Long term care, wealth and housing

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This version: January 20, 2014

Abstract

In this paper we study long-term care expenditure in connection with wealth and housing at the household level. Nursing home care in the Netherlands has become less accessible, due to attempts by the national government to mitigate the increasing costs of long-term care. More elderly households with deteriorating health will be aging in the house they already occupied for a long time. Moreover, the government tries to increase co-payments to LTC consumption by also taking into consideration the wealth possessed by households. Our analysis, however, reveals that wealth and LTC consumption are negatively correlated so that renters and households with relatively low wealth have a remarkably higher incidence of LTC use as well as incur higher average costs of LTC compared to homeowners or households with relatively high accumulated wealth. After introducing a large number of controls this relationship is still significant for long-term care with residence, but the impact of home equity and other wealth components largely disappears. Our findings imply that a system of (increased) compulsory co-payments for LTC based on wealth may possibly have an adverse effect on those individuals in lower wealth cohorts who also appear to be most intensive LTC users. Besides, our results show that residence in an elderly dwelling is found to be positively related to LTC consumption which is probably due to a self-selection effect of those expecting to make use of long-term care due to their health condition.

1 Introduction

During the last decades health care costs have outpaced gross domestic product (GDP) growth in Western countries. For instance, in 2011, the Netherlands spent 70.1 billion euro on health care, which corresponds to 11.9 percent of GDP (OECD, 2013). This is the second highest percentage among OECD countries after the United States, and the figures of a number of other European countries are close to those of the Netherlands. The high score of the Netherlands is mainly due to the system of long-term care (LTC). The costs of curative care as a percentage of GDP are close to the OECD average, but the costs of LTC are 3.7 percent of GDP in 2011, far above the average of 1.6 percent. This makes the Netherlands a leader in the public costs of LTC. More than 800,000 people, of a total of around 16 million, make use of LTC in the Netherlands. About 15% of the total is care for disabled, another 15% is care for chronic psychiatric patients and the remaining 70% is care for elderly people (KVS Preadviezen 2012, 2012). Besides the high use of public LTC, the exceptionally low co-payments in the Netherlands are another important reason for the relatively sharp rise in government spending (Ministerie van Financiën, 2010).

In the upcoming years, the OECD expects that LTC expenditures in the Netherlands will continue to rise, directly and indirectly due to population aging. Important determinants of the upward pressure on LTC expenditure are the decline in births since World War II and the continuing rise in life expectancy. The outflow of the baby-boom generation from the labor force started in 2011. Since that year the share of inhabitants in the age group of 20 to 65 began to fall and that of people over 65 began to increase. According to a population forecast of Statistics Netherlands (CBS), aging will cause an increase in the relative proportion of 65+ from 16% in 2012 to 26% in 2040[1] and an increase in the absolute number of individuals of age 65 and older from 2.7 million in 2012 to 4.7 million in 2040 (van Duin & Stoeldraijer, 2012). Given this relative and absolute increase of elderly people and their high use of LTC, it seems that a continuing rise in LTC expenditures is indeed inevitable which motivates the long-term care reform which is in transition now in the Netherlands at the moment of writing.

The prospect of a substantial further increase in LTC expenditure is unattractive. A transition in the supply of long-term care to reduce costs is generally regarded as inevitable and happening at the moment of writing (Rijksoverheid, 2014). In 2015 legislation governing long-term care will change: the Social Support Act (WMO) will change and a new Long-term Care Act (WLZ) will replace the current Exceptional Medical Expenses Act (AWBZ). More detail on the Dutch long-term care system is provided in Section 2. An important aspect is the emphasis on outpatient care, which refers to the shift from care provided in institutions to care provided at the client's home. Besides the reduction of high institutional costs, in which it is expected to result, this is motivated by the wish of elderly people to stay in their own place as long as possible (Nieboer et al., 2010), (Rouwendal & Thomese, 2013). The regulation of the government to postpone institutionalization and provide more care at home already started in 2013 and proceeds in stages. Since then, new patients already receive an indication for extramural care and support (in types and classes) in case of a light Care Intensity Package

[1] In 1900 the share of persons aged 65+ in the population was only 6%.

(ZZP). In 2015 municipalities –who carry out the WMO – will have more responsibility and only people with severe long-term care needs will get an indication for care which is reimbursed by the Long-term Care Act.

An obvious possibility for counteracting the further increase in LTC expenditure is an increase in the co-payments. Until the 1990s co-payments for some types of long-term care were based on household wealth and could imply the necessity to 'eat your house.' Since then co-payments were determined solely on the basis of household income, but recently the government has again started to consider household wealth when determining the level of co-payments. It is not clear how much relief can be expected. It is well-known that higher educated people, who often have higher incomes and more wealth, live longer in good health. However, higher life expectancy of individuals with higher social-economic status (SES) relative to individuals with lower SES (van Kippersluis et al., 2010) may potentially lead to comparable or even higher total LTC costs over the lifetime of high-SES individuals compared to low-SES individuals.

This papers aims to shed light on two central aspects of this policy change: the housing situation of elderly people in the Netherlands and their wealth in connection to the demand for long term care. To do so, we consider the Dutch households with at least one member aged 55 or more who participated in the WoON survey of 2009 and their demand for long-term care in the following years. The WoON survey is a large sample of Dutch households that concentrates on household composition and housing circumstances. The survey contains a wealth of information on housing characteristics – for instance whether the house is suitable for elderly people – and health – for instance ADL/HDL indicators. We have combined this information with administrative data that inform us about the long-term care consumed by these people in the period 2009-2012 and about their wealth. This enables us to consider the relationship between long term care consumed by these households on the one hand, and their housing and wealth situations on the other.

Empirical assessment of the determinants of long-term care use and the associated expenditures are of great importance for health policy decisions. De Meijer has already put a great effort on this subject (De Meijer, 2012). For example, she showed that disability is an important determinant of long-term care use and the associated expenditures, while self-reported health and chronic conditions are less important. In this study, we like to expand the research of determinants by taking into account not only health characteristics, but also housing characteristics. A good understanding of the relationship between health- and housing characteristics of elderly people (55 years and older) with their long-term care utilization and associated expenditures is of great relevance – especially with the extramuralization of the long-term care reform – and therefore investigated in this study.

The paper is organized as follows. In the next section we discuss some aspects of the Dutch long-term care system. In section 3 we discuss the data and in section 4 we present some preliminary results on the joint distribution of wealth, homeownership and LTC expenditure. Sections 5 and 6 report an econometric analysis of this expenditure using a two-part model. Section 7 concludes.

2 The Dutch long-term care system

In 1968, the Netherlands was the first OECD country that introduced a universal mandatory social LTC insurance system (the Exceptional Medical Expenses Act, abbreviated as AWBZ). Since then it has undergone several changes, but its goal is still the same: to provide a broad coverage of LTC services to all who need it through a collective insurance scheme. The system mainly serves elderly, chronic mentally handicapped and disabled persons. The funding is through a mandatory premium payments based on the income of workers and additional tax contributions. Adults who make use of the system also have to pay an income-dependent own contribution (co-payment).

Since 2004, the eligibility check for AWBZ care is assessed by the Care Assessment Centre (CIZ) and based on national standardized indication procedures. Patients, their relatives or their health care providers have to file a request and the CIZ decides the eligibility for care in an institution or at home and the amount of care that is necessary. The amount and sort of care in an institution is divided in different Care Intensity Packages (ZZP) for sectors in Nursing & Care (VV), Disabled Care (GHZ) and Mental Health Care (GGZ). Care at home has distinctions between Personal Care (PV), Nursing (VP) and Individual Assistance (BGI). If eligible, the CIZ sends this decision to a care office. Patients can choose to receive the care in kind or since 1996 as a cash benefit ("personal budget", abbreviated as PGB) to purchase care themselves. Cash benefits – accounting for 11% of total expenditures (Schut, Sorbe, & Høj, 2013) – make it possible to finance informal or private care with public funds. Since 2007, the provision of domestic help like household work, aiding tools (such as wheel chairs) and home adjustments is decentralized to municipalities. This responsibility is formalized in the Social Support Act (WMO).[2]

3 Data and study population

For this study a number of Dutch datasets are used, which are all collected by Statistics Netherlands (CBS). Our starting point is data from the Netherlands Housing Research 2009 (WoON 2009), which contains information about the living situation and dwelling characteristics, but also about the self-reported health status and ADL/HDL disabilities. The CBS has supplemented this dataset with personal and household characteristics of the Dutch Municipal Register (GBA), which contains basic information like date of birth and having a partner for everyone registered in a Dutch municipality. We select the persons aged 55 and above from WoON 2009 and are able to observe their use of LTC in the three years that follow, because we are able to merge this dataset with data from the Central Administration Office (CAK) about long-term care use and with data from the Care Assessment Centre (CIZ) about indications for long-term care. Moreover, we add CBS data with information about (household) wealth from the Tax Office (Belastingdienst) and data of deceased people, from

[2] For a more detailed description of the health care services in the Netherlands before the long-term care reform happening at the moment of writing, the reader is referred to two reports of the Leyden Academy (Rolden & Van der Waal, 2012, 2013).

which relevant variables are also implemented in our final dataset. Merging is possible through an anonymous identification key which identifies persons at an individual level and is implemented by the CBS in their available datasets. Below we present more detailed information about the datasets we use.

3.1 Netherlands Housing Research (WoON)

The Netherlands Housing Research (WoON) is the successor of the Housing Needs Survey (WBO, since before 1981) and is the largest nationwide study in the Netherlands in the field of housing, households and their overall life situation. The target population is the Dutch population living in private households – thus excluding institutionalized persons. It consists of specific modules, based on a three-yearly net sample of at least 40,000 respondents. The sample is drawn from all persons of 18 years and older in the GBA and takes into account the fact that certain groups participate relatively more or less in surveys. Questionnaires by telephone (CATI), face-to-face (CAPI) or internet (CAWI) are conducted for the data collection. Municipalities or regional partnerships participated in the oversampling. As indicated above, for this study we use WoON 2009. We focus on respondents aged 55 years and older who can be classified as (partner of) the head of the household and (partner of) the main tenant/owner of the house.

3.2 Central Administration Office (CAK)

AWBZ-funded care with residence

This dataset contains all care with residence which are funded by the AWBZ and for which one has to pay an own contribution.[3] For persons aged 18 years and older co-payments are legally obliged when care is funded by the AWBZ. This is usually from the first day of institutionalization until the last day of institutionalization, although there are some exceptions, e.g.:

- The first year of admission to a rehabilitation center or hospitalization (not institutionalization) is accounted for by the Health Insurance (ZVW) and thus no co-payments for AWBZ-care are required.
- When one is waiting in a hospital for a place in an institution, an own contribution has to be paid from the date that the CIZ issues the indication for AWBZ-funded long-term care.
- If a place in an institution is reserved – even though one does not stay there at that moment – an own contribution is still obliged.

Care in kind without residence

This dataset contains data of persons who received care in kind without residence which is funded by the AWBZ or WMO and for which one has to pay an own contribution. WMO-funded care without residence includes Domestic Help (HV) and AWBZ-funded care without residence includes Personal Care (PV), Nursing (VP) and since 2011 also Individual Assistance (BGI). For this study we focus on AWBZ-funded care, thus excluding domestic

[3] Persons younger than 18 years do not have to pay an own contribution and are thus not included in the dataset. As we focus on respondents aged 55 years and older this is no limitation for this study.

help. Respite care in an institute with an indication for short stay is not included in care without residence, but in care with residence.[4]

3.3 Care Assessment Centre (CIZ)

Indication for AWBZ-funded long-term care

This dataset contains all valid indications – which give access to AWBZ-funded long-term care – issued by the CIZ to persons who are registered in the GBA. Indications are usually issued with a maturity of five years.[5]

It is important to note that there does not exist a one-to-one relationship between the indication and actual use of LTC in the data. Persons having an indication that do not show up in the data about actual use – 489 persons in total – might pay their care from a personal budget (PGB) or might still wait to receive care. Including these people as persons without LTC might lead to substantial bias and therefore we exclude them from the analysis. And vice versa there are persons without an indication that do show up in the data about actual use. This can be explained by the incomplete registration of indications in earlier years,[6] or because they only receive WMO-funded domestic help for which no indications are issued by the CIZ. However, this will not lead to bias as we only use the actual use of LTC as a dependent variable for the analysis.

The total sample for this study – consisting of the people from WoON 2009 aged 55 years and older who can be classified as (partner of) the head of the household or (partner of) the main tenant/owner of the house, and excluding the persons that have an indication but do not show up in the data about actual LTC use – consists of 28,270 respondents.

3.4 Computing the cost of long term care

Individual costs of long-term care are not directly provided in the data. However, prices for the different ZZPs of inpatient care and the different functions of outpatient care are provided by the Dutch Healthcare Authority (NZa), and we use this information to estimate individual costs. We use the prices of 2014, see (NZa, 2014a, 2014b).

For persons who received AWBZ-funded care without residence in kind we calculate the total costs as follows:

1. For each person, the care in kind used without residence is given in the data in minutes per type (personal care, nursing and since 2011 also individual assistance; domestic help is excluded). We divide the minutes per function by 60 to get the hours per function and multiply this with the associated price per hour according to the NZa (NZa, 2014b).

[4] A year of care in the data differs from a calendar year: in the data a year of care is defined as 13 periods of 4 weeks (and once in 5 years as 12 periods of 4 weeks and 1 period of 5 weeks) and always from Monday till Sunday.

[5] Indications issued before 2003 are missing in our data and indications in the period of 2003-2005 are incomplete. It is therefore possible that indications valid in 2009 or 2010 are missing in our data because they were issued in 2004 or 2005.

[6] See the previous note.

2. There can be several types of care for one person. The total costs for one person are calculated by summing the individual costs per function.

The cost of care without residence C_{ZZV} is thus simply the product of the number of hours (minutes/60) per function of received care in kind without residence *ZZV* and its price per hour, summed over the three functions of care in kind:

$$C_{ZZV} = \sum_{i=1}^{3}(\alpha_i * ZZV_i). \quad (1)$$

For persons who received AWBZ-funded care with residence (ZMV), computation of the individual costs is more involved. As the average price per day differs considerably between the different types of indications by care intensity, called ZZPs, it is important to take this information into account when estimating the individual costs. However, we only have information about the indications for ZZPs on individual level from the CIZ and about the number of days long-term care with residence was consumed. We thus know whether a person has an indication for a specific ZZP, but not whether the actual received care was in accord with this ZZP. The approximation of the individual costs of AWBZ-funded care with residence is calculated as follows.

1. For each period a person received ZMV, the start date of this period is compared to the indication dates of this person. If this start date of ZMV is similar to the start date of an indication, or falls between a start and end date of an indication, the associated indicated ZZP is used as an approximation for the ZZP actually received.
2. Then, again for each period a person received ZMV, we multiply the amount of days of this period with the associated price per day of the ZZP according to the NZa (NZa, 2014a).
3. There can be several different periods of ZMV with different (indications for) ZZPs for one person, in which case for all different situations the costs are calculated as above, and added together. This gives the total costs of ZMV per person.

However, two problems can arise which are solved in the following way:

1. For a small number of persons there are some periods where they received ZMV while there was no indication for a ZZP at that time. In this case we have no information of the most likely actually received ZZP for that period. Therefore the average cost of ZMV per day of the other periods of this person is calculated and used as an approximation for the costs per day for the periods where there was no indication for a ZZP.
2. For another small number of persons there is no indication for a ZZP recorded in the dataset at all, while they did receive ZMV. In this case we approximate the individual costs by calculating an overall average price per day of ZMV and multiply this by their individual amount of days of ZMV.

The computations can be summarized in the following formula:

$$C_{ZMV} = \frac{\sum_{k=1}^{M} p_k * D_k}{\sum_{m=1}^{M} D_j}. \quad (2)$$

In this equation C_{ZMV} denotes the total cost of care with residence, p_k is the cost per day of type k of such long-term care, D_k is the number of days care the person consumed care with residence and the indication for care of type k was valid. $\sum_{j=1}^{M} D_j$ is thus at least equal to the total number of days the person consumed care with residence under at least one indication, but it can be larger. If during one or more days when care with residence was consumed two or more indications were valid, $\sum_{j=1}^{M} D_j$ is strictly larger than the number of days care was consumed. The total computed cost C_{ZMV} is thus a kind of average of the costs of the relevant types of care with residence. If a person consumed care with residence on a day when no indication was valid (according to our information), formula (2) is applied as if all the indications that were valid on other days for this person were relevant on this day.

Over the time span of three years that we consider, individuals can – of course - have used both care with and without residence. The total cost of the long term care they consumed is simply the sum of the costs of long-term care with and without residence:

$$C_{LTC} = C_{ZZV} + C_{ZMV} . \qquad (3)$$

4 The distribution of health, wealth and housing

In this section we present first explorative results on the distribution of wealth, housing and LTC expenditure over the population.

Table 1 provides background information about the relationship between wealth and long term care consumption. This cross-tabulation consists of pairs of columns (panels) that refer to households for which wealth or a particular wealth component is positive and for which it is zero, respectively.

The first of these panels refers to total household wealth and shows that individuals with positive wealth realize on average just over 50% of the health care expenditure of those without any wealth. Notably, the vast majority of individuals in our sample, both home owners and renters, possess some positive wealth beyond home equity (proportion of individuals with residual wealth is 94.6%). In the second panel we disregard housing wealth and look only at the other wealth components, which we call residual wealth. Residual wealth as used in this paper includes savings, stocks, shares and bonds, entrepreneurship, valuable goods as well as real estate other than home equity.[7] The differences between the two groups are now a bit smaller. The small number of households that own a house, but have no other wealth components (N=1,761) thus appears to have substantially higher than average LTC expenditures of 5,030€ (see column 4 of Table 3). In the third panel where we compare renters and owners, the differences in mean costs become even more pronounced. This is the case both for long term care with residence (mean costs ZMV of 580€ for home owners vs 2,507€ for renters), and for long term care without residence (mean costs ZZV of 707€ for

[7] Our information originates from the tax authority, which implies that wealth is only observed if it exceeds a tax-free threshold. Wealth tax exemption in 2009 amounted to 20,661€ for single individuals and double of that for households consisting of fiscal partners. For elderly individuals of age 65 and above, extra tax exemption was applicable for households with low income, in the amount up to 26,892€ per year.

owners vs 2,078€ for renters). This confirms the findings of Rouwendal and Thomese (2013), who used LASA data, on the strong effect of home ownership on long-term care costs. When we compare owners with and without other wealth components (the fourth panel of Table 1) we find again marked differences for total LTC expenditure and LTC without residence (ZZV), but not for LTC with residence (ZMV). If we compare renters with and without residual wealth, we do not find large differences in mean LTC expenditures.

Note the large standard deviations reveal substantial heterogeneity in LTC expenditure. It may be conjectured that this heterogeneity is in large part due to the fact that many households do not consume any LTC. To explore this issue, Table 2 presents information on the LTC expenditure conditional on its use. The differences between the sub-groups with and without wealth or home equity are now less pronounced, but still substantial, and we notice two effects here. First, the incidence rate, i.e. the proportion of individuals making use of LTC, is higher among elderly people without (residual) wealth (1st and 2nd panels in Table 2); even more so among renters compared to home owners (3rd panel, ibid with 22.3% vs 9.7% for LTC use, respectively). Compared to home owners, more than double the percentage of renters makes use of non-residential LTC; for the use of residential care the difference mounts to a factor three. At the same time, there is barely any difference in the use of LTC among home renters by wealth (5th panel, ibid). The incidence rates are about the same for total LTC, ZZV and ZMV[8]. Second, we notice that there remain substantial differences in mean care expenditures; these are however levelled off across the three wealth categories (panels 1, 2 and 3, ibid). Relative differences in the mean LTC expenditures on total LTC, ZZV and ZMV have slightly increased between renters with and without residual wealth (5th panel in Table 2 relative to Table 1). These findings show that the households with and without wealth do not only differ in the extensive margin (as indicated by the incidence rates at the bottom of Table2), but also in the intensive margin. The numbers in the Table 2 also show that the variance in LTC expenditure among those who use it, remain large.

Further heterogeneity in LTC costs may stem from a dispersed distribution in costs made. Table 3 presents distributions of the total LTC expenditure, as well as distributions of the residential (ZMV) and non-residential (ZZV) care. The Table shows that all three distributions have a substantial portion of users with relatively low expenditures (see conditional percentages). 29.5% of ZZV users utilize up to 1,000€ of non-residential care in three years and 30.3% of ZMV users utilize up to 5,000€ of residential care in three years. At the same time, about a quarter of ZZV users entail non-residential care expenditure of above 10,000€, and about a third of ZMV users entail residential care expenditure of above 20,000€. The percentages of users entailing costs above hundred thousand euros are 0.61% and 7.5%, respectively.

[8] Low number of home owners without residual wealth does not allow us to draw conclusions of general character about differences in LTC expenditure by wealth within home owners cohort

Table 1. Cross-tabulations for mean LTC expenditure by household wealth and ownership, in euros (std. in parentheses)[a]

	total hsh wealth#		**residual hsh wealth#**		**house ownership**		**OWNERS**		**RENTERS**	
	positive	zero	positive	zero	yes	no	res.wealth >0	res.wealth=0	res.wealth >0	res.wealth=0
Total LTC exp.	2,803	5,383	2,812	5,030	1,287	4,586	1,283	2,507	4,522	5,424
	(13,442)	*(21,158)*	*(13,471)*	*(20,272)*	*(8,634)*	*(17,592)*	*(8,640)*	*(11,336)*	*(17,158)*	*(21,290)*
Total ZZV	1,328	2,538	1,327	2,480	707	2,078	698	2,062	2,038	2,551
(w/o residence)	*(7,406)*	*(12,223)*	*(7,398)*	*(11,983)*	*(5,413)*	*(9,486)*	*(5,374)*	*(9,844)*	*(9,126)*	*(12,292)*
Total ZMV	1,475	2,845	1,485	2,551	580	2,507	585	445	2,484	2,872
(LTC w. residence)	*(10,521)*	*(16,671)*	*(10,503)*	*(15,730)*	*(6,043)*	*(14,140)*	*(6,083)*	*(4,111)*	*(13,844)*	*(16,785)*
N	27,239	1,552	26,900	1,761	14,769	14,225	14,187	226	12,590	1,529
within group %	*94.61%*	*5.39%*	*93.86%*	*6.14%*	*50.94%*	*49.06%*	*98.43%*	*1.57%*	*89.17%*	*10.83%*

total hsh wealth = hsh home equity + residual hsh wealth

[a] Source: CBS data

Table 2. Cross-tabulations for conditional mean long-term medical costs (total LTC, ZZM and ZMV in euros in the period of 2009-2011) by household wealth and ownership (std. in parentheses)

	total hsh wealth		**residual hsh wealth**		**house ownership**		**OWNERS**		**RENTERS**	
	positive	zero	positive	zero	yes	no	res.wealth >0	res.wealth=0	res.wealth >0	res.wealth=0
Total LTC | LTC use	17,841	25,475	17,846	25,097	13,230	20,598	13,185	18,886	20,047	25,674
	(29,696)	*(40,126)*	*(29,725)*	*(39,369)*	*(24,669)*	*(32,566)*	*(24,704)*	*(26,018)*	*(31,530)*	*(40,366)*
Total ZZV | ZZV use	9,579	13,729	9,550	13,995	8,094	10,665	8,009	15,532	10,321	13,832
	(17,794)	*(25,615)*	*(17,757)*	*(25,515)*	*(16,609)*	*(19,244)*	*(16,517)*	*(23,138)*	*(18,340)*	*(25,788)*
Total ZMV | ZMV use	27,224	35,609	27,225	35,375	20,855	30,125	20,752	n.a.	29,478	35,707
	(36,646)	*(48,225)*	*(36,690)*	*(47,810)*	*(29,856)*	*(39,641)*	*(29,932)*	*n.a.*	*(38,466)*	*(48,440)*
N (LTC users)	4,285	328	4,239	335	1,437	3,167	1,381	30	2,840	323
N (ZZV users)	3,777	287	3,739	312	1,290	2,772	1,237	30	2,486	282
N (ZMV users)	1,476	124	1,467	127	411	1,184	400	n.a.	1,061	123
incidence rate LTC	*15.73%*	*21.13%*	*15.76%*	*19.02%*	*9.73%*	*22.26%*	*9.73%*	*13.27%*	*22.56%*	*21.12%*
incidence rate ZZV	*13.87%*	*18.49%*	*13.90%*	*17.72%*	*8.73%*	*19.49%*	*8.72%*	*13.27%*	*19.75%*	*18.44%*
incidence rate ZMV	*5.42%*	*7.99%*	*5.45%*	*7.21%*	*2.78%*	*8.32%*	*2.82%*	*n.a.*	*8.43%*	*8.04%*

n.a. – data not available due to a low number of sub-group observations

[a] Source: CBS data

Table 4 shows similar inequality in the distributions of wealth and home equity, where - apart from a large spike at zero in the home equity distribution, with 50.7% renters - the distributions show a high concentration of frequencies in the low wealth segment and a long thin right-hand-side for the high wealth segment. For example, about a quarter of the individuals in our sample (25.6%) possess residual wealth of up to 10,000€; and only 7.5% of above 500,000€. For home equity, for 46% of home owners possess home equity is found to mount up to 200,000€, and for 9% of owners possess above 500,000€.

The simultaneous distribution of mean LTC expenditures by category of wealth reveals important additional information (see Figures 1 and 2). Panel A of Figure 1 shows no clear pattern in the distribution of mean total LTC, ZZV and ZMV expenditures dependent on the height of home equity (these categories correspond to the respective frequency distribution from Table 4). Panel B of Figure 1 refers to costs conditional upon usage. It shows a relatively flattened picture particularly for the non-institutionalized care ZZV and for total LTC costs. The differences in the long-term care costs between home owners and renters are thus primarily due to higher incidence rate among renters. However, there does not seem to be a relationship between LTC use and the volume of home equity.

Figure 2 shows similar simultaneous distributions of long-term care costs and residual wealth. Again, panel A resembles raw means that in this case show a smooth decrease in LTC, ZZV and ZMV means as the wealth component increases in value (the only exceptions are slightly increased mean LTC and ZZV costs for the most wealthy). From the distribution of conditional health cost means (panel B) it becomes apparent that for the users of LTC, there is a smooth decrease in costs as wealth increases. Besides, our data shows (not reported) that incident rates per category residual wealth also decreases as the mean costs do.

Our data thus show a clear negative correlation between non-housing wealth and LTC expenditure, as well as substantial differences in long-term care costs between home owners and renters. We could not trace a pattern between the height of home equity and LTC expenditure.[9] Our analyses so far implies that increasing co-payments on the basis of either wealth or home equity should be expected to have a limited effect on public long-term care expenditures. Wealth-based co-payments would particularly hit individuals with relatively low wealth due to a relatively high incidence rate as well as high mean LTC expenditures among this group. Compulsory contributions would force them to deplete their limited resources. Second, the effects of higher co-payments on those with relatively high wealth will also be limited due to a relatively low incidence rate and the low average LTC expenditure of this group.

The numbers presented in this section give a first impression of the simultaneous distribution of wealth, homeownership and LTC expenditure. In the next two sections we give a more elaborate econometric analysis of the determinants of LTC expenditure.

[9] This is perhaps not too surprising as much home equity is the result of the prolonged housing market boom in the Netherlands between 1985 and 2005. The large majority of those who already owned a house in 1985, or bought it soon after had self-amortizing mortgages, implying that the mortgage was often completely repaid in 2009, and they experienced huge windfall gains in home equity. The size of home equity in 2009 thus had little to do with saving behavior.

Table 3. Distributions of long-term care expenditures (LTC, ZZV and ZMV)				
	freq.	**%**	**cum.%**	**cond.%**
total LTC expenditure				
Zero	24,505	84.13%	84.13%	
up to €1,000	1,014	3.48%	87.61%	21.93%
€1,000 - €10,000	1,860	6.39%	94.00%	40.23%
above €10,000	1,749	6.00%	100.00%	37.83%
Total LTC	**29,128**	**100.00%**		**100.00%**
total non-residential care expenditure (ZZV)				
Zero	25,049	86.00%	86.00%	
up to €1,000	1,205	4.14%	90.13%	29.54%
€1,000 - €10,000	1,780	6.11%	96.24%	43.64%
above €10,000	1,094	3.76%	100.00%	26.82%
Total ZZV	**4,079**	**100.00%**		**100.00%**
total residential care expenditure (ZMV)				
Zero	27,527	94.50%	94.50%	
up to €5,000	485	1.67%	96.17%	30.29%
€5,000 - €20,000	533	1.83%	98.00%	33.29%
above €20,000	583	2.00%	100.00%	36.41%
Total ZMV	**1,601**	**100.00%**		**100.00%**

Table 4. Distributions of total wealth, residual wealth and home equity as of 2009				
	freq.	**%**	**cum.%**	**cond.%**
Total household wealth				
Zero	1,552	5.39%	5.39%	
up to €10,000	5,082	17.65%	23.04%	18.66%
€10,000 - €50,000	5,215	18.11%	41.16%	19.15%
€50,000 - €100,000	1,901	6.60%	47.76%	6.98%
€100,000 - €200,000	3,766	13.08%	60.84%	13.83%
€200,000 - €500,000	7,254	25.20%	86.03%	26.63%
above €500,000	4,021	13.97%	100.00%	14.76%
total	**28,791**	**100.00%**		**100.00%**
Residual household wealth				
zero	1,761	6.14%	6.14%	
up to €10,000	6,879	24.00%	30.15%	25.57%
€10,000 - €50,000	9,546	33.31%	63.45%	35.49%
€50,000 - €100,000	3,255	11.36%	74.81%	12.10%
€100,000 - €200,000	2,875	10.03%	84.84%	10.69%
€200,000 - €500,000	2,396	8.36%	93.20%	8.91%
above €500,000	1,949	6.80%	100.00%	7.25%
total	**28,661**	**100.00%**		**100.00%**
Home equity				
zero	14,553	50.65%	50.65%	
up to €100,000	2,009	6.99%	57.64%	14.17%
€100,000 - €200,000	4,509	15.69%	73.33%	31.80%
€200,000 - €300,000	3,623	12.61%	85.94%	25.55%
€300,000 - €400,000	1,833	6.38%	92.32%	12.93%
€400,000 - €500,000	925	3.22%	95.54%	6.52%
above €500,000	1,282	4.46%	100.00%	9.04%
total	**28,734**	**49.35%**		**100.00%**

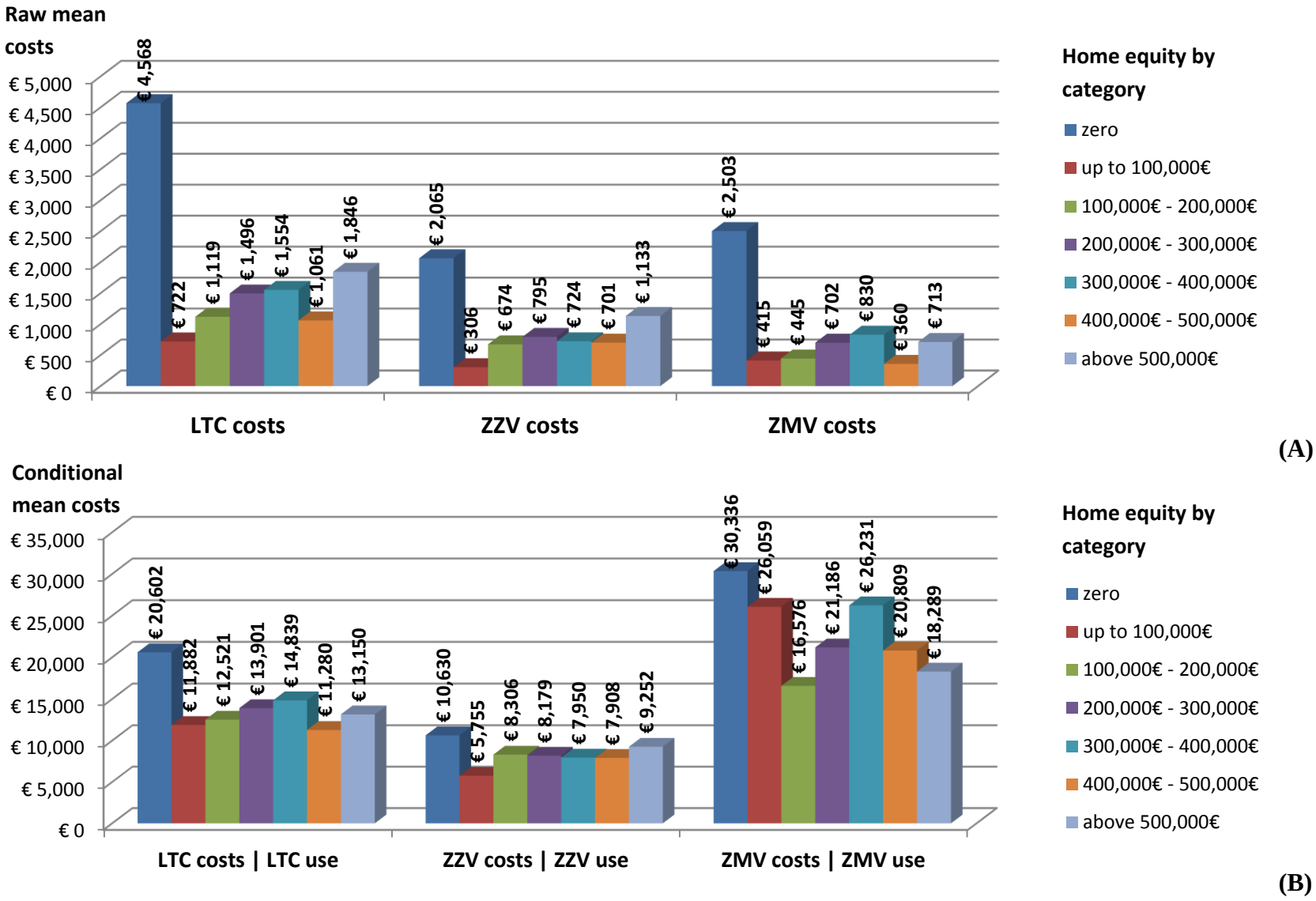

Figure 1. Distribution of average raw (panel A) and conditional (panel B) mean costs of long-term care (LTC, ZZV and ZMV costs, respectively) by category home equity

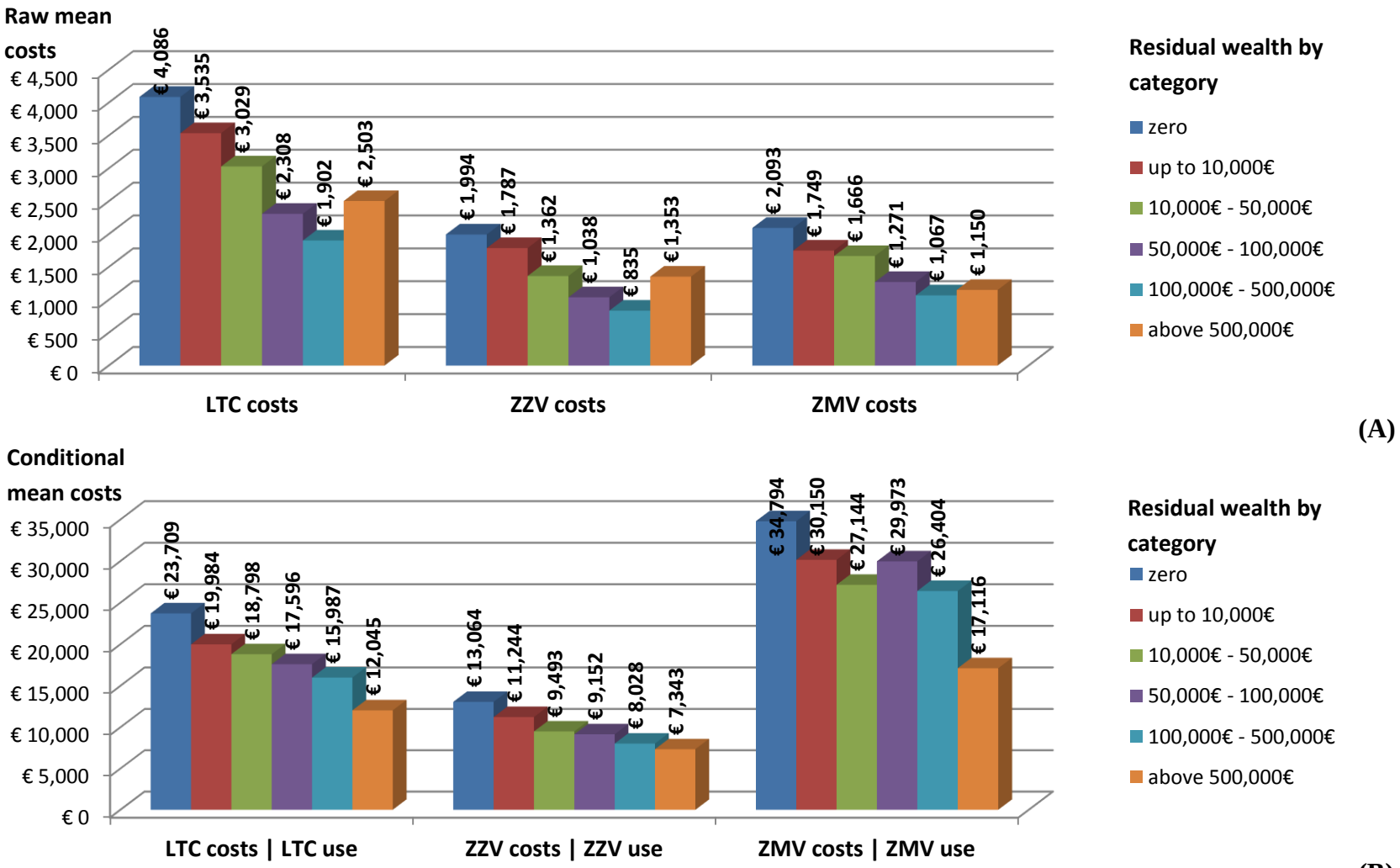

Figure 2. Distribution of average raw (panel A) and conditional (panel B) mean costs of long-term care (LTC, ZZV and ZMV costs, respectively) by category residual wealth

5 Econometric model specification

In this section and the next one we discuss an multivariate analysis of the LTC expenditure of the members of our sample. At this stage we only consider our estimates as giving a description of LTC expenditure, therefore the models presented in this section are meant to reflect the level of association between LTC and a selection of independent variables and controls, without an intention to make claims about causality. The reason is that as Tables 1 and 2 show, correlation is detected between wealth and home ownership on the one hand, and use and expenditure of LTC on the other hand. Therefore, in this section we shall estimate statistical models that test for association between wealth, ownership and LTC, when controlling for other factors, such as demographics and health status.

A central issue in the econometric analysis of individual level data on LTC utilization and associated expenditures concerns the functional form specification. The data normally exhibit at least three characteristics that must be addressed in order to develop a valid model. First of all, the outcomes of the measurements are nonnegative as LTC use and costs cannot be lower than zero. Second, the cumulative distribution has a 'spike' at zero, because a large percentage of individuals do not use any LTC. Third, for the remaining individuals who do use LTC the distribution of the LTC expenditures is highly skewed to the right, with non-constant variance (heteroscedasticity) as the variability among large expenditures tends to be higher than among small expenditures.

Econometric methods for the analysis of such data have been discussed extensively (Blough, Madden, & Hornbrook, 1999; Diehr, Yanez, Ash, Hornbrook, & Lin, 1999; Duan, Manning, Morris, & Newhouse, 1982; Griswold, Parmigiani, Potosky, & Lipscomb, 2004; Jones, Rice, Bago d'Uva, & Balia, 2007; Manning, 1998; J Mullahy, 1998; John Mullahy, 2009). The simplest approach is to use a one-part model like ordinary least squares (OLS), but this ignores the fact that the underlying distribution is actually a mixed distribution because of the positive mass at the point zero. A more convenient approach is to split the model in two parts, where the specification can be given by

$$E(y|x) = Prob(y > 0|x) \times E(y|y > 0, x).$$

The first component on the right is the probability that an individual uses any LTC at all and thus deals with the excess zeroes, and the second component is the expectation of the LTC expenditures conditional on using any LTC. An individual's estimated LTC expenditures is the multiplication of those two components. Under the given characteristics, this two-part model has found considerable acceptance for modeling health care utilization and expenditures (Blough et al., 1999; Diehr et al., 1999; Duan et al., 1982; Dunn, Mirandola, Amaddeo, & Tansella, 2003; Manning & Mullahy, 2001). The first part can be estimated by a binary choice model, such as a logit or probit specification.

The second part is more complicated. The skewness of the distribution plays a role here and therefore a log transformation of the dependent variable might seem appropriate. However, modeling $\log(y) = b * x + u$ for y > 0 will give an estimate of $E(\log(y) \,|\, y > 0, x) = b * x$ instead of our desired $E(y|y > 0, x)$. In general $\log\big(E(y|y > 0, x)\big) \neq E(\log(y)|y > 0, x)$

thus we cannot compute $E(y|y > 0, x)$ by simply taking the exponent of $E(\log(y)\,|y > 0, x)$. In other words, retransformation of log model results to the original scale is not simply done by taking the exponential of the coefficients, as this results in estimates of geometric means rather than arithmetic means. This may provide a misleading and biased estimate of the impact of covariates on the untransformed scale (Manning, 1998). A factor, like the 'smearing estimate' discussed by Duan (Duan, 1983), would be necessary to correct for this retransformation bias. However, due to difficulties in the estimation, the use of this smearing estimate is limited (Jones, Rice, Bago D'Uva, & Balia, 2013).

Another solution is to use a generalized linear model (GLM) for part two (McCullagh & Nelder, 1989). The primary method of estimation for this model is maximum likelihood and it represents a reparametrization of the model that retains the original scale of the response variable. This method does not require normality or homoscedasticity and avoids the problems that arise when transformations – such as with the log transformation mentioned above - are used for the conditional expectation stage (Mullahy, 1998). Specification of appropriate part one and part two probability distributions will give maximum likelihood estimates of model parameters. Manning and Mullahy (Manning & Mullahy, 2001) describe an algorithm for analysts to choose between different approaches for the second part of the two-part model.

A GLM is easiest explained in three steps. First of all, consider a linear component which is similarly defined as a traditional linear model:

$$\eta_i = x_i'\boldsymbol{\beta}$$

where x_i is a column vector of covariates for observation i and $\boldsymbol{\beta}$ is a column vector of unknown coefficients. Second, a monotonic differentiable link function g directly characterizes how the linear combination of the determinants is related to the expected value of the response on the original scale:

$$g(\mu_i) = x_i'\boldsymbol{\beta}$$

where $\mu_i = E(y_i)$. This link function describes how the mean on the original scale is related to the set of regressors which avoids the retransformation problem. Third, the response variables $y_1, y_2, \ldots$ are assumed to be independent, having a particular distribution from the exponential family – a large range of probability distributions including the Gaussian, Binomial, Poisson and Gamma distributions. The variance depends on the mean and is given by the variance function:

$$Var(y_i) = \sigma_i^2 = \phi V(\mu_i)$$

where ϕ is a constant known as the dispersion parameter. The exponential family specifies the distribution that reflects the relationship between the mean and variance:

– Gaussian: Constant variance

– Poisson: Variance is proportional to mean

– Gamma: Variance is proportional to square of mean

– Inverse Gaussian or Wald: Variance is proportional to cube of mean

Except for the Gaussian distribution, these families relax the assumption of homoscedasticity. Given a particular link function, the modified Park test as described in (Manning & Mullahy, 2001) can be used to choose the appropriate family. It is important to keep in mind that using a GLM can suffer substantial precision losses when the log-scale residuals have high kurtosis (>3) or when the family is miss-specified.

A detailed description of the application of the GLM for modeling health care costs can be found in (Jones et al., 2013).

For this study we will use the logit specification

$$Prob(y > 0|x) = \frac{\exp(x\alpha)}{1 + \exp(x\alpha)}$$

for the first part of the model and the log link with a gamma variance for the second part. The latter specification is the most widely accepted one for modelling health care expenditures.

6 Results

6.1 Descriptives

Table 3 shows the descriptive statistics of the study population concerning personal characteristics, wealth, health, long-term care and deceased. The mean and median age in our sample are found above 65 years (67.7 and 66, respectively), with 43% men and 56% living with a partner. The distribution of education of the elderly cohort mirrors that of the general Dutch population with 35% with basic or lower vocational education, 41% with secondary education and 23% of the sample with a college or university degree (for a small part of the sample education is not known). 86% of the sample is native Dutch, almost 10% of Western and slightly less than 4% of non-Western origin. 44% are home owners, so splitting the sample 50x50 according to ownership status. Mean residual household wealth (situation as of 2009) consisting in most part of financial assets is at 122,660€ per household, with a median of 23,732€. As we already mentioned in section 4, a vast majority of individuals in our sample have reported to possess residual wealth, both in the home owners and renters sub-groups (see Table 1). Data on health status reveals that according to ADL/HDL standardised measurement, almost ¾ of the sample do not have any disabilities (73%), 6% has mild disabilities, and 16% and 5% have moderate or severe disabilities, respectively. 39% of the sample suffer a long-term illness, disease or disability. The data on the use and expenditures on the LTC reveals that 16.4% of the sample obtained an indication for LTC in the period between 2009 and 2011and 15.9% made use of some type of LTC (in Section 3 we have already reported on the existing discrepancies in our data between the number of indications and respective use of LTC). Mean expenditures on LTC in the period of 2 years between 2009

Table 5. Descriptive statistics of study population: personal characteristics.
(SD = standard deviation)

		Sample (N=29,128) Median (SD)/ Mean / % for dummy vars.	Subsample (N=15,562) Median (SD)/ Mean / % for dummy vars.
Personal characteristics:			
Gender, male (%)		42.80%	47.09%
Age (in years)	mean	67.7	65.35
	(SD)	(8.86)	(7.62)
	Median	66	64
55-64 years old		44.66%	53.10%
65-74 years old		31.93%	32.92%
75 years and older		23.40%	13.98%
Partner (=1; no partner =0)		55.54%	63.93%
Highest achieved education			
Basic education		35.40%	28.60%
Secondary education		41.25%	43.43%
College / university degree		23.24%	27.80%
Not specified		0.12%	0.16%
Ethnicity			
Autochthonous (Native Dutch)		86.48%	87.60%
Non-Western		3.91%	2.78%
Western		9.61%	9.62%
ADL/HDL disabilities			
None		72.86%	100%
Mild disabilities		5.84%	n.a.
Moderate disabilities		16.44%	n.a.
Severe disabilities		4.86%	n.a.
Long-term illness, disease or disability, yes (%)		39.46%	n.a.
Homeowner(=1; renter=0)		44.06%	61.41%
Residual household wealth (2009)[a]	mean	122,660	149,293
	(SD)	(621,330)	(708,533)
	median	23,732	32,030
Home owners [b]	mean	205,174	219,671
	(SD)	(867,786)	(904,534)
	median	55,216	59,997
Renters [c]	mean	51,559	57,121
	(SD)	(149,018)	(170,645)
	median	15,000	17,210
Elderly dwelling		37.54%	31.19%

[a] N=28,434 for the full sample
[b] N=14,187 for the full sample and N=9,173 for the sub-sample
[c] N=12,590 for the full sample and N=5,390 for the sub-sample

and 2011 are reported at 2,910€ for the whole sample and hit 18,333€ for those who made use of long-term medical care services. While almost three times as many individuals made use of non-residential care (ZZV, 14.0%) compared to residential care (ZMV, 5.5%), the two components contribute about equal to the total LTC expenditure. So, mean institutionalised care costs (ZMV) make up 1,531€ on the sample level, and 27,858€ for individuals who made use of ZMV. Mean non-institutionalised costs (ZZV) are 1,378€ for the whole sample and 9,843€ conditional on the use of ZZV.

Table 6. Descriptive statistics of study population: long-term care.
SD = standard deviation, LTC = long-term care, ZZV = non-residential care (excluding domestic help), ZMV = residential care. (LTC, ZZV and ZMV expenditures are in x1,000€).

		Sample (N=29,128) Median (SD)/ Mean / % for dummy vars.	Subsample (N=15,562) Median (SD)/ Mean / % for dummy vars.
Long-term care (2009-2011)			
Indication for LTC		16.38%	6.15%
Any use of LTC		15.87%	5.74%
Any use of ZZV		14.00%	4.97%
Any use of ZMV		5.50%	1.65%
Total cost of LTC	mean	2,910	440
	(SD)	(13,901)	(4,166)
	median	0	0
Total cost of LTC | use of LTC [a]	mean	18,333	7,673
	(SD)	(30,578)	(15,713)
	median	5,231	2,102
Total cost of ZZV	mean	1,378	175
	(SD)	(7,704)	(1,678)
	median	0	0
Total cost of ZZV | use of ZZV [b]	mean	9,843	3,525
	(SD)	(18,455)	(6,700)
	median	2,777	1,342
Total cost of ZMV	mean	1,531	265
	(SD)	(10,884)	(3,646)
	median	0	0
Total cost of ZMV | use of ZMV [c]	mean	27,858	16,074
	(SD)	(37,715)	(23,520)
	median	10,147	6,613

[a] N=4,623 for the full sample and N=894 for the sub-sample
[b] N=4,079 for the full sample and N=774 for the sub-sample
[c] N=1,601 for the full sample and N=257 for the sub-sample

6.2 Estimates

Table 7 shows the first step – a logit regression – of the two-step model. The first analysis has the dichotomous dependent variables that predicts probability of an individual using long-term care in the 2 year period between 2009 and 2011. We use three indicators of LTC and therefore estimate three models for using any long-term care (total LTC), for using any non-residential care (ZZV, excluding domestic help) and for using any residential care (ZMV) in 2009-2011 as the dependent variables, respectively. We have first estimated basic models for all dependent variables with demographic and health variables. Next, extended models were estimated where housing and wealth variables were added.

We first discuss the results of the basic model. Men are found to have a statistically significant higher probability to make use of LTC. Age is positively associated with the probability of using any type of LTC, while having a partner significantly decreases the probability of LTC use of any kind. Individuals with secondary and higher education compared to persons with basic education have a lower probability of using LTC, and in particular non-residential care (ZZV); however, not residential care (ZMV).

Table 7. Step 1 of two-part model: logit regression.
Dependent variables: incidence of care use LTC = long-term care, ZZV = non-residential care (excluding domestic help), ZMV = residential care. Basic and extended models.

	LTC use		ZZV use		ZMV use	
VARIABLES	basic	extended	basic	extended	basic	extended
Gender (male)	0.0868**	0.103**	0.0664	0.0874**	0.133**	0.138**
	(0.0416)	(0.0430)	(0.0429)	(0.0445)	(0.0643)	(0.0667)
Age (65-74)	0.729***	0.693***	0.677***	0.636***	1.063***	1.012***
	(0.0529)	(0.0549)	(0.0552)	(0.0573)	(0.103)	(0.106)
Age (75+)	1.884***	1.847***	1.765***	1.728***	2.120***	2.097***
	(0.0508)	(0.0532)	(0.0527)	(0.0552)	(0.0968)	(0.100)
Partner	-0.807***	-0.814***	-0.721***	-0.751***	-0.994***	-0.912***
	(0.0412)	(0.0434)	(0.0426)	(0.0451)	(0.0693)	(0.0721)
Secondary education	-0.204***	-0.196***	-0.222***	-0.223***	-0.0233	0.0248
	(0.0420)	(0.0438)	(0.0431)	(0.0450)	(0.0616)	(0.0642)
College / University	-0.324***	-0.277***	-0.328***	-0.307***	-0.133	0.0194
	(0.0559)	(0.0594)	(0.0579)	(0.0616)	(0.0883)	(0.0932)
Educ. not specified	0.133	0.150	0.251	0.260		
	(0.602)	(0.597)	(0.595)	(0.591)		
Ethnicity: non-western	-0.521***	-0.477***	-0.513***	-0.462***	-0.380**	-0.392**
	(0.112)	(0.115)	(0.116)	(0.120)	(0.181)	(0.189)
Ethnicity: western	-0.0388	-0.0278	0.0171	0.0286	-0.125	-0.0974
	(0.0652)	(0.0674)	(0.0665)	(0.0689)	(0.101)	(0.103)
ADL/HDL (mild)	0.596***	0.568***	0.604***	0.576***	0.564***	0.544***
	(0.0703)	(0.0725)	(0.0727)	(0.0750)	(0.113)	(0.116)
ADL/HDL (moderate)	1.119***	1.082***	1.074***	1.041***	1.126***	1.091***
	(0.0488)	(0.0508)	(0.0505)	(0.0526)	(0.0759)	(0.0785)
ADL/HDL (severe)	2.410***	2.363***	2.162***	2.135***	2.038***	1.986***
	(0.0764)	(0.0801)	(0.0742)	(0.0782)	(0.0939)	(0.0987)
Chronic disability	0.320***	0.309***	0.331***	0.328***	0.0542	0.0273
	(0.0430)	(0.0443)	(0.0443)	(0.0457)	(0.0651)	(0.0669)
Homeowner		-0.0705		-0.0143		-0.249***
		(0.0446)		(0.0461)		(0.0707)
Residual hsh wealth		-0.00942		0.00824		-0.299**
		(0.0459)		(0.0428)		(0.152)
Elderly dwelling		0.244***		0.262***		0.146**
		(0.0405)		(0.0418)		(0.0615)
Constant	-2.720***	-2.803***	-2.839***	-2.944***	-4.319***	-4.308***
	(0.0581)	(0.0641)	(0.0603)	(0.0668)	(0.107)	(0.115)
Estimation statistics						
LL	-9287	-8783	-8886	-8376	-4707	-4446
Pseudo R2	0.2664	0.2687	0.2420	0.2463	0.2373	0.2389
P (chi2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Observations	28,639	27,800	28,639	27,800	28,604	27,766

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Non-Western origin has a similar negative effect on the use of LTC in general and ZZV in particular compared to the native Dutch group. Physical disabilities of any type (ADL/HDL) significantly increase the chance of making use of medical care compared to persons without

any disabilities, as does the presence of a chronic disease or disability. Notably, the presence of chronic disease does not affect the probability of using institutionalised care (ZMV).

The coefficients for the variables included in the basic model hardly change if we extend the model with housing and wealth variables. The only exception is the gender dummy in the ZZV model). The extended models have a higher loglikelihood and reveal that living in an elderly residence, that is either one-level residence or a house adapted to disability use, has a significant and positive association with the probability of using long-term care (LTC), both residential (ZNM) and non-residential (ZZV). However, home ownership and residual household (financial) wealth are only associated with a significantly lower chance of using institutionalised care (ZMV), and have no statistically significant influence on either non-residential care (ZZV) or overall LTS..

The results of the second part model – the log-gamma generalized linear model – are given in Table 8. Again, we start with a discussion of the basic models. They show a different pattern of association between LTC expenditure and independent variables and control variables than the models in step 1. The height of total LTC costs and ZZV costs are only significantly higher for the elderly group of age 75 and above relative to those aged 55-64. Notably, age has an unexpected effect on the amount of consumed institutionalised care, ZMV: here, individuals of age 65-74 have significantly lower ZMV costs compared to the reference group of 55-64 years olds. The reason is not clear, however this seems to come from the renters sub-group where renters in the middle age cohort indeed have the lowest conditional mean ZMV costs (for home owners, mean long-term costs gradually increase with age). Besides, the presence of a partner has a significant negative association with the height of the LTC, ZZV and ZMV costs (this effect however disappears in the extended model for ZMV). Education has a negative impact on the institutionalised costs (ZMV) and LTC in the basic model, but only for individuals with secondary and vocational education compared to those with basic education. There is, however, no statistically significant effect for the higher educated cohort. Physical disability has a positive association with long-term care costs: for all types of ADL/HDL disabilities regarding non-residential care costs ZMV, and only moderate to severe ADL/HDL disabilities with the LTC and ZMV costs. Chronic diseases have a significant but negative effect on the total LTC expenditure, however not for ZMV or ZZV expenditures separately. Ethnicity and gender are not statistically associated with the height of LTC expenditure.

Additional housing and wealth variables included in the extended models do not show statistically significant association between the height of household wealth and the height of long-term care expenditure of any type. This means that decrease in mean LTC costs for elderly people with higher residual wealth as discussed in section 4 (see Figure 2) is due to their decreasing incidence rate of using LTC care; however controlling for age, education and health condition, there is no association between the amount of household wealth and LTC costs for those making use of it. At the same time, housing variables do influence LTC expenditures. Home owners make significantly lower institutionalised costs (ZMV) as well as total LTC costs.

Table 8. Step 2 of two part model: log-gamma GLM.

Dependent variables: monetary costs of LTC = long-term care (ZZV + ZMV), ZZV = non-residential care (excluding domestic help), ZMV = residential care. Basic and extended models.

	LTC costs		ZZV costs		ZMV costs	
VARIABLES	basic	extended	basic	extended	basic	extended
Gender (male)	0.0572	0.0362	0.0114	0.00525	0.0751	0.0423
	(0.0597)	(0.0609)	(0.0663)	(0.0682)	(0.0797)	(0.0810)
Age (65-74)	-0.00473	0.0111	-0.0333	-0.0117	-0.322**	-0.294**
	(0.0877)	(0.0893)	(0.0959)	(0.0985)	(0.141)	(0.142)
Age (75+)	0.361***	0.365***	0.223**	0.228**	-0.149	-0.171
	(0.0800)	(0.0824)	(0.0867)	(0.0899)	(0.131)	(0.133)
Partner	-0.496***	-0.427***	-0.458***	-0.439***	-0.151*	-0.115
	(0.0601)	(0.0625)	(0.0669)	(0.0704)	(0.0868)	(0.0881)
Secondary education	-0.127**	-0.0883	0.0168	0.0218	-0.284***	-0.262***
	(0.0584)	(0.0605)	(0.0648)	(0.0675)	(0.0749)	(0.0774)
College / University	-0.103	-0.0100	-0.0469	-0.0266	-0.193*	-0.148
	(0.0831)	(0.0874)	(0.0923)	(0.0978)	(0.110)	(0.115)
Educ. not specified	-0.743	-0.720	-0.194	-0.188		
	(0.907)	(0.893)	(0.941)	(0.935)		
Ethnicity: non-western	-0.0417	-0.0541	0.111	0.125	0.0211	0.0308
	(0.168)	(0.171)	(0.187)	(0.193)	(0.233)	(0.239)
Ethnicity: western	-0.0854	-0.0560	0.0223	0.0708	-0.136	-0.136
	(0.0943)	(0.0961)	(0.103)	(0.106)	(0.128)	(0.128)
ADL/HDL (mild)	0.193*	0.164	0.269**	0.241**	0.101	0.0880
	(0.105)	(0.107)	(0.116)	(0.119)	(0.145)	(0.146)
ADL/HDL (moderate)	0.426***	0.373***	0.463***	0.437***	0.229**	0.160*
	(0.0692)	(0.0708)	(0.0764)	(0.0788)	(0.0931)	(0.0944)
ADL/HDL (severe)	1.157***	1.121***	1.327***	1.345***	0.583***	0.508***
	(0.0838)	(0.0870)	(0.0932)	(0.0974)	(0.107)	(0.111)
Chronic disability	-0.130**	-0.129**	-0.0878	-0.0983	-0.120	-0.106
	(0.0623)	(0.0632)	(0.0684)	(0.0700)	(0.0820)	(0.0825)
Homeowner		-0.185***		0.0208		-0.199**
		(0.0641)		(0.0718)		(0.0877)
Residual hsh wealth		-0.120		-0.0433		0.160
		(0.0912)		(0.0957)		(0.231)
Elderly dwelling		0.207***		0.188***		0.263***
		(0.0572)		(0.0641)		(0.0748)
Constant	9.338***	9.288***	8.637***	8.537***	10.36***	10.29***
	(0.0925)	(0.0985)	(0.101)	(0.111)	(0.146)	(0.149)
Estimation statistics						
LL	-49348	-46190	-40917	-38295	-17927	-16842
AIC	21.3548	21.3874	20.0689	20.0955	22.4107	22.4472
BIC	-27592	-25487	-24563	-22630	-8920	-8330
Observations	4,623	4,321	4,079	3,813	1,601	1,502

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Residence in elderly housing is associated with higher costs of all types, total LTC, ZZV and ZMV. This effect may however be endogenous and testify of self-selection.

6.3 Endogeneity

A robust result of the estimations reported in the previous sections is that people living in elderly residences have a higher demand for LTC. Such houses are meant to enable elderly people to live more comfortably than in other dwellings even when their health deteriorates. For instance, houses without stairs enable the residents to use all rooms even if climbing stairs becomes difficult. In this section we report the results of a number of exercises we carried out to investigate this issue.

Although such dwellings could therefore be expected to mitigate the demand for medical care, it must also be expected that people who expect or already experiencing bad health will be more inclined to choose such a dwelling. The controls that we use in our estimating equations may not be sufficient to address this problem and if this is the case, the error term and the indicator for an elderly dwelling will be correlated. As a consequence, the estimated coefficients may be biased.

Some additional models were performed in order to investigate this endogeneity issue. In Table 9 we report estimates of a two-step model with a control function. This is an alternative to 2SLS models with instrumental variables in linear modelling also known as 2-step residual inclusion (Terza et al., 2008). We used the proportion of elderly residences in a zip-code area as an instrument, and regressed the indicator for an elderly dwelling on this variable and the other explanatory variables in the model. The residuals of this linear regression were used as an additional variable in the two parts of our model for LTC demand.

Results of model estimations controlling for endogeneity are reported in Table 9. The effect of a number of variables here compared to the respective extended models in Tables 7 and 8 is limited to the logit model. So, age, physical condition and chronic diseases are all significantly associated with a higher probability of long-term care use of any type (except for the latter affecting only LTC and ZZV). Higher education levels decrease the probability of LTC and ZZV use. The effect of the presence of a partner stays stable and negative in all models except for the amount of institutionalised care ZZV. For the additional variables, residual wealth preserves its negative effect on the LTC use and costs (with a somewhat lower statistical significance), as well as on the probability of using institutionalised care ZMV. The effect of an elderly residence that is suited for receiving care in place remains positive and significant on both the probability of LTC, ZZV and ZMV use, and the height of LTC and ZZV expenditures. Interestingly, the effect of home ownership in these models has changed its sign from negative (resembling lower use of LTC as well as lower associated costs) to positive. This implies that controlling for the proportion of elderly residences, home ownership increases the probability of long-term care (total LTC) and non-residential care (ZZV) use, as well as is associated with higher average ZZV costs.

We have rerun the model of Table 9, for a subsample of elderly individuals without disabilities of chronic diseases, and not making use of LTC in the first half year of observations. Descriptive statistics for this subgroup are found in Table 6. Estimation results in Table 10 show that statistical power of the estimates has decreased, in particular for GLM models.

Table 9. Two-part model with 2-step residual inclusion.

Dependent variables: monetary costs of LTC = long-term care (ZZV + ZMV), ZZV = non-residential care (excluding domestic help), ZMV = residential care. Basic and extended models.

	LTC costs		**ZZV costs**		**ZMV costs**	
VARIABLES	logit	GLM	logit	GLM	logit	GLM
Gender (male)	0.115***	0.0421	0.100**	0.00408	0.148**	0.0468
	(0.0431)	(0.0611)	(0.0446)	(0.0678)	(0.0668)	(0.0814)
Age (65-74)	0.292***	-0.226*	0.197**	-0.289**	0.617***	-0.386**
	(0.0885)	(0.132)	(0.0913)	(0.144)	(0.145)	(0.188)
Age (75+)	1.053***	-0.104	0.856***	-0.321	1.303***	-0.354
	(0.148)	(0.209)	(0.152)	(0.226)	(0.222)	(0.278)
Partner	-0.608***	-0.302***	-0.524***	-0.288***	-0.702***	-0.0679
	(0.0562)	(0.0808)	(0.0581)	(0.0904)	(0.0889)	(0.108)
Secondary education	-0.131***	-0.0485	-0.152***	0.0638	0.0893	-0.244***
	(0.0452)	(0.0628)	(0.0465)	(0.0689)	(0.0662)	(0.0810)
College / University	-0.201***	0.0392	-0.223***	0.0186	0.0947	-0.127
	(0.0609)	(0.0899)	(0.0632)	(0.0987)	(0.0952)	(0.119)
Educ. not specified	-0.402	-1.062	-0.347	-0.594		
	(0.607)	(0.906)	(0.602)	(0.942)		
Ethnicity: non-western	-0.112	0.160	-0.0599	0.384*	-0.0206	0.114
	(0.131)	(0.193)	(0.137)	(0.216)	(0.210)	(0.264)
Ethnicity: western	0.0534	-0.00462	0.118*	0.133	-0.0156	-0.116
	(0.0689)	(0.0986)	(0.0705)	(0.108)	(0.105)	(0.131)
ADL/HDL (mild)	0.369***	0.0498	0.358***	0.116	0.344***	0.0392
	(0.0803)	(0.117)	(0.0830)	(0.128)	(0.126)	(0.160)
ADL/HDL (moderate)	0.593***	0.0871	0.505***	0.104	0.599***	0.0477
	(0.0986)	(0.137)	(0.101)	(0.149)	(0.145)	(0.178)
ADL/HDL (severe)	1.508***	0.623***	1.195***	0.768***	1.124***	0.311
	(0.168)	(0.222)	(0.171)	(0.240)	(0.236)	(0.285)
Long-term disability	0.350***	-0.0962	0.374***	-0.0630	0.0742	-0.0922
	(0.0449)	(0.0648)	(0.0464)	(0.0710)	(0.0680)	(0.0848)
Homeowner	0.344***	0.0426	0.440***	0.286**	0.161	-0.109
	(0.0847)	(0.113)	(0.0870)	(0.124)	(0.124)	(0.149)
Residual hsh wealth	-0.0792*	-0.163*	-0.0682	-0.0874	-0.370**	0.131
	(0.0475)	(0.0926)	(0.0447)	(0.0971)	(0.154)	(0.234)
Elderly dwelling	4.325***	2.539***	4.740***	2.910***	4.196***	1.173
	(0.710)	(0.956)	(0.728)	(1.037)	(1.012)	(1.218)
Estimated residual	-4.096***	-2.341**	-4.494***	-2.738***	-4.065***	-0.913
	(0.712)	(0.958)	(0.730)	(1.041)	(1.014)	(1.219)
Constant	-4.297***	8.437***	-4.584***	7.546***	-5.791***	9.959***
	(0.268)	(0.361)	(0.275)	(0.392)	(0.388)	(0.469)
Estimation statistics						
LL	-8767	-46180	-8357	-38283	-4438	-16841
Pseudo R2	0.2701		0.2480		0.2403	
AIC		21.383		20.090		22.448
BIC		-25489		-22645		-8324
Observations	27,800	4,321	27,800	3,813	27,766	1,502

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Further, the results show that age, education, partner and residence type effects are present for the association with the probability of use of long-term care. The effect of home ownership

Table 10. Two-part model with 2-step residual inclusion: SELECTED SUBSAMPLE

Dependent variables: monetary costs of LTC = long-term care (ZZV + ZMV), ZZV = non-residential care (excluding domestic help), ZMV = residential care. Basic and extended models.

	LTC costs		**ZZV costs**		**ZMV costs**	
VARIABLES	logit	GLM	logit	GLM	logit	GLM
Gender (male)	8.26e-05	-0.151	-0.0427	0.0724	0.0671	-0.320
	(0.0776)	(0.143)	(0.0826)	(0.151)	(0.141)	(0.197)
Age (65-74)	0.507***	0.00892	0.364**	-0.351	1.227***	0.0441
	(0.154)	(0.289)	(0.163)	(0.293)	(0.302)	(0.428)
Age (75+)	1.470***	0.255	1.207***	-0.473	2.576***	0.293
	(0.261)	(0.475)	(0.276)	(0.483)	(0.477)	(0.654)
Partner	-0.533***	-0.0861	-0.424***	0.104	-0.997***	0.107
	(0.0993)	(0.181)	(0.106)	(0.186)	(0.187)	(0.257)
Secondary education	-0.136	0.120	-0.152*	0.154	0.230	-0.242
	(0.0854)	(0.158)	(0.0906)	(0.162)	(0.154)	(0.223)
College / University	-0.229**	0.255	-0.258**	-0.0509	0.151	0.00695
	(0.110)	(0.204)	(0.118)	(0.213)	(0.203)	(0.287)
Educ. not specified	0.381	-1.291	0.347	-0.992		
	(0.679)	(1.240)	(0.681)	(1.200)		
Ethnicity: non-western	0.115	-0.185	0.122	0.130	-0.196	-0.0892
	(0.258)	(0.503)	(0.280)	(0.521)	(0.529)	(0.753)
Ethnicity: western	0.0270	0.0546	0.123	0.0847	-0.265	0.241
	(0.130)	(0.250)	(0.136)	(0.248)	(0.246)	(0.368)
Home owner	0.0959	-0.227	0.202	0.382	-0.226	-0.401
	(0.131)	(0.237)	(0.139)	(0.242)	(0.235)	(0.334)
Residual hsh wealth	-0.119	-0.264*	-0.0888	-0.225	-1.293**	0.450
	(0.0945)	(0.138)	(0.0828)	(0.153)	(0.518)	(0.918)
Elderly dwelling	3.479***	2.567	4.357***	4.577*	0.791	1.139
	(1.318)	(2.449)	(1.399)	(2.478)	(2.324)	(3.220)
Estimated residual	-3.457***	-2.446	-4.303***	-4.404*	-0.845	-0.978
	(1.322)	(2.438)	(1.403)	(2.480)	(2.331)	(3.197)
Constant	-4.252***	7.847***	-4.679***	6.352***	-5.138***	9.295***
	(0.475)	(0.883)	(0.504)	(0.890)	(0.843)	(1.172)
Estimation statistics						
LL	-2902	-8535	-2647	-6829	-1066	-2652
Pseudo R2	0.1254		0.1122		0.1610	
AIC		19.766		18.297		21.406
BIC		-3632		-3345		-920
Observations	15,180	865	15,180	748	15,156	249

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

has vanished compared to the full sample (Table 9), but the effect of residual household wealth persists reflecting a lower probability of institutionalised care use for individuals with higher levels of wealth. The positive coefficient for elderly residences is still present, although it is no longer significant for care with residence (ZMV).

Table 11. Linear regression model

Dependent variables: monetary costs of LTC = long-term care (ZZV + ZMV), ZZV = non-residential care (excluding domestic help), ZMV = residential care. OLS and 2SLS models.

		OLS			2SLS	
VARIABLES	LTC costs	ZZV costs	ZMV costs	LTC costs	ZZV costs	ZMV costs
Gender (male)	159.9	0.939	158.9	171.6	16.80	154.8
	(161.8)	(91.30)	(133.0)	(163.2)	(94.88)	(133.5)
Age (65-74)	258.9	148.1	110.8	-53.78	-274.6	220.8
	(179.2)	(101.1)	(147.3)	(344.4)	(200.2)	(281.5)
Age (75+)	4,493***	1,915***	2,578***	3,872***	1,075***	2,797***
	258.9	148.1	110.8	(622.6)	(361.8)	(509.0)
Partner	-2,045***	-1,021***	-1,023***	-1,889***	-810.2***	-1,078***
	(169.5)	(95.64)	(139.3)	(224.9)	(130.7)	(183.9)
Secondary education	-480.8***	-114.1	-366.7**	-429.8**	-45.21	-384.6**
	(180.2)	(101.7)	(148.1)	(187.6)	(109.0)	(153.4)
College / University	-397.5*	-203.0	-194.5	-335.7	-119.5	-216.2
	(220.2)	(124.2)	(181.0)	(229.1)	(133.2)	(187.3)
Educ. not specified	-1,104	-251.7	-852.3	-1,539	-840.3	-699.1
	(2,182)	(1,231)	(1,793)	(2,234)	(1,298)	(1,826)
Ethnicity: non-western	-1,922***	-897.2***	-1,025***	-1,642***	-518.0*	-1,124***
	(408.6)	(230.5)	(335.8)	(488.3)	(283.8)	(399.2)
Ethnicity: western	-428.3	-42.64	-385.7*	-367.2	40.05	-407.2*
	-480.8***	-114.1	-366.7**	(269.7)	(156.7)	(220.5)
Home owner	-168.3	212.7**	-381.0***	154.9	649.6***	-494.7*
	(174.1)	(98.22)	(143.1)	(350.2)	(203.5)	(286.3)
Residual hsh wealth	-20.76	-0.954	-19.80	-73.65	-72.46	-1.186
	(124.1)	(70.01)	(102.0)	(134.4)	(78.11)	(109.9)
Elderly dwelling	1,142***	480.9***	661.4***	4,322	4,780***	-457.9
	(165.6)	(93.43)	(136.1)	(2,988)	(1,737)	(2,443)
Health indicators	y	y	y	y	y	y
Constant	1,565***	542.1***	1,023***	405.8	-1,025	1,431
	(231.6)	(130.7)	(190.4)	(1,112)	(646.5)	(909.3)
Estimation statistics						
Observations	28,254	28,254	28,254	28,254	28,254	28,254
R-squared	0.154	0.128	0.063	0.143	0.063	0.060

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

It has been argued by Angrist and Pischke (2009) and others that even if we know that the true model is nonlinear, estimating a simple OLS regression may be useful. We have therefore repeated the analysis using first simple OLS and then 2SLS, using the same instrument. The results are reported in Table 11. Interestingly, we now find a negative coefficient for long term care with residence (ZMV) if we instrument the elderly home variable, although it is insignificant. The coefficient for elderly houses in the equation for LTC without residence (ZZV) is still positive and significant.

7 Discussion

In this paper we have studied long-term care expenditure in connection to wealth and homeownership. Nursing home care in the Netherlands has become less accessible, due to attempts by the national government to mitigate the increasing costs of long-term care. More elderly individuals with deteriorating health will be aging in place. While this is mostly aligned with the wish of the elderly to stay in place, it is important to consider this development in the light of government policy intending to further promote use of non-institutionalised care. Recent policy changes thus include increase in co-payments to LTC consumption by also taking into consideration the wealth possessed by households. Our descriptive analysis (section 4) indeed confirms that wealth and LTC use as well as the amount of LTC consumption are negatively correlated and that homeowners have a remarkably lower consumption of LTC than renters. These effects are mostly due to a lower incidence rate among home owners and individuals with high wealth compared to renters or those with low wealth. Results of regression analyses where a number of controls are introduced, however, differ from our initial findings. The relationship between long-term care, home ownership and wealth is still significant and negative for the use of long-term care with residence (ZMV); however, the impact of wealth disappears if we consider the height of LTC expenditures. Our findings thus reveal that individuals with higher wealth enjoy a lower incidence rate of using LTC care; however there is no independent association between household wealth and the amount of LTC expenditure. This implies that compulsory increased co-payments based on wealth may not have a desired effect on the use and costs of long-term care. In particular, higher compulsory co-payments would expectedly have the most disadvantageous effect on elderly individuals with lower wealth, who appear to be the most intensive users of LTC. Because wealth distribution is skewed to the left with high LTC costs associated with lower wealth, increased co-payments may possibly deplete meagre wealth resources or even prevent individuals with low wealth from using the necessary care. A system of compulsory co-payments for LTC based on wealth might thus cut overall LTC costs however at the cost of potential users of LTC, jeopardising participation in LTC use for those in need, particularly among the lower wealth cohorts.

We have also investigated the possible endogeneity of living in a house that is intended to be especially suitable to elderly people. The issue here is that the positive association between LTC expenditure and living in such a dwelling is probably due to a selection effect: those in bad health or expecting bad health in the near future are probably more inclined to move into such a house than others.

A final remark concerns the fact that we have considered LTC expenditure at the individual level, whereas wealth, home equity and income refer to the household level. We would therefore like to analyse LTC expenditure at the household level as well. If the demand for LTC of two partners is independent this is essentially adding up the demand for two partners. However, it's probable that this is not the case. For instance, the presence of a partner has been found to decrease demand for LTC, but this effect is likely to disappear if the partner experiences health problems.

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Index of abbreviations (afkortingen)

AFBZ = Exceptional Medical Expenses Fund (*Algemeen Fonds Bijzondere Ziektekosten*)

AOW = State pension law (*Algemene Ouderdomswet*)

AWBZ = Exceptional Medical Expenses Act (*Algemene Wet Bijzondere Ziektekosten*)

AZR = AWBZ Care Registration (*AWBZ Brede Zorgregistratie)*

BIKK = Contribution to Reduction Expenses (*Bijdrage in de Kosten Kortingen*)

BKZ = Budget for Health Care (*Budgetair Kader Zorg*)

BSN = Citizen Service Number (*Burgerservicenummer*)

CAK = Central Administration Office (*Centraal Administratie Kantoor*)

CBS = Central Bureau for Statistics (*Centraal Bureau voor de Statistiek*)

CIZ = Centre for Needs Assessment / Care Assessment Centre (*Centraal Administratie Kantoor*)

CVZ = Health Insurance Board (*College Voor Zorgverzekeringen*)

GBA = Dutch Municipal Register (*Gemeentelijke Basis Administratie*)

IGZ = Health Care Inspectorate (*Inspectie voor de Gezondheidszorg*)

NZa = Dutch Health Care Authority (*Nederlandse Zorgautoriteit*)

PGB = Personal Budget (*Persoonsgebonden budget*)

SSB = Social Statistics Database (*Sociaal Statistisch Bestand*)

VWS = Ministery of Public Health, Welfare, and Sports (*Ministerie van Volksgezondheid, Welzijn en Sport*)

WMO = Social Support Act (*Wet Maatschappelijke Ondersteuning*)

WoON = Dutch Housing Survey (*Woon Onderzoek Nederland*)

ZMV = Residential care (*Zorg Met Verblijf*)

ZVW = Health Insurance Act (*Zorgverzekeringswet*)

ZZP = Care Intencity Package (*Zorgzwaartepakket*)

ZZV = Non-residential care (*Zorg Zonder Verblijf*)