

Long-term care use in the Netherlands: equal treatment for equal needs? An assessment using administrative data

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Abstract

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 health 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 a measure of LTC use (resp. needs) as the monetary value of all institutional care and home care services the individual used (resp. 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. Our unexpected findings question the roles of co-payments and preferences.

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Keywords: Long-term care, socioeconomic disparities, inequality in use, horizontal inequity.

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1 INTRODUCTION

All developed countries have introduced some forms of social support for the disabled elderly, yet we observe substantial variation in the resources devoted to LTC policies: while, in 2014, public LTC spending represent less than 1% of GDP in Southern Europe countries, it exceeds 3% in Nordic countries [OECD, 2017]. 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 countries achieve insurance against old-age disability risk, affordability of LTC services and redistribution between different segments of the population is still largely undocumented. In particular, there is limited evidence on whether public 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 levels of LTC support, irrespective of their socio-economic status. Pinpointing inequalities and potential inequity in the use of LTC services is especially useful as many countries discuss potential reforms of their LTC systems, either to broaden coverage or to curb increasing spending. The economic literature has produced a fair deal of theoretical and empirical assessments of horizontal equity in the context of health status and health care use [Fleurbaey and Schokkaert, 2012, van Doorslaer et al., 2000, 2006, Bago d’Uva et al., 2009], which offer guidance for the empirical investigation of equity in LTC use.

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 LTC public insurance is relevant for two reasons. First, the Dutch system stands out as a model: with the highest spending in terms of GDP of all OECD countries (4.3% of GDP in 2014 [OECD, 2017]), 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 et al., 2015a]. As a result of its 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”. Yet empirical evidence is scarce and focuses on regional disparities. It highlights both limited disparities in *eligibility* for public LTC [Duell et al., 2017] and

substantial variations across regions in the *actual use* of LTC [Rekenkamer, 2015]. Given the large investment of resources made by the Netherlands in LTC policies, it is critical to assess whether the public LTC insurance reaches one of its key goals.¹

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 by the Dutch central agency CIZ, in charge of needs assessments for applicants to the public LTC insurance scheme, in 2012.

To our knowledge, only three papers have specifically focused on socio-economic inequality and horizontal inequity in LTC use.² 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 index 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 are 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 nursing home care, which still represents the vast majority of LTC spending in all OECD countries (e.g. 90% in the Netherlands [Schut et al., 2013, OECD, 2017]). Second, they only study the decision whether to use care, but ignore the decision about how much to use, which is likely to witness substantial variation – home care use may be limited to two hours of care for a couple of months after surgery up to round-the-clock

¹This is all the more important as the Dutch public LTC insurance has been undergoing major changes since 2013. 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.

²These 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 et al., 2015b]. However, these papers do not investigate further into socio-economic inequalities in the use of LTC nor attempt to summarize the inequity in terms of concentration indexes.

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 and hence these studies suffer from relatively low statistical precision. We overcome these three problems by using administrative on the universe of long-term care eligibility and use.³

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 et al., 1991, 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 Dutch agency in charge of the eligibility decisions as the only indicator of legitimate needs for LTC. A crucial element is that CIZ is a central agency, independent from budgeting or care allocation considerations; it has the explicit goal of ensuring that eligibility decisions are taken in a uniform way across regions and that all applicants are treated in a similar way. 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 unsuspected feature of the Dutch LTC system.

³ A fourth advantage of administrative data over survey data is that administrative data does not suffer from reporting and recall bias. This reporting bias may be substantial: e.g. while public LTC insurance provides universal coverage (and private LTC insurance is almost non-existent) in the Netherlands, [FIG]% of the Dutch SHARE respondents reports not having long-term care insurance.

2 THE DUTCH LONG-TERM CARE SYSTEM

The Dutch public LTC insurance (*Algemene Wet Bijzondere Ziektekosten* - 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 over received public LTC support [OECD, 2017, Muir, 2017], while private LTC is believed to remain marginal in the Netherlands [Statistics Netherlands, 2017]. Individuals can receive support either in the community or in specialized institutions, such as nursing homes and residential care homes. 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 I). 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).⁴

Table I: 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 public LTC insurance. For institutional care, we

Decisions regarding eligibility for public LTC are taken by the regional office of 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

⁴ We describe the pre-2015 system because we use data from 2012. See van Ginneken and Kroneman [2015] for details of the 2015 reform .

application contains information on the functional limitations of the applicant, her health status and background characteristics.⁵ The application is reviewed by an assessor, who has also information about any past use of public LTC and potential previous applications. 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 pluridisciplinary 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 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].⁶

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.⁷

Mandatory social security contributions to the scheme represent about 2/3 of the total costs, 25% are tax-funded and less than 10% of total public LTC costs are paid from co-payments [Schut et al., 2013]. These co-payments

⁵Individuals may also specify which types of care they would like to receive; yet the documentation about the assessment procedure shows that the preferences expressed by applicants need not be taken into account [CIZ, 2014]. According to Bakx et al. [2017], who interviewed several CIZ assessors, these preferences rarely play a role in the assessment process.

⁶The 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.

⁷The table of tariffs applied in 2012 are presented in Table A.III, Appendix A.2.

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.⁸ 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 with lowest incomes.⁹ 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 is *descriptive*, and consists in documenting potential *inequalities* in care use. The second step involves *normative* judgments to distinguish between acceptable inequalities and unfair ones [Wagstaff et al., 1991, Wagstaff and van Doorslaer, 2000, Van Doorslaer and van Ourti, 2011, Fleurbaey and Schokkaert, 2011].

Assessing income-related inequalities is traditionally done by drawing the concentration curve of the outcome of interest [Wagstaff and van Doorslaer, 2000]. 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].¹⁰ A negative concentra-

⁸Co-payments also depend marginally on wealth and include allowances for a range of circumstances. See Appendix A.2 for further details on the schedule of co-payments.

⁹The agency in charge of computing the individual co-payments, CAK (*Centraal Administratie Kantoor*), is fully distinct from CIZ.

¹⁰The 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 in-

tion 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:

$$CI(y) = \frac{2}{\mu} cov(y, r^I) \quad (1)$$

where r_i^I denotes the fractional rank of individual i in the income distribution of the population of interest ($r_i^I = i/N$ 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 μ denotes the population average LTC use over 2012.

3.2 Horizontal inequity in LTC use

3.2.1 From horizontal inequality to horizontal inequity in LTC use

Not all income-related inequality in LTC use should be considered as horizontally inequitable in LTC use. In particular, heterogeneity in functional status may correlate with income, and induce differences in LTC use along the income distribution that should not be considered as inequitable. 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 traditionally called the “need” variables.¹¹ Conversely, all the individual characteristics the impact of which on LTC use is considered as unfair are defined as “non-need variables”.

Pinpointing need factors is however not sufficient: we need a stance in terms of *how different* should the use of LTC services be for individuals with different levels of needs. Horizontal equity assessment involves the incorporation of a norm of vertical equity in care use in the empirical analysis.¹² 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. The typical way of proceeding is to assume that the population average relationship between need variables and care use, when controlling

dex implicitly attributes arbitrary weights to the inequality observed at different parts of the distribution [O'Donnell et al., 2008].

¹¹This 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.

¹²Note 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.

for potential confounders, provides a sensible norm of vertical equity in care use. This statistical derivation of the norm relies on the assumption that “on average, the system gets it right” [Van de Poel et al., 2012]. 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.¹³

In the context of the Dutch LTC system, a norm of vertical equity in use is defined in the eligibility assessment rules set by the Minister of Health and implemented by the CIZ assessors. Hence, in our empirical study we choose to use the monetary value of assessed needs for LTC as the only need variable. We consider that 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. Such an institutionalized norm of “needed care” is seldom available in other contexts: in 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 health care providers. There is then 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 the policy objectives regarding access to LTC in the Netherlands. The monetary value of the assessed needs is then the best proxy of the underlying vertical equity norm. 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?”.

3.2.2 The horizontal inequity index

Empirically, in order to disentangle the impact of need and non-need variables on LTC use, we estimate a model of LTC use [Van Doorslaer and van Ourti, 2011]. Assume the monetary value of LTC services consumed by individual i , y_i , is a linear function of the needs of LTC as assessed by CIZ, x_i ,

¹³Ruling out (average) vertical inequity is a 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.

and of K “non–need variables”, Z_i , which are additively separable:

$$y_i = \beta_0 + \beta^N x_i + \sum_{k=1}^K \beta_k^{NN} z_i^k + \epsilon_i \quad (2)$$

From the estimation of Equation (2), we construct the need–predicted LTC use \hat{y}_i^N as:

$$\hat{y}_i^N = \hat{\beta}_0 + \hat{\beta}^N x_i + \sum_{k=1}^K \hat{\beta}_k^{NN} \bar{z}^k \quad (3)$$

where \bar{z}^k is the population average of variable z^k .¹⁴

Need–predicted use gives the value of LTC services that would be observed if only needs mattered. We use this variable to construct a measure of LTC use that “purges” the individual measure of use from the predicted effects of legitimate needs for LTC. We compute the need–standardized LTC use for individual i , \hat{y}_i^{IS} , as:

$$\hat{y}_i^{IS} = y_i - \hat{y}_i^N + \mu \quad (4)$$

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.¹⁵ 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. We then derive a synthetic measure of income–related horizontal inequity in LTC use by computing the concentration index of need–standardized use.

¹⁴Taking 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}^N is equal to μ . This is a necessary condition to make the difference between the concentration index of actual consumption and the concentration index of need–predicted consumption interpretable in terms of horizontal inequity.

¹⁵We 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.

The horizontal inequity index of LTC use $HI(y)$ is equal to:¹⁶

$$HI(y) = CI(\hat{y}_i^{IS}) \quad (5)$$

Interpreting our horizontal inequity index as a measure of income-related horizontal *inequity* in LTC use in the Netherlands hinges on two main conditions. Firstly, it rests on the normative stance that eligibility decisions made by CIZ give the “relevant” norm of vertical 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. If individual preferences for formal care, or for institutional care as opposed to home care services, correlate with income even when CIZ-assessed needs are controlled for, then $HI(y)$ will capture both the differential preferences by income and potential residual horizontal inequity.

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 A.1.1) that are linked through a unique identifier.¹⁷ 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 the individual 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 I in Section 2). We also know whether and when an individual was receiving cash

¹⁶The horizontal inequity index could be alternatively obtained following the exact same steps as described here-above, but constraining the coefficient β^N to 1 in Equation (2). By doing this, we would ensure that the norm of vertical equity we plug in the analysis is exactly the one embodied by CIZ eligibility decisions. By not constraining the coefficient to 1, we actually allow any systematic correlation between eligibility and the non-need factors to be captured by the β_k^{NN} coefficients. Practically, this means that we partly rely on the 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. We checked that our results are qualitatively invariant to this assumption. The horizontal inequity indexes we derive when constraining β^N to 1 are quantitatively close the indexes we present and discuss in the paper (Appendix A.6.1).

¹⁷Access to the microdata and permission to merge different datasets are granted by Statistics Netherlands (CBS) under a confidentiality agreement.

benefits. Additional administrative records provide information on household income and assets, personal address and demographic information.¹⁸

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 condition 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.¹⁹

Given that we measure needs as CIZ entitlements for 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 if 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%²⁰, meaning a final sample of 616,934 individuals.

¹⁸As individuals who died in 2012 were not taxed in 2012, for all individuals we consider the taxable income and wealth of year 2011. Some characteristics (household composition, existence of partner, address) have changed during 2012: in that case, we keep the situation with longest duration in 2012. See Appendix A.1.2 for more details.

¹⁹Other 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 old-age disability.

²⁰Appendix A.1.3 provides additional details.

4.3 Variables of interest

4.3.1 The ranking variable

We focus on *income*-related inequality and horizontal inequity. Individuals are ranked by their equivalized household taxable income.²¹ The distribution of income is smooth, with no mass point, making it empirically straightforward to rank individuals from the poorest to the richest.²² making it empirically straightforward to rank individuals from the poorest to the richest.

4.3.2 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 the use by the prices (for institutional care) or the maximum tariff (for home care) that are set by the Dutch Healthcare Authority (NZA).²³

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.²⁴ 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.

One issue when considering the *annual* LTC use is for individuals who died before the end of 2012: their use of LTC services is right-censored by their death. As mortality is not uniform across the income distribution, ignoring this data issue is likely to bias our assessment of income-related inequalities and inequity in LTC use. We thus prorate the monetary value of LTC use of individuals who died in 2012 on the basis of the proportion of the year they were alive.²⁵

Similarly, we compute the monetary value of the LTC services the individual was eligible for.²⁶

²¹We use the square root equivalence scale: the equivalized income of an individual is equal to her household income divided by the square root of the number of household members [OECD, 2011].

²²In particular, only [FIGURE] individuals have an income equal to 0.

²³Additional details and the grid of tariffs are reported in Appendix A.2.

²⁴See Appendix A.2.1. The cash equivalent of in-kind services represents about 75% of their price.

²⁵For example, for an individual who died at the end of June, we multiply the value of her actual use of LTC services and CIZ entitlements by 2.

²⁶Eligibility for home care services is granted in hours per week and is expressed as a range (e.g.,

4.3.3 Non-need factors

As we assume that CIZ eligibility decisions capture the sources of legitimate interpersonal differences in LTC use, any other determinant of LTC use is considered as a non-need factor, i-e a variable z_j^{NN} in the model of LTC use (Equation (2)). In particular, we consider gender, age and household composition to be illegitimate sources of systematic differences in LTC use *conditional* on CIZ-assessed needs.²⁷

We additionally control for the individual's migration background. Economic status is captured by the deciles of equivalized household taxable income and of per capita net wealth, and by a dummy indicating home ownership.²⁸ Finally, we control for the LTC contracting region the individual lives in.

4.4 Descriptive statistics

Table II 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 2012.²⁹ 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 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 mid-point is the one taken into account when entitlements to in-kind services are converted into entitlements to cash benefits.

²⁷The absence of a partner or other family members in the household could be seen as a need factor if we considered that public LTC services should be a complement of, rather than a substitute for, the informal care provided in the household. We assume that all demographic characteristics that legitimately call for a higher use of LTC services have been incorporated in the eligibility decision according to the equity norm expressed in CIZ needs assessment procedure (cf. Section 2).

²⁸One potential concern for the estimation of the model 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.

²⁹Someone may 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.

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 is spent on institutional care, one third on home care. Individuals opting for cash benefits represent less than 5% of the sample; about 8% of the eligible 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€125.³⁰

³⁰The annual cost of staying the entire year in a nursing home with most intensive care reaches k€93. The most expensive users are using home care. Providing long-term care in the community can be more costly than providing institutional care for the most severely disabled elderly because there is no ceiling on the volume of home care services that someone may be eligible for.

Table II: Sample descriptive statistics

	Mean	Standard-deviation
<i>Panel A: Eligibility</i>		
Eligibility for home care	0.650	—
Eligible for institutional care	0.467	—
Value of entitlements to home care	12.179	25.686
Value of entitlements to informal 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
<i>Panel B: Use</i>		
Use of in-kind home care	0.615	—
Use of institutional care	0.387	—
Any take-up of cash benefits	0.044	—
Use of care	0.918	—
Value of in-kind home care used	7.430	17.565
Value of informal care used	14.595	23.580
Value of cash benefits used	0.935	6.572
Value of total care used	22.960	26.664
<i>Panel C: Demographic characteristics</i>		
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	—
Have 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	—
Origin: Suriname	0.010	—
Origin: Dutch Caribbean	0.002	—
Origin: foreign Western country	0.088	—
Origin: other non-Western country	0.006	—
<i>Panel D: Socio-economic characteristics</i>		
Equivalized household income	29.519	24.187
Net wealth (per capita)	159.302	53.7157
Owner of main residence	0.322	—
Observations	616934	

SAMPLE: Individuals 60 and over 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 in thousands euros.

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 II 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 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.

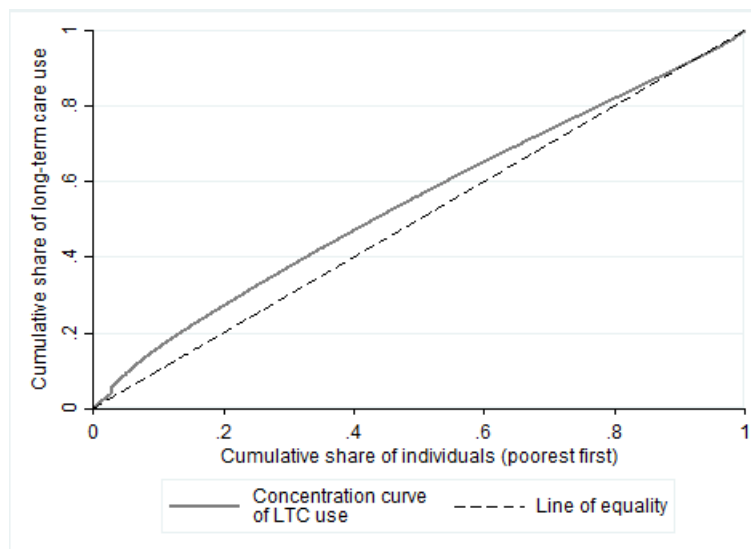
5 BASELINE RESULTS

5.1 Income-related inequality in LTC use

Figure 1 shows that the concentration curve of LTC use is above the line of equality 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 (-0.0850),³¹ reflecting pro-poor concentration of LTC use. This pro-poor concentration seems to be driven both by the higher institutionalization rate of the poor and by the lowest utilization rate of LTC services of the rich: Figure 2 shows that the spikes in the distribution of LTC use among the 50% poorest that are linked with institutional care use are higher, while the proportion of individuals with no or little LTC use is higher among the 50% richest individuals.

³¹Appendix A.4 presents the methods and formulas used to derive the standard error of the concentration index.

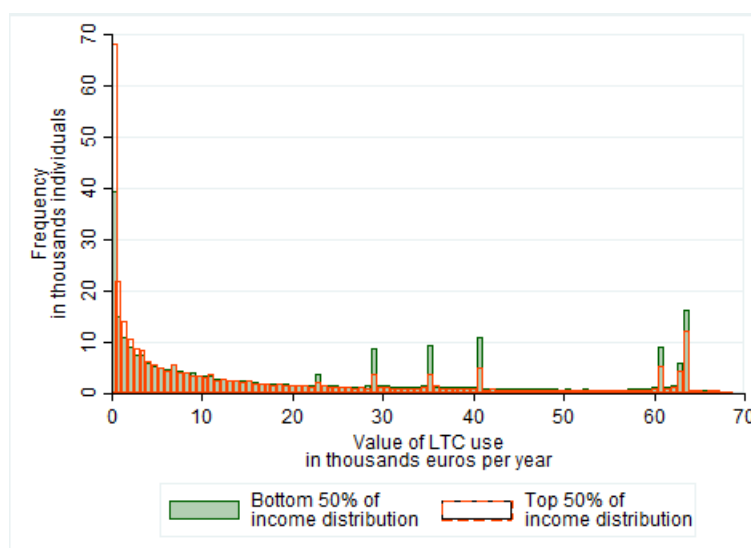
Figure 1: Concentration curve of LTC use.



SAMPLE: Individuals 60 and over 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 2: Distribution of LTC use, among the 50% poorest and 50% richest individuals.



SAMPLE: Individuals 60 and over 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.

5.2 Regression analysis: Model of LTC use

We estimate the model of LTC use (Equation (2)) using an OLS regression, as our outcome variable is continuous. Estimates are presented in Table III.³² The R-square of the model is high (66.2%), meaning that the model leaves relatively little of the inter-individual variations in LTC use unexplained. The partial correlation between CIZ-assessed needs and actual use indicates that an additional €1,000 of entitlements to LTC during the year is associated with an increase of €687 in the value of services used.³³

Most non-need factors have a statistically significant impact on LTC use, suggesting deviation from the principle of equal care for equal needs. In particular, we find a strong negative association between income and LTC use. Older individuals, with no partner in the household tend to have a higher use of care, while individuals with a non-Western migrant background are predicted to use less LTC services.³⁴

Dummies for LTC contracting regions are found to have jointly an effect. The largest gap in average LTC use across two of the 32 regions, once needs and non-need factors are controlled for, reaches €3,000 a year (Figure A.6, Appendix A.5.1). This represents about 15% 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 inter-regional differences in the ratio of LTC services used to CIZ entitlements was recently documented by the Dutch Audit Office [Rekenkamer, 2015]; in spite of the Netherlands being a relatively small country, these differences persist even when we control for a rich set of individual characteristics. On the contrary, 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 potential inequity in the Dutch LTC system.

³²For better readability, the estimates of the coefficients of income deciles, wealth deciles and the LTC contracting regions are displayed on dedicated Figures in Appendix A.5.1.

³³This estimate is statistically and practically significantly different from 1: on average, the value of actual use is below the value of LTC entitlements. As previously mentioned, we assess the robustness of our analysis by estimating the model with the coefficient of CIZ-assessed needs set to 1 (Appendix A.6). The estimates of non-need factors change with this assumption are somewhat different from the ones obtained with our baseline specification (Table III). This reflects the fact that entitlements to LTC correlate with the demographic and socio-economic characteristics we control for.

³⁴See Appendix A.5.1 for further discussion on the coefficients of non-need variables.

Table III: Model of LTC use: OLS regression results (entire sample)

	Dependent variable: value of LTC use (1)
<i>Need variable</i>	
CIZ-assessed LTC needs	0.687*** (0.002)
<i>Non-need variables</i>	
Age: 60–69	-3.273*** (0.078)
Age: 70–79	-1.779*** (0.058)
Age: 80–84	Reference
Age: 85–89	1.270*** (0.058)
Age: 90+	3.275*** (0.066)
Gender: woman	-0.061 (0.045)
Partner in household	-5.060*** (0.066)
Number of household members	1.099*** (0.045)
Origin: the Netherlands	Reference
Origin: foreign Western country	-0.493*** (0.075)
Origin: Turkey	-5.978*** (0.226)
Origin: Morocco	-4.771*** (0.298)
Origin: Suriname	-3.046*** (0.242)
Origin: Dutch Caribbean	-1.603*** (0.483)
Origin: other non-Western country	-4.709*** (0.296)
Owner of main residence	-1.660*** (0.211)
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	-0.392 (0.076)
Observations	616934
R^2	0.662

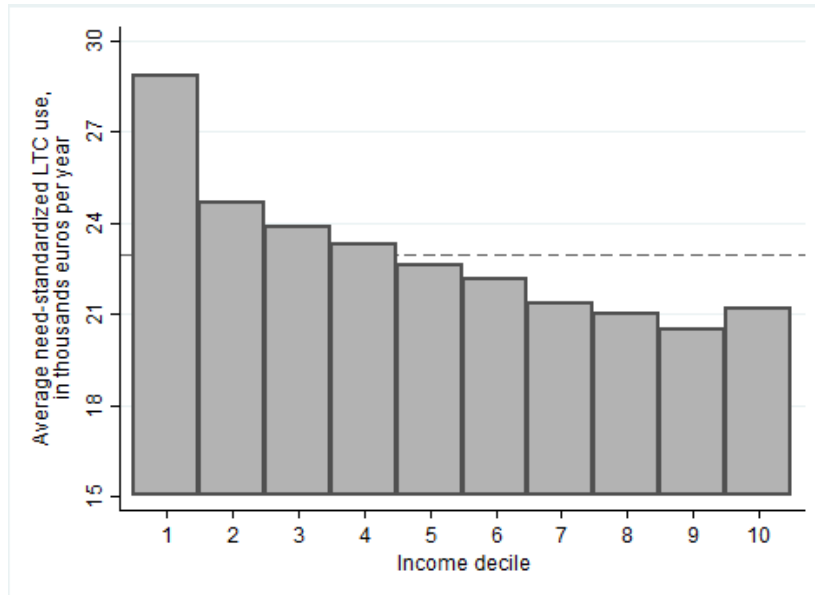
NOTES: Huber–White robust standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The monetary value of LTC use and CIZ-assessed needs, income and wealth are expressed in thousands euros. Standard errors in parentheses. P-values for the test of joint significance (F-test) of the dummies for contracting regions, for income deciles and for wealth deciles.

5.3 Differential use by income for equal needs

Using the estimates of the model of LTC use presented in Table III, we compute for each individual her need-predicted use, y_i^N , and her need-standardized use, y_i^{IS} , following Equations (3) and (4) presented in Section 3.

Figure 3 shows the distribution of need-standardized LTC use across income deciles. There is a clear negative income gradient, meaning that the poor tend to consume more LTC (in value) even conditional on needs reflected in entitlements. The gradient is observed throughout the entire distribution, but is more marked at the very bottom: the first income decile is expected to consume €6,000 more than the 5th decile when we control for differential needs.

Figure 3: Distribution of need-standardized LTC use across income deciles



SAMPLE: Individuals 60 and over 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.

Table IV compares the concentration indexes of actual use and need-standardized use. The difference, i.e. the horizontal inequity index, is -0.0517 , indicating a disproportionate pro-poor concentration of LTC use. Differential use by income for equal needs is substantial: when adjusting for LTC needs the 10% poorest individuals are predicted to use almost 40% LTC services more than the 10% richest individuals.

Table IV: Concentration and horizontal inequity indexes of LTC use

$CI(y)$	$HI(y) = CI(\hat{y}^{IS})$
(1)	(2)
-0.0850*** (0.0008)	-0.0520*** (0.0005)

SAMPLE: Individuals 60 and over 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 A.4 about the computation of the standard errors.

5.4 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 non-need factors that correlate most strongly with both income and LTC use [Wagstaff et al., 2003, O’Donnell et al., 2012].³⁵ 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.³⁶

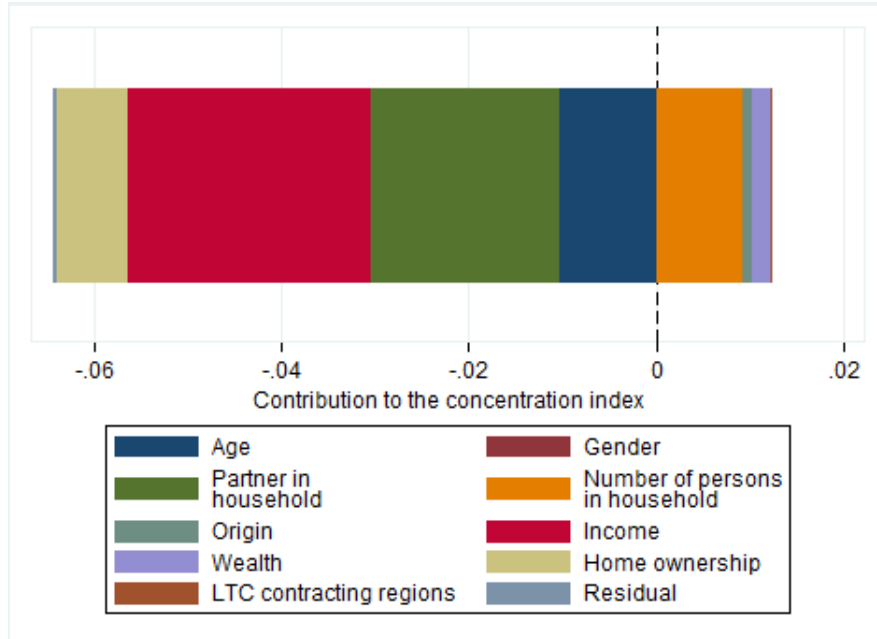
As shown by Figure 4, age, the presence of a partner in the house and income are the main factors behind the higher use of LTC services by the poor. Being older increases the use of care, and the eldest tend to be poorer. Having a partner in the house is associated with a lower value of LTC services used; this situation is more frequently encountered among the rich, both because those are less likely to live in an institution and given socio-economic differences in the probability to have a spouse. The high contribution of income is due to the high income elasticity of LTC use being augmented by the concentration of income (Gini index of 0.33). Conversely, we find that additional household members have a positive contribution to the HI index, meaning that, when taking into account differential needs, they are associated with richer individuals using more LTC than the poor. Finally, the contribution of having a non-Western migrant background and regional differences are almost zero, implying that practice variation across LTC purchasing regions does not contribute to the differential use of LTC *by income*.³⁷

³⁵The formula of the decomposition is presented in Appendix A.5.2

³⁶The contribution of a factor is also proportional to the population average value of this factor. To interpret the contribution of a variable z_k , we combine the descriptive statistics (Table II) to get \bar{z}_k , the OLS estimates of Table III to get β_k^{NN} , and the concentration index $CI(z_k)$ of the variable, which is provided in Table A.X in Appendix A.X.

³⁷The residual term in the decomposition is very small (−0.0003), indicating that our model of LTC use performs well in capturing the determinants of LTC use associated with income.

Figure 4: Contribution of non-need factors



SAMPLE: Individuals 60 and over eligible for public “elderly” LTC in the Netherlands in 2012 (N=616,934).

NOTES: On a total horizontal inequity index of -0.0521 , income contributes negatively by -0.0258 . 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.

Although the effect of each variable needs not be causal [van Doorslaer et al., 2000], our decomposition can provide some useful insights into the potential source of inequity and guide further research. In particular, the strong contribution of income questions the schedule of co-payments in the Dutch LTC insurance. As evidenced by Roquebert and Tenand [2017] and Non [2017], who used data on French or Dutch beneficiaries of home care public schemes, the disabled elderly are price-sensitive in their consumption of formal LTC. 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.

6 HOME CARE *VERSUS* INSTITUTIONAL CARE: SUBGROUP ANALYSIS

6.1 Subgroup definition

One of the reasons for the differences in need-standardized use may be that the rich live at home longer than low-income counterparts with similar needs, thereby substituting institutional stays for a less costly form of care. To gain insight into this potential channel in our cross-sectional setting, we separately analyze LTC use among the individuals eligible for home care and among the individuals eligible for institutional care.

Table V describes the measures of LTC use and needs in each of the subgroups. When focusing on the subgroup of 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. When focusing on the subgroup analysis of individuals eligible for home care (65% of the total population),³⁸ we compute the monetary value of LTC use as the sum of in-kind home care services and cash benefits used while she was eligible for home care support.

³⁸The two groups overlap: someone can be eligible for both institutional and home care in a year.

Table V: Definition of LTC use and needs in the subgroup analysis

	<i>Subgroup A: Individuals eligible for home care</i>	<i>Subgroup B: Individuals eligible for institutional care</i>
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
<i>N</i>	401,262	287,932
<i>Share of total sample</i>	64.9%	46.6%

Table A.VII (Appendix A.3.2) provides the descriptive statistics for each subgroup. 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.

6.2 Income-related inequality and horizontal inequity index by subgroup

Table VI shows the inequality and the horizontal inequity in each of the subgroups.³⁹ In Column (1), we see from the negative concentration indexes that LTC use is concentrated among the poor in both subgroups.⁴⁰ Interestingly though, Column (2) suggests that the rich tend to have *higher* needs for home care than the poor: the positive sign of CI^N 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 ($HI = -0.0484$). Within the subgroup eligible for institutional care, the pro-poor concentration of use is partially offset by the pro-poor concentration of needs ($CI^N = -0.0235$) leading to a horizontal inequity index that is less negative ($HI = -0.0268$).⁴¹

Table VI: Concentration index and horizontal inequity index: subgroup results

	CI	CI^N	CI^{NN}	Residual	HI
	(1)	(2)	(3)	(4)	(5)=(1)-(2)
Entire population	-0.0853*** (0.0008)	-0.0333*** (0.0005)	-0.0516	-0.0003	-0.0520*** (0.0005)
Subgroup eligible for home care	-0.0358*** (0.0008)	+0.0126*** (0.0008)	-0.0480	-0.0004	-0.0484*** (0.0012)
Subgroup eligible for institutional care	-0.0504*** (0.0008)	-0.0235*** (0.0006)	-0.0266	-0.0002	-0.0268*** (0.0004)

SAMPLES: Individuals 60 and over 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 A.4. Bootstrap derivation of the standard errors of the contribution of non-need factors and of the residual has not been completed yet.

³⁹Estimates of the model of LTC use for each subgroup can be found in Appendix A.5, Table A.IX.

⁴⁰Concentration curves of LTC use in both subgroups are provided in Appendix A.5, Figures A.2 and A.3.

⁴¹The 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.

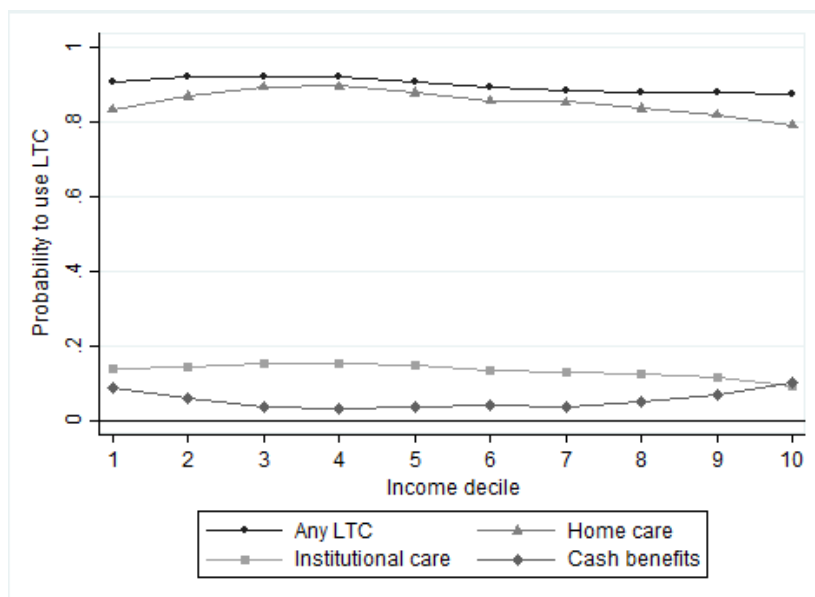
If the co-payment schedule contributed to explaining the pro-poor concentration of LTC use conditional on needs, and unless the poor are much more price-elastic than the rich, we would expect that among those eligible for institutional care, the rich would be more likely to convert their entitlements into in-kind home care services or cash benefits. Indeed, out-of-pocket costs vary more by income levels when individuals use institutional care than when they use home care services. In addition, cash benefits may be used to pay for services that individuals may value more than public nursing homes (like informal care or private care facilities). 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 6). In the subgroup eligible for home care, we only observe a slight decrease in the probability to use any care (in-kind or in cash) when income increases (Figure 5).⁴²

What we observe in the data is consistent with the rich being more likely to forgo some formal care for which they are eligible; and when eligible for institutional care, to opt for home care or cash benefits, which are much less costly.⁴³

⁴²These patterns are robust to controlling for CIZ-assessed needs and the non-need factors.

⁴³See Appendix A.2.1 for a comparison between institutional care tariffs and the costs of an equivalent packages of home care services.

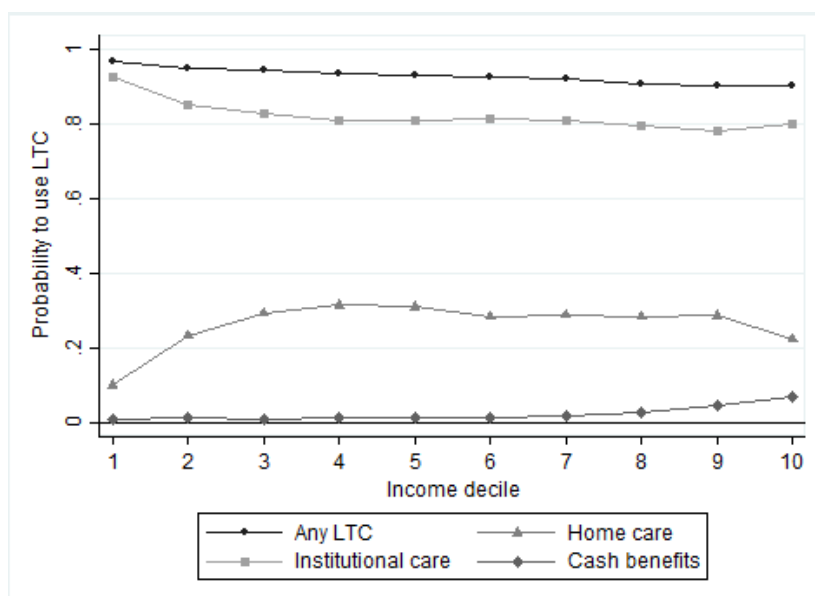
Figure 5: Probability of using a given type of LTC in the subgroup eligible for home care



SAMPLE: Individuals 60 and over eligible for public home care in the Netherlands in 2012 (N=401,262).

NOTES: Probability of using a given type of care while the individual was eligible for home care. A given individual may use several types of care over the period she is eligible for home care.

Figure 6: Probability of using a given type of LTC in the subgroup eligible for institutional care



SAMPLE: Individuals 60 and over eligible for public institutional care in the Netherlands in 2012 (N=287,932).

NOTES: Probability of using a given type of care while the individual was eligible for institutional care. A given individual may use several types of care over the period she is eligible for institutional care.

7 DISCUSSION

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 need” principle by relying on an explicit norm of vertical equity in care use, which is derived from the central assessment agency’s eligibility decisions.

The results are somewhat at odds with the common view that the Dutch LTC system is very egalitarian [Mot, 2010, Bakx et al., 2015b]. 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.

Most individuals in our population of interest are retired. For the retired, income is mostly made of pensions, which are more equally distributed than the housing and financial wealth accumulated by the elderly cohorts.⁴⁴ By taking income as our ranking variable, we neglect an important component of socio-economic resources in the elderly population. 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]. 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. As displayed by Figure A.10 (Appendix A.7.1), the differences in the need-standardized use between wealth deciles is smaller than those observed between the income deciles; yet the 30% wealth-richest individuals tend to use more LTC (in value), conditional on their entitlements.

A downside of administrative data is that it does not contain information on the informal care. For personal care and assistance with IADL and ADL limitations, informal care was found to be a substitute for formal care [Bolin

⁴⁴In our population, the Gini coefficient equals 0.32 for equivalized income and 0.45 for individualized wealth.

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.

The lack of data on informal care also means 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 extreme views. On one hand, the comprehensive coverage offered to all elderly for all types of LTC means that formal care is collectively valued. 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 [CIZ, 2012]. 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 care is of policy relevance in the Netherlands.

Our “pro-poor” horizontal inequity index may 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 have a larger impact on the rich than the poor. Yet another cause of the differential use of LTC services conditional on LTC entitlements may be systematic differences in forward-looking behavior or preferences for ageing in place across socio-economic groups. Although individual relative preferences for care settings seem to fluctuate even in the short run [Wolff et al., 2008] and are therefore hard to assess, 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.⁴⁵ If we are to respect preferences, this would imply that our horizontal inequity index partly reflect fair differences in LTC use across the income distribution.

⁴⁵Nieboer 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 institutionalization actually is an inferior good, then the disproportionate use of nursing home by the poor relative to the rich may only reflect that they lack the financial or family resources to stay home. If we were to define fairness as the absence of envy between individuals, then our findings might reveal that the Dutch LTC system put the elderly with low financial resources at a disadvantage in terms of well-being.

Finally, interpreting our results in terms of horizontal inequity also requires CIZ entitlements to be a relevant indicator of the characteristics leading to fair inequalities in the use of LTC. 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 use and how they relate to socio-economic conditions is needed so that 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.

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A Appendices

A.1 Data treatment and sample selection

A.1.1 Description of datasets

We match together different microdatasets, the access to which was granted by CBS, by the means of a unique identifier. The datasets are described in Table [A.I](#).

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).

Table A.I: Description of the microdata sources

Dataset	Source	Unit of observation	Number of obs.	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 (<i>Integraal Huishoudens Inkomen</i>)	Tax records	An individual		Total household taxable income
Assets (<i>Integraal Vermogen</i>)	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 (GBAOVERLIJ-DENTAB)	Municipal population registers	An individual		Date of death, if any
Spouse/registered partner identifier (GBAVERBINTENISPARTNERBUS)	Municipal population registers	One partner of an individual		Date of formation of the couple; date of dissolution; Identifier of the spouse
Household composition (GBAHUISHOUDENS-BUS)	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 (GBAADRESOBJECT-BUS + 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 3 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, loose or change partners, and have a varying household composition.

A.1.2 Data treatment

In this Appendix, we describe the treatment we applied to the data, highlight some potential pitfalls of the data and the way we addressed the issues.

In progress

A.1.3 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.⁴⁶ Our population of interest is made of 618,041 individual.

We keep individuals for which we have information on all the demographic and socio-economic characteristics we consider as non-need factors in the equity assessment (age, gender, marital status, household composition, migrant background, income, wealth, home ownership, address). The data contain very few missing values. As displayed in Table A.II, 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 A.II: 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 (<i>Population of interest</i>)	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 (<i>Baseline sample</i>)	616,934	99.88%	99.82%

⁴⁶CIZ 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 this condition is registered as the primary or as the secondary condition.

A.2 Additional information of the Dutch long-term care system

A.2.1 Prices of LTC services in the Netherlands

The monetary costs of LTC services funded through the public insurance system are defined by a national grid of tariffs, presented in Table A.III.

Long-term care institutions, who are public in the Netherlands, receive funding in accordance to 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 A.III: 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: [Zorgautoriteit \(2011a,b\)](#).

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 verzorging* (stays in a nursing home, residential care home, rehabilitation center or palliative care center).

When individual 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 A.IV.

Table A.IV 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, 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 A.IV: 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: [voor Zorgverzekeringen \(2012\)](#), [Zorgautoriteit \(2011a,b\)](#). 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 verzorging* (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 A.IV). 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 A.III, 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.

A.2.2 Co-payments in the Dutch LTC system

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 \(2017\)](#), on the rules and values applicable in 2012.

For home care, a year is divided into 13 periods of 4 weeks. The computation of co-payment is based on the total number of hours of home care used each care period at the household level.⁴⁷ 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.

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:

$$\bar{C}P = \max(18; 0.0115 \times \tilde{I} - 167)$$

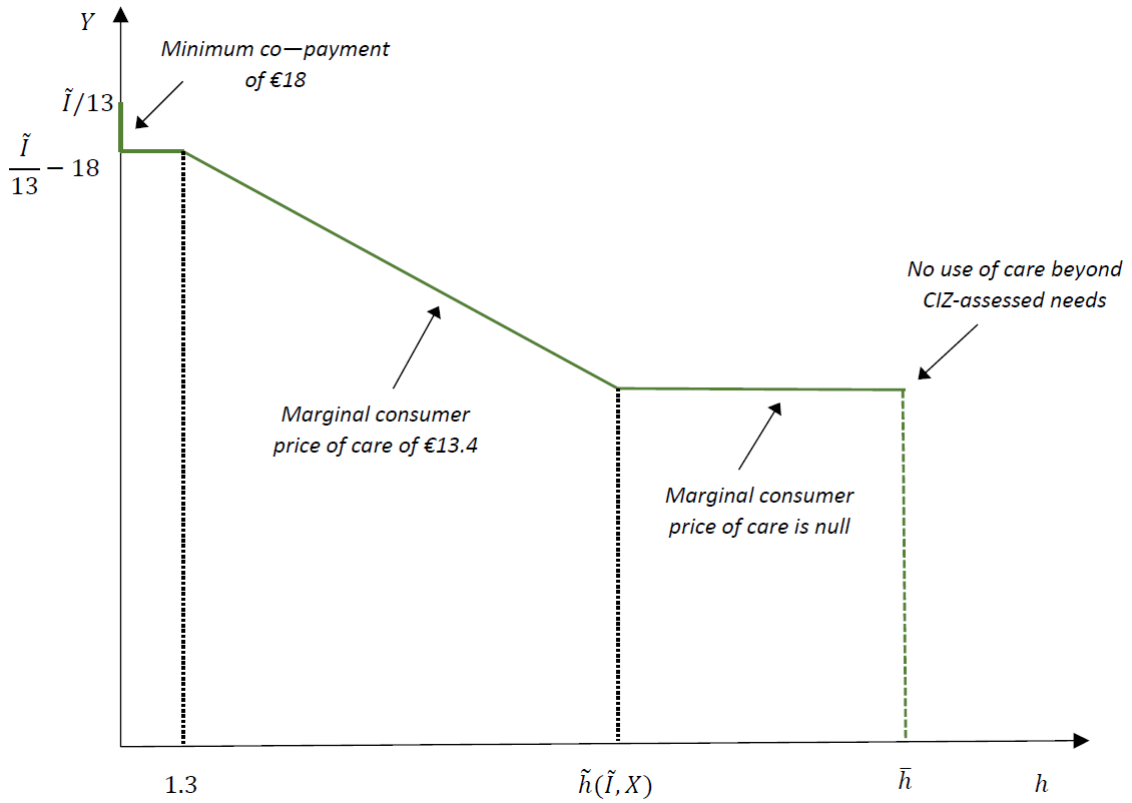
where $\bar{C}P$ denotes the co-payment cap (per four week period) and \tilde{I} the relevant (annual) income measure. For individuals with income below €14,521 annually, this means that the co-payment will be capped to €18 per care period.⁴⁸

⁴⁷The 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).

⁴⁸The 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).

On Figure A.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 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 A.1: Budget constraint for single, 65+ individuals eligible for home (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 (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.⁴⁹

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 A.V: Co-payments and effort rate on home care: some practical examples

	Annual income measure \tilde{I}		
	€15,000	€25,000	€70,000
Very low use: 2 hours/week	€58 5.0%	€107 5.6%	€107 2.0%
Low use: 5.5 hours/week	€58 5.0%	€208 10.8%	€295 5.5%
Median use: 13 hours/week	€58 5.0%	€208 10.8%	€697 12.9%
Intensive use: 28.5 hours/week	€58 5.0%	€208 10.8%	€883 16.4%

NOTES: Co-payments per care period are expressed in euros. 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 A.IV).

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 permanent basis.

The schedule for computing the monthly co-payment on institutional care depends on the individual and household characteristics of the individual:

- When the beneficiary's spouse does not live in a nursing home, or when the beneficiary was admitted less 6 months ago in the institutional set-

⁴⁹These are the assets held in bank accounts, stocks and bonds in excess of an amount of €21,139 per individual.

ting, or when one she is raising a child:

$$CP_{inst} = 0,125 \times (\tilde{I}^{inst}/12)$$

where \tilde{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:

$$CP_{inst} = \min(2,248; \tilde{I}^{inst}/12)$$

Co-payment on institutional care do not depend on the intensity of care received: for individuals with high income and moderate needs, co-payments are 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).

In progress

A.3 Additional descriptive statistics

A.3.1 LTC utilization rates in the Dutch elderly population

To ease the comparison of the Dutch LTC system with other countries, Table A.VI provides the share of the elderly population eligible for publicly-funded LTC and the utilization rates of LTC services.

Table A.VI: 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 among the 60+ population (resp. 65+ population) are computed on the basis of all individuals who were born in or before 1952 (resp. 1947) 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 a given type of care in 2012, and dividing by the of individuals who were born before 1952 (or 1947) and were alive at least one day in 2012. This is an important point to keep in mind when interpreting these figures and comparing them with other available statistics (e.g. Muir (2017)), as similar rates may be derived taking the ratio of the number of individuals eligible for or using care to individuals alive one specific day of the year, depending on the country.

A.3.2 Descriptive statistics: Individuals eligible for home care and individuals eligible for institutional care

Table A.VII: Descriptive statistics by subgroup of eligibility

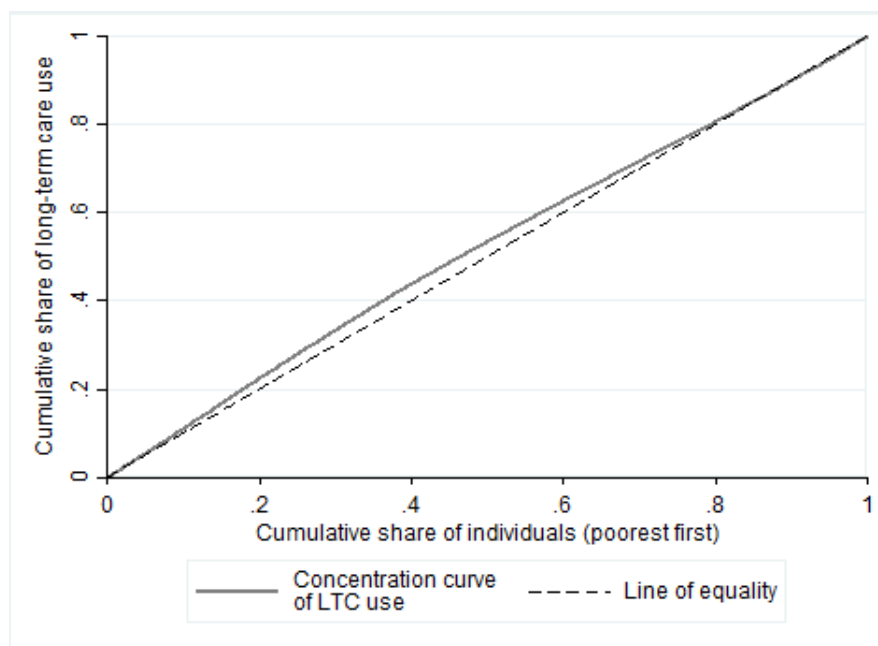
	Eligible for home care	Eligible for institutional care <i>Mean</i>
<i>Panel A: Eligibility</i>		
Eligibility for HC in the year	1.000	0.254
Eligible for IC in the year	0.182	1.000
Eligible for both home care and institutional care	0.182	0.254
Value of entitlements to home care	18.726	4.052
Value of entitlements 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
<i>Panel B: LTC Use</i>		
Use of in-kind home care	0.854	0.364
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 HC used	9.929	5.643
Value of IC used	2.216	31.271
Value of cash benefits	1.161	0.823
Value of total care used	13.307	37.737
<i>Panel C: Demographic characteristics</i>		
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
Have 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
<i>Socio-economic characteristics</i>		
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 over 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.

A.3.3 Concentration curves of LTC use among individuals eligible for home care and among individuals eligible for institutional care

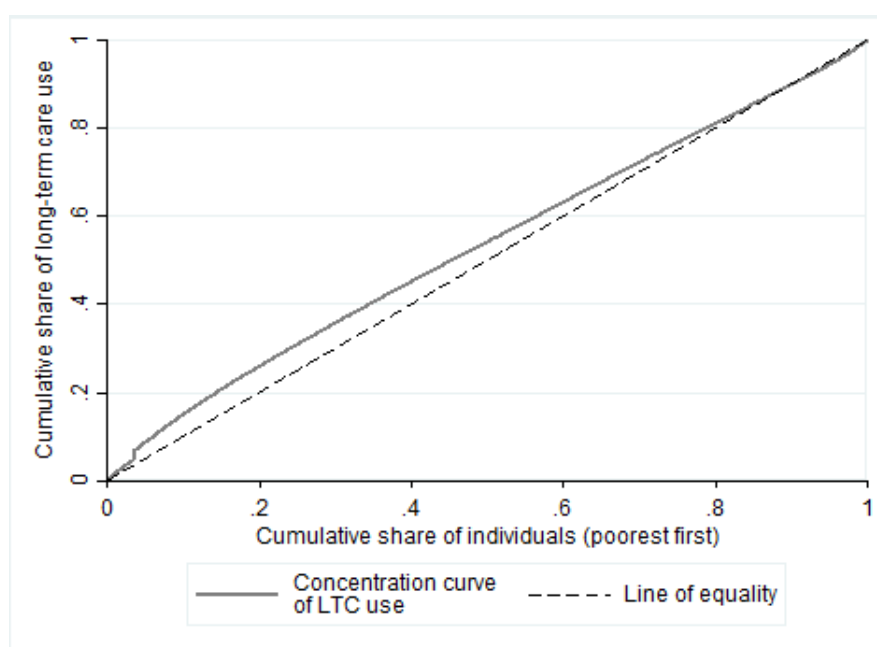
Figure A.2: Concentration curve of LTC use among individuals eligible for home care.



SAMPLE: Individuals 60 and over eligible for public “elderly” home care in the Netherlands in 2012 (N=401,262).

NOTES: LTC use is expressed in annual monetary value. 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.

Figure A.3: Concentration curve of LTC use among individuals eligible for institutional care.



SAMPLE: Individuals 60 and over eligible for a stay in a public nursing or residential care home in the Netherlands in 2012 (N=287,932).

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.

A.3.4 Use of cash benefits by income deciles

Table A.VIII: Take-up and average value of cash benefits, by income deciles.

	Entire population (1)	Eligible for HC (2)	Eligible for IC (3)
<i>Take-up of cash benefits</i>			
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
<i>Average imputed value of cash benefits among users</i>			
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 she was eligible for home care in Column (2), while she was eligible for institutional care in Column (3)). The number of observations displayed on the last row give 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.

A.4 Inference in horizontal equity analysis

A.4.1 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:

$$Var(\hat{CI}) = \frac{1}{n} \left[\frac{1}{n} \sum_{i=1}^n a_i^2 - (1 + CI)^2 \right] \quad (6)$$

with:

$$a_i = \frac{y_i}{\mu} (2r_i^I - 1 - CI) + 2 - q_{i-1} - q_i$$

and:

$$q_i = \frac{1}{n\mu} \sum_{j=1}^i y_j$$

(q_i is the ordinate of the Lorenz curve for the i^{th} poorest individual, and $q_0 = 0$).⁵⁰

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:

$$2\sigma_r^2(y_i/\mu) = \alpha + \delta r_i^I + \epsilon_i \quad (7)$$

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 1.

However, the standard error associated to δ does not incorporate the sampling variability of the dependent variable in Equation 7 (which contains an estimate of the population mean of LTC use, μ). The solution is to regress the untransformed outcome, y , on the fractional rank, then transform the coefficient on the fractional rank, and apply a delta method to derive a correct

⁵⁰This 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).

standard error:

$$y_i = \alpha_1 + \delta_1 r_i^I + u_i \quad (8)$$

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:⁵¹

$$\hat{\delta} = \left(\frac{2\sigma_r^2}{\hat{\alpha}_1 + \hat{\delta}_1/2} \right) \hat{\delta}_1$$

The estimate of the concentration index is now written as a function of the regression coefficients from Equation 8; 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)).

A.4.2 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 3). The concentration index of need–predicted LTC use, CI^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 CI^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 A.4.4). So far, we have used the convenient regression approach to derive approximate values for the standard error of CI^N . Given our very large sample size, we do believe that our results will remain unchanged when we derive the standard errors appropriately.

A.4.3 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, CI^N . Alternatively, we can derive the horizontal inequity index as the

⁵¹Using 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.

concentration index of the (indirectly) need-standardized LTC use, y_i^{IS} (cf. Equation 4, Section 3).

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.⁵²

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 .

A.4.4 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 derive these standard errors using a Bootstrap procedure.

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 $b = 1, \dots, B$, we re-estimate Equation (2) (Section 3) and derive the coefficient estimates $\hat{\beta}_0$, $\hat{\beta}^N$ for $j = 1, \dots, J$ and $\hat{\beta}_k^{NN}$ for $k = 1, \dots, K$. For each Bootstrap sample, we can construct an individual-level measure of need-predicted LTC use \hat{y}_i^N , following Equation (3) (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 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.

⁵²On the interpretation of and differences between direct and indirect standardization of health care use variables, see O'Donnell et al. (2008), Chapter 5.

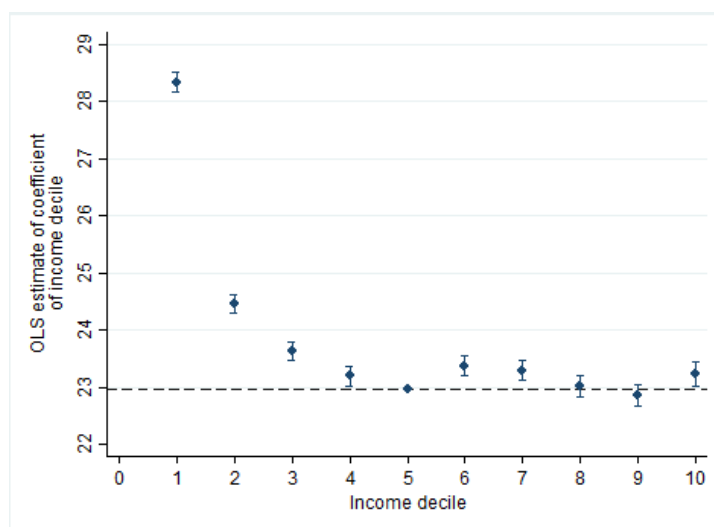
A.5 Complementary inputs of horizontal inequity assessment and decomposition analysis

A.5.1 OLS estimates of the model of LTC use: baseline sample

In this Appendix, we complement the comments made on the estimates of the model of LTC use presented in 5.2.

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 €5,000 in annual LTC use, as compared to being in the middle of the income distribution (5th decile). Belonging to the second income decile is also associated with higher LTC use (+€1,500), while differences across the richest 7 deciles are rather limited.⁵³

Figure A.4: OLS 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.

READING: Being in the 2nd bottom income decile is associated with a higher use of LTC by €1,500, compared to belonging to the 5th income decile.

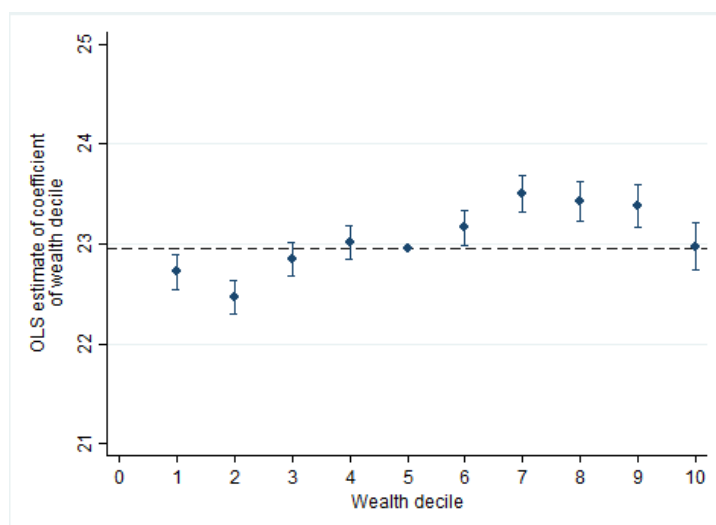
Differences across the wealth distribution – controlling for income – are much less pronounced and, if anything, the bottom deciles are predicted to use less LTC (in value) than the top deciles (Figure A.5, Appendix A.5.1).

Owning one's house is predicted to decrease the value of LTC used during the

⁵³To preserve space, discussion about the interpretation of the estimates is presented in Appendix A.5.1.

year. This may reflect the fact that owners are more likely to prefer to stay home, as compared to renters. This interpretation should be however made with caution: individuals residing in an institution are more likely to have sold their house. Residing in a nursing home (and thus having a relatively high value of LTC use) would then be mechanically negatively correlated with home ownership.⁵⁴

Figure A.5: OLS estimates of the coefficients of wealth deciles



NOTES: 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 (2)).

READING: Being in the 2nd bottom wealth decile is associated with a lower use of LTC by €500, compared to belonging to the 5th wealth decile.

Turning to the effect of demographic characteristics, we find age to be associated with LTC use even when we factor in the need assessment made by CIZ. We find a clear positive age gradient, while gender is not found to have any effect. Having a partner in the household is associated with lower LTC use (€5,000 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 [REF]. 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. Again,

⁵⁴In addition, as we control for total wealth, we actually compare individuals with the same level of wealth but who are either home owners or renters. The coefficient of home ownership also captures the specific characteristics of those who did not buy a house, like preferences for liquidity or risk aversion.

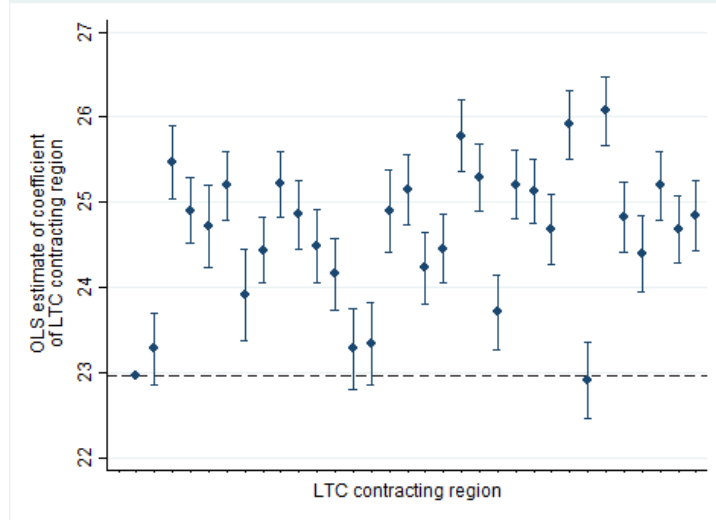
this coefficient may capture a composition effect. Individuals who live in an institution do not have a partner in the house, by definition, and they use LTC services that tend, in most cases, to be more expensive than care provided in the community. Surprisingly maybe, having an additional co-residing relative (beyond the partner) is associated with a higher value of LTC use. 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.⁵⁵

Having a migrant background is also found to have a statistically and practically significant impact on the use of LTC services. The negative coefficient is highest for individuals with Turkish or Moroccan origins and those coming from a non-Western country other than the former Dutch colonies. Having origins in a Western country other than the Netherlands is also associated with a lower LTC use, but the effect is practically small. These coefficients may reflect the inequitable treatment of foreign origin populations by the public LTC system. Yet a now large literature has documented the variations in care arrangements and in the degree of substitution between informal care and formal care across countries. Several studies, relying on SHARE data, have shown that informal care is more widespread in Mediterranean European countries [REF]. While this certainly also reflects the differential generosity and organization of public LTC schemes, we cannot rule out that preferences for living and care arrangements are shaped by cultural differences, which could be captured by our estimates.

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.

⁵⁵It might also be that the “extra” household members compete for care if they are young children or elders as well, or that non-coordination of potential informal caregivers induces an equilibrium with lower informal care provision than the level we would observe in the presence of a unique co-residing relative [REF].

Figure A.6: OLS estimates of the coefficients of LTC contracting regions



NOTES: 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 (2)).

READING: Living in the region ranked second from the left is associated with a higher LTC use of less than €500, compared to living in the region ranked first from the left. Ranking of regions from the left to the right is arbitrary.

A.5.2 Decomposition formula

The concentration index of LTC use can be decomposed following [Wagstaff et al. \(2003\)](#) and [O'Donnell et al. \(2012\)](#):

$$CI(y) = \left(\beta^N \frac{\bar{x}}{\mu}\right) CI(x) + \sum_{k=1}^K \left[\left(\beta_k^{NN} \frac{\bar{z}^k}{\mu}\right) CI(z^k) \right] + \frac{2cov(\epsilon, R^I)}{\mu} \quad (9)$$

$$= CI^N(y) + CI^{NN}(y) + \frac{2cov(\epsilon, R^I)}{\mu} \quad (10)$$

$$= CI^N(y) + HI(y) \quad (11)$$

where:

- μ is the population average LTC use;
- $\beta^N \bar{x} / \mu$ is the population average elasticity of h with respect to CIZ-assessed needs for LTC;
- $\beta_k^{NN} \bar{z}^k / \mu$ is the population average elasticity of h with respect to non-need variable z^k ;
- $CI(x)$ (resp. $CI(z^k)$) is the concentration index of the CIZ-assessed need for LTC (resp. of the non-need variable z^k);

- $CI^N(y)$ represents the contribution of needs to the concentration index of LTC use;
- $CI^{NN}(y)$ represents the contribution of the non-need determinants of care to the concentration index of LTC use;
- $2cov(\epsilon, R^I)/\mu$ is the generalized concentration index of the error term.

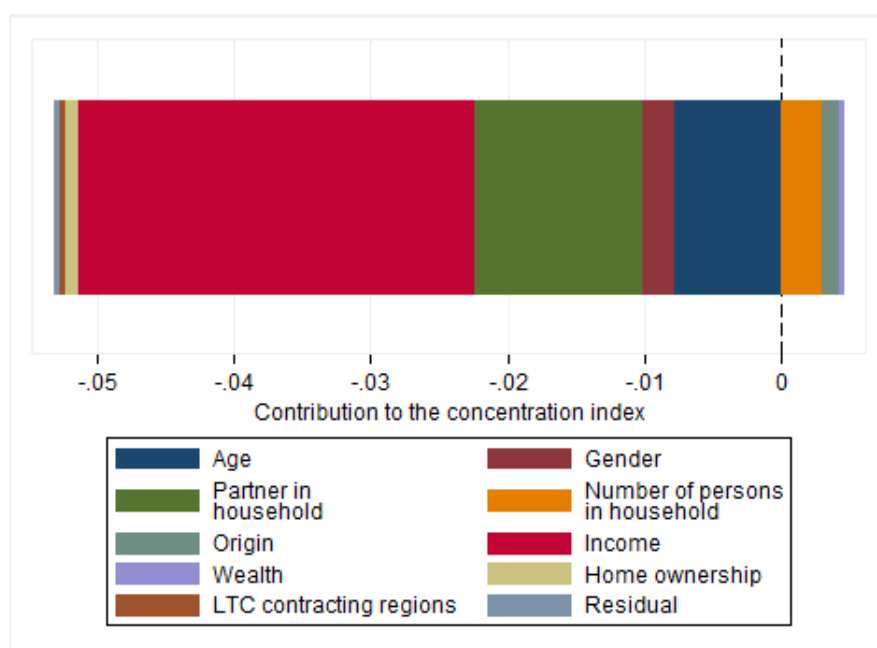
We can then rewrite the horizontal inequity index as:

$$\begin{aligned} HI(y) &= CI^{NN}(y) + \frac{2cov(\epsilon, R^I)}{\mu} \\ &= CI(y) - CI^N(y) \end{aligned}$$

The decomposition formula can be used to study the contribution of each non-need factor to the horizontal inequity index. As shown by Equation (9), the variable z^k will contribute to the horizontal inequity index only if this variable has an impact on LTC use (coefficient β_k^{NN} in the model of LTC use should be different from zero) and if this variable is unequally distributed across the income distribution (the concentration index of z^k , $CI(z^k)$, should also be different from zero). Intuitively, if a given variable is predicted to have a strong impact on the value of LTC services used over the year, but that the poor and the rich are equally endowed with this variable, then it will have nothing to do with poorer individuals consuming more LTC services than the rich. Conversely, a very unequally distributed characteristic (such as wealth) may explain none of the differential use of LTC services across the income distribution if it is not associated with a higher or lower use of LTC services. The contribution of a given variable to $HI(y)$ is all the larger as the prevalence of the characteristic is high or, more generally, the average value of the variable, \bar{z}^k , is so (in absolute value). This is due to the fact that concentration index and horizontal inequity index aim at providing a synthetic picture of inequalities in the system as a whole. Being from a given region may well have a high impact on the average use of LTC services, it will not contribute that much to system-wide inequalities if only a very small share of the Dutch elderly population live there.

A.5.3 Contributions of non-need factors to inequality and horizontal inequity in the subgroup analysis

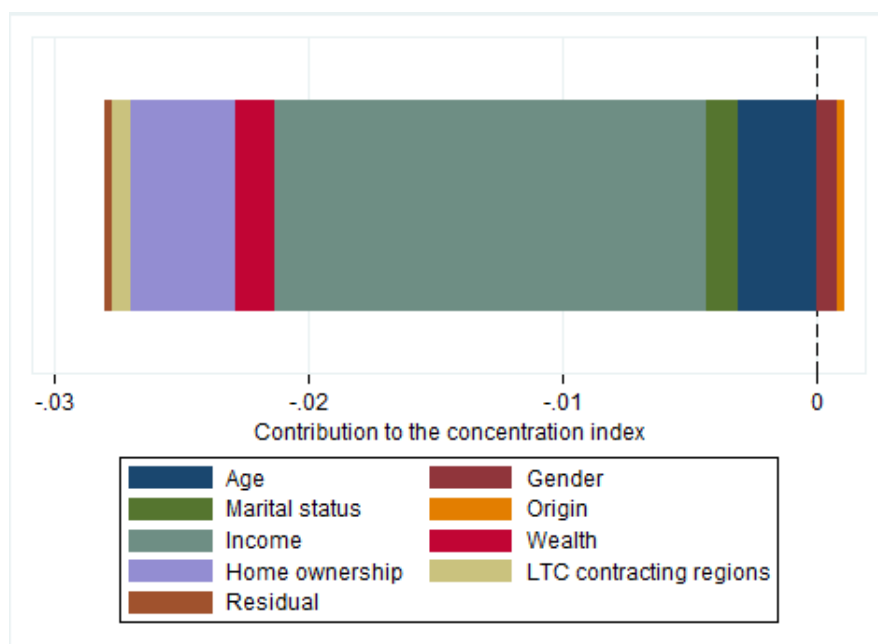
Figure A.7: Contribution of non-need factors to inequality in the subgroup eligible for home care



SAMPLE: Individuals 60 and over eligible for public “elderly” home care in the Netherlands in 2012 (N=401,262).

NOTES: On a total horizontal inequity index of -0.0521 , income contributes negatively by -0.0289 . 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.

Figure A.8: Contribution of non-need factors to inequality in the subgroup eligible for home care



SAMPLE: Individuals 60 and over eligible for a stay in a public nursing or residential care home in the Netherlands in 2012 (N=287,932).

NOTES: On a total horizontal inequity index of -0.0521 , income contributes negatively by -0.0169 . 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.

A.5.4 OLS estimates of the model of LTC use in the subgroups eligible for home care or eligible for institutional care

Table A.IX: Model of LTC use: OLS regression results by subgroup

	Dependent variable: value of LTC use	
	(1)	(2)
CIZ-assessed LTC needs	0.498*** (0.002)	0.975*** (0.002)
Age: 60–69	-1.141*** (0.077)	-2.921***
Age: 70–79	-0.682*** (0.057)	-1.389*** (0.057)
Age: 80–84	<i>Reference</i>	<i>Reference</i>
Age: 85–89	0.566*** (0.058)	0.639*** (0.058)
Age: 90+	1.712*** (0.066)	1.436*** (0.065)
Gender: woman	0.460*** (0.045)	0.687*** (0.045)
Partner in household [if at home] / Married [if in institution]	-1.276*** (0.065)	-0.891*** (0.065)
Number of household members	0.162*** (0.045)	
Origin: the Netherlands	<i>Reference</i>	<i>Reference</i>
Origin: foreign Western country	-0.336*** (0.074)	-0.205*** (0.045)
Origin: Turkey	-2.581*** (0.225)	-8.349*** (0.074)
Origin: Morocco	-1.259*** (0.297)	-8.349*** (0.225)
Origin: Suriname	-0.648*** (0.241)	-1.985*** (0.297)
Origin: Dutch Caribbean	0.489 (0.483)	0.770*** (0.241)
Origin: other non-Western country	-2.253*** (0.295)	-3.686*** (0.483)
Owner of main residence	-0.093 (0.075)	1.435*** (0.117)
Dummies for LTC contracting regions	Yes $p < 0.01$	Yes $p < 0.01$
Dummies for equivalized household income deciles	Yes $p < 0.01$	Yes $p < 0.01$
Dummies for per capita wealth deciles	Yes $p < 0.01$	Yes $p < 0.01$
Constant	0.074 (0.211)	-7.350*** (0.208)
Observations	401262	287932
R^2	0.594	0.711

NOTES: Huber–White robust standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 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.

A.5.5 Concentration indexes of CIZ needs and non-need factors

Table A.X: 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 control variables, but include instead 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 A.X indicates that women non-Western migrants tend to be poorer, while home owners and individuals with a partner tend to be richer.

A.6 Robustness checks

A.6.1 Constraining the coefficient of CIZ-assessed needs to 1 in the model of LTC use

In this Appendix, we compare the concentration index and horizontal inequity index obtained in the baseline analysis with those derived when constraining the coefficient β^N to 1 in Equation (2).

Table A.XI: Horizontal inequity index: sensitivity to constraining the coefficient of needs to 1.

	CI	CI^N	CI^{NN}	Residual	HI
	(1)	(2)	(3)	(4)	(5)=(1)-(2)
<i>Entire population</i>					
Baseline	-0.0853***	-0.0333***	-0.0516	-0.0003	-0.0520***
Constraint	-0.0853***	-0.0322***	-0.0243	-0.0287	-0.0530***
<i>Subgroup eligible for home care</i>					
Baseline	-0.0358***	+0.0126***	-0.0480	-0.0004	-0.0484***
Constraint	-0.0358***	+0.0254***	-0.0606	-0.0005	-0.0612***
<i>Subgroup eligible for institutional care</i>					
Baseline	-0.0504***	-0.0235***	-0.0266	-0.0002	-0.0268***
Constraint	-0.0504***	-0.0241***	-0.0260	-0.0002	-0.0262***

SAMPLES: Individuals 60 and over 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 A.4. Bootstrap derivation of the standard errors of the contribution of non-need factors and of the residual has not been completed yet.

When conducting the analysis on the entire population, we see that the horizontal inequity index HI is almost invariant to constraining the coefficient to 1. However, the decomposition of total inequalities shows that the residual term is much higher than in the baseline specification (-0.0287 against -0.0003): when constraining the coefficient β^N to 1, the model leaves out much more of the unobserved determinants of LTC use correlating with income. On the contrary, the residual term remains fairly small in the two sub-sample analysis. This is explained by the fact that income correlates with the type of care the individual is eligible for (high-income individuals are more likely to be eligible for home care), and that entitlements for institutional care are converted into LTC use at a higher rate than entitlements for home care (cf. Figures A.13 and A.14 in previous Appendix).⁵⁶

⁵⁶As 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

Constraining the coefficient to 1 has more impact of the decomposition of inequality in use for the subgroup of individuals eligible for home care. In the baseline (unconstrained) estimation of the model, the coefficient on needs is further away from 1 in the subgroup eligible for home care than in the subgroup eligible for institutional care (0.49 *versus* 0.97; Table A.IX).⁵⁷

What ultimately induces the difference between the two estimations in terms of the concentration index of need-predicted use (CI^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 A.7.2). Comparing Figures A.13 and A.14, 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 these differences, our main conclusions remain robust: there is pro-poor concentration of need-standardized use, which is strong in the subgroup eligible for home care than among those eligible for institutional care.

correspond only to CI^{NN} . Given that we have (mostly) identified needs *ex ante* here, the high residual in the decomposition of inequality does not challenge the interpretation of HI when defined as the sum of CI^N and the residual. However, if it signals omitted variables or unmodelled heterogeneity along the income distribution, the high residual could be a sign that the estimates of the non-need variables are biased. It invites to remain cautious about the decomposition analysis in the full sample.

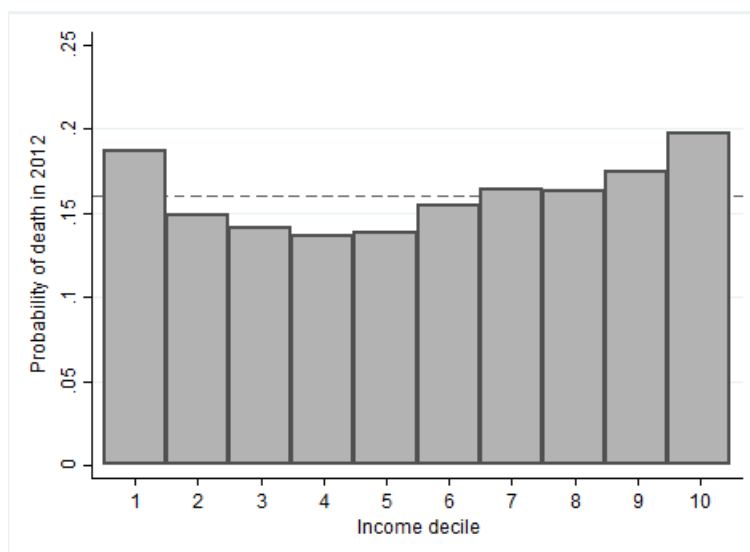
⁵⁷Given the decomposition formula presented in Appendix A.5.2, CI^N in the constrained estimation is expected to be equal to $(1/0.49)$ (about 2) times the value of CI^N obtained in the baseline specification.

A.6.2 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 the individuals aged 60 or more on January, 1st 2012 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 A.9). 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 would bias the measurement of income-related inequalities in LTC use.⁵⁸

Figure A.9: Probability to have died in 2012 by income decile



SAMPLE: Individuals 60 and over eligible for public “elderly” home care in the Netherlands in 2012 (N=401,262).

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 individuals were alive. With this solution, individuals who

⁵⁸It 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.

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 A.XII: Concentration and horizontal inequity indexes: Excluding the deceased (entire sample)

	<i>CI</i> (1)	<i>CI^N</i> (2)	<i>HI</i> (3)	N
Baseline	-0.0850***	-0.0333***	-0.0517***	616,934
Excluding the dead	-0.0941***	-0.0443***	-0.0499***	[FIG]

From Table A.XII, 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, so that the horizontal inequity index remains roughly the same (around -0.05).

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 before 1952) 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.

A.7 Complementary analysis

A.7.1 Wealth-related horizontal inequity

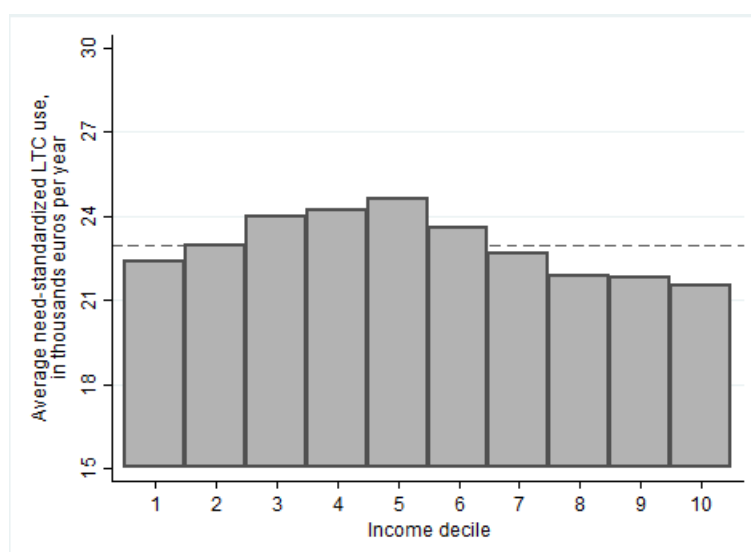
As argued in Section 7, wealth, or some combination of wealth and income, may be used as an alternative indicator of socio-economic status in the elderly population (Van Ourti, 2003, Wagstaff and Watanabe, 2003, Rodrigues et al., 2017). In addition, in some OECD countries, access to public LTC support or the amount of transfers is made conditional on both wealth and income (Muir, 2017). It is thus of interest 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 A.10 to A.12, 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 30% in the entire population and in both subgroups seem to use less services in value than the average, while the bottom-middle of the distribution (deciles 3 to 5) tend to use more care for a given level of CIZ-assessed needs. However, the differences in need-standardized use across the wealth distribution are much smaller than what we observe across the income distribution.

Yet 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 does 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 2011, when co-payments would depend on income and 4% of taxable wealth. A 2012 reform (described in Non (2017)) increased to 12% the share of 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 trade-off between the marginal value of LTC services and the utility they derive from their wealth.

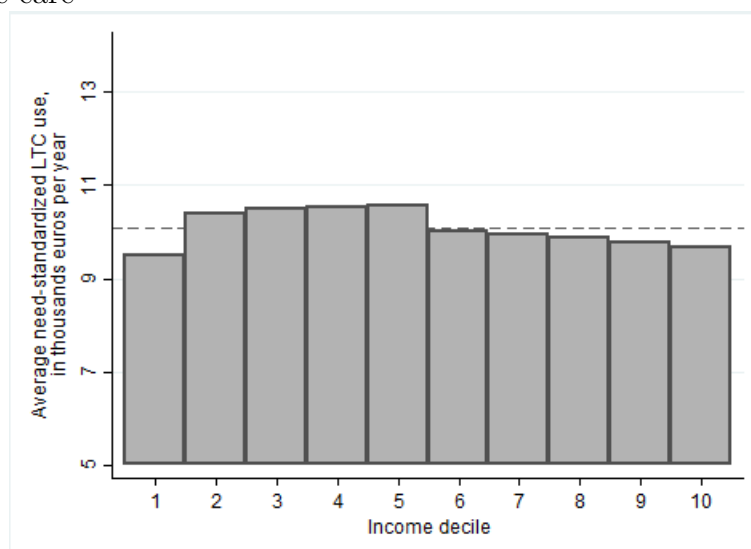
Figure A.10: Distribution of need-standardized LTC use across wealth deciles: Entire population



SAMPLE: Individuals 60 and over 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.

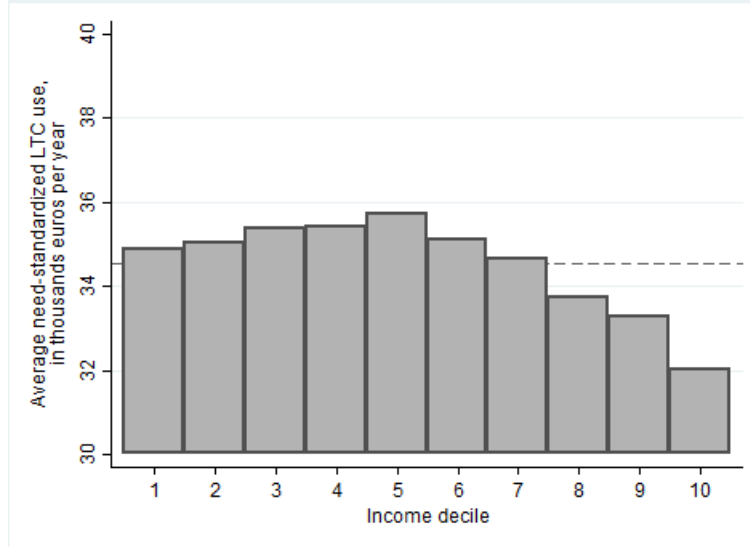
Figure A.11: Distribution of need-standardized LTC use across wealth deciles: Subgroup eligible for home care



SAMPLE: Individuals 60 and over eligible for public “elderly” home care in the Netherlands in 2012 (N=401,262).

NOTES: LTC use is expressed in annual monetary value, in thousands euros. 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. 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 A.12: Distribution of need-standardized LTC use across wealth deciles: Subgroup eligible for institutional care



SAMPLE: Individuals 60 and over eligible for a stay in a public nursing or residential care home in the Netherlands in 2012 (N=287,932).

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. 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.

A.7.2 Conversion rates of CIZ entitlements into use by income decile

We estimate a variant of Equation (2):

$$y_i = \beta_0 + \beta^N x_i + \sum_{d=1, d \neq 5}^{10} \theta^d I_i^d + \sum_{d=1, d \neq 5}^{10} \mu^d I_i^d x_i + M_i' \theta^{NN} + \nu_i$$

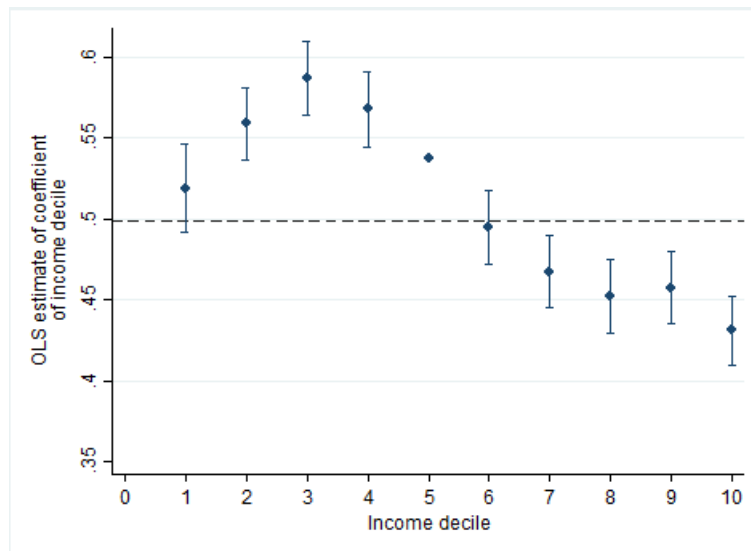
where I_i^d is a dummy equal to 1 if individual i is in the d^{th} income decile, and M_i is the vector of non-need factors excluding the income deciles. Income decile 5 is defined as the reference category. If coefficients μ^d , $d = 1, \dots, 10$ differ from zero, this means that the ability to convert one additional euro of CIZ entitlements into actual use (in value) varies across the income distribution, for a given level of CIZ entitlements. This could also be interpreted as evidence that the effect of income on use varies with the levels of CIZ-assessed needs.

Figures A.13 and A.14 display the estimates $\hat{\beta}^N + \hat{\mu}^d$ for the income deciles $d = 1, \dots, 10$. Empirically, we find the coefficients μ^d to be almost linearly decreasing with income decile, and statistically significantly different from zero for all income deciles apart from 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 A.13) 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 Figure A.14 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.

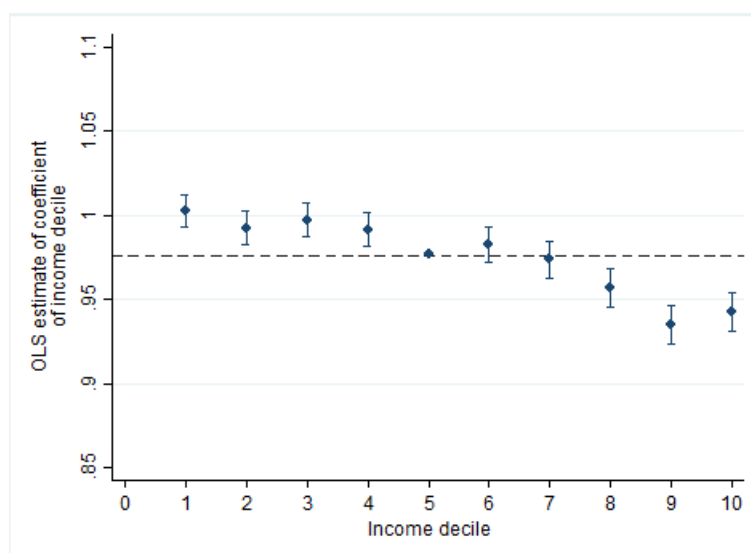
Figure A.13: OLS estimates of the impact of needs on LTC use, by income decile: Subgroup of individuals eligible for home care.



SAMPLE: Individuals 60 and over eligible for public “elderly” home care in the Netherlands in 2012 (N=401,262).

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).

Figure A.14: Interaction terms between income decile and CIZ needs: Subgroup of individuals eligible for institutional care.



SAMPLE: Individuals 60 and over eligible for a stay in a public nursing or residential care home in the Netherlands in 2012 (N=287,932).

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). It happens to have almost exactly the same value as the coefficient of CIZ needs for individuals in the reference category.