changed in the course of 2012 for an individual, we retain the situation she spent the most time in.

4.4   Descriptive statistics

Table 4.2 provides summary statistics on the baseline sample. The top panel provides information on eligibility for public LTC. Almost two thirds of the individuals eligible for LTC benefits were eligible for home care services, while less than half were eligible for institutional care; about 12% of individuals were eligible for both home care and institutional care in year 2012.[31] The average monetary value of LTC an individual was eligible for amounted to k€31 — slightly more than the average equivalized income in the population of interest. The average annual value of needs for institutional care assessed by CIZ is higher than the average value of needs for home care, reflecting the fact that institutional care is generally a more costly form of LTC. Finally, about half of the population was not eligible for LTC during the entire year: most of them entered the scheme during the year, and 16% of the sample died before the end of 2012.

As shown in Panel B, the average value of LTC use is about k€23 in the year; roughly two thirds are spent on institutional care, one third on home care. Individuals opting for cash benefits represent less than 5% of the sample; about 8% of those eligible for publicly-subsidized LTC did not use any in-kind care or cash benefits. The distribution of the value of CIZ-assessed LTC needs has a very high standard deviation (equal to half the mean) and a long upper tail, reflecting the combination of the heterogeneity of the population of interest and the comprehensive coverage offered by the Dutch LTC insurance. The distribution of actual use is even more spread out: 1% of individuals having a use exceeding k€125.[32]

Comparing use and CIZ needs, we find that for 70% of individuals, the value of LTC services used is strictly below the value of their entitlements to care. In terms of socio–demographic characteristics, Panel C of Table 4.2 shows that most individuals in the population of interest are women, in their 80s. 70% of the sample lived without a partner for most of 2012: for 5pp of them, this is because they spent the largest part of the year in a nursing home. 12% of individuals have a migrant background: 9pp. are first or second generation migrants from a foreign Western country. The remaining 3pp. hail from non-Western countries.

Equivalized income exhibits a long upper tail, but wealth per capita is even more unequally distributed. One third of individuals own the house in which they live; roughly half of (net) wealth is housing wealth.

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[31]Someone can be eligible for only one type of care *at a point in time*. However, an individual can have her needs reassessed and become eligible for another care setting.

[32]The annual cost of staying the entire year in a nursing home with the most intensive care package reaches k€93. It turns out that the most expensive users are using home care. Providing care in the community can prove more costly than providing institutional care for the most severely disabled elderly; as there is no ceiling on the volume of home care services that someone may be eligible for in the Netherlands, this may translate into some home care users benefiting from higher public spending than institutional care recipients.

Table 4.2 – Sample descriptive statistics

	Mean	Standard-deviation
Panel A: Eligibility		
Eligible for home care (yes/no)	0.650	–
Eligible for institutional care (yes/no)	0.467	–
Value of entitlements to home care	12.179	25.686
Value of entitlements to institutional care	18.882	24.973
Value of total LTC entitlements	31.061	29.871
Number of eligibility decisions over the year	1.8	1.2
Number of days of LTC eligibility	255.4	132.3
Panel B: Use		
Any use of in-kind home care (yes/no)	0.615	–
Any use of institutional care (yes/no)	0.387	–
Any take-up of cash benefits (yes/no)	0.044	–
Any use of LTC (yes/no)	0.918	–
Any use of in-kind home care used	7.430	17.565
Value of institutional care used	14.595	23.580
Value of cash benefits used	0.935	6.572
Value of total LTC used	22.960	26.664
Panel C: Demographic characteristics		
Gender: woman	0.670	–
Age: 60–69	0.125	–
Age: 70–79	0.258	–
Age: 80–84	0.227	–
Age: 85–89	0.222	–
Age: 90+	0.168	–
Has died in 2012	0.160	–
Married/in civil partnership	0.345	–
Partner in household	0.309	–
Number of household members	1.446	0.737
Origin: Dutch	0.880	–
Origin: Turkey	0.009	–
Origin: Morocco	0.005	–
Orign: Suriname	0.010	–
Orign: Dutch Caribbean	0.002	–
Origin: foreign Western country	0.088	–
Origin: other non-Western country	0.006	–
Panel D: Socio-economic characteristics		
Equivalized household income	29.519	24.187
Net wealth (per capita)	159.302	53.715
Owner of main residence	0.322	–
Observations	616934	

SAMPLE: Individuals 60 and older eligible for public "elderly" LTC in the Netherlands in 2012.

NOTES: Values of LTC entitlements and use and income are expressed in thousands euros per year. Wealth is expressed in thousands euros.

5 Baseline results

5.1 Income-related inequality in LTC use

Figure 4.1 shows that the concentration curve of LTC use is above the line of equality almost over the entire income distribution: the *x*% poorest individuals consumed more than *x*% of the total value of LTC services used in 2012. Hence, the concentration index of LTC use is negative (−0.0853) and statistically significant at the 1% level,[33] reflecting a pro-poor concentration of LTC use.

Figure 4.1 – Concentration curve of LTC use.
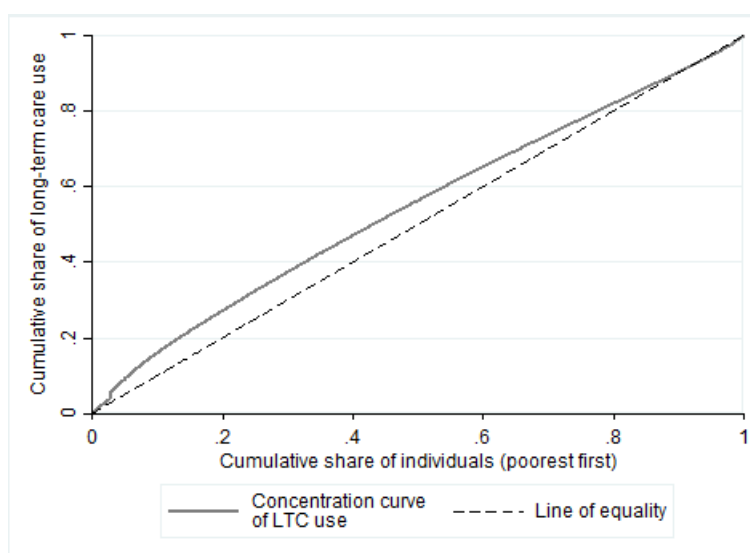
SAMPLE: Individuals 60 and older eligible for public "elderly" LTC in the Netherlands in 2012 (N=616,934).
NOTES: LTC use is expressed in annual monetary value. It is the sum of the value of home care services used in kind, of the value of cash benefits granted and of elderly institutional care received in 2012. Individuals are ranked by their equivalized 2011 household taxable income.

Figure 4.2 suggests that this pro-poor concentration seems to be driven both by the lowest utilization rate of LTC services of the rich and by the higher institutionalization rate of the poor. Indeed, we observe that the proportion of individuals with no or little LTC use is higher among the 50% richest individuals, while the spikes in the distribution of LTC use, which reflect a full year spent in an institution,[34] are more marked among the 50% poorest.

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[33]Appendix 4.G presents the formula used to derive the standard error of the concentration index.

[34]Each of these spikes (with a strictly positive value) corresponds to individuals spending the full year in an institution with a given package of services or, equivalently, a given severity of disability. We have truncated Figure 4.2 from the right (individuals spending the entire year in a nursing home with the highest level of services have an annual value of LTC use exceeding k€90).

Figure 4.2 – Distribution of LTC use, among the 50% poorest and 50% richest individuals.

5.2 Differential use by income for equal needs

Using the formula presented in Section 3, we now compute the contribution of needs to total inequality, $C^N(y)$ and derive the horizontal inequity index of LTC use. As displayed in Table 4.3, $C^N(y)$ is negative, statistically and practically significant (-0.0485), indicating that the poor tend to be assessed higher needs. The pro-poor concentration of needs is yet lower than the pro-poor concentration of use, resulting in a negative horizontal inequity index equal to -0.0368 and thus a *disproportionate* pro-poor concentration of LTC use on balance.

Table 4.3 – Concentration and horizontal inequity indexes of LTC use

CI(y)	$C^N(y) = CI(x)\bar{x}/\bar{y}$	HI(y) = CI($\hat{y}^{IS}$)
(1)	(2)	(3)
-0.0853***	-0.0485***	-0.0368***
(0.0008)	(0.0006)	(0.0007)

SAMPLE: Individuals 60 and older eligible for public "elderly" LTC in the Netherlands in 2012 (N=616,934).
NOTES: Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
See Appendix 4.G about the computation of the standard errors.

We now compute for each individual her need-standardized use, y_i^{IS}, following Equation (4.4) (Section 3). Figure 4.3 shows the distribution of the average need-standardized LTC use per income decile.

Figure 4.3 – Distribution of need-standardized LTC use across income deciles
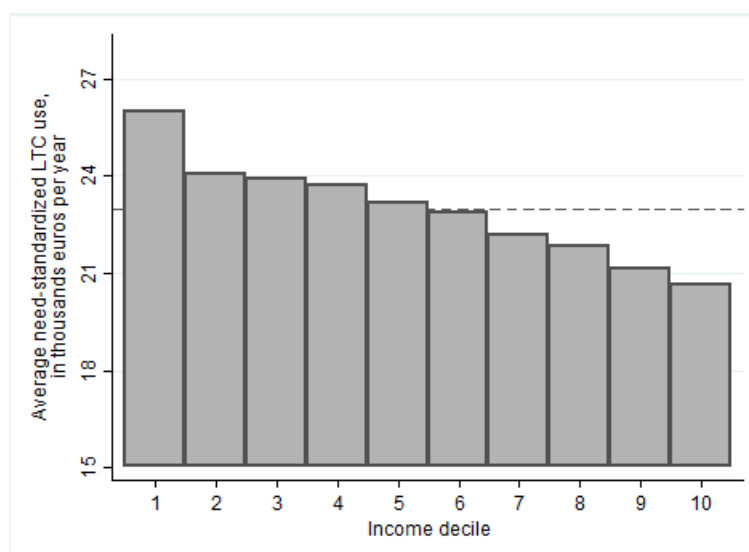
SAMPLE: Individuals 60 and older eligible for public "elderly" LTC in the Netherlands in 2012 (N=616,934).
NOTES: Need-standardized LTC use is expressed in annual monetary value. The dashed horizontal line indicates the average value of actual LTC use in the sample. Income deciles are defined using equivalized 2011 household taxable income.

There is a clear negative income gradient: the poor tend to consume more LTC (in value) *even conditional on needs,* along the entire income distribution. The gradient is however more marked at the very bottom and at the top: when adjusting for LTC needs the 10% poorest individuals are predicted to use 25% LTC services more than the 10% richest individuals. Differential use by income for equal needs is thus substantial.

5.3 Decomposition of potential horizontal inequity

To get a better sense of what may drive such a marked differential use of LTC across the income distribution, we use a decomposition technique to highlight the individual characteristics that correlate most strongly with both income and LTC use (Wagstaff *et al.*, 2003; O'Donnell *et al.*, 2012). Following the literature, we call a "non-need factor" a variable z_k that is considered to be an illegitimate determinant of the use of LTC. We can break the total income-related inequality in use down in the following way:

$$\text{CI}(y) = \frac{\bar{x}}{\bar{y}}\text{CI}(x) + \sum_{k=1}^{K}\left[\left(\beta_k^{\text{NN}}\frac{\bar{z}^k}{\bar{y}}\right)\text{CI}(z^k)\right] + \frac{2cov(\epsilon, r^{\text{I}})}{\bar{y}} \tag{4.6}$$

$$= \text{C}^{\text{N}}(y) + \text{C}^{\text{NN}}(y) + \frac{2cov(\epsilon, r^{\text{I}})}{\bar{y}} \tag{4.7}$$

$$= \text{C}^{\text{N}}(y) + \text{HI}(y) \tag{4.8}$$

where $\bar{z}^k$ denotes the population-average of variable z^k. The β_k^{NN}, $k = 1,...,\text{K}$, are the coefficients from a linear regression of the use of LTC, y_i, on the needs x_i and the K non-need factors z_i^k :

$$y_i = \beta_0 + 1.x_i + \sum_{k=1}^{K}\beta_k^{\text{NN}}z_i^k + \epsilon_i \tag{4.9}$$

with ϵ being the error term.[35] As non-need factors, we include age (5 brackets), gender, whether the individual has a partner living in the house, the number of household members, the migrant background (7 categories) and whether the individual owns her house.[36] In order to take into account potential nonlinear effects of income and wealth, we include dummies for the income and wealth deciles. The model also includes dummies for the LTC purchasing region the individual lives in.

In the decomposition, $\text{C}^{\text{NN}}(y)$ represents the total contribution of the observable non-need determinants of care to the concentration index of LTC use; $2cov(\epsilon, \text{R}^{\text{I}})/\bar{y}$ is the generalized concentration index of the error term and captures the degree of correlation between

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[35]The coefficient of needs is constrained to be equal to 1, so that the contribution of needs $\text{C}^{\text{N}}(y)$ is exactly equal to the concentration index of CIZ-assessed needs times $\bar{x}/\bar{y}$. Appendix 4.E provides a discussion of this constraint in line of the choice of a norm of vertical equity in use.

[36]The categories can be read directly from the regression results, in Table 4.D.1, Appendix 4.D.

LTC use and income that is not explained by neither needs nor non-need factors. The contribution of a given factor to inequality is all the larger as its partial correlation with LTC use is high and that is is unequally distributed across the income distribution.

As it derives from a linear regression without ruling out all sources of endogeneity, the contribution of each variable needs not be causal (Fleurbaey and Schokkaert, 2011; van Doorslaer and van Ourti, 2011). Yet such a decomposition can provide some useful insights into the potential sources of inequity and guide further investigation.[37] We thus use the available socio-demographic information as non-need factors to perform the regression underlying the decomposition. By doing so, we do not assume that age and gender, in particular, are not legitimate determinants of LTC use: given that we control for needs in the regression, we instead take that age and gender (and all the other non-need factors) should not weigh in the use of LTC services *above and beyond* the assessment done by CIZ.

Figure 4.4 displays the results of the decomposition. To interpret the contribution of a variable z_k, we combine the descriptive statistics (Table 4.2) to get $\bar{z}_k$, the estimates of Table 4.D.1 (Appendix 4.D) to get $\hat{\beta}_k^{NN}$, and the concentration index $CI(z_k)$ of the variable provided in Table 4.D.2 (Appendix 4.D). Age, not living with one's partner and income are the main observed factors behind the higher use of LTC services by the poor. Being older increases the use of care, and the eldest tend to be poorer. Having a partner in the house is associated with a lower value of LTC services used; this situation is more frequently encountered among the rich, because those are less likely to live in an institution and more likely to have a spouse. The high contribution of income is not mechanical: it is due to the high negative income elasticity of LTC use being augmented by the concentration of income (Gini index of 0.33).

Home ownership also contributes to pro-poor horizontal inequity in use: being a home owner is much more frequent for the high-income elderly and is associated with a lower use of LTC (in value). This may reflect the fact that home owners are more likely to stay home rather than to enter a nursing home, as compared to renters, and therefore use less expensive services than institutional care. Individuals residing in an institution may also be more likely to have sold their house, inducing a negative relationship between home ownership and the use of expensive forms of LTC.

The contributions of gender, having a migrant background, wealth, the household composition and the region of residence are small. Differences in wealth are only associated with limited differences in LTC use. Interpretation is different for migrant background and the region of residence: while these variables are found to have statistically significant and

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[37]In particular, one potential concern is that income and wealth could be lowered by a high use of LTC services. We believe there is little scope for a reverse causality bias here: income being mostly made of pensions, it is independent from the disability status of the individuals. As individual co-payments are capped, the medium-run impact of intensive LTC use on wealth is limited. We also exclude individuals with mental health issues and handicaps, which may affect life-time earnings.

practically important effects on the use of LTC, their correlation with income is not systematic. Schematically, individuals with a non-Western country origin tend to consume less LTC in value than the Dutch natives while being poorer on average. However, individuals with origins in a Western country (other than the Netherlands) tend to be richer than the average elderly in our population and are predicted to use only slightly less LTC than a Dutch native. Given that the horizontal inequity index gives a synthetic measure of system-wide inequity,[38] the pro-poor contribution of the 3% of non-Western migrants that we find in our population of interest is offset by the pro-rich contribution associated with the Western migrants, who amount to 9% of our population.

Figure 4.4 – Contribution of non-need factors
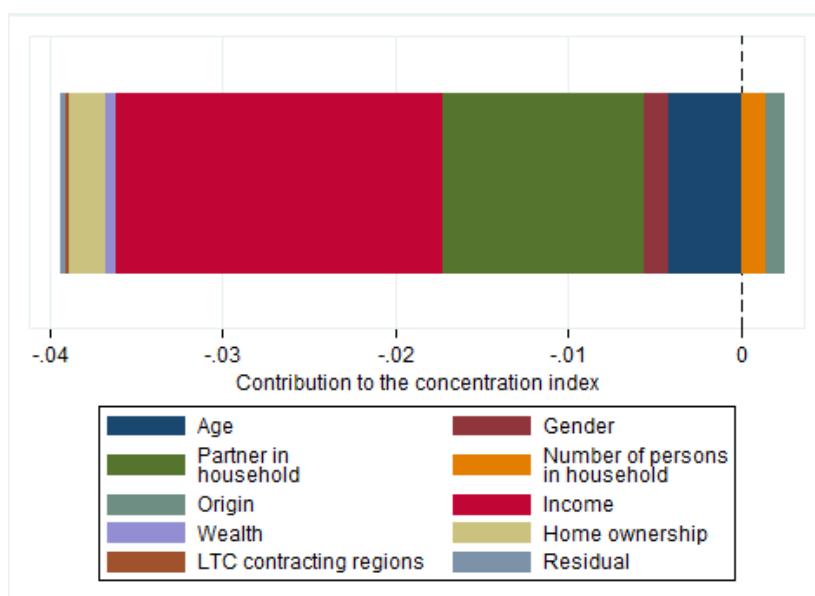
SAMPLE: Individuals 60 and older eligible for public "elderly" LTC in the Netherlands in 2012 (N=616,934).
NOTES: Variables depicted on the right-hand side of 0 contribute to pro-rich inequality; variables on the left-hand side of 0 contribute to pro-poor inequality.
READING: On a total horizontal inequity index of −0.0368, income contributes negatively by −0.0188.

The case of the contribution of the place of residence can be discussed in the light of recent Dutch and international empirical findings. The largest gap in average LTC use across two of the 32 Dutch LTC purchasing regions, once needs and other non-need factors are controlled for, reaches €5,000 a year (Figure 4.D.3, Appendix 4.D). This represents more than 20% of the average LTC use nationwide. Practice variation (Chandra et al., 2011) in access to and use of LTC services by the elderly has been documented in the US and in Nordic countries (Trydegård and Thorslund, 2001; Miller, 2002; Pulkki et al., 2016). The existence of

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[38]Recall that the contribution of each non-need factor is proportional to the population average of this variable.

cross-regional differences in the ratio of LTC services used to CIZ entitlements was recently documented by the Dutch Audit Office (Netherlands Court of Audit, 2015); our results show that, in spite of the Netherlands being a relatively small country, territorial differences persist even when we control for a rich set of individual characteristics. In contrast, Duell *et al.* (2017) find that practice variation in eligibility for public LTC is limited in the Netherlands and correlates little with health care supply characteristics. Our estimates suggest that it is relevant to look at actual use, beyond eligibility, when interested in horizontal inequity in the Dutch LTC system. Nonetheless, we find that regional disparities do not contribute to differential care use *that relates to income*, as the high-use regions are not found to be systematically richer or poorer.

The last thing to be noticed from Figure 4.4 is that the residual is fairly small, meaning that our model does a good job at capturing out unobserved determinants of LTC use that correlate with income.

Although it provides an encompassing picture of inequalities and horizontal inequity in the Dutch LTC system, our baseline analysis has the drawback of putting together two potentially heterogeneous populations, namely individuals eligible for institutional care and those eligible for home care. Digging further into horizontal inequity in LTC use and the factors associated with it thus requires to have a separate look at institutional care and home care. A separate analysis is also motivated by the strong contribution of income to HI, and negligible contribution of wealth. In 2012, co-payments in the Dutch LTC insurance were such that, except for the very wealthy individuals, assets did have a limited impact on co-payments. By contrast, co-payments are strongly tied with income and they have a substantially different schedule when individuals are using institutional care rather than home care.

6   Home care *versus* institutional care: subgroup analysis

6.1   Subgroup definition

We now construct a subgroup of individuals who were eligible for home care at least one day in 2012 and a subgroup of individuals who were eligible for institutional care at some point that year. Table 4.4 describes the measures of LTC use and needs in each of the subgroups. When focusing on individuals eligible for institutional care (47% of the total population), we compute the monetary value of CIZ needs as the value of institutional stays the individual was made eligible for. LTC use is then computed as the value of institutional stays *while the individual was eligible for such stays.* As entitlements to institutional care can be converted into home care services or cash benefits, we add the value of home care services and the (imputed) value of any cash benefits that were used during the periods the individual

was eligible for institutional care.[39] When focusing on the subgroup analysis of individuals eligible for home care (2/3 of the total population), we compute the monetary value of LTC use of each individual as the sum of in-kind home care services and cash benefits used while she was eligible for home care support.

Table 4.4 – Definition of LTC use and needs in the subgroup analysis

	Subgroup A: Individuals eligible for home care	Subgroup B: Individuals eligible for institutional care
Monetary value of LTC needs	Monetary value of home care services the individual was eligible for	Monetary value of institutional stays the individual was eligible for
Monetary value of LTC use	Monetary value of in-kind home care services + monetary value of cash benefits granted when the individual was eligible for home care	Monetary value of institutional care + monetary value of in-kind home care + monetary value of cash benefits granted when the individual was eligible for institutional care
N	401,262	287,932
Share of total sample	64.9%	46.6%

Individuals eligible for institutional care tend to be older, more often women and single, and less likely to have a migrant background. They have lower wealth and a lower income.[40]

6.2 Income-related inequality and horizontal inequity index by subgroup

Table 4.5 shows the inequality and the horizontal inequity indexes in each of the subgroups.[41] In Column (1), we see from the negative concentration indexes that LTC use is concentrated among the poor in both subgroups.[42] Interestingly though, Column (2) suggests that the rich tend to have *higher* needs for home care than the poor: the positive sign of C^N (equal to 0.0254) indicates that, if only needs for home care mattered for actual use of LTC services, then we would expect the rich to consume relatively *more* home care than the poor. Because the needs are distributed pro-rich and the use pro-poor, the horizontal inequity index is strongly negative (HI = −0.0612). Within the subgroup eligible for institutional care, the pro-poor concentration of use is partially offset by the pro-poor concentration of needs leading to a horizontal inequity index that is less strongly negative.[43]

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[39] This means that, in order to relate the CIZ-assessed needs for institutional care with a chronologically consistent measure of use, we disregard any LTC used while the individual was not eligible for institutional care.

[40] See Table 4.C.2 in Appendix 4.D for the descriptive statistics in each subgroup.

[41] Estimates of the model of LTC use for each subgroup can be found in Appendix 4.D, Table 4.D.3.

[42] Concentration curves of LTC use in both subgroups are provided in Appendix 4.D, Figure 4.C.1.

[43] The horizontal inequity indexes of the two subgroup do not add up to the value of the index in the entire sample. This is due to the fact that about 12% of the population of interest is eligible for both types of care in 2012, and thus contribute to the indexes of both sub-groups.

The pro-*rich* concentration of entitlements for *home* care, contrasting with the pro-*poor* concentration of entitlements for *institutional* care might be explained by systematic differences in functional status, health and household composition at the point of entry in the LTC system depending on income. This pattern would be consistent with individuals with a low socio-economic status going through the frailty and disability process faster and being more frequently deprived from a supporting physical and family environment, leading them to be assessed higher needs for formal care.

Table 4.5 – Concentration index and horizontal inequity index: subgroup results

	CI	C^N	C^{NN}	Residual	HI
	(1)	(2)	(3)	(4)	(5)=(1)-(2)
Subgroup eligible for home care	-0.0358*** (0.0018)	+0.0254*** (0.0009)	-0.0606	-0.0005	-0.0612*** (0.0009)
Subgroup eligible for institutional care	-0.0453*** (0.0008)	-0.0238*** (0.0010)	-0.0215	-0.0000	-0.0214*** (0.0010)

SAMPLES: Individuals 60 and older eligible for public "elderly" LTC in the Netherlands in 2012 (N=616,934), eligible for home care (N=401,262) or eligible for institutional care (N=287,932).
NOTES: Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Computation of standard errors are described in Appendix 4.G. Bootstrap derivation of the standard errors of the contribution of non-need factors, C^{NN}, and of the residual has not been completed yet.

We also replicate the full decomposition analysis on each subgroup to highlight the contribution of each non-need factor. Results are reported in the Appendices (Figure 4.D.4, Appendix 4.D). In the subgroup eligible for home care, the two variables relating to household composition are found to contribute to pro-poor inequity in use. This is consistent with Ilinca *et al.* (2017), who use SHARE data and find the contribution of household composition to inequality in the home care utilization rate to be highest in the Netherlands, relative to other European countries. In both subgroups, income has the highest contribution relative to the other non-need factors. In relative terms, the contribution of income is especially high in the subgroup eligible for institutional care. One assumption for the weight of income is that the income-rich may be more likely to convert their entitlements to institutional care into a package of home care services when eligible for entering a nursing or residential care home. In the Dutch LTC insurance, co-payments tend to be higher when using institutional care than for home care services. This is especially true for individuals with a relatively high income.[44] For relatively rich individuals, the differential co-payment on home care and institutional care use thus creates a financial incentive to substitute institutional care for — socially and privately — less costly home care services.

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[44]Take the example of an individual with an annual equivalized income equal to €70,000, who is eligible for a stay in a nursing home with the most intensive level of care. If she enters the nursing home, she will be required to pay €2,248 per month out-of-pocket. If she instead decides to receive an equivalent package of care services at her house (28.5 hours a month), she will instead incur a co-payment around €900 per month.

Recent studies (Bourreau-Dubois, Gramain, Lim and Xing (2014); Hege (2016); Non (2017) and Roquebert and Tenand (2017) [Chapter 2 of this thesis]) used data on beneficiaries of home care public schemes from either France or the Netherlands and found the disabled elderly to be price-sensitive in their consumption of home care. Evidence regarding the price sensitivity of institutional care use is more mixed.[45] If our hypothesis that LTC use is price-elastic and that this contributes to explaining the differential use of LTC along the income distribution, for given needs, is a valid assumption, then we should observe some differential in the probability to use LTC services when eligible for them across income levels.[46] To explore this assumption, we depict the probability to use institutional care, in-kind home care or cash benefits depending on the income decile and the type of care the individual is eligible for. Among individuals eligible for institutional care, the probability of staying in an institution decreases from 92% in the bottom income decile, to 80% in the top 70% of the income distribution (Figure 4.5, Panel B). In the subgroup eligible for home care, we observe a roughly constant LTC use along the income distribution (Figure 4.5, Panel A), but the bottom and top income deciles are more likely to use cash benefits, as opposed to in-kind care, than the middle of the income distribution.

One obvious limitation with these simple statistics is that they do not control for needs and only focus on the extensive margin of LTC use. We additionnally estimate a model in which the outcome variable is the value of LTC use and the main regressors are the needs, the income deciles and the interaction terms between deciles and needs.[47] We find a negative income-gradient in the conversion rate between needs and use among individuals eligible for institutional care. Among those eligible for home care, the relationship is nonlinear; yet, when controlling for needs, individuals in the top 50% of the income distribution are found to convert a lower share of their entitlements into actual use.

These patterns would be consistent with the hypothesis that the lower use of LTC, or the use of lower-value services, by the rich that we observe might be partly explained by them adjusting their consumption to the higher co-payments they face, relative to poorer beneficiaries. However, this is probably only part of the story, if any. In the subgroup eligible for home care, we find that other non-need factors, such as household composition, marital

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[45]Focusing on the United States, Hoerger *et al.* (1996) exploit state-level variation in Medicaid reimbursement rates of nursing home stays and find that it affects the use of institutional care. However, the decrease in the relative price of home care induced by state variation in home care subsidy programs has no effect on the probability to enter a nursing home. Using a rich set of indicators of the generosity of Medicaid reimbursement rules, again at the state level, Grabowski and Gruber (2007) conclude to the demand for institutional care being price inelastic, confirming the findings obtained by Reschovsky (1996) with data from the US Channeling Demonstration. Yet in another study, Reschovsky (1998) find demand for nursing home stays to be elastic to price; this echoes the result obtained by Garber and MaCurdy (1990), who exploit the temporal variation in Medicare reimbursement rules for nursing home stays and find peaks in the hazard rate of nursing home stays around the discontinuities in the reimbursement schedule.

[46]Unless income effects offset the price effects, which we cannot a priori rule out.

[47]Results are presented in Figures 4.E.2 and 4.E.3, in Appendix 4.E.

status and gender, bring an important contribution to pro-poor income-related horizontal inequity. The fact that women tend to receive more formal home care when eligible for it may reflect their lower propensity to receive informal care from their spouse (Katz *et al.*, 2000). The lower conversion rate of entitlements into actual use and the higher take-up of cash benefits at the very bottom of the income distribution may also reveal a higher propensity to use one's entitlements to pay for informal caregivers among the poorest.

Figure 4.5 – Probability of using a given type of LTC, by subgroup
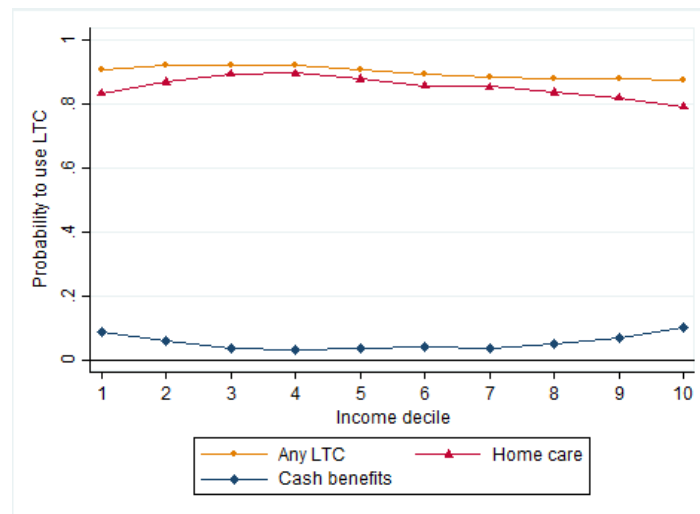
Panel A (top): Individuals eligible for home care.
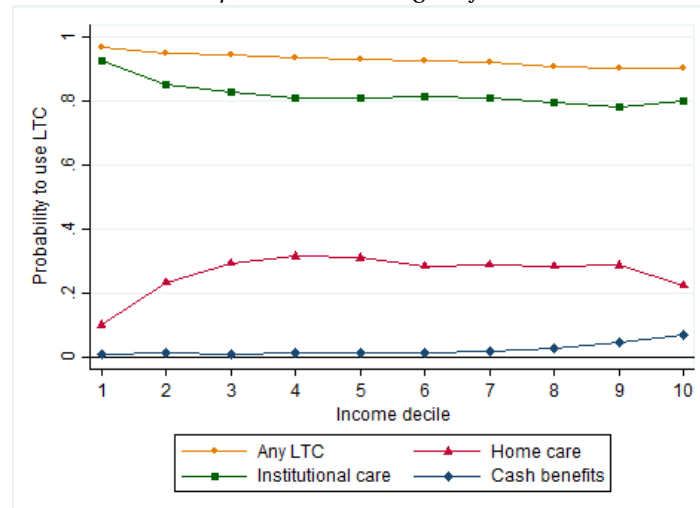
Panel B (bottom): Individuals eligible for institutional care.

SAMPLE: Individuals 60 and older eligible for public home care (Panel A) or institutional care (Panel B) in the Netherlands in 2012 (N=401,262 in Panel A; N=287,932 in Panel B). NOTES: Probability of using a given type of care while the individual was eligible for home care (Panel A) or institutional care (Panel B). A given individual may use several types of care over the period she is eligible for either home care or institutional care.

7 Discussion

7.1 Robustness check and wealth-related horizontal inequity

Our analysis aims at providing a measure of average socio-economic horizontal inequity in the Dutch LTC system. Within our population of interest, the share of individuals who died before the end of year 2012 is far from negligible (16%). As mortality is not uniform across the income distribution, ignoring this sub-population may bias our assessment of income-related inequalities and inequity in LTC use. Yet when pro-rating the needs and consumption of those who have died in the year, we create some outliers with respect to our two main variables of interest. We thus checked that our conclusions are not sensitive to our methodological choice by replicating the analysis excluding individuals who died before the end of 2012. As shown in Appendix 4.F, the concentration and horizontal inequity indexes remain pro-poor.

We have focused on *income*-related inequality in use. Most of our population of interest has retired. For the retirees, income is mostly made of pensions, which are more equally distributed than the housing and financial wealth accumulated by the elderly cohorts.[48] By taking income as our ranking variable, we neglect an important component of socio-economic resources in the elderly population. As a complementary analysis, we assess whether the pattern of differential use of LTC services across the per capita wealth distribution echoes the one observed across the income distribution.[49] As displayed by Figures 4.F.2 and 4.F.3 (Appendix 4.F), the differences in the need-standardized use between wealth deciles are smaller than those observed between income deciles; nonetheless the 30% wealth-richest individuals tend to use less LTC (in value), conditional on their entitlements.

The indicator of socio-economic status is thus not neutral to our conclusions in terms of horizontal inequity in LTC use in the Netherlands. Given that co-payments in 2012 would mostly depend on income, we believe it is especially relevant to document how actual use of LTC varies along this dimension.

7.2 Interpretation of the results

Interpreting our horizontal inequity index as a measure of income-related horizontal *inequity* in LTC use in the Netherlands hinges on two necessary conditions. Firstly, it rests on the normative stance that eligibility decisions made by CIZ give the "relevant" norm of ver-

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[48]In our population, the Gini coefficient equals 0.32 for equivalized income and 0.45 for individualized wealth.

[49]Theoretically, the degree of socio-economic inequality and horizontal inequity in LTC use is all the more sensitive to taking income rather than wealth as the measure of socio-economic background as the individuals have different ranks in the income and wealth distributions (Carrieri *et al.*, 2017; Wagstaff and Watanabe, 2003).

tical equity. Secondly, taking HI(y) as a measure of inequity can only be done if there are no systematic differences in preferences for the use of LTC services across the income distribution, or if these preferences are not considered as legitimate determinants of care use.

The unique institutional setting and information system of the Dutch LTC system provide us with an explicit and grounded norm of vertical equity in use. We have yet tested what our conclusions in terms of horizontal inequity would be if we were to rely on the more classical "the system gets it right" assumption. The results (Appendix 4.E) show that the negative horizontal inequity index is robust to this alternative assumption, although the magnitude of the disproportionate pro-poor concentration of use changes.

Can we assume preferences for aging in place and forward-looking behavior to be invariant to socio-economic status? Individuals' preferences over care settings seem to fluctuate even in the short run (Wolff *et al.*, 2008) and are therefore hard to test empirically. However, experimental evidence from the Netherlands (Nieboer *et al.*, 2010) suggests that income-rich individuals have a negative willingness to pay for nursing home care, relative to living independently, while the income-poor tend to derive a positive relative utility from institutional care.[50] These studies may be evidence either that preferences differ with income or that institutional care is an inferior good, i.e. that its use has a negative income elasticity. In both cases, the lower use of more costly forms of care by the rich may well be consistent with individuals trading-off optimally between additional care and other consumption goods, given their preferences, their economic resources and the amount of subsidies provided by the Dutch LTC system. In the same vein, the lower use of LTC services by individuals with a non-Western migrant background we document might be interpreted as the result of different norms regarding old-age disability and the role of the family rather than evidence of an inequitable treatment (Morris *et al.*, 2005).

There has been a vivid debate about whether, and how, equity considerations may and should be reconciled with Paretian economics and the respect of preferences (Fleurbaey, 2008; Culyer *et al.*, 1992; Mooney *et al.*, 1991). As highlighted by Culyer *et al.* (1992) and van Doorslaer and van Ourti (2011) in the health care context, the non-Welfarist Marxist or egalitarian principle of distributive justice of "allocation of care according to needs", irrespective of preferences, seems to command a strong support among physicists and the public opinion. Assume that this is the fairness principle consistent with the public view on public LTC support. Then our "pro-poor" horizontal inequity index would suggest that the Dutch LTC system overshoots its goal of ensuring equitable access to LTC. One reason may be that the income-dependent co-payments are set too high for the relatively rich individuals and induce them to forgo their care entitlements to an unfair extent.

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[50] Nieboer *et al.* (2010) derive willingness to pay for care settings by running a discrete choice experiments on middle-aged (mostly non-disabled) individuals, who are asked to consider different scenarios of disability for a fictitious relative.

Yet our results may lend themselves to a very different interpretation if we are to adopt a Welfarist stance: if institutionalization actually is an inferior good, then the disproportionate use of expensive nursing home care by the poor might reveal that the Dutch LTC system put the elderly with low financial resources at a disadvantage in terms of well-being or the perceived value of the care they receive. Beyond raising equity concerns, the higher consumption of institutional care by the poor may reveal some inefficiencies, if there would be alternative ways of providing lesser-cost but higher-value care.

Another value judgment implicit in our analysis, and made necessary given the absence of any data on the use of informal care in our population of interest, is that we make inferences on inequities in the use of formal care only. Whether one is interested in inequity in i) the use of *formal care* or ii) in the use of total care, i.e. formal care plus *informal care*, depends on whether formal care is both individually and collectively preferred over informal care or merely perceived as a back-up option for when there is insufficient informal care available. The perspective of the Dutch public LTC insurance is in-between these two polar views. On one hand, the comprehensive coverage offered to all elderly for all types of LTC means that formal care is collectively valued, in a normative sense. On the other hand, entitlements to personal care in the first months are reduced by the amount of "usual care" that household members are expected to provide. Given this position, we may infer that whether LTC beneficiaries have equal access to formal LTC independently from the informal care they may receive, beyond usual informal care, is of policy relevance in the Netherlands.

8   Conclusion

In this paper, we use high-quality population data to measure income-related inequality in the use of LTC services in the context of the generous Dutch public LTC insurance. We test the "equal care for equal needs" principle by relying on an explicit norm of vertical equity in care use, which is derived from the eligibility decisions issued by the central needs assessment agency.

The results are somewhat at odds with the common view that the Dutch LTC system is very egalitarian. Rich or poor, the old Dutch appear to be using a value of LTC lower than what they are entitled to. However, the "under-utilization" of LTC, in relation to assessed needs, is more pronounced among the rich than among the poor. This implies that the income-related inequality in use we document cannot be entirely explained by differential needs for LTC across the income distribution. Separate analyses for home care *versus* institutional care show that i) differential (under)use of LTC is more marked among individuals eligible for home care and ii) the differential probability to stay in a nursing home, when eligible, contributes to the difference in LTC use.

Interpreting our results in terms of horizontal inequity requires several important assumptions regarding the definition of fairness, the role of preferences and about informal care being a legitimate substitute for publicly-subsidized formal care. It also rests on CIZ entitlements being a relevant indicator of the legitimate determinants of LTC use. In the case the rich are more able to navigate the LTC system and claim benefits, relying on CIZ-assessed needs would hide potential socio-economic inequity at the stage of the eligibility decision. Further empirical evidence on the drivers of LTC eligibility and how they relate to socio-economic conditions is needed, so that we can fully assess whether the allocation of public support to the disabled elderly meets with the concern for equitable access to LTC, while ensuring that the highest value is derived from the publicly-subsidized services being used.

Appendix

4.A   Data treatment and sample selection

4.A.1. Description of datasets

We match together different microdatasets, the access to which was granted by Statistics Netherlands, by the means of a unique identifier. The datasets are described in Table 4.A.1.

Table 4.A.1 – Description of the microdata sources

Dataset	Source	Unit of observation	Content
Long–term care			
CIZ eligibility decisions (INDICAWBZTAB)	CIZ	One eligibility decision of an individual	Date of start; date of end; types of care prescribed; volume of care prescribed
Use of home care (GEBZZVTAB)	CAK	One care period for an individual	Care period; types of care used; volume of care used
Use of institutional care (ZORGMVTAB)	CAK	One institutional stay of an individual	Date of start; date of end; ZZP package
Take-up of cash benefits (GBBAWBZTAB)	Vektis	A period of cash benefits use of an individual	Date of start; date of end; types of care for which the budget was granted
Income and wealth			
Personal and household income (*Integraal Huishoudens Inkomen*)	Tax records	An individual	Total household taxable income
Assets (*Integraal Vermogen*)	Tax records	An individual	Household financial and housing assets and debts
Others			
Demographic information (GBAPERSOONTAB)	Municipal population registers	An individual	Age, gender, migrant background
Record of deaths (GBAOVERLIJDENTAB)	Municipal population registers	An individual	Date of death, if any
Spouse/registered partner identifier (GBAVERBIN-TENISPARTNERBUS)	Municipal population registers	One partner of an individual	Date of formation of the couple; date of dissolution; identifier of the spouse
Household composition (GBAHUISHOUDENSBUS)	Municipal population registers	One household of an individual	Date of formation of the household; date of dissolution; number of adults and children in the household
Address (GBAADRESOBJECTBUS + VSLGWBTAB)	Municipal population registers	One address of an individual	Housing identifier; corresponding exact address code (neighborhood, district, municipality)

NOTES: In the Netherlands, individuals have to declare any change of address (if their stay exceeds 4 months) to the municipality of their new address. Deaths and births have also to be reported to the municipality. We can thus track individuals' location, couples and household composition. Over one year, an individual can have different addresses, can get, lose or change partners or household composition.

To complement the individual-level data sources, we use the following additional data and grids:

1. The grid of the official tariffs of LTC services applied in 2012 (source: CAK);

2. The grid used to convert entitlements to institutional care with a given package of services (ZZP package) into a package of home care services (source: *College voor Zorgverzekeringen*, CVZ);

3. The grid used to convert entitlements to home care services into cash benefits (source: CVZ);

4. The correspondence map between the municipalities and the 32 contracting LTC regions (source: *Gebieden in Nederland* 2012 dataset, CBS).

4.A.2. Sample selection

Our population of interest is made of all individuals who were born in or before 1952, who were alive at least one day in 2012 and who were made eligible for "elderly" LTC by CIZ at least one day in the year 2012.

An individual is considered as eligible for "elderly" LTC if she was made eligible at least one day for home care services, for a stay in a nursing home, in a residential care home, in a rehabilitation center or in a palliative care center, due to a somatic or psycho-geriatric condition.[51] Our population of interest is made of 618,041 individual.

We keep individuals for which we have information on age, gender, marital status, household composition, migrant background, income, wealth, home ownership and address. The data contain very few missing values. As displayed in Table 4.A.2, we loose only 1,107 individuals throughout the matching of our different data sources. Our baseline sample is made of 616,934 individuals (99.82% of the population of interest).

Table 4.A.2 – Sample selection

	Sample size	Share of previous sample	Share of population of interest
After treatment of information on eligibility for and use of care, date of birth and date of death *(Population of interest)*	618,041	100.0%	100.0%
After merging additional socio-demographic information	618,034	99.99%	99.99%
After merging income and wealth information	617,635	99.94%	99.93%
After merging information on address *(Baseline sample)*	616,934	99.88%	99.82%

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[51]CIZ assigns an applicant a primary condition and a secondary condition motivating the entitlements to LTC. We retain individuals with a somatic or psycho-geriatric condition, whether one of these conditions is registered as the primary or as the secondary condition.

4.B Additional information of the Dutch long-term care system

4.B.1. Prices of LTC services in the Netherlands

The monetary costs of LTC services funded through the public insurance system are computed using a national grid of tariffs, presented in Table 4.B.1.

LTC institutions, who are public in the Netherlands, receive funding in accordance with this grid. Providers of home care services are mostly private; those covered by the public LTC insurance contract with the regional authorities and agree on hourly prices that should not exceed the national tariffs reported below.

Table 4.B.1 – Tariffs of publicly-funded LTC services in the Netherlands in 2012

Home care services		Nursing and residential care homes	
Type of care	Tariff/hour	Level of services (ZZP package)	Tariff/day
Personal care	€49.81	Level 1	€63.03
Guidance	€57.75	Level 2	€80.44
Nursing care	€71.52	Level 3	€98.07
		Level 4	€113.117
		Level 5	€174.32
		Level 6	€168.28
		Level 7	€210.35
		Level 8	€239.14
		Level 9	€211.21
		Level 10	€259.72

SOURCES: Nederlandse Zorgautoriteit (2011*b*,*a*).
NOTES: In the Netherlands, domestic help is not funded by the public LTC insurance. The ZZP packages we refer to correspond to institutional care of type *Verpleging en verzoging* (stays in a nursing home, residential care home, rehabilitation center or palliative care center).

When individuals are eligible for institutional care but they choose to stay in the community and receive home care services instead, the package of services they would have received in an institutional setting is converted into a certain package of home care services, following the grid presented in Table 4.B.2.

Table 4.B.2 also provides a comparison between the monetary value of an institutional stay and the monetary value of the equivalent package of home care services. The absolute difference between monetary values, as a function of the level of services (thus, roughly as a function of the severity of disability), is U-shaped. The difference exceeds a hundred euros per week for low levels of disability; it decreases until the two living arrangements are equally costly (for ZZP package 7), before increasing again for the most severe disability levels. Individuals who opt for home care when they are eligible for institutional care with low and high

levels of LTC services have thus a lower value of LTC use than similar individuals opting for a stay in an institution.

Table 4.B.2 – Correspondence between institutional care and home care: Official conversion grid and comparison of costs

	Hours of home care services, per week			Monetary value, per week		
	Personal care	Nursing care	Guidance	Cost of home care equivalent	Difference institutional care – home care	Ratio of home care cost /institutional care cost
Level of services (ZZP package)	(1)	(2)	(3)	(a)	(b)	(c)
Level 1	1	1.5	3	€330	€110	74.9%
Level 2	5.5	1.5	1	€440	€123	78.1%
Level 3	8.5	1.5	1	€589	€97	85.8%
Level 4	5.5	1.5	5.5	€699	€92	88.3%
Level 5	5.5	5.5	8.5	€1,158	€61	95.0%
Level 6	8.5	5.5	5.5	€1,135	€42	96.4%
Level 7	8.5	5.5	11.5	€1,481	-€9	100.6%
Level 8	11.5	5.5	11.5	€1,631	€42	97.5%
Level 9	8.5	5.5	8.5	€1,308	€170	88.5%
Level 10	14.5	8.5	5.5	€1,649	€168	90.7%

SOURCE: College voor Zorgverzekeringen (2012); Nederlandse Zorgautoriteit (2011*b*,*a*). Authors' computations of weekly monetary values.
READING: An individual made eligible for institutional care with a ZZP package of level 1 will be equivalently entitled to receive 1 hour of personal care, 1.5 hour of nursing care and 3 hours of guidance per week. The monetary value of home care services equivalent to the level of services the individual would receive in institution represents 74.9% of the monetary value of the institutional care she is entitled to.
NOTES: The ZZP packages we refer to correspond to institutional care of type *Verpleging en verzoging* (stays in a nursing home, residential care home, rehabilitation center or palliative care center).

Individuals eligible for either home or institutional care can also opt for cash benefits (or a combination of cash benefits and in-kind care). If the individual is eligible for institutional care, her entitlements are first converted into a package of home care services (grid in Table 4.B.2). The value of the cash benefits is equal to the monetary value of the package of home care services, computed using the tariffs of Table 4.B.1, minus a 25% discount.

From the individual point of view, these figures do not adequately capture the incentive to substitute institutional care for home care: the individual bears only part of the cost of the care she receives and the schedule of co-payments is not the same for home care and institutional care. The schedule of the co-payments on public LTC is described in the following section.

4.B.2. Co-payments in the Dutch LTC system

The use of LTC services within the Dutch public LTC insurance requires beneficiaries to pay part of the costs of the services. Co-payment schedules are not the same for institutional care and home care.

Co-payment on home care use

Co-payment schedule

The following description is partly based on Non (2017) and presents the rules and values applicable in 2012.

For home care, a year is divided into 13 periods of 4 weeks. The computation of co-payments is based on the total number of hours of home care used each care period at the household level.[52] Basically, the cost-sharing rule is such that individuals have to bear part of the cost of each additional hour of care they consume, before they reach a volume of care beyond which each additional hour consumed becomes free of charge. This threshold volume of care is increasing with the income measure relevant for the scheme and additionally depends on some individual and household characteristics. In practice, this means that there is a cap on the co-payment to be paid in each care period, which depends on income — and never exceeds it.[53]

When applicable, the marginal price of care that individuals have to pay out-of-pocket is €13.4 (18% of the national tariff of one hour of nursing care and 27% of the tariff of one hour of personal care).

Taking the case of individuals who are 65+ and are single (the most typical case in our population of interest), the co-payment cap (per care period) is equal to the maximum of:

$$\bar{CP} = max(18; 0.0115 \times \tilde{I} - 167)$$

where $\bar{CP}$ denotes the co-payment cap (per four-week period) and $\tilde{I}$ the relevant (annual) income measure. For individuals with income below €14,521 annually, this means that the co-payment will be capped to €18 per care period.[54]

On Figure 4.B.1, we have depicted the budget constraint (per four-week period) of individuals eligible for home care (who are single and 65+), in the plane (h, Y) (h is the number of

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[52]The hours taken into account group together the hours of personal care, nursing care and guidance that are part of the public LTC insurance scheme, and the hours of domestic help that are financed by municipalities (Wmo scheme).

[53]Whatever the levels of income, wealth and disability levels, an individual is never required to finance privately more than 25% of the total costs of the care she may receive in the community.

[54]The amount of €18 is also the minimum co-payment that individuals have to pay every four week as soon as they receive home care (for single individuals).

home care hours consumed per four-week period, Y is the composite good). $\bar{h}$ denotes the number of hours the individual was made eligible for (per care period) by CIZ; $\tilde{h}$ is the number of hours consumed beyond which the co-payment cap becomes binding (it is a function of the individual's income and characteristics X). For individuals with $\tilde{I} \leq 14,521$, except for the very first half-an-hour of care, the marginal price of care is null whatever their consumption level (as long as it remains below what they are entitled to).

Figure 4.B.1 – Budget constraint for single, 65+ individuals eligible for home care (per four-week period).
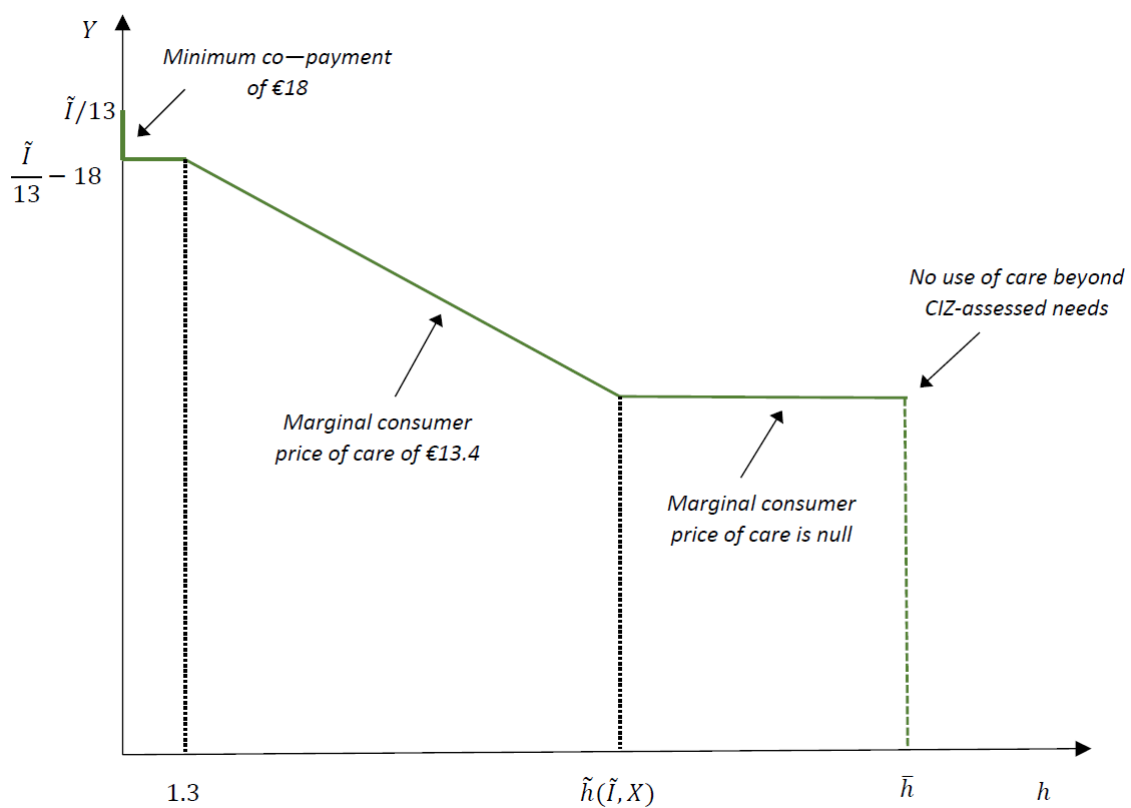
For individuals who are single but have not turned 65 yet, the annual income threshold (below which their co-payment is capped at €18 per care period) is of €21,391. For individuals who live with other household members, the minimum co-payment is of €25.8. This is also the co-payment cap for low-income individuals in this family setting (household income below €20,173 if both partners are 65 and older, or household income below €26,173 if one partner is younger than 65).

Relevant income measure for home care

The income measure taken into account to compute co-payments on home care includes all income from work, social benefits and pension benefits, as well as 4% of taxable financial

assets.[55]

For individuals living with other household members, taxable household income is taken into account.

For LTC services consumed in 2012, the computation of co-payments is based on income of year 2010 and on the financial assets held on January, 1st 2010.

Practical examples

Table 4.B.3 – Co-payments and effort rate on home care: Some practical examples

	Annual income Ĩ		
	€15,000	€30,000	€70,000
Very low use: 2 hours/week	€18 1.6%	€107 4.7%	€107 2.0%
Low use: 5.5 hours/week	€18 1.6%	€178 7.7%	€295 5.5%
Median use: 13 hours/week	€18 1.6%	€120 7.7%	€638 11.9%
Intensive use: 28.5 hours/week	€18 1.6%	€120 7.7%	€638 11.9%

NOTES: Co-payments per care period are expressed in euros. We assume here that per capita wealth is lower than €21,139. The effort rate is expressed in percentages and is equal to the ratio of co-payments to income. Levels of use (low, median and intensive) are defined in reference to ZZP packages (cf. Table 4.B.2).

As shown by Table 4.B.3, when individuals have no taxable wealth, the effort rate (computed as the ratio of co-payments to income) is systematically lower than 12%. For individuals with very low income, co-payments are capped at a very low level (effort rate of 1.6%, whatever the consumption level). Finally, for individuals with income close to the average equivalized household income observed in our population of interest (€30,000), the co-payments do not exceed 8% of income.

If we now take into account taxable wealth, we observe that effort rates increase: for an individual with average income and average per capita wealth (€150,000), the share of income that she has to pay for LTC can reach 10% even for low use of LTC. Yet, unless individuals enjoy very high levels of wealth, the effort rate remains lower than 16%.[56]

All in all, co-payments are capped at relatively low levels when care is received in the community, meaning that the public LTC system eliminates a substantial share of the

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[55]These are the assets held in bank accounts, stocks and bonds in excess of an amount of €21,139 per individual.

[56]This is the level reached by an individual with annual income equal to €70,000 and per capita wealth equal to €500,000. For an individual with an income €70,000, the maximum amount of co-payments (about €1,500 per 4-week period) she can be expected to pay for intensive care use is hit only if her wealth exceeds M€2.

financial risk associated with old-age disability for the majority of individuals.

Co-payment schedule on institutional care use

The concept of care period is not used for institutional care, as stays in institution are meant to be on a permanent basis.

The schedule for computing the monthly co-payment on institutional care depends on the individual and household characteristics of the beneficiary:

- When the beneficiary's spouse does not live in a nursing home, or when the beneficiary was admitted less than 6 months ago in the institutional setting, or when she is raising a child:

$$\text{CP}_{inst} = 0,125 \times (\tilde{\text{I}}^{inst}/12)$$

  where $\tilde{\text{I}}^{inst}$ is the relevant income measure. The co-payment is subject to a minimum of €156 and a maximum of €816.4 per month.

- Otherwise:

$$\text{CP}_{inst} = min(2,248; \tilde{\text{I}}^{inst}/12)$$

Co-payment on institutional care does not depend on the intensity of care received. Thus, for individuals with high income and moderate needs, co-payments can be much higher if they choose to enter a nursing home than if they convert their entitlements into home care use.

Relevant income measure for institutional care

The relevant income measure is the beneficiary's income minus health insurance premiums, an allowance for pocket money, a rebate if the beneficiary is retired, 15% of labor income and 25% of any income above the income threshold (€8,076 when the beneficiary is single; €9,785 for two beneficiaries living together).

4.C   Additional descriptive statistics

4.C.1. LTC utilization rates in the Dutch elderly population

To ease the comparison of the Dutch LTC system with other countries, Table 4.C.1 provides the share of the elderly population eligible for publicly-funded LTC and the utilization rates of LTC services.

Table 4.C.1 – LTC eligibility and utilization rates in the Dutch elderly population in 2012

	Among the 60+	Among the 65+
Eligible for LTC	14.8%	19.3%
Eligible for home care	9.7%	12.3%
Eligible for institutional care	6.9%	9.2%
Use of LTC	13.6%	17.7%
Use of home care	9.1%	11.8%
Use of institutional care	5.7%	7.7%
Take-up of cash benefits	0.6%	0.7%
Size of population	4,149,445	3,038,407

NOTES: Eligibility and utilization rates in the 60+ population (resp. 65+ population) are computed on the basis of all individuals who were born in 1952 (resp. 1947) or before and who were alive at least 1 day in 2012. Are taken into consideration only entitlements to "elderly LTC" (granted due to a somatic or psycho-geriatric condition; institutional stays in an institution other than a nursing home, a residential care home, a rehabilitation center or a palliative care center are not taken into account). Only the use of LTC and cash benefits while the individual was eligible for "elderly LTC" is taken into consideration.

These eligibility and utilization rates were obtained computing the number of all individuals eligible for or using either "elderly" institutional care or home care at any point of 2012, and dividing by the of individuals who were born before 1952 (or 1947) and were alive at least one day in 2012. Moreover, these figures do not take into consideration the elderly who were eligible for and used LTC services because of cognitive, physical or sensory handicaps or of long-term mental health problems. These are two important elements to keep in mind when interpreting these figures and comparing them with other available statistics (e.g. Muir (2017); OECD (2017a)): similar rates may be derived taking the ratio of the number of individuals eligible for or using (any type of) LTC to individuals alive one specific day of the year, depending on the country and type of care being considered.

4.C.2. Descriptive statistics: Individuals eligible for home care and individuals eligible for institutional care

Table 4.C.2 – Descriptive statistics by subgroup of eligibility

Eligible for:	Home care	Institutional care
	Mean	
Panel A: Eligibility		
Eligibility for home care in the year	1.000	0.254
Eligible for institutional care in the year	0.182	1.000
Eligible for both home care and institutional care	0.182	0.254
Value of entitlements to home care	18.726	4.052
Value of entitlements to institutional care	4.275	40.457
Value of LTC prescribed during the year	23.000	44.509
Number of indications over the year	2.0	1.8
Number of days of LTC eligibility	242.9	279.6
Panel B: LTC Use		
Any use of in-kind home care	0.854	0.364
Any use of institutional care	0.134	0.829
Any take-up of cash benefits	0.058	0.024
Use of LTC	0.905	0.956
Value of in-kind home care used	9.929	5.643
Value of institutional care used	2.216	31.271
Value of cash benefits	1.161	0.823
Value of total LTC used	13.307	37.737
Panel C: Demographic characteristics		
Gender: woman	0.645	0.704
Age: 60–69	0.159	0.064
Age: 70–79	0.302	0.192
Age: 80–84	0.233	0.227
Age: 85–89	0.195	0.269
Age: 90+	0.111	0.247
Has died in 2012	0.131	0.211
Married/in civil partnership	0.404	0.262
Partner in household	0.396	0.190
Number of household members	1.5	1.3
Origin: Dutch	0.869	0.898
Origin: foreign Western country	0.090	0.085
Origin: non-Western country	0.040	0.017
Panel D: Socio-economic characteristics		
Equivalized household income	30.569	27.721
Net wealth (per capita)	170.839	142.606
Owner of main residence	0.367	0.263
Observations	401262	287932

SAMPLES: Individuals 60 and older eligible for public "elderly" home care or institutional care in the Netherlands in 2012.

NOTES: Values of LTC entitlements and use and income are expressed in thousands euros per year. Wealth is expressed in in thousands euros. Individuals eligible for institutional care may be considered as having a partner in the household in the case they have not spent the entire year in an institutional setting.

4.C.3. Concentration curves of LTC use among individuals eligible for home care and among individuals eligible for institutional care

Figure 4.C.1 – Concentration curve of LTC use, by subgroup.
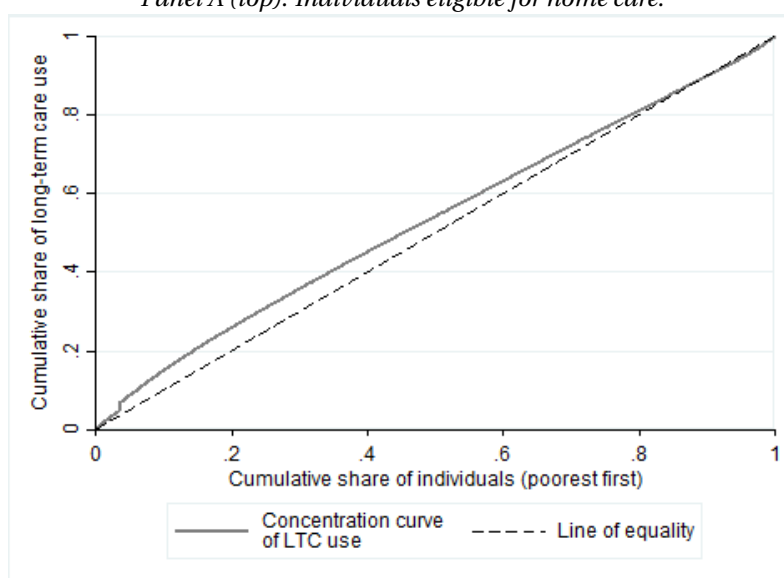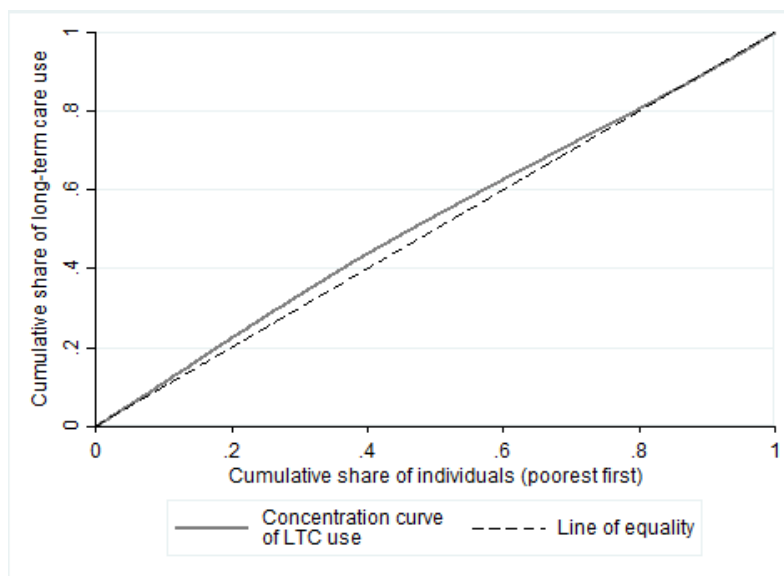
Panel A (top): Individuals eligible for home care.

Panel B (bottom): Individuals eligible for institutional care.

SAMPLE: Individuals 60 and older eligible for public home care (Panel A) or institutional care (Panel B) in the Netherlands in 2012 (N=401,262 in Panel A; N=287,932 in Panel B). NOTES: LTC use is expressed in annual monetary value. In Panel A, it is the sum of the value of home care services used in kind and of the imputed value of cash benefits granted while the individual was eligible for home care in 2012. In Panel B, it is the sum of the value of home care services used in kind and of the imputed value of cash benefits granted while the individual was eligible for home care in 2012. Individuals are ranked by their equivalized 2011 household taxable income.

4.C.4. Use of cash benefits by income deciles

In the Netherlands, individuals eligible for some public LTC have, in most cases, the option to opt for cash benefits rather than receiving in-kind care. In 2014, cash-benefits represented 9% of all LTC expenditures and the sustained rise in this figure turns out to be a policy concern (Maarse and Jeurissen, 2016). Yet the take-up of cash benefits (also called personal budgets, or PGB) is more frequent for individuals with handicaps or mental health problems than among the disabled elderly.

As displayed in Table 4.C.3, the proportion of the population eligible for some LTC in 2012 that used cash benefits that year is less than 5%. The take-up rate however increases at the top of the income distribution: it exceeds 9% among the 10% richest individuals. The positive income-gradient in the take-up of cash benefits is especially noticeable among individuals eligible for institutional care, while the differences in the average value of cash benefits for those who use them when eligible for institutional care are less marked. This pattern is consistent with anecdotal evidence suggesting that some very well-off individuals opt for cash benefits, when eligible for institutional care in order, to arrange their own LTC provision in a private luxury residential care home.[57]

Among individuals eligible for home care, the take-up rate of cash benefits is relatively high in the bottom 2 income deciles, and it increases again in the top 3 income deciles. When looking at the average value of cash benefits being received, we now see a strong positive income-gradient: among those receiving cash benefits when eligible for home care, the income-rich beneficiaries receive an amount 50% higher on average. Again, in line with some anecdotal evidence, these patterns may suggest two things: i) the poor are more likely than individuals in the middle of the distribution to opt for cash benefits to formally hire some informal caregivers, and ii) the rich are more likely to take up cash benefits, even at relatively high levels of needs as assessed by CIZ, to arrange their home care provision themselves.

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[57]On aggregate though, privately-funded LTC facilities seem to remain marginal in the Netherlands.

Table 4.C.3 – Take-up and average value of cash benefits, by income deciles.

	Entire population	Eligible for:	
		Home care	Institutional care
	(1)	(2)	(3)
	Take-up of cash benefits		
Income decile 1	0.038	0.090	0.011
Income decile 2	0.043	0.065	0.016
Income decile 3	0.029	0.040	0.015
Income decile 4	0.026	0.033	0.014
Income decile 5	0.032	0.042	0.015
Income decile 6	0.034	0.044	0.019
Income decile 7	0.034	0.042	0.021
Income decile 8	0.046	0.055	0.032
Income decile 9	0.065	0.076	0.049
Income decile 10	0.093	0.108	0.072
Observations	616934	401262	287932
	Average imputed value of cash benefits among users		
Income decile 1	18.829	17.399	32.787
Income decile 2	17.895	16.680	31.246
Income decile 3	18.888	18.007	32.053
Income decile 4	18.926	17.623	32.762
Income decile 5	19.150	18.129	32.341
Income decile 6	18.924	17.683	34.028
Income decile 7	19.870	18.731	33.403
Income decile 8	19.497	17.644	32.605
Income decile 9	22.605	21.425	33.869
Income decile 10	27.188	26.473	35.898
Observations	27143	23316	7035

NOTES: The average value of cash benefits is computed among individuals who used at least once cash benefits in the year (while eligible for home care in Column (2), or while eligible for institutional care in Column (3)). The number of observations displayed on the last row gives the number of individuals who were granted cash benefits in 2012 in each of the samples. The value of cash benefits used has to be imputed based on information on LTC eligibility. The value is expressed in thousands euros per year. This is the value of cash benefits before income-dependent deductions apply.

4.D Complementary inputs on horizontal inequity assessment and decomposition analysis

4.D.1. Estimates of the model of LTC use: baseline sample

In this Appendix, we complement the comments made on the estimates of the regression of LTC use on needs and non-need factors (Equation (4.9), Section 5.3), on which the decomposition analysis is based. Table 4.D.1 reports the estimates $\hat{\beta}_k^{NN}$. For better readability, we report the coefficients associated with the income, wealth and regional dummies separately (Figures 4.D.1 to 4.D.2).

The negative income gradient in LTC use is mostly driven by the high positive coefficients in the bottom of the income distribution: being among the 10% poorest individuals is associated with an increase of almost €2,500 in annual LTC use, as compared to being in the middle of the income distribution (5th decile), while differences between income deciles 2 to 8 are rather limited (Figure 4.D.1). The top two income deciles use significantly less (about €1,000) than individuals in the middle of the income distribution. Differences across the wealth distribution — controlling for income — are much less pronounced (Figure 4.D.2).

Having a partner in the household is associated with lower LTC use (-€3,000 a year). This seems to suggest that the partner provides informal care substituting for formal LTC services above and beyond the level of "usual care" provided by co-residing relatives that should, by law, be taken into account by CIZ assessors. Following this interpretation, the coefficient could be read as a rough estimate of the additional savings that informal care could generate for the public LTC insurance — beyond the domestic help and personal care that household members are already expected to provide. Yet this coefficient may capture a composition effect. Individuals who live in an institution do not have a partner in the house, by definition, and they use LTC services that tend, in most cases, to be more expensive than care provided in the community. Surprisingly maybe, having an additional co-residing relative (beyond the partner) is associated with a higher value of LTC use.[58]

Overall, our estimates show that demographic and socio-economic characteristics have a substantial impact on the use of LTC, even when we control for CIZ-assessed LTC needs. The statistical significance of our coefficients *per se* suggests that the Dutch elderly population do receive different levels of care for equal needs, depending on their characteristics.

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[58]Given that only few elderly in the Netherlands reside with a relative other than their spouse, this coefficient may pick up very specific living arrangements and informal care patterns. It might also be that the "extra" household members compete for care if they are young children or elders as well, or that the non-coordination of potential informal caregivers induces a Nash equilibrium with lower informal care provision than the level we would observe in the presence of a unique co-residing relative (see e.g. Fontaine *et al.* (2009) for an illustration of this mechanism in the case the potential caregivers are non-co-residing children).

Table 4.D.1 – Model of LTC use: OLS regression results (entire sample)

	Dependent variable: value of LTC use
	(1)
Need variable	
CIZ-assessed LTC needs	1.000
	(.)
Non-need variables	
Age: 60–69	-1.929***
	(0.095)
Age: 70–79	-0.856***
	(0.067)
Age: 80–84	*Reference*
Age: 85–89	0.268***
	(0.063)
Age: 90+	0.598***
	(0.070)
Gender: woman	0.662***
	(0.053)
Partner in household	-2.932***
	(0.074)
Number of household members	0.179***
	(0.051)
Origin: the Netherlands	*Reference*
Origin: foreign Western country	-0.759***
	(0.088)
Origin: Turkey	-5.370***
	(0.308)
Origin: Morocco	-3.926***
	(0.396)
Orign: Suriname	-4.461***
	(0.295)
Orign: Dutch Caribbean	-1.870***
	(0.558)
Origin: other non-Western country	-4.957***
	(0.374)
Owner of main residence	-0.452***
	(0.086)
Dummies for LTC contracting regions	Yes
	$p < 0.01$
Dummies for equivalized household income deciles	Yes
	$p < 0.01$
Dummies for per capita wealth deciles	Yes
	$p < 0.01$
Constant	-9.493***
	(0.236)
Observations	616934
R^2	0.662

NOTES: Huber-White robust standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The monetary value of LTC use and CIZ-assessed needs, income and wealth are expressed in thousands euros. Standard errors in parentheses. P-values for the test of joint significance (F-test) of the dummies for contracting regions, for income deciles and for wealth deciles.

Figure 4.D.1 – Estimates of the coefficients of income deciles.
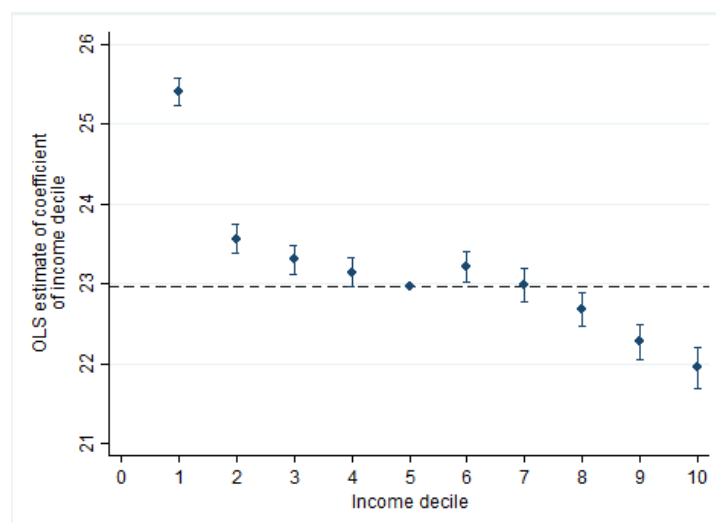
NOTES: For each coefficient, the 5% confidence interval is depicted (computed using the Huber-White robust standard errors). LTC use is expressed in monetary value, in thousands euros per year. Individuals are ranked by their equivalized 2011 household taxable income. Estimates from the baseline regression (Equation (4.9)).
READING: Being in the 2nd bottom income decile is associated with a higher use of LTC by €2,500, compared to belonging to the 5th income decile.

Figure 4.D.2 – Estimates of the coefficients of wealth deciles
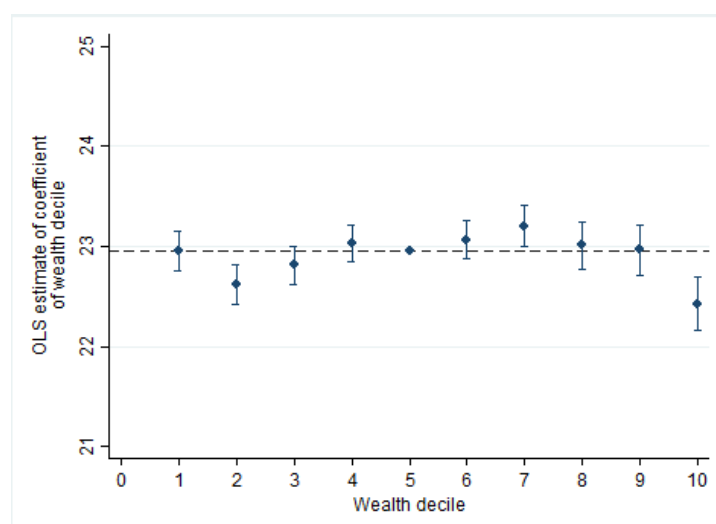
NOTES: For each coefficient, the 5% confidence interval is depicted (computed using the Huber-White robust standard errors). LTC use is expressed in monetary value, in thousands euros per year. Individuals are ranked by their 2011 per capita household wealth. Estimates from the baseline regression (Equation (4.9)).
READING: Being in the 10th wealth decile is associated with a lower use of LTC by €500, compared to belonging to the 5th wealth decile.

Figure 4.D.3 – Estimates of the coefficients of LTC contracting regions.
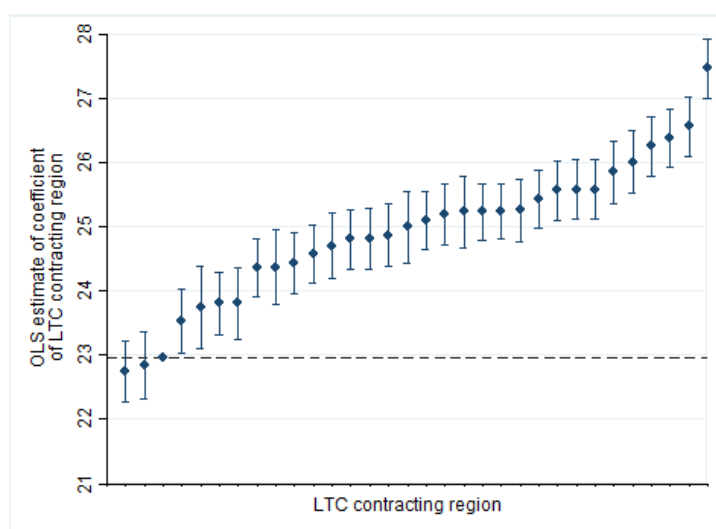
NOTES: For each coefficient, the 5% confidence interval is depicted (computed using the Huber-White robust standard errors). LTC use is expressed in monetary value, in thousands euros per year. Ranking of regions from the left to the right is made according to the value of their coefficient. Estimates from the baseline regression (Equation (4.9)). READING: Living in the region ranked eight from the left is associated with a higher LTC use of about €1,500, compared to living in the region ranked first from the left.

4.D.2. Concentration indexes of CIZ needs and non-need factors

Table 4.D.2 – Concentration indexes of CIZ-assessed needs and non-need factors.

	Entire sample	Eligible for:	
		Home care	Institutional care
	(1)	(2)	(3)
CIZ-assessed LTC needs	-0.0358	0.0136	-0.0260
Age	-0.0134	-0.0123	-0.0088
Woman	-0.0728	-0.0777	-0.0599
Having a partner in the household	0.0263	0.2443	–
Number of household members	0.1307	0.1218	–
Married	–	–	0.1843
Origin: foreign Western country	0.0434	0.0385	0.0498
Origin: Turkey	-0.1407	-0.2033	-0.0990
Origin: Morocco	-0.0868	-0.1581	-0.0231
Origin: Suriname	-0.2603	-0.2834	-0.2782
Origin: Dutch Caribbean	-0.2706	-0.2758	-0.3101
Origin: other non–Western country	-0.2177	-0.2602	-0.2048
Equivalized household income	0.3215	0.3120	0.3228
Per capita household wealth	0.4459	0.4314	0.4585
Home owner	0.3264	0.2759	0.3771

NOTES: When estimating the model of LTC use on the subgroup of individuals eligible for institutional care, we do not include the household composition as a control variable. In additional, we replace the dummy "having a partner in the house" by the marital status.

A negative (positive) concentration index indicates that the characteristic is relatively more (less) widespread among the income-poor than among the rich. For example, Table 4.D.2 indicates that women and non-Western migrants tend to be poorer, while home owners and individuals with a partner tend to be richer.

4.D.3. Contributions of non-need factors to horizontal inequity in the subgroup analysis

Figure 4.D.4 provides the decomposition of the horizontal inequity index in each of the subgroups, which is discussed in Section 6.2.

The contribution of each factor depends on its sub-sample average (reported in Table 4.D.2, Appendix 4.D) and on the OLS estimate of the coefficient of this factor in the sub-group regression of LTC use on needs and non-need factors (reported in Table 4.D.3, Appendix 4.D, p. 305).

Figure 4.D.4 – Contribution of non-need factors to horizontal inequity, by subgroup.
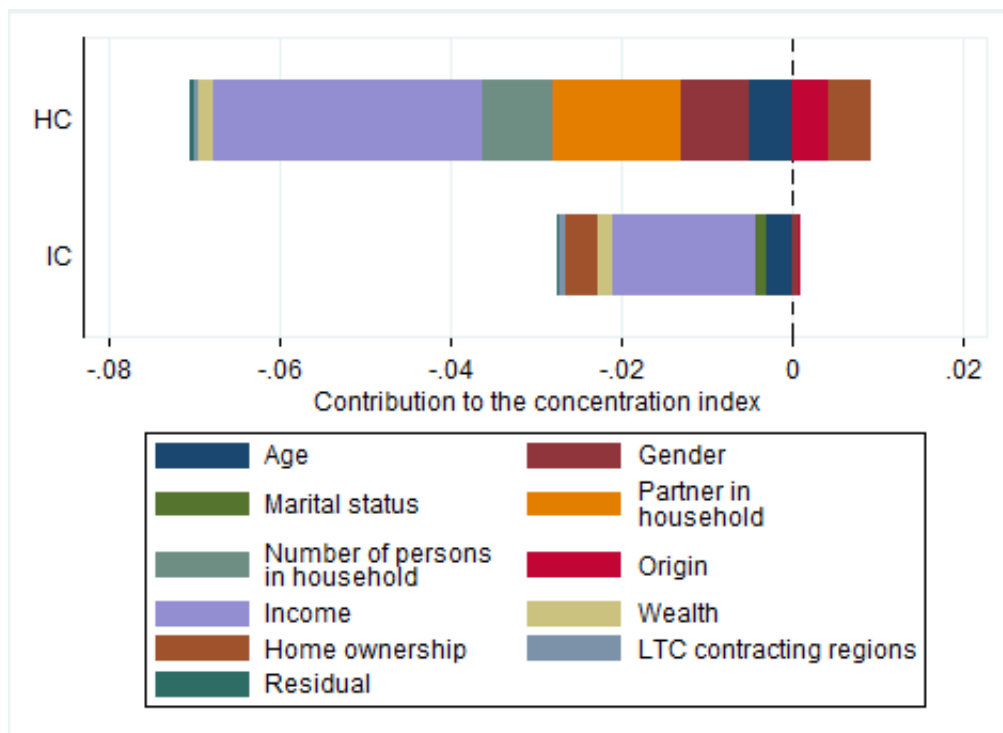
SAMPLES: Individuals 60 and older eligible for either public "elderly" home care (top bar, N=401,262) or public "elderly" institutional care (bottom bar, N=287,932) in the Netherlands in 2012.
NOTES: Variables depicted on the right-hand side of 0 contribute to pro-rich inequality; variables on the left-hand side of 0 contribute to pro-poor inequality. Having a partner in the house and the number of additional household members are variables only included in the model of LTC use estimated in the subgroup eligible for home care. Conversely, marital status is only included in the model of LTC use estimated on the subgroup eligible for institutional care.
READING: On a total horizontal inequity index of −0.0612, income contributes negatively by −0.0314 (top bar).

4.D.4. Estimates of the model of LTC use in the subgroups eligible for home care or eligible for institutional care

The linear estimates of the model of LTC use that are used for the decomposition analysis in the subgroups of individuals eligible for home care or institutional care are presented in Table 4.D.3, Columns (4) and (6).

This Table additionally presents the estimates for an alternative specification of the model of LTC use (for the three samples of interest), which we discuss in Appendix 4.E.

Notes for Table 4.D.3: Columns (1), (3) and (5) are obtained by not constraining the coefficient of needs to 1. All specifications include dummies for LTC contracting regions, for income deciles and for wealth deciles. In each specification, the F-test for joint significance of LTC contracting regions (resp. income deciles or wealth deciles) gives a p-value $p < 0.01$. Age 80–89 is the category of reference for age dummies; coming from the Netherlands is the category of reference for the migrant background. Linear estimates are obtained by OLS estimation in Columns (1), (3) and (5) and by Maximum Likelihood estimation in Columns (2), (4) and (6). We use the Stata command `cnsreg` to run the constrained linear estimations.

The table provides the Huber-White robust standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4.D.3 – Model of LTC use: OLS regression results by subgroup.

	Entire sample		Home care		Institutional care	
Eligible for:	(1)	(2)	(3)	(4)	(5)	(6)
CIZ-assessed LTC needs	0.687***	1.000	0.499***	1.000	0.990***	1.000
	(0.002)	(.)	(0.003)	(.)	(0.001)	(.)
Age: 60-69	-3.273***	-1.929***	-1.142***	-1.808***	-2.799***	-2.762***
	(0.078)	(0.095)	(0.069)	(0.112)	(0.128)	(0.128)
Age: 70-79	-1.779***	-0.856***	-0.684***	-0.633***	-1.390***	-1.368***
	(0.058)	(0.067)	(0.052)	(0.081)	(0.081)	(0.081)
Age: 85-89	1.270***	0.268***	0.567***	-0.182*	0.615***	0.602***
	(0.058)	(0.063)	(0.057)	(0.084)	(0.069)	(0.069)
Age: 90+	3.275***	0.598***	1.714***	-1.381***	1.397***	1.360***
	(0.066)	(0.070)	(0.078)	(0.113)	(0.070)	(0.070)
Gender: woman	-0.061	0.662***	0.460***	1.574***	-0.631***	-0.634***
	(0.045)	(0.053)	(0.044)	(0.070)	(0.059)	(0.059)
Married					-0.805***	-0.794***
					(0.064)	(0.064)
Having a partner in the household	-5.060***	-2.932***	-1.278***	-1.579***		
	(0.066)	(0.074)	(0.059)	(0.095)		
Number of household members	1.099***	0.179***	0.168***	-0.450***		
	(0.045)	(0.051)	(0.045)	(0.073)		
Origin: foreign Western country	-0.493***	-0.759***	-0.338***	-1.065***	-0.079	-0.084
	(0.075)	(0.088)	(0.071)	(0.115)	(0.096)	(0.096)
Origin: Turkey	-5.978***	-5.370***	-2.594***	-5.093***	-3.651***	-3.649***
	(0.226)	(0.308)	(0.165)	(0.322)	(0.724)	(0.727)
Origin: Morocco	-4.771***	-3.926***	-1.264***	-3.373***	-4.195***	-4.186***
	(0.298)	(0.396)	(0.240)	(0.416)	(0.897)	(0.900)
Orign: Suriname	-3.046***	-4.461***	-0.653**	-5.906***	-0.140	-0.150
	(0.242)	(0.295)	(0.227)	(0.362)	(0.372)	(0.373)
Orign: Dutch Caribbean	-1.603***	-1.870***	0.452	-1.740*	-0.411	-0.414
	(0.483)	(0.558)	(0.478)	(0.704)	(0.611)	(0.611)
Origin: foreign non-Western country	-4.709***	-4.957***	-2.262***	-5.495***	-1.846***	-1.833***
	(0.296)	(0.374)	(0.253)	(0.455)	(0.480)	(0.481)
Owner of main residence	-1.660***	-0.452***	-0.093	0.498***	-1.412***	-1.370***
	(0.076)	(0.086)	(0.075)	(0.117)	(0.094)	(0.094)
Constant	-0.392	-9.493***	-0.110	-7.488***	-7.862***	-8.217***
	(0.211)	(0.236)	(0.205)	(0.332)	(0.254)	(0.254)
Observations	616934		401262		287932	
R^2	0.662	–	0.595	–	0.734	–

NOTES: See page 4.D.

4.E   Playing around with the norm of vertical equity in use

As explained in Section 3.2, the empirical assessment of *horizontal* inequity in use must rely on a stance regarding *vertical* equity in use. We have claimed that CIZ eligibility decisions provide an explicit and relevant norm of vertical equity in the use of LTC services within the Dutch LTC system.

An alternative assumption that could be made with our data is that CIZ-assessed needs sum up all the relevant information regarding the legitimate needs for LTC without *exactly* embodying the relevant norm of vertical equity. We could then invoke the conventional assumption that "on average the system gets it right" in terms of how much individuals with different levels of needs should receive different levels of care (van de Poel *et al.*, 2012). Put it differently, rather than assuming that CIZ eligibility decisions provide both a relevant measure of needs *and* determine how needs for LTC should legitimately relate to use, we could instead assume that CIZ eligibility decisions indeed give a relevant measure of needs, but that the system-wide average relationship between needs and use reveals what is fair.

One drawback of this alternative assumption is that it amounts to ruling out that there is vertical inequity in use on average. In addition to the institutional elements that make a strong case for considering that CIZ decisions embody an equity norm (as discussed in Section 3.2), this is the reason why we stick to our initial assumption. We however show in this Appendix the results we would obtain under the alternative assumption. This way, we will provide an assessment of how different the conclusions would be if we were to rely on a different (less grounded, in our opinion) value judgment.

The literature has underlined that the results from an empirical assessment of horizontal inequity may be extremely sensitive to the explicit or implicit stance in terms of fairness. For the studies that rely on survey data with no straightforward, single measure of needs, this means that estimates may vary depending on where we draw the line between legitimate determinants of care use (needs) and illegitimate ones (non-need factors). This is remarkably illustrated by Morris *et al.* (2005) in the context of health care use; using SHARE data, Ilinca *et al.* (2017) show that the horizontal inequity index in formal home care use varies substantially in some European countries when household structures are considered as needs rather than as non-need factors.

For the reader not familiar with this literature, this Appendix will also precisely shows how our empirical approach (closely) relates to the methodology used in the other existing papers that have derived a synthetic measure of horizontal inequity in the use of LTC services in several European countries (García-Gómez *et al.*, 2015; Carrieri *et al.*, 2017; Ilinca *et al.*, 2017; Rodrigues *et al.*, 2017)

4.E.1. Statistical derivation of the norm of vertical equity in use

If we take that CIZ assessments provide a relevant measure of needs but do not say how these needs should legitimately relate to LTC use, we can statistically derive the norm of vertical equity in use, following the methodology developed by Wagstaff and van Doorslaer (2000b).

In our framework, assume the monetary value of LTC services consumed by individual i, y_i, is a linear function of the needs as assessed by CIZ, x_i, and of the K "non-need variables", z_i^k, which are assumed to be additively separable:

$$y_i = \beta_0 + \beta^{\mathrm{N}} x_i + \sum_{k=1}^{K} \beta_k^{\mathrm{NN}} z_i^k + \epsilon_i \tag{4.10}$$

where ϵ_i is an idiosyncratic error term. From the estimation of Equation (4.10), we construct the *need-predicted* LTC use $\hat{y}_i^{\mathrm{N}}$ as:

$$\hat{y}_i^{\mathrm{N}} = \hat{\beta}_0 + \hat{\beta}^{\mathrm{N}} x_i + \sum_{k=1}^{K} \hat{\beta}_k^{\mathrm{NN}} \bar{z}^k \tag{4.11}$$

where $\bar{z}^k$ is the population average of variable z^k.[59] Need-predicted use gives the value of LTC services that would be observed if only needs mattered. We now compute the *need-standardized* LTC use for individual i, $\hat{y}_i^{\mathrm{IS}}$, as:

$$\hat{y}_i^{\mathrm{IS}} = y_i - \hat{y}_i^{\mathrm{N}} + \bar{y} \tag{4.12}$$

The horizontal inequity index of LTC use, HI(y), is then equal to:

$$\mathrm{HI}(y) = \mathrm{CI}(\hat{y}^{\mathrm{IS}}) \tag{4.13}$$

$$= \mathrm{CI}(y) - \mathrm{CI}(\hat{y}^{\mathrm{N}}) \tag{4.14}$$

In this framework, the contribution of needs to total income-related inequality in use, $\mathrm{CI}(\hat{y}^{\mathrm{N}})$, is equal to $\left(\beta^{\mathrm{N}} \frac{\bar{x}}{\bar{y}}\right) \mathrm{CI}(x)$. The horizontal inequity index is indeed obtained by subtracting fair inequalities from total inequalities.

Obviously, the analysis bears close resemblance with the empirical approach we adopt in the paper. Equation (4.9), on which we base the decomposition of horizontal inequity in Section 5.3, is nested in Equation (4.10): we obtain it by constraining the coefficient β^{N} to 1. We can fit our own analysis into this more general framework by defining the need-predicted LTC use $\hat{y}_i^{\mathrm{N}}$ in our baseline analysis as $x_i + (\bar{y} - \bar{x})$. We obtain: $y^{\mathrm{IS}} = (y_i - x_i) + \bar{x}$. In both cases,

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[59]Taking the population averages of need variables to plug them in the need-predicted care is a normalization made to ensure that the population average of $\hat{y}^{\mathrm{N}}$ is equal to $\bar{y}$.

the horizontal inequity index is equal to the concentration index of the need-standardized use, or to the difference between the concentration index of actual use and the concentration index of need-predicted use.[60]

In our own analysis, the inclusion of non-need factors only affects the decomposition analysis: whether we can interpret the β_k^{NN} in a causal way in Equation (4.10) (with β^{N} equal to 1) or not will affect the way we can interpret the contribution of each factor, but will not impact the computation of the horizontal inequity index.

When relying on a statistical derivation of the norm of vertical equity, the empirical challenge consists in specifying the "right" model of care use. The econometric model should be such that the estimate of the coefficient ahead of the need variable reveals how much an additional euro of CIZ entitlements would translate into extra spending on LTC, assuming that the system is vertically equitable. The inclusion of the non-need variables in the model has been the object of some debates (Wagstaff and van Doorslaer, 2000a), but there seems now to be a consensus that all non-need determinants of LTC use that correlate with needs should be included. Failing to include one such factor in the model would induce an omitted variable bias on $\hat{\beta}^{\text{N}}$. In practical terms, this means we would end up comparing individuals with different needs that also differ in some other (illegitimate) determinants of LTC use. This will in turn bias the estimate of the concentration index of need-predicted use and, ultimately, HI. The derivation of HI under the alternative assumption is thus sensitive to having a limited set of socio-economic and demographic control variables.

In the standard methodology, the decomposition formula rewrites as:

$$\text{CI}(y) = \left(\beta^{\text{N}}\frac{\bar{x}}{\bar{y}}\right)\text{CI}(x) + \sum_{k=1}^{\text{K}}\left[\left(\beta_k^{\text{NN}}\frac{\bar{z}^k}{\bar{y}}\right)\text{CI}(z^k)\right] + \frac{2cov(\epsilon, r^{\text{I}})}{\bar{y}} \qquad (4.15)$$

$$= \text{C}^{\text{N}}(y) + \text{C}^{\text{NN}}(y) + \frac{2cov(\epsilon, r^{\text{I}})}{\bar{y}} \qquad (4.16)$$

$$= \text{C}^{\text{N}}(y) + \text{HI}(y) \qquad (4.17)$$

We replicate the analysis presented in the core of the paper without constraining the coefficient β^{N} to 1. The results are presented in the following two Appendices. We use Equation (4.15) to understand the differences with our baseline results:

- The difference between the contribution of needs in our own analysis and under the alternative assumption (that $\beta^{\text{N}} \neq 1$) will be all the higher as $\hat{\beta}^{\text{N}}$ differs from 1.
- While in our analysis, the residual in the decomposition was unambiguously treated as horizontal inequity, this is less clear-cut under the alternative assumption. If ϵ includes unobserved factors that correlate with needs, then the residual may be the counterpart of

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[60]In the case β^{N} is constrained to 1, the contribution of needs to total inequality is: $\text{CI}(\hat{y}^{\text{N}}) = \frac{\bar{x}}{\bar{y}}\text{CI}(x)$.

the omitted variable bias on $\hat{\beta}^N$. If the residual is high, one may take the contribution of non-need factors $C^{NN}(y)$ as a conservative horizontal inequity index (Bago d'Uva *et al.*, 2009).[61]

- Finally, the difference in the contribution to HI of a given non-need factor z^k in our baseline analysis and under the alternative assumption will arise because of the difference in the estimate $\hat{\beta}_k^{NN}$ in the two specifications. The contribution of z^k will varies all the more between the two analysis as z^k correlates with CIZ-assessed needs, x.

4.E.2. Robustness of the results under the alternative assumption

Linear estimation of the impact of needs and non-need factors

In Table 4.D.3 (page 305), we report the estimates of Equation (4.10) for each subgroup and each specification. In Columns (2), (4) and (6), β^N is constrained to 1 (as in our core analysis); in Columns (1), (3) and (5), it is estimated empirically.

Comparing Columns (5) and (6), we observe that the alternative assumption makes very little difference when we focus on individuals eligible for institutional of care: $\hat{\beta}^N$ is extremely close to 1. This means that the norm of vertical equity of CIZ assessors almost perfectly fits the average relationship between entitlements for care and actual use. This result stands in sharp contrast with the results obtained on the individuals eligible for home care: $\hat{\beta}^N$ is less than 0.5, meaning that an additional €1,000 of needs for home care empirically translates into an additional €498 of LTC use on average. The analysis on the entire population is in-between, as the partial correlation between needs and use is 0.687.

Concentration of needs and horizontal inequity index

When conducting the analysis on the entire population, we see that the horizontal inequity index HI is affected by the assumption we make on the norm of vertical equity in use. However, under both assumptions, the horizontal inequity index is negative.

Constraining the coefficient to 1 has more impact of the decomposition of inequality in use for the subgroup of individuals eligible for home care. This was expected given than $\hat{\beta}^N$ is found to be much further away from 1 in the subgroup eligible for home care.[62]

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[61]As suggested by Bago d'Uva *et al.* (2009), in the empirical analysis of horizontal equity that rely on a statistical derivation of the norm of vertical equity in use, the residual term can be alternatively considered as reflecting unobserved needs. In this more conservative approach, the horizontal equity index would correspond only to C^{NN}. Given that we have identified needs *ex ante* here, the high residual in the decomposition of inequality does not challenge the interpretation of the conventional HI. However, as it may reflect omitted variables or unmodelled heterogeneity along the income distribution, a high residual calls for a non-causal interpretation of the estimates of the non-need factors β_k^{NN}. In particular, if we were to observe some of the components of the error term, the contribution of income might be lower.

[62]C^N in the constrained estimation is expected to be equal to 1/0.49 (about 2) times the value of C^N obtained when $\beta^N \neq 1$.

Table 4.E.1 – Concentration of needs and horizontal inequity index: Comparison of results under the two norms of vertical equity in use.

	CI	C^N	C^{NN}	Residual	HI
	(1)	(2)	(3)	(4)	(5)=(1)-(2)
Entire population					
$\beta^N = 1$	-0.0853***	-0.0485***	-0.0365	-0.0002	-0.0368***
$\beta^N \neq 1$	-0.0853***	-0.0333***	-0.0516	-0.0003	-0.0520***
Subgroup eligible for home care					
$\beta^N = 1$	-0.0358***	+0.0254***	-0.0606	-0.0006	-0.0612***
$\beta^N \neq 1$	-0.0358***	+0.0126***	-0.0483	-0.0001	-0.0484***
Subgroup eligible for institutional care					
$\beta^N = 1$	-0.0453***	-0.0238***	-0.0215	-0.0000	-0.0215***
$\beta^N \neq 1$	-0.0453***	-0.0236***	-0.0217	-0.0000	-0.0217***

SAMPLES: Individuals 60 and older eligible for public "elderly" LTC in the Netherlands in 2012 (N=616,934), eligible for home care (N=401,262) or eligible for institutional care (N=287,932).
NOTES: Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Computation of standard errors are described in Appendix 4.G. Bootstrap derivation of the standard errors of the contribution of non-need factors and of the residual has not been completed yet.

Ultimately, what induces the difference between the two estimations in terms of the concentration of needs (C^N) — and thus the split between fair inequalities and potential horizontal inequity — is the fact that the partial correlation between CIZ entitlements and LTC use varies across the income distribution. The average under-use of CIZ entitlements is (overall) lower in the bottom of the income distribution than in the 5th income decile, and is much more pronounced as income increases (see Appendix 4.E). Comparing Panel A and Panel B of Figure 4.E.3, we indeed see that the differences across the income distribution in terms of the gap between actual use and CIZ entitlements are more marked (in absolute value) in the subgroup eligible for home care.

Despite some differences, our conclusions in terms of horizontal inequity are robust to statistically deriving the norm of vertical equity in use: the horizontal inequity index is statistically and practically significant and negative, and is stronger when individuals are eligible for home care than when they are eligible for institutional care.

Decomposition analysis

The comparison of the decomposition analysis depending on the value of β^N is reported in Figure 4.E.1, for all three samples.

When looking at the entire sample, the differences in the relative contributions to inequity in the entire sample are not striking.

When focusing on individuals eligible for home care, the number of persons in the house-

Figure 4.E.1 – Decomposition of horizontal inequity: Comparison of results under the two norms of vertical equity in use.
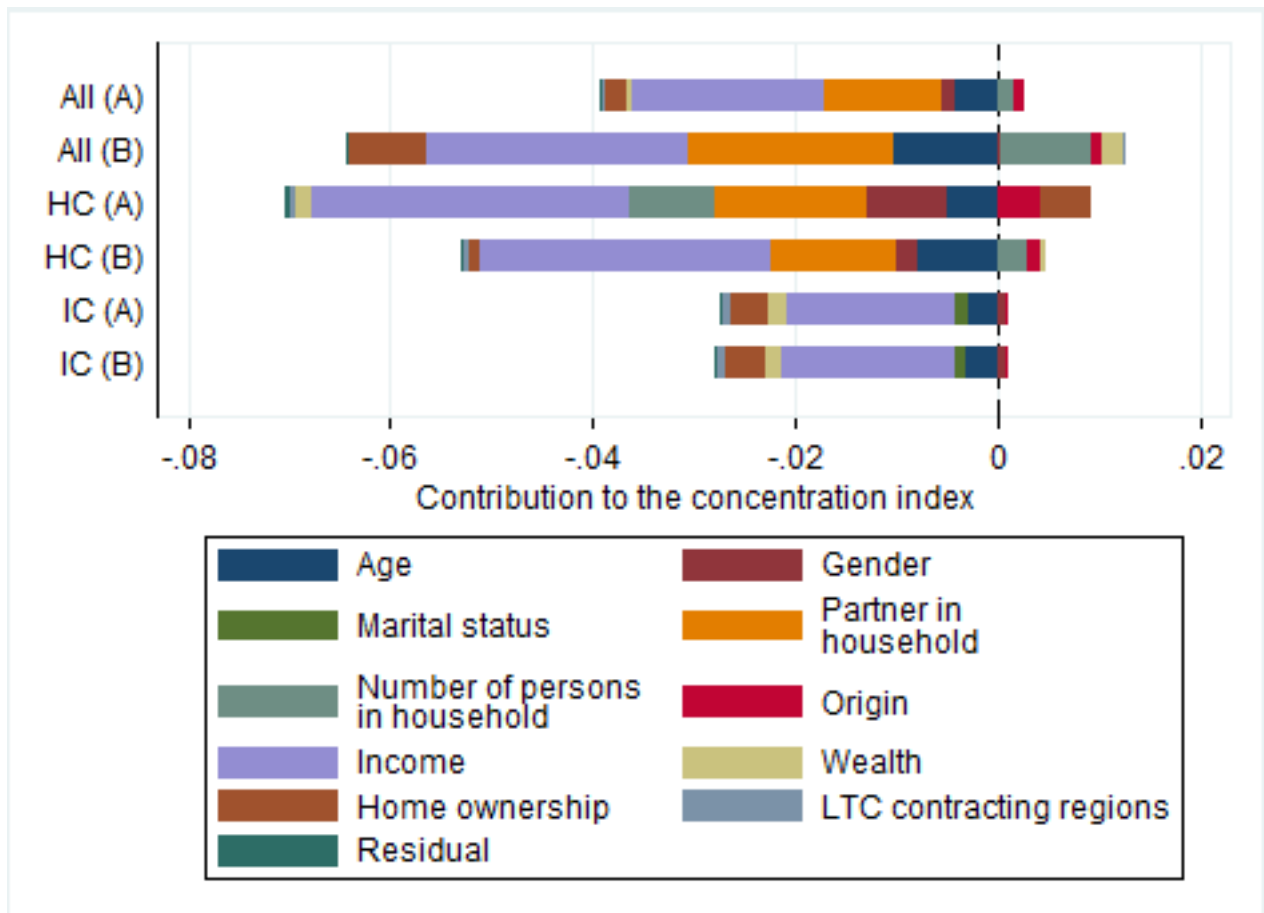
SAMPLES: Individuals 60 and older eligible for public "elderly" LTC (top two bars), eligible for home care (middle two bars) or institutional care (bottom two bars) in the Netherlands in 2012 (N=401,262).
NOTES: Bars 1, 3 and 5 (from the top) give the decomposition obtained in the baseline analysis ($\beta^N = 1$); bars 2, 4 and 6 give the decomposition derived under the alternative norm of vertical equity ($\beta^N \neq 1$). Variables depicted on the right–hand side of 0 contribute to pro-rich inequality; variables on the left–hand side of 0 contribute to pro-poor inequality.

hold (beyond the presence of a spouse) is found to contribute to pro-poor inequity in our baseline analysis, while it is found to have a pro-rich contribution under the alternative assumption. This is due to the negative correlation between CIZ-assessed needs and household size, which is partially picked up by coefficient β^N under the alternative assumption, but not in our core analysis. The pro-rich contribution of age is more pronounced under the alternative assumption, while the contributions of home ownership, origin and gender decrease much.

When looking at individuals eligible for institutional care, results are much more stable: again, this was expected given that a β^N-estimate close to 1 reveals that needs and the non-need factors little correlate in this subgroup. Only gender is found to have a (pro-poor) contribution to horizontal inequity under the alternative assumption while it has essentially

none with our preferred assumption.

Under both assumptions and in all samples, the contributions of wealth and LTC contracting regions are found to be very limited.

We thus conclude that, although our conclusions are robust to making a different assumption on the norm of vertical equity in use, the decomposition of the horizontal inequity index is less so when we focus on the population eligible for home care. This is where our stance on what the assumption we believe is more credible is empirically matters.

This also suggests that the results from the decomposition analysis should be interpreted in a cautious way, keeping in mind that the contributions are non-causal. A downside of our administrative data is that they do not contain information on informal care receipt. For personal care and assistance with IADL and ADL limitations, informal care was found to be a substitute for formal care (Bolin *et al.*, 2008; Bonsang, 2009; Van Houtven and Norton, 2004). If informal care receipt correlates with non-need factors, then our estimates of their contributions to inequality may be biased. This bias may in particular affect the contributions of income and marital status. If income correlates negatively with informal care provision in the Netherlands, as suggested by Rodrigues *et al.* (2017), the impact of income on LTC use and its contribution to pro-poor differential use would be *under*-estimated.

4.E.3. Conversion rates of CIZ entitlements into use by income decile

We estimate a variant of Equation (4.10):

$$y_i = \beta_0 + \beta^N x_i + \sum_{d=1, d \neq 5}^{10} \theta^d I_i^d + \sum_{d=1, d \neq 5}^{10} \mu^d I_i^d x_i + M_i' \theta^{NN} + \nu_i$$

where I_i^d is a dummy equal to 1 if individual i is in the dth income decile, and M_i is the vector of non-need factors excluding the income deciles. Income decile 5 is defined as the reference category. If coefficients μ^d, $d = 1, ..., 10; d \neq 5$ differ from zero, this means that the ability to convert one additional euro of CIZ entitlements into actual use (in value) varies across the income distribution. This could also be interpreted as evidence that the effect of income on use varies with the levels of CIZ-assessed needs.

Figure 4.E.3 displays the estimates $\hat{\beta}^N + \hat{\mu}^d$ for the income deciles $d = 1, ..., 10$. Empirically, we find the coefficients μ^d to be almost linearly decreasing with income decile in the entire sample analysis (Figure 4.E.2), and statistically significantly different from the coefficient associated with the reference decile.

This means that low-income individuals are able to convert more of additional entitlements for LTC into actual use. This pattern is observed when considering the entire population and the total LTC use. It holds when considering the sub-sample of individuals eligible for home care (Figure 4.E.3, Panel A) if we exclude deciles 1 and 2: one additional euro of CIZ entitlements translate into €0.6 more LTC use for deciles 3 and 4, and to only €0.45 more for deciles 6–7. When looking at individuals eligible for institutional care and their use of LTC, the pattern is less salient; yet the bottom 4 deciles are found to "convert" 1 euro more of entitlements into almost 1 euro more LTC use, 5 cents more than the top 3 deciles.

When individuals are eligible for institutional care, if they choose to enter an institution they have virtually no ability to adjust the intensity of the care they receive "on paper", as they are assigned a package of services by the CIZ assessor. The only reason some of the coefficients in Panel B of Figure 4.E.3 are below one is that individuals may choose to receive home care or cash benefits rather than entering in institution. On the contrary, individuals eligible for home care may adjust their use of services at the intensive margin.

As underlined by Fleurbaey and Schokkaert (2011), Gravelle (2003) and van de Poel *et al.* (2012), variation in the responsiveness of care use to needs by socio-economic status contributes to the horizontal inequity index, although an additively separable model like Equation (4.15) does not make this contribution explicit (van Doorslaer *et al.*, 2004). Figure 4.E.3 shows that the existence of a substantial differential in the needs-use relationship among individuals eligible for home care is an important driver of the income-related horizontal inequity we measure.

Figures 4.E.2 and 4.E.3 are also evidence that, empirically, the income-use relationship is not the same for all needs levels. This implies that, if we were to assume a different norm of vertical equity in use (e.g. the one based on the population average relationship between needs and use), the fact that individuals with low income tend to consume more care (which was considered as vertically equitable under our preferred norm, given the higher needs of the poor) may then be partly recategorized as unfair inequalities in use between individuals with different income levels. Consistently, we observe that the income-related horizontal inequity indexes are indeed higher under the "on average, the system gets it right" norm of vertical equity in use, when looking at the entire population.[63]

Figure 4.E.2 – Estimates of the impact of needs on LTC use, by income decile.
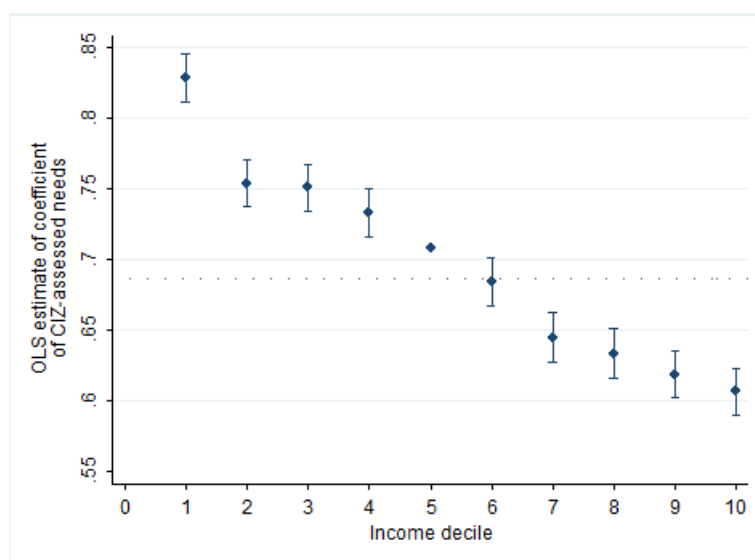
SAMPLE: Individuals 60 and older eligible for public "elderly" home care in the Netherlands in 2012 (N=616,934).
NOTES: LTC use is expressed in annual monetary value, in thousands euros. The 5th income decile is the reference. The dashed horizontal line indicates the value of the coefficient of CIZ needs in the baseline model (without interaction terms).

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[63]The effect goes in the other direction when we look at the sample of individuals eligible for home care, as the concentration of needs is not pro-poor but pro-rich.

Figure 4.E.3 – Estimates of the impact of needs on LTC use, by income decile and subgroup.
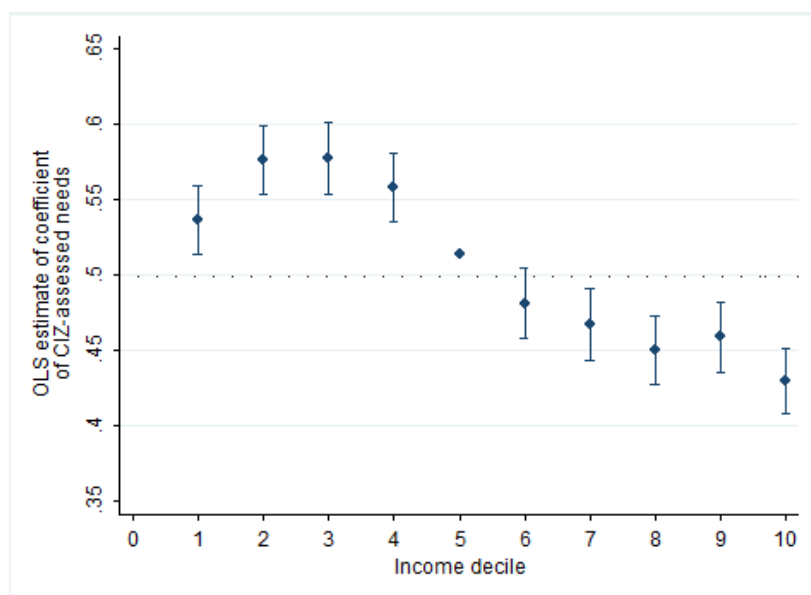
Panel A (top): Individuals eligible for home care.
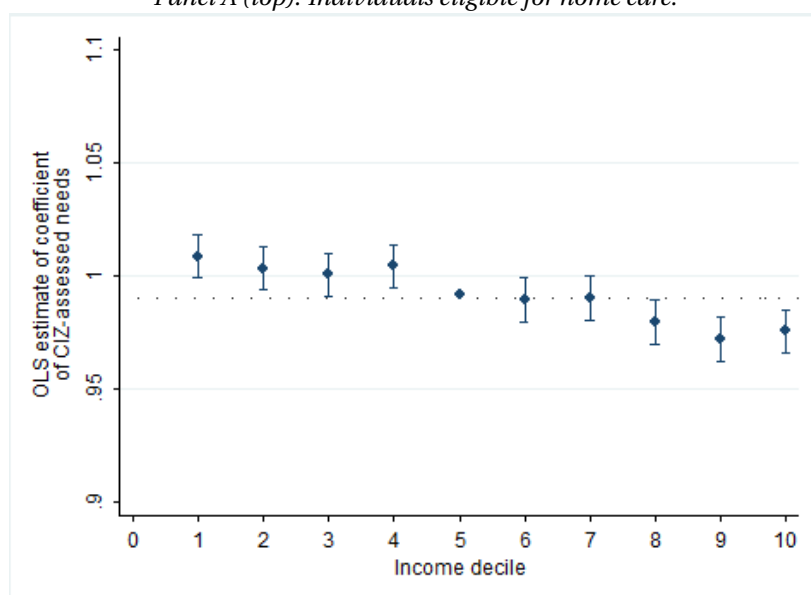
Panel B (bottom): Individuals eligible for institutional care.

SAMPLES: Individuals 60 and older eligible for either public "elderly" home care (Panel A; N=401,262) or public "elderly" institutional care (Panel B; N=287,932) in the Netherlands in 2012.

NOTES: LTC use is expressed in annual monetary value, in thousands euros. The 5th income decile is the reference. The dashed horizontal line indicates the value of the coefficient of CIZ needs in the baseline model (without interaction terms). In Panel B, it happens to have almost the same value as the coefficient of CIZ needs for individuals in the reference category.

4.F   Robustness check and wealth-related inequality

4.F.1. LTC use and needs for individuals who died in 2012

Our population of interest being made of elders in relatively bad health, mortality is high: 16% of them died before December, 31ˢᵗ 2012. For these individuals, we observe a censored measure of their annual LTC needs and use. Were mortality uniform across the income distribution, we could focus only on individuals who survived through the entire year. However, the probability to have died in 2012 varies across the income distribution, ranging from 13.6% to 19.7% (Figure 4.F.1). Mortality is highest among the very poor but also among the top two deciles: this reflects the fact that the rich are on average older given their higher life expectancy.

In addition, needs for and the use of LTC services tend to increase steadily in the months preceding death (de Meijer *et al.*, 2011). Leaving out the dead may then bias the measurement of income-related inequalities in LTC use.[64]

Figure 4.F.1 – Probability to have died in 2012, by income decile.
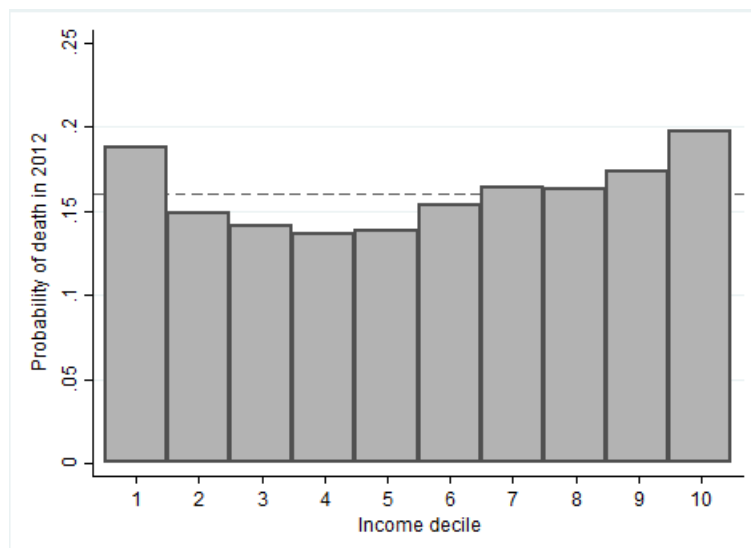
SAMPLE: Individuals 60 and older eligible for public "elderly" home care in the Netherlands in 2012 (N=616,934).
NOTES: The dashed horizontal line indicates the sample one-year mortality rate.

In order to include those who died before the end of 2012 in the analysis, we pro-rate the observed CIZ-assessed needs and use of LTC services based on the share of the year indi-

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[64]It is however less clear that it would necessarily bias the computation of the horizontal inequity index. de Meijer *et al.* (2011) show that time-to-death hardly explains any variation in the use of LTC services when we control for detailed information on disability and health. If CIZ entitlements capture adequately the severity of disability, it remains theoretically possible that differential use by income decile when controlling for needs is robust to the exclusion of the dead even in the presence of differential mortality.

viduals were alive. With this solution, individuals who have died very early in the year may have extremely high (pro-rated) values of needs and use. One concern is that some outlying observations, which are not randomly distributed in the income distribution, may drive our results. As a robustness check, we replicate the analysis only on the individuals who survived through the year.

Table 4.F.1 – Concentration and horizontal inequity indexes: Excluding the deceased (entire sample)

	CI	C^N	HI	N
	(1)	(2)	(3)	
Entire sample				
Baseline	-0.0853***	-0.0485***	-0.0368***	616,934
Excluding the dead	-0.0941***	-0.0609***	-0.0332***	518,097
Eligible for home care				
Baseline	-0.0358***	0.0254***	-0.0612***	401,262
Excluding the dead	-0.0530***	-0.0079***	-0.0450***	348,702
Eligible for institutional care				
Baseline	-0.0453***	-0.0238***	-0.0214***	287,932
Excluding the dead	-0.0493***	-0.0246***	-0.0246***	227,251

From Table 4.F.1, we see that the concentration index of LTC use is higher when we leave out the deceased. This is also the case for the concentration index of need-predicted use (C^N), so that the horizontal inequity index remains roughly the same (around −0.03).

Differential mortality across socio-economic status raises another conceptual issue: when focusing on the individuals who are alive at the beginning of 2012, we select out all the individuals from the birth cohorts of interest (who were born in 1952 or before) but who died before that date. Given differential longevity across the income distribution, this causes a selection issue in the measurement of inequality at the cohort level (Lefebvre *et al.*, 2013). Given the conceptual challenges associated with the issue of "dealing with the dead", we do not attempt to address this source of selection.

4.F.2. Wealth-related horizontal inequity

As argued in Section 7, wealth, or some combination of wealth and income, may be used as an alternative indicator of socio-economic status in the elderly population (Van Ourti, 2003; Wagstaff and Watanabe, 2003; Rodrigues *et al.*, 2017). In some OECD countries, access to public LTC support or the amount of transfers is actually made conditional on both wealth and income (Muir, 2017). Although co-payments on LTC use would depend only little on wealth in the Netherlands until 2012,[65] it is of interest for international comparisons to document how effective use of LTC varies with wealth in the Netherlands.

As a preliminary analysis, we have computed the average need-standardized LTC use by per capita household wealth decile, in the entire population of interest and in the subgroups of individuals eligible for home care or individuals eligible for institutional care. As shown by Figures 4.F.2 and 4.F.3, there is no clear wealth-gradient in the actual use of LTC services when differential needs across the wealth distribution are taken into account. The wealth-richest 10% in the entire population and in both subgroups seem to use less services in value than the average, while the middle of the distribution (deciles 3 to 5) tend to use more care for a given level of CIZ-assessed needs. Panel B of Figure 4.F.3 suggests that the wealth-rich are significantly less likely to use institutional care when eligible for it. Yet, overall, the differences in need-standardized use across the wealth distribution are much smaller than what we observe across the income distribution.

Given the relatively high level of insurance offered by the public LTC insurance, it is unlikely that wealth is a barrier to LTC access. Except for individuals with very high level of wealth, the co-payment schedule ensures that out-of-pocket expenditures on public LTC services do not exceed income: contrary to what is observed in other countries, the majority Dutch elderly do not need to draw on their housing or financial wealth to finance the use of public LTC services.

This was the case at least until 2012, when co-payments would depend on income and 4% of taxable wealth. A 2013 reform (described in Non (2017)) increased to 12% the share of taxable wealth to be taken into account when computing co-payments. It is thus possible that the wealth-gradient of LTC use is different after the reform than what we measure in our data, and that high-wealth individuals had to adjust their consumption of LTC services based on their their trade-off between the marginal value of LTC services and the utility they derive from their wealth.

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[65] See Appendix 4.B for information on co-payments.

Figure 4.F.2 – Distribution of need-standardized LTC use across wealth deciles: Entire population
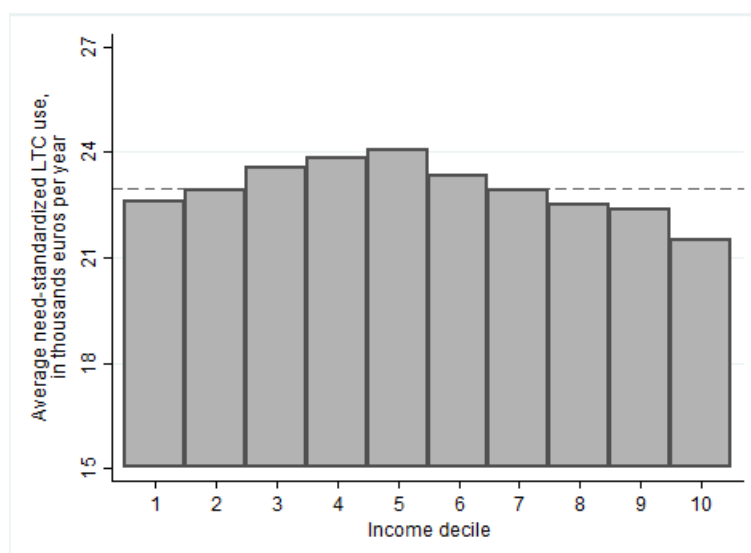
SAMPLE: Individuals 60 and older eligible for public "elderly" LTC in the Netherlands in 2012 (N=616,934).
NOTES: LTC use is expressed in annual monetary value, in thousands euros. The dashed horizontal line represents the average value of LTC use in the sample. Individuals are ranked by their per capita 2011 household taxable wealth.

Figure 4.F.3 – Distribution of need-standardized LTC use across wealth deciles, by subgroup.
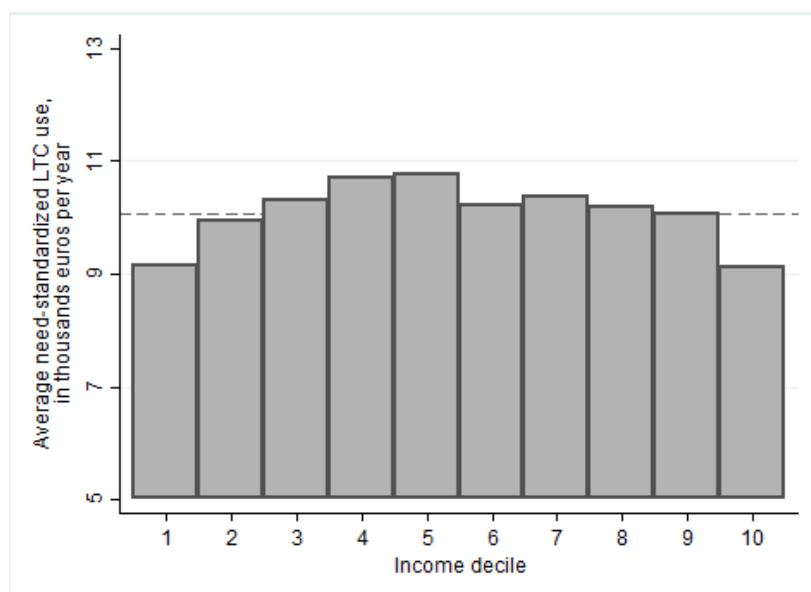
Panel A (top): Individuals eligible for home care.
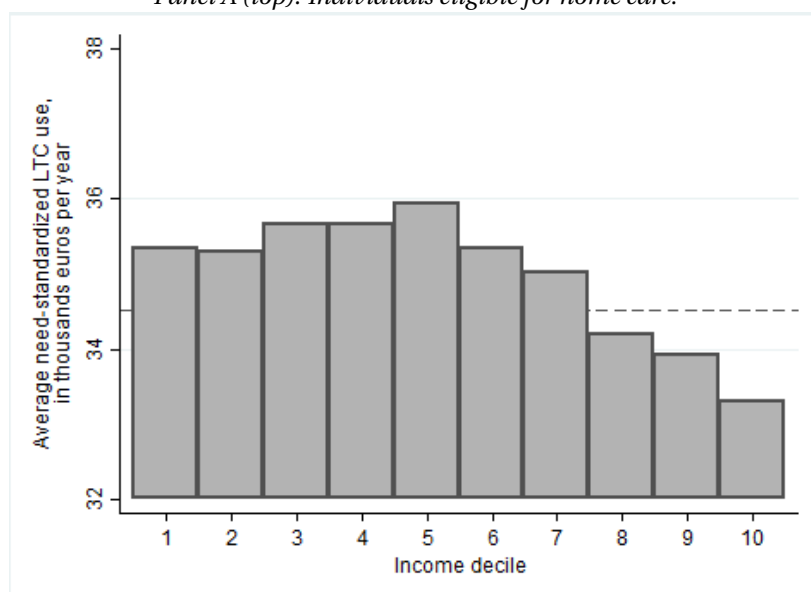
Panel B (bottom): Individuals eligible for institutional care.

SAMPLES: Individuals 60 and older eligible for either public "elderly" home care (Panel A; N=401,262) or public "elderly" institutional care (Panel B; N=287,932) in the Netherlands in 2012.

NOTES: LTC use is expressed in annual monetary value. LTC use is expressed in annual monetary value. In Panel A, it is the sum of the value of home care services used in kind and of the imputed value of cash benefits granted while the individual was eligible for home care in 2012. In Panel B, it is the sum of the value of home care services used in kind, of the value of cash benefits granted and of elderly institutional care received in 2012. Individuals are ranked by their per capita 2011 household taxable wealth.

4.G   Inference in horizontal equity analysis

4.G.1. Standard error of concentration index of actual use

In order to assess the statistical significance of inequality in use, we need to associate standard errors with the concentration index of actual LTC use, CI. The literature has proposed two ways of deriving the standard errors.

Kakwani *et al.* (1997) have derived a closed-form formula for the standard error by applying the delta method. The formula is the following:

$$\mathrm{V}ar(\hat{\mathrm{CI}}) = \frac{1}{n}\Big[\frac{1}{n}\sum_{i=1}^{n} a_i^2 - (1 + \mathrm{CI})^2\Big] \tag{4.18}$$

with:

$$a_i = \frac{y_i}{\mu}(2r_i^{\mathrm{I}} - 1 - \mathrm{CI}) + 2 - q_{i-1} - q_i$$

and:

$$q_i = \frac{1}{n\mu}\sum_{j=1}^{i} y_j$$

(q_i is the ordinate of the Lorenz curve for the ith poorest individual, and $q_0 = 0$).[66]

Another method is to use the convenient regression (O'Donnell *et al.*, 2008). The convenient regression (Kakwani *et al.*, 1997) allows to derive the concentration index directly from the estimation of the regression of a transformation of the LTC use variable on the fractional rank in the income distribution. The convenient regression corresponds to the following specification:

$$2\sigma_r^2(y_i/\mu) = \alpha + \delta r_i^{\mathrm{I}} + \epsilon_i \tag{4.19}$$

where σ_r^2 is the variance of the fractional rank. The OLS estimate of δ corresponds to the concentration index of y and is equivalent to the index computed using Equation (4.1).

However, the standard error associated to δ does not incorporate the sampling variability of the dependent variable in Equation 4.19 (which contains an estimate of the population mean of LTC use, μ). The solution is to regress the un-transformed outcome, y, on the fractional rank, then transform the coefficient on the fractional rank, and apply a delta method to derive a correct standard error:

$$y_i = \alpha_1 + \delta_1 r_i^{\mathrm{I}} + u_i \tag{4.20}$$

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[66]This formula is only valid when there are no sampling weights and that the sampling is random (which is the case with our exhaustive administrative data).

The estimate of the concentration index CI is then equal to:

$$\hat{\delta} = \left(\frac{2\sigma_r^2}{\mu}\right)\hat{\delta}_1$$

This expression can be rewritten as:[67]

$$\hat{\delta} = \left(\frac{2\sigma_r^2}{\hat{\alpha}_1 + \hat{\delta}_1/2}\right)\hat{\delta}_1$$

The estimate of the concentration index is now written as a function of the regression coefficients from Equation 4.20; we can then apply the delta method to derive the standard error of the concentration index (in Stata, this can be done using the command `nlcom` (O'Donnell *et al.*, 2008)).

4.G.2. Standard error of concentration index of need-predicted use

Need-predicted use of LTC services, $\hat{y}_i^N$, is constructed as the linear prediction from the fitted model of LTC use, setting the individual value of the non-need variables to their sample mean (cf. Equation (4.11)).[68] The concentration index of need-predicted LTC use, C^N, gives the degree of income-related inequality in LTC use that we should observe if differences in actual use would only reflect differences in needs.

The standard error of C^N cannot be simply derived by applying the formulas presented in the previous subsection to $\hat{y}_i^N$, as it would not take into account the sampling variability of $\hat{y}_i^N$. Correct inference can be achieved by Bootstrap (see Section 4.G). So far, we have used the convenient regression approach to derive approximate values for the standard error of C^N. Given our very large sample size, we do believe that our results will remain unchanged when we derive the standard errors appropriately.

4.G.3. Standard error of horizontal inequity index

The horizontal inequity index is equal to the difference between the concentration index of actual use, CI, and the concentration index of need-predicted use, C^N. Alternatively, we can derive the horizontal inequity index as the concentration index of the (indirectly) need-standardized LTC use, y_i^{IS} (cf. Equation (4.12), Section 3).

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[67] Using the fact that the sample mean OLS predicted value of the outcome is by construction equal to the mean of the outcome, μ, and that it is also equal to the predicted outcome at the sample mean of the fractional rank. The sample mean of the fractional rank is simply equal to 0.5.

[68] We describe the method for the general setting presented in Appendix 4.E, in which β^N may differ from 1. Inference in our core analysis is based on this method, with constraining β^N to 1.

The distribution of (indirectly) need-standardized LTC use across income gives the distribution of LTC use that would be observed if needs were uniformly distributed across the income distribution.[69]

Again, the standard error of HI cannot be simply derived by applying the formulas presented in the previous subsection to y_i^{IS}, for the same argument as the one stated in the previous section. So far, we have used the convenient regression approach to derive approximate values for the standard error of HI; again, we believe that our results are not qualitatively affected by this approximation. Nonetheless, we plan to implement a Bootstrap resampling method to obtain correct standard errors for HI.

4.G.4. Standard errors of the contributions of non-need variables to inequity and of the residual

No analytical expressions of the standard errors of horizontal inequity index, of the contributions of need and non-need factors and of the residual term in the decomposition of inequality are available. We intend to derive these standard errors using a Bootstrap procedure.[70]

The procedure would go as follows. For each bootstrap replication, we draw with replacement N pairs of observations (dependent variable, explanatory variables) from our original sample of size N. For each Bootstrap sample $b = 1, ..., B$, we re-estimate Equation (4.10) (Section 3) and derive the coefficient estimates $\hat{\beta}_0$, $\hat{\beta}^{\text{N}}$ and $\hat{\beta}_k^{\text{NN}}$ for $k = 1, ..., K$. For each Bootstrap sample, we can construct an individual–level measure of need-predicted LTC use $\hat{y}_i^{\text{N}}$, following Equation (4.11) (Section 3). We are then able to compute, for each Bootstrap sample, the concentration index of actual consumption and the concentration index of need-predicted consumption, and the income-related horizontal inequity index as the difference between the two.

For each of these three indexes, a Bootstrap standard error can be computed as the standard deviation of the sample made of the B different values derived from the B Bootstrap samples. We may then use the Bootstrap samples in a similar way to derive standard errors for the contributions of each need and non-need factor and of the residual.

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[69]On the interpretation of and differences between direct and indirect standardization of health care use variables, see O'Donnell *et al.* (2008).

[70]Due to time constraints, this has not been achieved yet.

General conclusion

To conclude this thesis, I propose a review of the key results obtained in the different chapters, with respect to the economic literature and the policy debates, as well as a discussion of their main limitations or blind spots. I also sketch directions for future research.

1   Main results and contributions

1.1   LTC in the Netherlands: a less egalitarian system than expected

Starting from the finish, Chapter 4 has investigated the degree of income-related inequalities in the consumption of publicly-subsidized LTC by the disabled elderly in the Netherlands. The use of exhaustive and high-quality administrative data is extremely valuable for the purpose of our distributional analysis. Observing the universe of the eligibility decisions issued by the Dutch LTC needs assessment agency makes it possible to construct an explicit measure of the needs for LTC. The specific institutional context of the Netherlands motivates the use of these "eligible needs" in a normative analysis of equity in LTC use. We find evidence of a differential use of LTC services across the income distribution, even when controlling for differential needs. For a given level of needs, the elderly in the bottom of the income distribution tend to consume more care in value than the rich. Given the strong egalitarian culture the Dutch social LTC insurance is embedded in, the existence of income-related horizontal inequity in the use of publicly-subsidized LTC was not expected.

By replicating the analysis on the subgroups of individuals eligible for home care and of those eligible for institutional care separately, we show that the patterns of LTC use and the conversion between eligible needs and actual use differ across the income distribution. The rich are less likely to effectively stay in a nursing home. This finding alone begs a host of further policy-relevant questions that our analysis does not address. Does this pattern arise because the higher co-payments the rich incur in nursing homes lead them to substitute home care for institutional care? If so, is the co-payment schedule tailored in a way that ensures that residential care is used when its marginal costs become lower that the costs of home care? Our results might also reflect that institutional care is an inferior good, consistently with the popular view that everyone who can afford to arrange her LTC at home would want to do so rather than entering a nursing home. If this is the case, then it would have important implications for the efficiency of the LTC schemes offering subsidies on the price of nursing homes, as the income effects associated with the ex post shift in care use would not induce efficiency gains. Of course, any sound welfare analysis should also take into account external effects associated with nursing home use, starting with the costs and benefits

accruing to informal caregivers. Those are important questions to address if we want to anticipate how the ongoing reforms in the Netherlands will affect the efficiency of the Dutch LTC policies and income-related inequalities in care use.

Our analysis also shows that among those eligible for home care, the income-rich tend to be assessed higher needs than the poor. That those in the bottom of the income distribution have a better functional status than the rich, at a given age, would be surprising. In the general population, good health is found to be pro-rich concentrated; this is also what the SHARE survey data suggest for functional status. The pro-rich concentration of "eligible needs" may rather reflect the fact that socio-economic status plays a role in the access to the LTC system. One scenario consistent with our results is that the poor are less likely to claim public support for LTC, or claim it later in the disablement process. Our implicit assumption in giving a normative content to CIZ-assessed needs for care is that CIZ does a good job at "scanning" out the population, by allowing health care providers, social workers and family members of a disabled individual to fill in a request for a needs assessment. Whether there is horizontal inequity at the very stage of the eligibility decisions is yet an empirical question, which is crucial to address, in order not only to give a sensible normative interpretation of CIZ-assessed needs but also to judge upon the fairness of the LTC system as a whole. As Culyer *et al.* (1992) put it:

"... 'equality of access' is almost certainly required in order that needs can be *assessed...* ".

1.2 A better understanding of the French at-home APA scheme

In Chapters 2 and 3, I focused on the largest home care subsidy program targeted to the elderly, the *Allocation personnalisée d'autonomie* (APA).

APA works as an hourly subsidy on the price of home care

The economic analysis of the scheme, which was undertaken within the MODAPA research project, made it possible to improve our understanding of its efficiency implications and redistributive properties. The APA is an in-kind transfer working as a subsidy on the hourly price of home care. The existence of an individual limit on the number of hours of professional care to be subsidized by APA creates a kink in the budget constraint of beneficiaries, whose magnitude is all the higher as individual income is low. The design of the APA scheme thus matters for the microeconomic modeling and empirical analysis of the demand for home care of the disabled elderly. It also has important implications for the statistical information available on professional care use and out-of-pocket payments: in their administrative records, the Departmental Councils only keep track of subsidized care use, i-e of what happens on the left-hand side of the kink in the budget constraint.

In my doctoral research, I have overcome this information gap either through appropriate econometric modeling, in Chapter 2, or by using records of APA beneficiaries' use of professional home care other than the ones kept by Departmental Councils, in Chapter 3.

The demand for home care by the disabled elderly is price-elastic

From a policy perspective, the estimate of the price elasticity of home care demand offered by Chapter 2 has several important implications. Together with the other studies led in the MODAPA project, this analysis provides evidence that APA beneficiaries adjust their consumption of professional home care to the price they pay out-of-pocket. The assumption that the individual care plan volume is a good proxy for the actual use of care does not hold. In the consumer theory framework, this suggests that the disabled elderly trade off the marginal utility of the professional care they consume and its costs, considering their resource constraints. The existence of behavioral reactions to a change in the price of home care services implies that any reform of cost sharing in home care subsidy programs should anticipate adjustments in individual and aggregate quantities of care consumption. As illustrated by Chapter 3, such behavioral reactions may alter the redistribution intended by a reform like the one implemented in France in 2016.

Adjustment to a price change goes through both income and substitution effects

Chapter 2 also demonstrates that the adjustment in home care use following a change in the relative price of care goes through both income and substitution effects. The ex post moral hazard in the consumption of formal care due to the price distortion alone is a fundamental reason why home care subsidies should not be analyzed as mere income transfers. This source of efficiency loss is to be taken into account when comparing the costs and benefits associated with a system of lump-sum payments, as opposed to a subsidy scheme. The nature of disability and of LTC services makes it practically feasible to condition eligibility for public support upon a unique needs assessment — which is not doable for health care. Under this regard, the case for a LTC insurance offering a price payoff rather than an income transfer is less compelling than in the field of health care insurance. The question of reforming the design of the APA scheme in a fundamental way, in particular by making the amount of public support independent from the choice of entering a nursing home rather than staying in the community, has recently come into force in the public debate in France (Bozio *et al.*, 2016; HCFEA, 2017). Progressing in the understanding of the efficiency implications of shifting to a system closer to one of lump-sum transfers is an important contribution that economics can bring to this debate.

The results from Chapter 2 also urge the economic literature to refrain from using the term "LTC needs" in positive analysis: by showing that APA beneficiaries' preferences exhibit

some substituability between LTC and other consumption goods, the available empirical evidence clashes with the idea that the disabled elderly would consume a definite amount of LTC services regardless of their relative prices. The extent to which the severity of functional losses affects the marginal rate of substitution between home care and other goods, and thus the efficiency gains and losses associated with subsidizing the price of care, remains an open question.

The 2016 reform should have decreased vertical equity in out-of-pocket payments and horizontal equity in home care use

In Chapter 3, I have focused on two features of the APA scheme that condition its redistributive properties: the income-dependent co-payment and the care plan volume, which were the targets of the 2016 APA reform. The customer files from a home care provider that I have used make it possible to observe total formal home care use for APA beneficiaries and to compute their total out-of-pocket payments, before the 2016 reform. The consumption of professional care beyond the care plan volume is more frequent for richer beneficiaries as well as for the most severely disabled. The relatively low levels of the APA national ceilings before the reform explain that beneficiaries with severe disability incurred high effort rates on home care spending. The decision of the department our data come from to compute APA subsidies on a lump-sum price rather than on the provider price induces non-negligible out-of-pocket payments at the bottom of the income distribution, even for those who do not consume unsubsidized care. Reaching progressivity in the out-of-pocket financing of formal home care nationwide would require explicit legal provisions regarding the computation of the APA subsidies, an issue that was left aside by the 2016 reform.

The ex ante evaluation of this reform that I have proposed in Chapter 3 is based on the estimates derived in Chapter 2. It suggests that the modifications in the co-payment schedule and the increase in care plan volumes should allow the most severely disabled beneficiaries (GIR 1 and 2) to lower their out-of-pocket payments more so than the rest of the beneficiaries, consistently with the objectives of the reform. But the reform may not hit its underlying target of improving vertical equity in out-of-pocket financing. The richer beneficiaries are predicted to incur lower out-of-pocket payments after the reform, while the increase in the use of home care in the bottom of the income distribution may actually lead to an increase in out-of-pocket payments. As directly shown by the companion analysis by Hege (2018), the increase in public transfers induced by the reform is predicted to be higher at the top of the income distribution than at the bottom. Differential effects across the income distribution would be accentuated if we were to take into account the suggestive evidence obtained in Chapter 2 that richer beneficiaries react more to a change in the price of home care than poorer beneficiaries.

Main limitations to Chapters 2 and 3

Due to several data limitations, the scope of the results derived in Chapters 2 and 3 should be qualified. First, the samples we use are local. The department from which the data used in Chapter 2 are taken is arguably close to the French average with respect to its disabled elderly population, except for its higher income level. If price sensitivity increases with income, our local estimate would be an upper bound of the price elasticity at the national level, in absolute value. In order to strengthen the internal validity of our estimates, we proceed to intra-departmental sample selection. In particular, we retain in the sample beneficiaries who are served by an authorized provider, which is seemingly the case of the majority of APA beneficiaries in France. The behavioral reactions we capture may be different from that of beneficiaries who have chosen a lower-price provider.

Having a sample of APA beneficiaries that is not nationally representative is arguably more problematic for distributional analysis like the one presented in Chapter 3. As APA beneficiaries whose care plan volume is close to their GIR-specific national ceiling are less prone to being served by an authorized provider, our estimation sample may give an inaccurate picture of home care use and out-of-pocket payments for the most severely disabled beneficiaries within each administrative disability group. In addition, socio-economic inequalities in the take-up of LTC benefits may also arise in the French LTC system. As our investigation of efficiency and equity in the APA scheme relies on administrative data and customer files providing information on APA beneficiaries only, I am only able to shed light on the distribution of care use, out-of-pocket payments and the behavioral reactions *of those who benefit from the program*. Given that I do not observe the entire elderly population and that I do not have any estimate of the price elasticity of the demand for home care at the extensive margin, the ex ante evaluation I have conducted does not integrate the additional take-up of APA benefits that the increase in the generosity in the scheme may drive.

Our APA-centered data do not allow us to take into account other public programs targeted to the disabled elderly that may impact the private financing of home care. Until 2016, APA beneficiaries were able to halve their out-of-pocket payments through an income tax rebate. This tax scheme would profit only those with taxable income; if anything, the pro-rich vertical inequity in the private financing of home care detected in Chapter 3 would be larger if we were able to take into account these tax rebates. Since 2017 however, the rebate has been converted into a tax credit, thereby increasing public effort towards low-income beneficiaries while not changing the spending drained by the beneficiaries with high taxable income. The ceiling on this credit is sufficiently high for those incurring high out-of-pocket expenses, because of a high consumption of professional care, not to hit it. In its review of the French LTC policies targeted to the elderly, the High Council of Family, Childhood and Age

(HCFEA) has asked the Ministry of Health to conduct some simulations of the joint impact of the 2016 APA reform and of the 2017 creation of the tax credit. Using a microsimulation model, the Ministry of Health predicts that the effort rate of GIR–1 and GIR–2 beneficiaries would decrease to less than 8% on average — although it is not clear what the assumptions in terms of the computation of the APA subsidies and of behavioral reactions are. This leads the HCFEA to consider that the reforms have made it possible to reach a satisfactory level of public financing of home care use (HCFEA, 2017).

The analysis presented in Chapter 3 is in line with the idea that the 2016 APA reform should allow a substantial decrease in out-of-pocket payments, especially with the back-up of the tax credit; it however calls for caution. The impact of the reform will, to a large extent, depends on the way the evaluation teams in charge of needs assessments in the Departmental Councils react to it. Chapter 3 has made the simple and favorable assumption that all care plan volumes will be adjusted proportionately to the increase in national ceilings. Even if we assume that the evaluation teams do set all care plans as a proportion of the levels of the national ceilings — which is not granted — the budget constraints weighing on Departmental Councils make my assumption little likely to hold.

Alternative assumptions are however not straightforward to implement empirically. For those beneficiaries who had a care plan equal to the national ceiling (*plan d'aide saturé*), inferring their "eligible needs" from the actual use of home care would amount to ignoring that they are price-elastic. The Ministry of Health relies on econometric analysis to predict "eligible needs" beyond the care plan volume of beneficiaries with a saturated care plan (Bérardier and Debout, 2011). Assuming in the first instance that only these beneficiaries will benefit from an increase in their care plan would be in line with the legal provision passed with the reform, stating that the Departmental Councils must reassess the situation of all beneficiaries with a saturated care plan. Given my limited sample size, I have preferred to rely on a simple assumption rather than on an econometric analysis. The limited availability of data on the evolution of care plan volumes between 2015 and 2016 at the departmental level makes it difficult to assess how far my assumption is from the real-world adjustment. Using data from a few departments, an administrative report assessing the implementation of the reform documents some unexpected adjustments — such as a *higher* increase in the care plan volumes of the *least* disabled (Bensadon *et al.*, 2017). This shows the importance of both the collection of data appropriate for an ex post analysis of this complex reform and improvement in the understanding of the practices of local evaluation teams, which will make it easier for researchers and administrations to draw up ex ante evaluations. The current initiatives launched by the National Fund for Solidarity and Autonomy (*Caisse nationale pour la solidarité et l'autonomie*, CNSA) in order to survey the practices of the evaluation teams and define guidelines for needs assessments will certainly help.

My ex ante evaluation of the reform relies on price and income elasticity parameters, which themselves were estimated based on modeling assumptions and limited data. As we have limited information on the supply of home care services at the local level, we make the implicit assumption that there is no rationing of quantities on this (regulated) market. We assume that the disabled elderly are sensitive to the spot price of home care and that they make consumption decisions individually, based on their own income. Rather, Hege (2018) proposes to interpret the price elasticity as a "collective" elasticity, which results from the joint reaction of the beneficiary, her family and her care providers. The economic and sociological literature has provided evidence that decisions regarding professional care use frequently involve the relatives. A more accurate modeling of the demand for formal care would take into account family composition, its resources and the informal care it may provide. Additionally, our analysis relies on the assumption that care consumption decisions are taken on a monthly based and by fully rational behaviors. The existence of weekly routines is suggested by several data sources; that APA beneficiaries do not behave like the typical consumer from the microeconomic theory is especially likely as many suffer from neuro-degenerative troubles. Relaxing the assumption that the observed care use equals the optimal consumption for APA beneficiaries, an ongoing study by two researchers of the MODAPA group finds a price elasticity much above unity in absolute value. It also finds a higher value than the one estimated in Chapter 2 when relaxing the assumption that the price elasticity is constant with the out-of-pocket price of care. Assessing the robustness of price and income elasticity estimates to modeling assumptions is a critical step before we engage in a full welfare analysis of home care subsidy programs.

1.3 Handicap versus dependence schemes: a challenging assessment

A policy evaluation of the age 60 threshold in LTC policies

With respect to Chapters 2 and 3, Chapter 1 has taken a larger focus by studying the effects of the French home care subsidy programs at large, including APA but also other smaller schemes targeted to the elderly and the benefits aimed at those aged less than 60. In this Chapter, I have used a reduced-form approach to assess the impact of the institutional threshold separating the dependent elderly from the handicapped adults in the French LTC policies, on the LTC services received by the individuals with activity restrictions. I have used a general population survey, the French Health and Disability Survey (HS), to select a sample of individuals aged 50–74 and compare care utilization rates and the probability to reside in institution of those aged 60-74 to the same quantities in the sub-sample aged 50–59.

By contrast with the approach to equity adopted in Chapters 3 and 4, Chapter 1 aims at uncovering the causal relationship between the design of LTC policies and an unequal treat-

ment of the equals. The arbitrary age threshold that separates handicap and dependence policies creates a priori a perfect setting for a quasi-experimental identification by a Regression Discontinuity Design (RDD) estimation. Even though the HS survey over-sampled individuals with functional limitations, among individuals living in the community the number of those reasonably close to the age threshold is too low to implement this strategy. In order to assess whether it makes a difference to be considered a dependent elderly rather than a handicapped adult in the home care one's receive, I have proposed multivariate estimations including a rich set of controls and age effects to capture systematic differences in unobserved determinants of care and preferences for care settings. Instead, thanks to a larger size of the sample representative of the entire population, I am able to assess the effect of the age 60 threshold on the probability to reside in an institutional setting by an RDD strategy.

Data limitations and conceptual challenges to the interpretation of the results

Among those living in the community, the dependent elderly are found to be more likely to receive formal home care but somewhat less likely to receive assistance with the activities of daily living from their relatives. This is true on average, but the effects differ substantially by gender and disability level. The interpretation of the results is challenging, for several reasons. First, I have thought it safer to make use of binary (use/no use), rather than continuous LTC measures. I thus assess the effects of the age 60 threshold at the extensive margin only; results at the intensive margin may well be different. Second, information in the HS survey regarding the LTC schemes the respondents actually benefit from is not deemed reliable and thus prevents me from digging into the mechanisms behind the results. Is the higher utilization rate of professional personal care by the 60+ due to their higher probability to benefit from a home care subsidy program? Or is it that they are more likely to receive LTC from nursing services (SSIADs), because the rationing of supply from SSIADs was still important for the handicapped adults at the time of the survey? Given the complexity of the French LTC policies and the co-existence of several schemes, the matching of administrative information on LTC benefits and on the use of nursing services paid by the Health Insurance with survey data would definitely better the understanding of the patterns of LTC use.

The third reason why the interpretation of the results should be made with caution is the dynamic aspect of the disablement process, that the cross-sectional nature of the HS survey is not able to capture. It is possible that the handicapped adults are less likely to receive formal home care due to their relatives being more involved in informal caregiving precisely because the onset of their disability happened at a relatively young age. The possibility that the "individual history of disability" has long-lasting effects on family dynamics and LTC arrangements raises an immediate empirical question for the econometrician interested

in uncovering the causal impact of LTC policies on the use of formal care: do I adequately control for differences in individual and contextual factors that may affect the use of LTC independently from the age 60 threshold? The empirical analysis proposed in Chapter 1 adopts a static approach to disability: differences in current functional limitations, activity restrictions and health status are controlled for, but not the duration for which health conditions have affected the individual, nor the coping strategies (e.g. housing adaptation) she may have adopted. This also raises more fundamental questions regarding the conceptual ground for assessing the effects of LTC schemes on care arrangements and horizontal equity in the use of LTC. Even if we agree on taking a consequentialist stance, the question remains whether preferences for care arrangements should be taken as given, or whether adaptation mechanisms should be netted out. This echoes the essential debate faced by responsibility-sensitive egalitarianism about the split between circumstances and effort when the former causally impacts the latter.

The age 60 threshold and data collection on LTC use

Chapter 1 provides original evidence that the dependent elderly are more likely to reside in an institutional setting on a permanent basis than the handicapped adults. This finding is counter-intuitive, as out-of-pocket payments on residential care tend to be substantially higher for the dependent elderly. Differences in the rationing of supply may explain this result. This finding also sheds light on the upstream effect that the age 60 barrier has on statistical categories and data collection: the definition of living arrangements in the HS survey was actually made contingent upon this age threshold and the existing disability schemes. This has important implications for the interpretation of the finding that individuals living in the community are less likely to receive formal home care when they are less than 60: those may actually receive unobserved professional care provided in day care facilities or handicap centers. This calls for future data collection operations to carefully take into account the age 60 barrier, so as to ensure a full mapping of the care options available to, and used by, each sub-population.

2   Future developments

2.1   Working with new French databases

In order to overcome some of the limitations discussed earlier, I intend to make use of new French data sources that will soon be made available.

New general population surveys

In the second semester of 2018, the French Ministry of Health will release a new general population survey, called CARE (Drees, 2015–2016a). This survey was conducted in 2015 for a sample representative of the 60+ population. One section of the survey was collected on individuals living in the community, whereas a second section surveyed individuals residing in institutions. Micro-linkage with administrative data will provide high-quality information on LTC benefits, income and wealth.

CARE will make it possible to dig further into the research questions addressed in Chapters 2 and 3. Joint information on out-of-pocket payments and the volume of care provided by professional caregivers for the community-dwelling elderly should provide new estimates of the price elasticity of the demand for home care. A possible identification strategy would draw inspiration from Hege *et al.* (2014) and Arnault (2015), and use departmental-level information on home care prices to obtain exogenous variations in the out-of-pocket price of care. Rich information on the tasks performed by caregivers will enable to test whether the price sensitivity varies with the type of LTC services, and thus whether cost sharing in home care subsidies programs should depend on this dimension. As CARE is a general population survey, it will make it possible to assess how the cost sharing associated with APA influences the take-up of the benefits, in particular among the richest beneficiaries, and to quantify the price sensitivity of home care use at the extensive margin. Rich information on socio-demographic and family characteristics as well as on informal care will reduce the risk of omitted variable biases and allow us to estimate the cross-price elasticity of informal care utilization. Linkage with fiscal data will provide a way to simulate the tax rebates on the out-of-pocket payments incurred by APA beneficiaries and assess what the price sensitivity of the disabled elderly is under the assumption that they react to the ex post price of home care.

Given these same features, CARE will also make it possible to considerably enrich the exploratory analysis provided in Chapter 3. Individual contributions to the financing of LTC policies may be simulated using the linked fiscal data. Comparing information on the contributions made by those living at home and of those in institutions might enable an assessment of vertical equity in the financing of LTC that would be immune to differential use of institutional care by socio-economic status.

However, as CARE only surveys the 60+, it cannot be used to extend or even assess the robustness of the analysis conducted in Chapter 1. The next general population survey including the entire population (AUTONOMY) will seemingly be collected in the early 2020s. The matching of administrative information modeled after what has been done for CARE would make it possible to compare the LTC benefits perceived by the dependent elderly *versus* the handicapped adults, and assess how they relate to differential LTC use.

CARE and AUTONOMY will both be cross-sectional surveys; given the dynamic aspects of disability and long-term care decisions, this is an important limitation. Under that regard, the international SHARE survey has a clear advantage. Although national sample sizes are limited, the number of waves may now be sufficient to shed light on the use of LTC by the "aging handicapped" in France, which I have not been able to consider in Chapter 1.

A renovated information system on APA beneficiaries

The law that enacted the 2016 APA reform also mandated an important renovation of the public statistical information system on LTC beneficiaries, described in Roy (2017). Each Departmental Council has now to send detailed aggregate information on its APA beneficiaries every quarter and the information is published online.[71] In the second quarter of 2017, more than 20% of Departmental Councils were still not able to report all the statistical information requested, but it can be hoped that the development of routine procedures for data output will soon enable a mapping of all departmental situations. Although they will not make it possible to assess the impact of the 2016 reform, these data will offer materials for a departmental-level analysis of the evolution of care plan volumes and APA spending following the reform.

The Ministry of Health will also collect this year individual-level information on all individuals who were entitled to APA in 2017. These data will be similar to the *Remontées individuelles* already collected in 2007 and 2011; as the transmission of information is now mandatory for the departments, the 2017 edition of *Remontées individuelles* will enjoy a larger sample size and no selection issue. Without additional information on home care prices, it is unlikely that these data alone can be used for the purpose of price elasticity estimations; they can however be much valuable for distributional analysis of subsidized care use and public spending on APA. In addition, the Ministry of Health is currently working towards the creation of a panel of APA beneficiaries (ENEAS panel); its longitudinal dimension will enrich distributional analysis by making it possible to take into account income-related differences in the time spent in the APA scheme.

All in all, the important enrichment of the statistical information system paves the way for extensions of the analysis conducted in this thesis, although the lack of national and departmental level information on home care providers and the prices they charge will remain an issue.

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[71] *Enquête trimestrielle APA; Décret 2017-334 du 16 mars 2017 relatif aux transmissions de données sur l'allocation personnalisée d'autonomie et l'aide sociale à l'hébergement.*

2.2   Take further advantage of the opportunities offered by the Dutch linked micro-data

Regarding the Netherlands, the matching of additional sources to the rich data that I have already exploited will make it possible to explore some of the issues adjacent to the research question raised by Chapter 4.[72]

Horizontal inequity in eligibility for publicly-subsidized LTC

A large sample size survey on health that is representative of the non-institutionalized adult Dutch population (the Health Monitor of 2012) was matched with our administrative data. For close to 200,000 individuals aged 60 or older, we observe self-reported information on health status, chronic conditions and functional limitations. We intend to shed light on possible socio-economic disparities at the very stage of eligibility for publicly-subsidized LTC. We would infer from a systematic correlation between the entitlements to LTC as assessed by the CIZ agency and income, when controlling for self-reported health status and functional limitations, that there is socio-economic horizontal equity in eligibility for LTC. If this is the case, this will have important implications for the use of CIZ-assessed needs as a relevant measure of needs for the purpose of equity assessments. Methodologically speaking, one way to go is to use concentration and horizontal inequity indexes as done in Chapter 4. We may alternatively expand the focus to horizontal inequity relating to ethnic origin, place of residence, etc. The release of a new wave of the Health Monitor survey for year 2016 offers the possibility to compare the 2012 and 2016 situations, in light of the reforms of the Dutch LTC social insurance that took place in-between these two dates.

The effect of cost sharing on LTC use

An agreement passed with the Dutch LTC Authorities has granted the Netspar research project within which Chapter 4 was conducted with an access to individual-level information on co-payments on LTC. We intend to use this dataset to assess how co-payments relate to the use of LTC services and, in particular, the decision to use institutional care. Several options will be explored to obtain exogenous variations in the out-of-pocket price of LTC. First, we intend to use the 2013 reform of the co-payment schedule; second, we will evaluate the feasibility of exploiting the non-linearities in the co-payment schedule. The use of bunching methods (Saez, 2010) should prove especially appropriate with exhaustive administrative records, while it was made impossible with the French data I have been using in Chapters 2 and 3, because of censoring at the kink of the budget constraint, sample

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[72]The projects described here-below will be carried out as part of a post-doc research at the Erasmus University of Rotterdam, jointly with Pieter Bakx and Eddy van Doorslaer.

selection and small sample size.

The impact of LTC use on health care consumption

Finally, we intend to take a broader perspective on the question of the efficiency of LTC policies by assessing the effects of LTC use on health care consumption. Under-use of LTC may indeed have adverse health effects and cause a greater use of medical care. Some commentators have suggested that the 2015 reforms of the Dutch LTC system have strongly pushed the Netherlands in this direction, yet citing only anecdotal evidence. Unwarranted hospitalizations, in particular, can have dreadful effects on frail elderly and are extremely costly for health care systems. If higher use of some LTC services decreases hospital care use, then a proper reallocation of budgets across schemes would improve overall allocative efficiency. Assessing the full budgetary savings and the welfare costs associated with cutbacks on health or LTC policies thus requires analyzing jointly health care and LTC use. We will exploit exogenous variations in LTC use induced by variations in co-payments (cf. *supra*) or by the random assignment of need assessors to applicants for public subsidies, which was already documented and exploited by Bakx *et al.* (2017). The matching of the data used in Chapter 4 with exhaustive administrative records of hospital care use will provide sufficient sample size to run heterogeneity analysis, which is critical to tailoring at best the future reforms of the Dutch public LTC insurance aiming at containing future public expenses.

2.3   Medium-run research agenda

Through and beyond the empirical studies I have just mentioned, I also wish to push forward a longer-run research agenda on LTC policies.

In a first direction, I would like to test alternative frameworks for the empirical assessment of equity in the use and financing of LTC. The health economics literature has recently proposed ways to amend the conceptual and empirical framework for the analysis of equity in health care, so that it can integrate concerns about the distribution of different goods (and not merely health or health care) and the respect of preferences. Given the specific nature of LTC, attention will have to be paid to the role assigned to informal care and the issue of quality in LTC delivery, which is especially difficult to observe and measure. A more integrated approach to equity and redistributive objectives will also make it easier to hold together efficiency and equity aspects of the performance of LTC policies. Adding more theoretical structure to empirical investigations will offer a way to quantify the equity-efficiency trade-offs of LTC reforms and their ultimate welfare gains.

Regarding empirical tools, the development of micro-simulation models would offer the way to progress in the ex ante evaluation and comparison of scenarios for reforms of LTC

schemes. Plugging estimates of the behavioral reactions to the out-of-pocket price of LTC will make it possible to predict quantity adjustments, which may be critical for the redistributive effects of reforms. The development and use of such tools will also favor the analysis of the interactions between LTC policies and other social insurance schemes, in particular health care and pension systems.

Following the example of the seminal ECuity project conducted on health care systems in the 1990s and early 2000s, the development of equity assessments on different countries may contribute to a better understanding of how the architecture of LTC systems affect the distribution of LTC use and financing across socio-economic groups. The recent studies based on the SHARE data have made a valuable step in this direction. The current development of statistical information systems on LTC policies in OECD countries will probably offer ways to retrieve administrative measures of eligible needs for LTC and to discuss to what extent they can, or not, be used to answer normative questions.

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Résumé

Dans les pays de l'OCDE, le vieillissement démographique et la prévalence croissante de maladies chroniques induisent un accroissement marqué des effectifs de personnes âgées dépendantes. Répondre à la préoccupation sociétale concernant l'accompagnement des personnes en incapacité dans un contexte de pression sur les finances publiques constitue un défi majeur pour les politiques publiques.

Comment les dispositifs publics visant à financer les soins de longue durée affectent les aides formelles et informelles reçues par les personnes en situation d'incapacité ? La distribution des aides médico-sociales et des restes-à-charge est-elle équitable ? Comment améliorer l'efficience et l'équité des dispositifs publics ? Cette thèse apporte un éclairage sur ces questions en mobilisant les outils conceptuels de la microéconomie et les méthodes de l'économie appliquée. Elle rassemble quatre investigations empiriques menées à partir de données françaises et néerlandaises récentes.

Les 3 premiers chapitres traitent du cas français. Le chapitre 1 étudie la distinction faite entre adultes handicapés et personnes âgées dépendantes. Il évalue l'effet de la « barrière des 60 ans » sur les aides formelles et informelles reçues. Les chapitres 2 et 3 se focalisent sur le dispositif-phare destiné aux personnes âgées dépendantes, l'Allocation personnalisée d'autonomie (APA). Le chapitre 2 estime les élasticités prix et revenu de la demande d'aide à domicile des bénéficiaires de l'APA. Le chapitre 3 évalue l'équité dans l'utilisation des aides et des restes-à-charge dans le cadre de l'APA. Le chapitre 4 évalue l'équité horizontale dans l'utilisation de soins de longue durée aux Pays-Bas.

Les subventions sur l'aide à domicile induisent des ajustements dans la consommation d'aide *via* des effets de revenu et de substitution, ce qui a des implications pour l'efficience de ces dispositifs. Des iniquités sont détectées dans les deux pays.

Abstract

In OECD countries, population ageing and the increasing prevalence of some chronic diseases cause a substantial increase in the number of the disabled elderly. Responding to both the societal concern for ensuring appropriate long-term care (LTC) to the disabled and the pressure on public spending is a major challenge for public policies.

How do public LTC schemes affect the use of formal and informal care by the disabled? Are there socio-economic disparities in the use of formal care? Is the allocation of LTC services and of the out-of-pocket payments incurred by the disabled elderly equitable? Which features of LTC policies could be changed to make them more efficient and more equitable?

My research sheds light on these questions, using conceptual tools from microeconomics and methods in applied economics. It brings together four empirical investigations led in the contexts of France and the Netherlands, which have contrasting LTC systems. I make use of recent administrative and survey microdata.

The first three Chapters focus on French policies. Chapter 1 studies the distinction that is made between the handicapped adults and the dependent elderly in access to public LTC support. It assesses the effect of the "age 60 threshold" on the formal and informal care received by individuals with a disability. Chapters 2 and 3 concentrate on the main scheme accessible to the disabled elderly, the *Allocation personnalisée d'autonomie* (APA). Chapter 2 estimates the income and price elasticities of formal home care demand by APA beneficiaries. Chapter 3 assesses equity in the use and financing of home care within the APA scheme. Chapter 4 lands in the Netherlands and assesses income-related horizontal equity in LTC use.

Home care subsidies trigger adjustments in the use of care through both substitution and income effects. This has implications for the efficiency of such policies. Some inequity is detected in both countries.

Mots-clés

Soins de longue durée ; Dépendance ; Vieillissement démographique ; Equité ; Efficacité ; Microéconomie appliquée

Keywords

Long-term care; Disability; Population ageing; Equity; Efficiency; Applied microeconomics