Essays on Long-Term Care

Thèse présentée
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To Fanny, to Paul.

Acknowledgements

"Les vieux ne parlent plus ou alors seulement parfois du bout des yeux
Même riches ils sont pauvres, ils n'ont plus d'illusions et n'ont qu'un cœur pour deux
Est-ce d'avoir trop ri que leur voix se lézarde quand ils parlent d'hier
Et d'avoir trop pleuré que des larmes encore leur perlent aux paupières
[. . .]"

Completing a PhD on old age can seem both surprising and depressing. Jacques Brel magnificently describes this period of life when it becomes difficult to be autonomous and your friends disappear. These seniors are our grandparents. Soon our parents. Eventually, they will be us. The economics of dependence affects all of us and all of us have a stake in this, directly or indirectly.

"Les vieux ne bougent plus leurs gestes ont trop de rides leur monde est trop petit
Du lit à la fenêtre, puis du lit au fauteuil et puis du lit au lit
Et s'ils sortent encore bras dessus bras dessous tout habillés de raide
C'est pour suivre au soleil l'enterrement d'un plus vieux, l'enterrement d'une plus laide [. . .]"

Sergio Perelman hired me after my master's degree in economics.

I thank him for the trust granted, for the help in my first empirical research, for being a co-author whose door is always open. I enjoy hearing his many anecdotes. Completing a PhD requires the help and advice of a supervisor. I was lucky to have two. I am indebted to Joe Tharakan and Pierre Pestieau for having decided to work with me despite my relative disorder and propensity to finish their sentences. While Pierre Pestieau introduced me to the theme of this thesis, Joe Tharakan made sure that I exceeded my limits. They put together an excellent Jury. Many thanks to Sergio Perelman, again, for discussions in his office, in my office, in the cafeteria, in the car, on the train, in Paris, . . . ; Joan Costa-i-Font for travelling from London to provide invaluable feedback and for answering many clarification emails; and Alfonso Sousa-Poza for his relevant comments that have significantly improved the manuscript. All remaining errors and shortcomings are my own.

"Les vieux ne meurent pas, ils s'endorment un jour et dorment trop longtemps
Ils se tiennent la main, ils ont peur de se perdre et se perdent pourtant
Et l'autre reste là, le meilleur ou le pire, le doux ou le sévère
Cela n'importe pas, celui des deux qui reste se retrouve en enfer [. . .]"

Over these thesis years, I have seen colleagues leave and others arrive. I thank Eric Bonsang for his expertise and the work done together, Justina for being an attentive and always helpful co-author, Julien Jacqmin for innovative ideas, Bernard Lejeune for his unvaluable econometric advice, Zoe for discussions on structural methods. Thanks also to the participants of the noon time: Axel, Frieda, Iman, Justine, Sarah, Antoine and Brieuc. It was always nice to bother my office neighbours: Alexandre and Sebastien or talk football with Jonas and Joe. I have a particular thought

for Mathieu Lefebvre who welcomed me with generosity to the department and who still is a comforting support from Strasbourg.

"Traverser le présent en s'excusant déjà de n'être pas plus loin
Et fuir devant vous une dernière fois la pendule d'argent
Qui ronronne au salon, qui dit oui qui dit non, qui leur dit : je t'attends
Qui ronronne au salon, qui dit oui qui dit non et puis qui nous attend.
[. . .]"

And then there are all the non-academic friends. Thanks to the Olympic Voroux and the Bastards for the oxygen brought, to the "Petits Mouchoirs" for the refreshing parties and the soothing holidays, to Sébastien and Emma for English language advice, to the extended family for their support and Paul's excessive care.

There is also someone who made this long journey possible. Loving mother of a wonderful little boy, convinced and unionized sociologist, Fanny bore my anxieties and my character. She is vital.

Contents

Introduction

This thesis on some issues of long-term care (LTC) is composed of four chapters. Three are the result of joint work. In the last decades, life expectancy at birth has sharply risen in all European countries and North America. This increasing life expectancy is definitely accompanied by an improvement of the health's state of elderly people. But an ageing population also leads to an increase in the number of dependent people. Dependence is defined as the partial or total impossibility for a person to perform without help some essential activities of daily living, such as getting in or out of bed, eating, showering or going to the bathroom. Although dependence is not a disease, this state can also result from medical conditions and is therefore closely related to health status. The question of life expectancy in good health is therefore relevant and it is essential to understand how the loss of autonomy evolves at the end of life.

In the first chapter, a joint work with Mathieu Lefebvre and Sergio Perelman, we use data from the SHARE survey to estimate the relationship between socioeconomic status, mortality and risk of dependence among Europeans aged 50+. We confirm that the subjective probabilities of survival as reported in the survey are

good predictors of the probability of actual survival. We then estimate the effect of wealth on this subjective probability. The results show that the wealthiest individuals have a higher probability of survival regardless of the estimation method used. The strength of this relationship differs between countries and we observe that in the most Bismarckian countries, wealth explains survival more than in Beveridgian countries. Finally, we also show the existence of a double penalty related to the relationship between wealth and dependence. The poorest individuals are those who are more likely to become dependent but also those with longer period of dependence.

This first chapter gives a first overview of the determinants of dependence. In assessing the adequacy of the financing and provision of long-term care, it is important to bear in mind the extent to which countries will be able to rely on the informal provision of care to elderly people in the future[1]. Effectively, two big actors and a smaller one come into play when it comes to covering the risk of dependence in old age. The **Family** and the **State** are the main care providers even in countries where **LTC insurance Market** is present (US and France principally). The next three chapters of this thesis deal respectively with these three key actors.

The purpose of the second chapter, a joint work with Justina Klimaviciute, Sergio Perelman and Pierre Pestieau published in 2017 in the *Journal of Population Economics*, is to test alternative models of long-term caring motives inside the **family**. We consider three main motives: pure altruism, exchange and family

[1] In the past, elderly people relied on their relatives for help. Now, with family values changing and more women working, older people can rely less on help from their families. Hence, progressively these actions are being outsourced outside of families.

norm. Our database is the second wave of SHARE (Survey of Health, Ageing and Retirement in Europe) which allows to link almost perfectly and with complete information children and their parents'characteristics. Comparing the empirical results to the theoretical models developed, it appears that, depending on the regions analyzed, long-term caring is driven by moderate altruism or by family norm, while Alessie et al. (2014), also using SHARE data, stress the importance of exchange motive in intergenerational transfers.

In order to treat the presence of the **state** in the provision of long-term care, the third chapter focuses on the possibility of a strategic behavior allowing elderly people to benefit from the public aid whereas they would have the financial means to buy this care on the market with their own resources. Indeed, few researchers have been interested in studying the empirical presence of a strategic behavior to qualify for public aid in United States (Stone, 1995). I demonstrate the presence of this strategic behavior (extolled by some lawyers) of impoverishment through an average increase in transfers for people concerned by the 2006 reform that extends the look-back period of financial transactions. These transfers to children allow parents to dive below a poverty line, making them eligible for Medicaid. Although these results based on HRS survey have yet to be confirmed by other research and perhaps other methods, I believe I have brought new interesting conclusions. Furthermore, I report two solutions (from Cremer and Pestieau, 2017) to counter this phenomenon that could bankrupt the system and that defeats Medicaid's initial purpose of helping the poorest (being at higher risk of dependence than richest, as shown in chapter 1).

Finally, in the fourth and last chapter, a joint work with Joe Tharakan, we are interested by the demand for **private LTC insurance**. As these caring activities are labor intensive, they are quite expensive. Therefore people should take an insurance which would cover their dependence costs in the future. Previous research has established that even though this insurance exists, for more than 30 years in the United States for example, only a small share of individuals take it out. This is the so-called "*long term care puzzle*". In this chapter, using dynamic discrete choice, we establish the determinants of the individual insurance purchase decision in a context where the individual's future health and income evolution is uncertain. Indeed, a rational individual considers the effect of his decision on his current utility but also the effect of his decision on his future (expected) utility. We show that difference in intertemporal utility between taking or not the insurance is not explained by difference in health, income, gender or education level. That means this insurance choice is related to other unobserved characteristics. As expected, we find negative difference in current utilities, the result of the immediate negative effect of the insurance premium on disposable income. Finally, the difference in continuation value measures the difference in expected benefit in the next period of having made the decision to buy the insurance in t. We estimate that less educated value less the LTC insurance than the educated.

In the conclusion of the thesis, we present global policy implications in terms of LTC taking into account the results of the four chapters (high dependence for the poorest, altruism in informal care, strategic spend-down and valorization differences for private LTC insurance according to education level).

In the different chapters of this thesis, data were at the centre of my research. Two databases have been used, SHARE and HRS. Several empirical techniques have been used (OLS, IV, Tobit, Mundlak correction, Fixed Effects, Difference-in-differences, Multinomial Logit, etc.). I became familiar with some theoretical models thanks to my different collaborations.

In this thesis, we analyzed almost exclusively the 3 actors of LTC, without possible interactions between them. Besides, we could be interested in looking at cross-effects between family, state and private insurance. In Klimaviciute et al. (2018), we resort to a more general empirical test of the relation between private LTC insurance and children's altruism, proxied by the informal help provided to non-dependent parents. The analysis shows that the presence of this help has a negative impact on the parents' insurance purchases, which seems to support our theoretical results proving that, under certain conditions, children's altruism discourages LTC insurance. On the other hand, the empirical effect of the intensity of aid is less clear suggesting that the relation between insurance and altruism might be more complex, as it is also well seen in the general case of the theoretical analysis. Other research is still ongoing, such as the one with Eric Bonsang on the link between taking out insurance and the presence of informal caregivers. Exploring the question of the absorbing state of dependence and its duration is also on the agenda.

In short, a multitude of questions are still unresolved and the dependence, a state that all will face one day (with a grandparent, a parent, a sibling, a friend or oneself) is a field of exalting research.

1

Inequalities in the face of death and dependence: lessons from the SHARE survey[1]

1.1 Introduction

In the last decades, life expectancy at birth has sharply risen in all European countries. Whereas life expectancy was 76 and 68 years for women and men respectively in 1970; figures are nowadays 85 years for women and 80 years for men. Many factors have been put forward to explain this increase in longevity such as

[1] Joint work with Mathieu Lefebvre and Sergio Perelman, forthcoming in Revue Française d'Economie (2018). The chapter has been adapted and translated to respond to the helpful comments from the Members of the Doctoral Jury. All remaining errors are my own.

living conditions or access and the quality of care increasing with technical progress. However, these good results sometimes hide substantial inequalities within the population.

Many studies have shown there is some heterogeneity in the field of health according to the categories of the population considered. Despite improved living conditions and a better access to health care, differences in mortality by socio-economic status continue (see Cutler et al. (2011) for an overview of studies on the topic). This status can be defined by education, income, wealth, or occupation, and a negative relationship between mortality and socio-economic status (SES) has been highlighted[2]. Even if it can be difficult to conclude about the causal nature of this relationship (see for instance Lleras-Muney, 2005; Lindhal, 2005; Balia et al., 2008; Van Kippersluis et al., 2011), the existence of mortality inequalities is undeniable. It appears then that beyond genetics, various elements related to socio-economic status, such as living and working conditions, risky behaviours, access to prevention and health care, are crucial for the health. In general, such differences must be taken into account if we somehow want to reduce economic and social inequalities (Belloni et al., 2013).

Beyond these inequalities, although the increasing life expectancy is definitely accompanied by an improvement of the health' state

[2]See Kitagawa et al., 1973; Duleep, 1986, 1989; Deaton et al., 1998; or Cristia, 2009; for the United States, Jusot, 2006; for France, Hupfeld, 2011; for Germany, Kalwij et al., 2013; for the Netherlands or Attanasio et al., 2003; for the United Kingdom. An exception is given by Snyder et al. (2006). They show that higher income groups face higher mortality than the poorest ones. Here, the authors compare two cohorts. The first cohort receives more social security benefits than the second but experiences higher mortality. They suggest as an explanation for this result contrary to usual conclusions that the compensatory increase in part-time employment for the 65s and + of the younger cohort reduced their social isolation and thus reduced their mortality.

of elderly people[3], an ageing population also leads to an increase in the number of dependent people. Dependence is defined as the partial or total impossibility for a person to perform without help some essential activities of daily living, such as getting in or out of bed, eating, showering or going to the bathroom. Although dependence is not a disease, this state can also result from medical conditions and is therefore closely related to health status. The question of life expectancy in good health is therefore relevant and it is essential to understand how the loss of autonomy evolves at the end of life. Because they are closely linked, it is likely that, as with longevity or morbidity, dependence is also related to income or wealth.

This is all the more important because with the combination of the cost of formal care, the low development of long-term care insurance contracts and the incomplete coverage of needs by the state, dependent people generally turn to family and friends to get the necessary help. Depending on the intensity of this dependence state and in the absence or in addition to this informal family help that may decrease[4], the poorest people will finally rely on public subsidies to finance the substantial care they will need. The current budgetary tensions in most welfare states will then be accentuated in the face of the papy-boom, that is to say, the combination of the extension of life and the arrival at advanced ages of the baby-boomers generation.

[3]However, a recent study by Cambois et al. (2017) shows that life expectancy in France decreased between 2014 and 2015 and that life expectancy without disability stagnated for women between 2004 and 2015.

[4]Family assistance is very uneven and could be reduced by changes in family structure (divorces, childless households, declining birth rates) but also by the positive evolution of women (primary caregiver)'s participation in labor market, thereby decreasing the potential supply of informal aid.

In this first chapter, we propose to analyse the link between socio-economic status, longevity and dependence. Throughout our analysis, we use the individual's level of wealth[5] as a variable reflecting socio-economic status[6]. The goal is then to identify on the one hand the link between the level of wealth of an individual and his probability of survival and, on the other hand, a possible difference in the incidence and intensity of dependence according to the wealth of individuals. The difficulty of such an analysis is that it is often hard to study the relationship between socio-economic status, morbidity and mortality from existing data. To do this, it is necessary to have long series that identify for some cohorts the evolution of the state of health and possible deaths. It is also challenging to identify exactly when a person becomes dependent. Data panels with sufficient information (in terms of years of observations and amount of data to determine individual characteristics) are rather rare.

To resolve this, we use the data from the SHARE survey (Survey of Health, Ageing and Retirement in Europe) and more specifically the information collected both during the lifetime of respondents but also after their death. SHARE is a biennial and longitudinal survey that follows people over 50 years old in European countries. The data contained in the survey can identify successive changes in health status, socio-economic characteristics and possibly death for each respondent. They also contain end-of-life information collected from respondent's relatives. In the survey, they are also asked to evaluate the probability of a series of events, among them

[5]Assets and wealth are considered as synonymous in this chapter. The SHARE survey estimates the household wealth from the information given by the reference person. For the purposes of this study, individual wealth is actually household wealth.

[6]Additional results based on education levels are presented in Appendixes.

the probability of reaching a target age (10 years or more). This information, although subjective, is rich in information. Recent research has shown that subjective estimates of survival probability are strongly correlated with the "*true*" mortality, as well as its main economic and social determinants (Hurd et al., 2002; Siegel et al., 2003; Bloom et al., 2007; Elder, 2007; Delavande et al., 2011; Peracchi et al., 2014).

After the presentation of the main characteristics of the selected sample in section 1.2, we verify the predictive power of the subjective survival probabilities on the actual mortality observed in section 1.3. We control this relationship with a lot of information about the objective health of the respondent. This link established, we try in section 1.4 to confirm that socio-economic status, and particularly wealth, has a causal effect on the subjective probability of survival, and therefore indirectly on actual life expectancy. Estimates made for each country separately allow to identify possible differences (as to the positive or neutral relationship between probability of survival and socio-economic status) that we attribute to the institutional environment and more specifically to the organization of social protection.

Finally, the last section (1.5) deals with the impact of socio-economic status, both on the probability of dependence and on the duration of dependence, using the answers obtained from the interviews conducted by SHARE with relatives of the deceased respondents. Our results show that we could really evoke a "triple penalty" for the poorest Europeans. They die earlier, have a greater risk of becoming dependent and this dependence period is longer.

1.2 SHARE data

The Survey of Health, Aging and Retirement in Europe (SHARE) is an international, interdisciplinary and longitudinal survey of people aged 50 and over. The survey has been conducted since 2004 every two years in 27 European countries plus Israel. At the present time, six waves of the survey are available. The questions relate to the health status (objective and subjective) of the respondents and their potential spouses, as well as to the economic and social situation of the household, including relations with their children and close relatives[7]. First, we focus on the subjective assessment of survey's respondents about their probability of survival. The question is[8]:

"*On a scale from 0 to 100, what are the chances that you will live to be age T or more?*"

[7]This paper uses data from SHARE Waves 1, 2, 3 (SHARELIFE), 4, 5 and 6 (DOIs: 10.6103/SHARE.w1.610, 10.6103/SHARE.w2.610, 10.6103/SHARE.w3.610, 10.6103/SHARE.w4.610, 10.6103/SHARE.w5.610, 10.6103/SHARE.w6.610), see Borsch-Supan et al. (2013) for methodological details. (1) The SHARE data collection has been primarily funded by the European Commission through FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARELIFE: CIT4-CT-2006-028812) and FP7 (SHARE-PREP: N°211909, SHARE-LEAP: N°227822, SHARE M4: N°261982). Additional funding from the German Ministry of Education and Research, the Max Planck Society for the Advancement of Science, the U.S. National Institute on Aging (U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04-064, HHSN271201300071C) and from various national funding sources is gratefully acknowledged (see www.share-project.org).

[8]At the beginning of the respondent's expectations module, SHARE introduces the concept of probability: "*Finally, I have some questions about how likely you think various events might be. When I ask a question I'd like for you to give me a number from 0 to 100. Let's try an example together and start with the weather. Looking at card 50, what do you think the chances are that it will be sunny tomorrow? For example, "90" would mean a 90 per cent chance of sunny weather. You can say any number from 0 to 100.*"

The target age T depends on the age of the respondent at the time of the interview. Between the ages of 50 and 65, they are asked about their probability of surviving at age 75, while between the ages of 66 and 69, the target age is 80. Between the ages of 70 and 74, it is 85. Between 75 and 79, 90, etc. The target age proposed to the respondent is thus between 10 and 25 years.

In this research, we are interested in the individuals who answered this question, either in wave 2 or wave 4. Precisely, our selected sample is composed of two sub-samples. On the one hand, all the people who participated in wave 2 and, on the other hand, all the newcomers to whom the question was specifically asked in the fourth wave. For the members of these two sub-samples, we follow their situation during the two next waves. In this way, the observed time space is approximately 4 years and we can evaluate the predictive power of their subjective probability of survival. For this purpose, we compare the subjective probability of survival in t with the actual probability of death in $t + 4$.

The second dimension of interest is the incidence of dependence as well as its duration. The data collected by SHARE lists the difficulties encountered by the respondents in their daily activities and thus their status as dependent or not. A person is considered dependent if two or more difficulties in performing the following daily tasks (ADLs) are met:

- Dressing, including putting on shoes and socks;
- Walking across a room;
- Bathing or showering;
- Eating, such as cutting up your food;
- Getting in or out of bed;

- Using the toilet, including getting up or down.

The incidence of dependence is calculated by identifying non-dependent persons at time t who become dependent in $t + 4$. But about the duration, if we can identify the beginning of the period of dependence, it is more difficult to know the end, which is usually characterized by death. Nevertheless, SHARE gives us the opportunity to know more about the last year of life of respondents, and about their possible state of dependence, using the end-of-life interviews ("*exit interviews*") made with a close relative of the deceased person. In these interviews, SHARE asks a number of questions about the period from the last interview to the death. Using these responses, we obtain an indicator of the length of dependence during the last year of life for respondents who died within the four-year period. Unfortunately, this information is only available for a small sample of deceased persons, for whom these interviews with a relative were carried out in the two subsequent waves. However, we can clearly identify the situation of the individual before death (in terms of dependence, care received, etc.), and we are able to link this pieces of data with information from previous waves.

Table 1.1 presents descriptive statistics about the sample. As previously specified, the final sample is the sum of two subsamples, 21736 observations in wave 2 (2007) and 24793 observations in wave 4 (2011). Only countries for which a complete series of three successive waves is available have been selected. This is why the Netherlands (NL), not having participated in wave 6, and Estonia (EE), Portugal (PO) and Slovenia (SI), new countries entering in SHARE in wave 4, are present only in one of the subsamples. For

the countries present in both samples, the one corresponding to wave 4 corresponds to the new entrants ("refresher sample" in the jargon of the SHARE survey).

The selection of the final sample is carried out step by step. Initially, 60936 individuals were questioned about their probability of survival. The attrition rate of respondents between time t and time $t+4$ is 15.8% (8709 people) and 5527 people (9%) were omitted because they did not answer the question about the subjective probability of survival. The final sample is thus composed by 46529 observations[9]. The average age is 64.6 years and women represent 55.3% of the sample. A large majority of respondents are in couple and have, on average, two children alive.

We note the substantial differences in socio-economic status between countries, reflected either by educational attainment levels, possessed wealth, or income. The wealth and income levels are some averages on the individual data. Persons from the same household have the same wealth and income, because they are calculated at the household level in SHARE. Assets are defined as the net sum of all assets (estimated value of real estate, amounts on bank accounts, value of shares and bonds, etc. to which any debts are subtracted, hence the presence of negative numbers in the raw database)[10].

[9] 171 people also left the sample because of missing information about their level of dependence and / or their marital status. We note that people who did not answer, potentially because they did not understand the question, have a higher probability of death than those who answered the question. For those who leave the sample (because of attrition), the average of their subjective probability of survival is close to those of respondents still alive in $t+4$.

[10] In order to obtain a wealth estimate based on missing data, SHARE uses an imputation method detailed in Christelis (2011).

Table 1.1: Summary statistics

Regions		North			Center					South				East			All
Countries		DK	NL	SW	AT	BE	CH	DE	FR	ES	IT	PO	SI	CZ	EE	PL	
Observations																	
	Wave 2	2057	1981	2131	893	2599	1198	1833	1904	1646	2304	-	-	1428	-	1762	21736
	Wave 4	366	-	58	3483	2218	2095	8	2431	1359	881	1375	2051	2944	5499	25	24793
	All	2423	1981	2189	4376	4817	3293	1 841	4335	3005	3185	1375	2051	4372	5499	1787	46529
Explanatory variables																	
Net worth in euros	Mean (€ 1000)	374.3	281.5	282.0	191.5	353.5	650.9	229.4	343.4	288.3	264.9	165.7	158.5	70.2	93.0	33.1	254.0
	Median (€ 1000)	242.4	190.0	167.8	115.2	269.2	336.1	151.0	237.2	185.6	193.0	158.5	112.1	52.5	42.4	20.8	133.9
Net Income	Mean (€ 1000)	44.7	43.2	36.2	32.7	48.9	90.5	35.3	36.4	20.7	25.4	24.9	30.8	9.8	8.7	5.9	32.5
Education	Low (0-2)	19.1	50.8	49.3	25.0	43.6	21.6	14.2	44.8	81.2	71.9	81.0	34.1	47.9	30.4	46.0	42.5
	Medium (3)	39.9	25.0	18.3	45.7	26.3	46.2	54.2	34.4	9.4	19.1	8.8	49.0	36.8	32.0	41.2	32.8
	High (4-6)	41.1	24.2	32.4	29.3	30.1	32.2	31.6	20.8	9.4	8.9	10.2	16.9	15.3	37.6	12.8	24.7
Women	%	52.7	54.2	52.8	57.6	53.8	53.2	52.9	55.3	53.0	52.7	55.6	56.3	57.6	60.1	54.9	55.3
Age	Mean	62.1	63.4	66.0	65.2	63.6	64.1	64.3	64.1	65.9	64.6	64.4	65.2	64.5	66.1	63.3	64.6
In couple	%	76.5	80.1	78.2	65.7	71.0	75.7	81.2	69.3	79.1	83.9	80.1	73.8	70.3	68.8	77.0	73.8
Children	Mean	2.3	2.3	2.3	2.1	2.1	2.1	2.0	2.2	2.5	2.1	2.2	2.0	2.1	2.0	2.6	2.2
Smoker	%	25.9	22.6	13.7	18.7	18.9	18.4	16.3	15.2	16.6	17.9	10.5	14.3	22.1	20.2	27.0	18.8
Physical Activity	%	54.8	66.2	52.1	53.2	45.5	59.4	56.3	42.2	38.4	38.8	35.9	54.7	42.4	50.6	35.1	48.1
Urban Areas	%	48.6	34.5	37.9	58.4	62.6	74.8	60.7	70.1	47.7	68.5	41.8	77.5	52.2	62.4	55.9	58.8

Countries: Austria (AT); Germany (DE); Sweden (SW); Netherlands (NL); Spain (ES); Italy (IT); France (FR); Denmark (DK); Switzerland (CH); Belgium (BE); Czech Republic (CZ); Poland (PL); Portugal (PO); Slovenia (SI); Estonia (EE)

Remark: Some countries participating in the SHARE survey are absent from some waves. This is the case for the Netherlands, which no longer participates since wave 5. Hungary, Luxembourg, Ireland, Greece and Israel are present at certain waves but do not allow this 4-year time horizon testing the prediction of the subjective probability of survival, unlike Portugal, Slovenia and Estonia, which are present in both wave 4 and wave 6, but not in the second wave of the survey.

1.3 Subjective probability of survival and mortality

The first step is to focus on the relationship between mortality and subjective probability of survival. The purpose is to verify that the subjective survival probabilities as reported in the SHARE survey are good predictors of observed mortality. In the next section, we will thereby be able to study the link between survival and socio-economic status and survival based only on subjective survival probabilities.

Delavande et al. (2011) had previously confirmed the predictive power of these measures in SHARE for the first waves of the survey by looking at the probability of survival in $t + 2$. We replicate their results by looking at the situation in $t + 4$ on a higher number of observations and countries. We can indeed observe in the sample who are still alive 4 years later and compare their survival with their own probability estimate 4 years ago. We report results according to certain socio-economic divisions in Table 1.2. First, we observe that the 4-year survival rate for the entire sample is 93.4%.

It is higher for women than for men with a differential of almost 3 percentage points. It is decreasing according to age and we observe that people in couple have a higher survival rate than singles.

A first interesting result for the completion of our analysis is that a positive gradient according to the economic status (whether it is wealth, income or education) is observed for the survival rate.

Table 1.2: Comparison of subjective survival probabilities in t and survival rates in $t + 4$

Socio-economic categories		Survival rate in t+4 (%)	Subjective probability of survival estimated at time t reaching target age T^* (%)		
			Average in t	Average for individuals deceased in t+4	Average for individuals in life in t+4
Sex	*Men*	91.9	59.7	40.0	61.4
	Women	94.7	59.7	37.1	60.9
Age	*50/65*	97.5	67.7	52.8	68.1
	66/69	94.8	60.3	45.5	61.1
	70/74	92.1	53.6	42.7	54.5
	75/79	86.7	42.2	35.1	43.3
	80+	73.7	33.5	28.2	35.4
In couple	*Yes*	94.5	61.9	40.9	63.1
	No	90.4	53.4	35.2	55.3
Dependent	*Yes*	70.7	35.9	25.8	40.2
	No	94.6	60.9	42.2	62.0
Wealth	*1st tercile*	90.7	54.1	35.8	56.0
	2nd tercile	93.8	59.8	40.4	61.1
	3rd tercile	95.6	64.9	42.5	65.9
Income	*1st tercile*	91.0	54.7	36.5	56.5
	2nd tercile	93.1	58.5	39.6	60.0
	3rd tercile	95.9	65.4	42.0	66.4
Education	*Low*	90.9	54.8	36.1	56.7
	Medium	94.8	62.1	43.6	63.1
	High	95.9	64.8	40.5	65.9
All		93.4	59.7	38.7	61.2

*Note: The target age T^* depends on the age of the respondent at the time of the interview. Between the ages of 50 and 65, they will be asked about their probability of surviving at age 75, while between the ages of 66 and 69, the target age will be 80. Between the ages of 70 and 74, it will be 85 years old. Between 75 and 79: 90, etc. The target age proposed to the respondent is thus between 10 and 25 years old.

In Figure 1.1, we present the distribution of the probabilities of subjective survival by wealth tercile[11]. The responses' distribution is multimodal with a peak at 50% regardless of socioeconomic category. The 100% answer is the second most common answer. We notice a distribution shifting to the right and thus more "*optimistic*" responses for higher levels of wealth or education. We also observe that the differential is very important between dependent and non-dependent persons at time t. This confirms that the episode of dependence is observed rather in the last period of life.

[11]Appendix A.1. presents the probabilities distribution by level of education.

However, we cannot say anything about the length of this period of dependence that we will discuss in section 1.5.

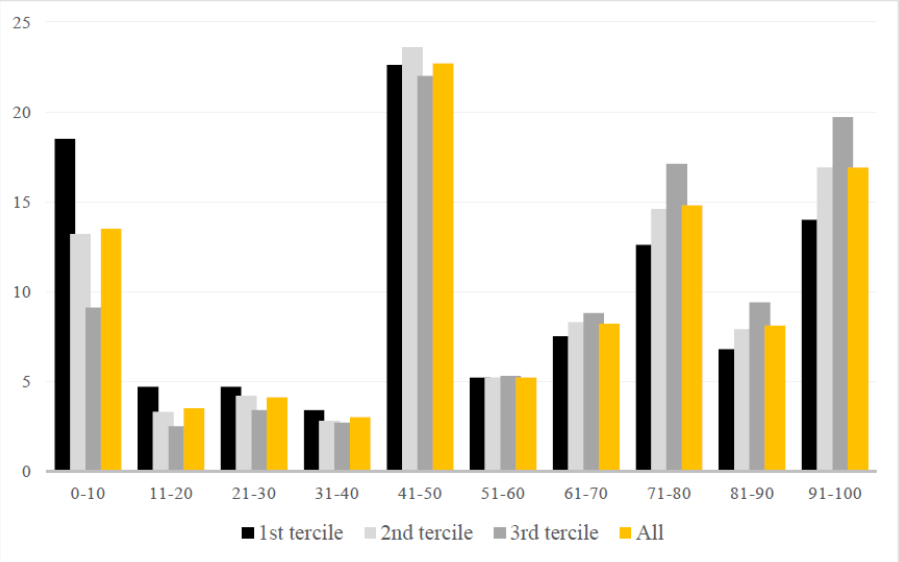


Figure 1.1: Subjective probabilities of survival and wealth terciles

The last columns of Table 1.2 provide evidence of a link between observed survival and the subjective probability of survival[12]. For this purpose, the distinction is made between the predictions made by the persons who die during the time interval considered and by those still alive in $t + 4$. On average, those who died within four years of the time of the survey had reported a lower probability of survival than those who remained alive. Whatever the category of population considered. In order to confirm these initial descriptive results, we econometrically estimate the predictive power of subjective survival probability on effective survival by controlling

[12]These averages are reported as an indication. They strongly depend on the age group of the population within each category. Indeed, as can be seen, probabilities vary with age and also within each age group. This is taken into account in the econometric part of this research by controlling our estimations by creating binaries for each age, eliminating the effect of age on the variables explained.

for a series of observable factors. It is a Probit model in which the dependent variable is the fact of being alive in $t + 4$ and the explanatory variables are the subjective probability of survival as well as control variables observed at time t: age, sex, marital status and a series of information on the state of health of the individual, mainly chronic diseases. The results are shown in Table 1.3. The effect of the subjective probability of survival is significantly different from zero and positive. Mortality increases with age but decreases if you are a woman or if you are in couple. Results are stable when we add country fixed effects (3) and if we control for the level education (4).

It is reasonable to assume that respondents correctly integrate information about their health and future survival, explaining the statistical relationship between these two measures. It can be argued, however, that optimistic individuals may also be in better health, which would explain the positive correlation observed. The information held by the individual would then not be related to his chances of effective survival. The results presented in Table 1.4 would rather indicate a combination of these two explanations. Indeed, once a measure of optimism has been introduced (the "CASP" variable summarizes the quality of life and the optimism of individuals based on 12 criteria, see Hyde (2003)), and when we control for the other measures of health, the subjective probability of survival remains predictive of actual mortality. It is difficult to distinguish between the effect of optimism and that of information because these variables influence each other[13] (Van Solinge and Henkens, 2017).

[13]The correlation between the subjective probability of survival and CASP is positive (0.40) and significant, whereas the correlations between CASP and the different diseases presented in Table 1.3 are negative and significant.

Table 1.3: Subjective probability of survival in t on actual survival in $t + 4$ (Probit models)

	(1)		(2)		(3)		(4)	
SSLE	0.068***	(0.004)	0.052***	(0.004)	0.046***	(0.004)	0.044***	(0.004)
Ages								
50/65	ref.		ref.		ref.		ref.	
66/69	-0.031***	(0.004)	-0.026***	(0.004)	-0.027***	(0.004)	-0.025***	(0.004)
70/74	-0.051***	(0.003)	-0.043***	(0.003)	-0.044***	(0.003)	-0.042***	(0.003)
75/79	-0.077***	(0.003)	-0.068***	(0.003)	-0.069***	(0.003)	-0.066***	(0.003)
80+	-0.124***	(0.003)	-0.114***	(0.003)	-0.116***	(0.003)	-0.113***	(0.003)
Woman	0.035***	(0.002)	0.031***	(0.002)	0.032***	(0.002)	0.033***	(0.002)
In couple	0.013***	(0.002)	0.012***	(0.002)	0.013***	(0.002)	0.012***	(0.002)
Health status indicators (binary variables)								
Heart attack			-0.022***	(0.003)	-0.020***	(0.003)	-0.019***	(0.003)
Hypertension			0.000	(0.002)	0.003	(0.002)	0.003	(0.002)
Cholesterol			0.023***	(0.003)	0.021***	(0.003)	0.021***	(0.003)
Cerebral vascular disease			-0.030***	(0.004)	-0.029***	(0.004)	-0.028***	(0.004)
Diabetes			-0.027***	(0.003)	-0.026***	(0.003)	-0.025***	(0.003)
Chronic lung disease			-0.028***	(0.004)	-0.028***	(0.004)	-0.027***	(0.004)
Asthma			-0.019***	(0.006)	-0.019***	(0.006)	-0.018***	(0.006)
Arthritis			-0.002	(0.003)	0.001	(0.003)	0.002	(0.003)
Osteoporosis			0.005	(0.005)	0.002	(0.005)	0.003	(0.005)
Cancer			-0.048***	(0.004)	-0.050***	(0.004)	-0.051***	(0.004)
Stomach ulcer			-0.006	(0.004)	-0.002	(0.004)	-0.001	(0.004)
Parkinson			-0.046***	(0.009)	-0.045***	(0.009)	-0.045***	(0.009)
Cataracts			0.007**	(0.003)	0.007**	(0.003)	0.006*	(0.003)
Hip fracture or femoral fracture			-0.017***	(0.006)	-0.017***	(0.006)	-0.016***	(0.006)
Other fractures			0.002	(0.004)	0.004	(0.004)	0.004	(0.004)
Alzheimer/ Dementia			-0.058***	(0.008)	-0.058***	(0.008)	-0.056***	(0.008)
Low Education							ref.	
Medium Education							0.011***	(0.003)
High Education							0.026***	(0.003)
Country Fixed Effects	No		No		Yes		Yes	
Observations	46529		46512		46512		46465	
Pseudo R^2	0.148		0.176		0.185		0.188	

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

In order to confirm the predictive power of the subjective probability of survival, taking into account the fact that the assessment could also be a reflection of their knowledge of objective life expectancies, additional analyzes were performed on different subsamples (notably, women vs. men and young vs. old) and the correlations hold for the different subgroups. We control for optimism but also the level of education because the knowledge of objective life expectancies is most probably dependent on

education, and less-educated individuals may systematically underestimate it (Deboosere, 2008). Table 1.4 illustrates the results and when the columns (1) and (2) distinguish women and men respectively, columns (3) and (4) concern young (50/65) and old (65+) respondents.

Health comparisons across nations have also been questioned and criticised as health evolution is affected by social and cultural values as well as by language specificities (Sommerfeld et al., 2005; Jurges, 2007). Jurges (2007) shows that Danish and Swedish respondents tend to largely over-rate their health (relative to the average) whereas Germans tend to under-rate their health. A survey of the Belgian Observatory of Life at Home shows that tenants are less happy than the owners (Layard, 2005). Nearly half of the tenants believe they would be happier in a home of their own. Morevoever, for 85% of Belgians, owning a home is essential to be happy. That could impact the reporting of subjective health and the merits of cross-country comparisons. One can also imagine that having no talk to or being alone might influence our health judgement insofar as respondents have no one to compare to (see Litwin and Shiovitz-Ezra, 2011). We could have used these two external factors which are likely to have different influence on such subjective questions according to the country. However, we use country fixed effects in order to take into account this heterogeneity[14].

On the contrary, within country comparisons of subjective questions about health (whether it is subjective survival or self-reported health) are less problematic (Deboosere, 2008). For instance, in-

[14]Whether in the case where the SSLE is the explanatory or the explained variable.

Table 1.4: Subjective probability of survival in t on actual survival in $t+4$ (women/men & young/old) (Probit models)

	(1)		(2)		(3)		(4)	
SSLE	0.024***	(0.005)	0.031***	(0.006)	0.020***	(0.004)	0.080***	(0.008)
CASP Index	0.065***	(0.011)	0.173***	(0.016)	0.031***	(0.008)	0.240***	(0.019)
Ages								
50/65	ref.		ref.					
66/69	-0.031***	(0.004)	-0.029***	(0.006)				
70/74	-0.051***	(0.003)	-0.054***	(0.005)				
75/79	-0.077***	(0.003)	-0.085***	(0.006)				
80+	-0.124***	(0.003)	-0.127***	(0.006)				
Woman					0.017***	(0.002)	0.060***	(0.005)
In couple	0.006**	(0.003)	0.017***	(0.004)	0.008***	(0.002)	0.040***	(0.005)
Health status indicators (binary variables)								
Heart attack	-0.008**	(0.003)	-0.025***	(0.004)	-0.011***	(0.003)	-0.031***	(0.005)
Hypertension	0.001	(0.003)	0.006*	(0.004)	-0.004*	(0.002)	0.017***	(0.005)
Cholesterol	0.021***	(0.003)	0.019***	(0.005)	0.013***	(0.003)	0.040***	(0.006)
Cerebral vascular disease	-0.016***	(0.005)	-0.034***	(0.007)	-0.016***	(0.005)	-0.044***	(0.008)
Diabetes	-0.023***	(0.004)	-0.023***	(0.005)	-0.011***	(0.003)	-0.031***	(0.006)
Chronic lung disease	-0.017***	(0.005)	-0.029***	(0.006)	-0.012***	(0.004)	-0.033***	(0.008)
Asthma	-0.019***	(0.007)	-0.007	(0.010)	0.000	(0.006)	-0.027**	(0.012)
Arthritis	0.003	(0.003)	0.007	(0.005)	-0.000	(0.002)	0.009*	(0.005)
Osteoporosis	0.006	(0.005)	-0.002	(0.015)	0.002	(0.006)	0.005	(0.010)
Cancer	-0.038***	(0.004)	-0.063***	(0.006)	-0.031***	(0.003)	-0.070***	(0.008)
Stomach ulcer	0.000	(0.005)	-0.001	(0.007)	-0.002	(0.004)	0.005	(0.009)
Parkinson	-0.036***	(0.012)	-0.037**	(0.016)	-0.015	(0.014)	-0.062***	(0.018)
Cataracts	0.001	(0.004)	0.014**	(0.006)	0.004	(0.006)	-0.009	(0.006)
Hip fracture or femoral fracture	-0.013**	(0.006)	-0.003	(0.011)	-0.013**	(0.006)	-0.027**	(0.011)
Other fractures	0.008*	(0.005)	-0.001	(0.006)	0.001	(0.003)	0.010	(0.008)
Alzheimer/ Dementia	-0.041***	(0.009)	-0.036**	(0.015)	-0.014	(0.012)	-0.090***	(0.015)
Low Education	ref.		ref.		ref.		ref.	
Medium Education	0.004	(0.003)	0.012***	(0.004)	0.010***	(0.002)	0.016***	(0.006)
High Education	0.020***	(0.004)	0.023***	(0.005)	0.020***	(0.003)	0.032***	(0.007)
Country Fixed Effects	Yes		Yes		Yes		Yes	
Observations	24757		20096		25956		18897	
Pseudo R^2	0.193		0.185		0.096		0.107	

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

come does not seem to impinge on the answering behaviour and thus does not bias health inequality indicators (Burstrom and Fredlund, 2001). However, divergences may arise by gender (Idler et al.,1992; Spiers et al., 2003; van Doorslaer and Gerdtham, 2003). Deboosere (2008) showed that evaluation of good and very good health is probably influenced by education and concluded that low-educated people tend to underestimate their health. On the contrary, no educational gradient has been found regarding bad

health assessment (Huisman et al., 2007).

In the following sections, when the sample size allows, we will perform analyzes for each country separately to reflect these cultural differences.

1.4 Mortality and socio-economic status

As we mention in the introduction, the literature has long pointed to the existence of a health differential according to socio-economic status. Descriptive statistics presented above also show differences in mortality by education, income or wealth. Data from SHARE survey allow to econometrically test this relationship. Since we have shown that the subjective probability of survival is a good predictor of survival (despite noteworthy differences between respondents depending on the country where they live), we can estimate the survival differential using this single subjective evaluation. The advantage is to have access to a large number of observations and to be able to compare countries with each other but also to control for a whole series of other factors that could explain the observed differences.

In the following of this chapter, we focus on wealth as the variable determining the socio-economic situation of the individual. We could also use the income or level of education, available in SHARE, but these three variables are highly correlated, as shown in Table 1.2, and we obtain fairly similar results in terms of subjective survival probability, whatever one of these three dimensions[15].

[15]Similar results are obtained with income but are not presented in this chapter. The results with education as SES variable are presented in Appendixes.

Nevertheless, the advantage of using wealth is related to the nature of the SHARE survey. We focus on individuals whose age is between 50 and 101 years old. It is therefore difficult to use income as a status variable to compare, for instance, the situation of a person still in the labour market with the situation of a widow approaching one hundred years. Regarding the level of education, although it is known as a major driver of health, we note that the overall level is very low for the elderly population in some southern and eastern countries[16]. We cannot ultimately discriminate very well individuals according to this socio-economic status (education) and that does not support potential comparisons between countries.

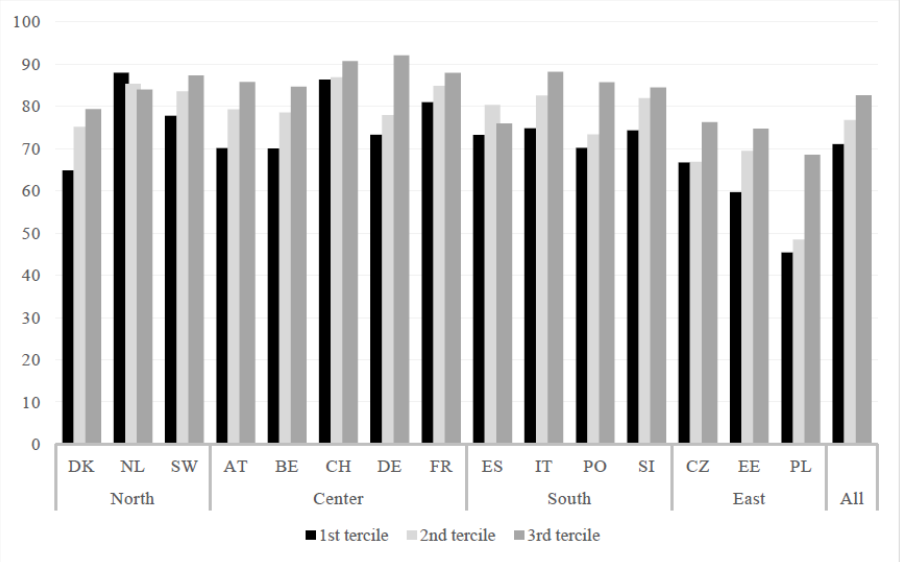


Figure 1.2: Survival rate at age 75 by wealth tercile (%)

Furthermore, as we show below, wealth can also be instrumentalised to correct a possible endogeneity bias in the estimation of the relationship between wealth and survival[17]. Figure 1.2 shows

[16]For instance, more than 80% of Spanish or Polish respondents are poorly educated.

[17]It is difficult to determine whether health affects the wealth or whether the

survival rates at age 75 in each country according to wealth terciles[18]. While there is a growing relationship in most countries, it is more difficult to identify a clear relationship for two countries. In Spain and the Netherlands, there does not seem to be a growing relationship between wealth and the probability of survival[19].

Table 1.5 presents the results of the econometric estimation of the relationship between subjective survival probability and wealth level. First, we estimate a simple linear regression of the effect of wealth on the subjective probability of survival by controlling for marital status, age, gender, and some health and environmental variables. The wealth is introduced after transformation into percentiles by country, instead of terciles. We could also use the variable wealth in absolute value but the results would be strongly influenced by the extreme values observed at the ends of the distribution. By defining the variable in percentiles within each country, we take into account the relative wealth levels. This measure of wealth makes also easier the interpretation of results in terms of percentile variation.

Results reported in the first columns of Table 1.5 show that the coefficient (average marginal effects) associated with wealth is positive and significant. People with higher wealth estimate their

wealth influences health (circularity problem). It is obviously possible that the two influence each other.

[18]On the basis of the observed death rates by country, we estimated survival rates per tercile in 5-year weighted brackets. These survival rates were then multiplied to obtain the 75-year survival rate for a 50-year-old person.

[19]We have also calculated these survival rates at age 85 and in Spain, Switzerland, Poland, the Netherlands or Slovenia, the relationship between wealth and survival is no longer monotonous. These last estimates should be taken with caution because the sample size becomes small. However, the aim of the next section is to confirm or refute these differences between countries, potentially explained by institutional and country-specific differences.

subjective probability of survival higher than those with lower wealth[20].

Table 1.5: Effects of wealth on the subjective probability of survival

	(1)		(2)		(3)		(4)	
	OLS		OLS		First Stage 2SLS		Second Stage 2SLS	
Wealth	0.144***	(0.005)	0.074***	(0.005)			0.072***	(0.008)
Woman	2.507***	(0.288)	1.569***	(0.275)	-1.254***	(0.227)	1.530***	(0.280)
Marital status								
Single	ref.		ref.		ref.		ref.	
Widowed	-15.227***	(0.551)	-1.704***	(0.554)	1.356***	(0.432)	-1.658***	(0.532)
In couple	-1.857***	(0.415)	-0.641	(0.404)	8.694***	(0.326)	-0.547	(0.420)
Married but single	-2.153*	(1.280)	-1.529	(1.236)	4.345***	(0.953)	-1.531	(1.174)
Environment								
Children			0.337***	(0.102)	-0.506***	(0.081)	0.330***	(0.100)
Smoker			-3.598***	(0.351)	-4.013***	(0.284)	-3.627***	(0.354)
Physical Activity			3.982***	(0.279)	3.723***	(0.228)	3.957***	(0.284)
Urban areas			-1.484***	(0.272)	-3.587***	(0.225)	-1.485***	(0.274)
Dependence			-8.182***	(0.743)	-2.875***	(0.535)	-7.888***	(0.659)
Instruments								
Heritage					11.007***	(0.275)		
Owner					37.790***	(0.272)		
Constant	54.420***	(0.458)	64.341***	(1.218)	16.108***	(1.013)	64.190***	(1.275)
Country Fixed Effects	No		Yes		Yes		Yes	
Chronic Disease Binaries	No		Yes		Yes		Yes	
Age Binaries	No		Yes		Yes		Yes	
F-stat	429.11 (0.000)		152.41 (0.000)		340.53 (0.000)		145.19 (0.000)	
Wald							13094.7 (0.000)	
F-test							11011.13 (0.000)	
Sargan Test							22.744 (0.000)	
Observations	46533		44187		43140		43140	
R^2	0.046		0.234		0.419		0.235	

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

However, this first estimate can suffer from an endogeneity bias. If the association between survival and wealth seems strong, the sense of causality is not especially so. Indeed, wealth can also be explained by either a larger or a smaller probability of survival, for

[20]In Appendixes A.2. and A.3., we present a series of tests of robustness of these results. We show that the estimated marginal effect of wealth seems constant across all levels of wealth (A.2.). We do not identify decreasing marginal returns of wealth in terms of health. When we take education (measured by the ISCED classification, ranging from 0 (without diploma) to 6 (university degree)) as the explanatory variable (A.3.) representing socio-economic status, we note its positive marginal effect but also constant.

at least two reasons. On the one hand, because of a serious illness or a state of heavy dependence, the household wealth may have been severely affected. On the other hand, people who anticipate a low probability of survival may have been led to make donations, also in advance, to their descendants. To correct this potential bias, we estimate a two-stage model (2 Stage Least Square, 2SLS) by instrumentalising wealth by having inherited and owning one's home, two variables available in SHARE. These two variables are strongly correlated with the level of wealth but are supposed to be weakly correlated with the probabilities of survival[21]. The results are similar to those presented in the first regression and confirm the effect of the level of wealth on the subjective probability of survival.

Instruments used for wealth can be criticized as mentionned in the footnote 21. We replaced the instruments by the ratio of housing price indices (HPIR[22]). In Appendix A.4., using the HPIR in time t (columns (1) and (2)) and the growth rate of HPIR from t to $t+4$ (column (3)) as instruments, we want to verify the positive

[21]Meer et al. (2003) also use inheritances as an instrumental variable for wealth. Apouey et al. (2015) criticize this choice by highlighting the possibility that the inheritance received also reflects the poor state of health in the family. They propose using lottery winnings as an exogenous instrumental variable to health. We do not have such information and also introduce house ownership to ensure the identification of our model. Sargan test on the whole sample presents strong evidence against the null hypothesis that the overidentifying restrictions are valid. Rejecting this null hypothesis implies that we need to reconsider our model or our instruments, even if we attribute the rejection to heteroskedasticity in the data (sub-populations, here countries, that have different variabilities from others). If we use only the inheritance or only the home ownership to instrumentalize wealth, the results (positive impact of wealth on SSLE) hold. F Cragg-Donald statistics for these 2SLS regressions, respectively 1872.4 and 20110.8, seem to reject the hypothesis of weak instrument.

[22]Nominal house prices divided by nominal disposable income per head. Net household disposable income is used. The population data come from the OECD national accounts database. Data are at the national level

impact of wealth on SSLE. In column (1), without the country fixed effects, this positive and significant link appears but the R^2 and the different β lead us to claim that regressions do not make sense. Columns (2) and (3) include country fixed effects. But when the instrument is the growth rate of HPIR (3), the first stage does not work and the F-stat is lower than 10 (4.766). If we focus on the case where HPIR in t is the instrument for wealth with country fixed effects, results tend to not confirm previous effects of wealth on SSLE. The positive link disappears.

But the weak-instrument problem can arise even when the first-stage tests are significant at conventional levels (5% or 1%) and the resercher is using a large sample (Baum, 2006). One rule of thumb is that for one endogenous regressor, an F statistic less than 10 is cause for concern (Staiger and Stock, 1997). The F-stat is 12.649 (0.000). However, we observe potential issues with Stock and Yogo (2005) ID test critical values for 2SLS, as well as Montiel Olea and Pflueger (2013) ones[23].

Nevertheless, referring again to Figure 1.2, there are differences

[23]Stock and Yogo (2005) tabulate critical values that enable using the first-stage F-statistic (or, when they are multiple endogenous regressors, the Cragg-Donald statistic) to test whether given instruments are weak. Montiel Olea and Pflueger (2013) develop a test for weak instruments robust to heteroscedasticity, autocorrelation and clustering. The command $weakivtest$ in Stata, implemented by Pflueger and Wang (2014), tests whether instruments are weak. Stock and Yogo or Montiel Olea and Pflueger establish what the bias would be in a worst-case scenario of completely weak instruments. This is the benchmark. We choose to tolerate a bias that is up to 10% (or 5, 15, 20, 25, 30%) of the worst-case bias. We choose a test size, for instance 5%. The null hypothesis is that the bias in the estimator is greater than 10% of the worst-case bias. If the Stock and Yogo or Montiel Olea and Pflueger test statistics are greater than the critical values, we reject the null at the 5% level and conclude that our instruments are strong in the sense that the bias is no more than 10% of the worst-case bias. It is not the case for the 5, 10 and 20% bias cases for Montiel Olea and Pflueger critical values for 2SLS (See Appendix A.5. for values and conclusions).

between countries in the relationship between survival rate and wealth that the results reported in Table 1.5 do not show. We can also estimate this link at the level of each country in order to identify clearly whether the results obtained with the whole sample are true or if we can identify differences by country.

We keep the first framework with inheritance and home ownership instruments. There are two reasons. First, we are always trying to solve the problem of endogeneity between wealth and health. As HPIR is available only at the national level[24], it is unusable for country-by-country analysis. In addition, F-statistics are all higher than 10 and Sargan tests do not reject the null hypothesis of overidentification in 9 over 15 countries. Appendix A.5. summarizes the different tests. Table 1.6 shows the same regressions as before but for each country separately. Once the possible bias of endogeneity is controlled, we observe that the positive relation between the level of wealth and the subjective survival probability is only true for some of them, namely Austria (AT), Germany (DE), France (FR), Denmark (DK), Belgium (BE), the Czech Republic (CZ), Poland (PL) and Estonia (EE). All these countries, with the exception of Denmark, have the particular feature of having social protection systems with a strong insurance structure. In other words, social benefits and health care coverage are the counterpart of contributions paid by individuals.

[24]If we could observe these HPIRs at lower NUTS levels or varying with time, 2SLS regressions could have been done with HPIR instruments for each country. It is unfortunately not the case.

Table 1.6: Effects of wealth on the probability of survival by country: the role of institutions?

		OLS			2SLS (Instruments: Heritage & Owner)			
		Wealth	N	R^2	Wealth	N	R^2	*F-test*
North	DK	0.051*** (0.020)	2348	0.309	0.072* (0.041)	2304	0.313	323.79 (0.000)
	NL	0.019 (0.020)	1904	0.230	0.022 (0.029)	1866	0.228	832.40 (0.000)
	SW	0.029 (0.022)	2051	0.332	-0.055 (0.049)	2026	0.325	242.09 (0.000)
Center	AT	0.120*** (0.015)	4190	0.252	0.113*** (0.021)	4128	0.254	2175.79 (0.000)
	BE	0.045*** (0.014)	4631	0.226	0.054** (0.025)	4550	0.224	986.51 (0.000)
	CH	0.023 (0.017)	3061	0.204	0.038 (0.028)	3008	0.201	1071.03 (0.000)
	DE	0.098*** (0.024)	1756	0.279	0.092*** (0.033)	1732	0.275	949.87 (0.000)
	FR	0.079*** (0.015)	4200	0.199	0.112*** (0.027)	4049	0.204	1006.23 (0.000)
South	ES	0.089*** (0.019)	2825	0.229	0.021 (0.047)	2699	0.233	266.38 (0.000)
	IT	0.031* (0.018)	3053	0.160	0.046 (0.032)	2979	0.161	715.87 (0.000)
	PO	0.095*** (0.028)	1294	0.234	0.075 (0.046)	1256	0.239	351.12 (0.000)
	SI	0.114*** (0.026)	1922	0.245	0.030 (0.054)	1875	0.243	266.43 (0.000)
East	CZ	0.084*** (0.017)	4023	0.167	0.075*** (0.028)	3890	0.170	1034.62 (0.000)
	EE	0.101*** (0.016)	5176	0.201	0.096*** (0.032)	5064	0.204	930.81 (0.000)
	PL	0.091*** (0.024)	1753	0.171	0.060* (0.032)	1715	0.172	986.12 (0.000)

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

Note: All regressions contain binaries by age, chronic disease, dependence status, and marital status. The environment is also controlled.

On the contrary, countries such as the Netherlands (NL), Denmark (DK) or Sweden (SW) are characterized by more redistributive social protection systems that provide uniform services to the whole population. In other words, in countries presented as Bismarckian (insurance), socioeconomic status is important in determining access to quality care and services since a significant

portion of the costs is supported by patients. On the other hand, in Beveridgian-qualified countries, the system offers equal social and health services.

Among these countries, only Denmark shows a weakly significant relationship (at the 10% threshold) between wealth and subjective survival probabilities[25]. In contrast, for the Netherlands (NL) and Sweden (SW), the effect is not significant. This is also the case for the Mediterranean countries, Italy (IT), Portugal (PO) and Spain (ES). They have a Bismarckian-qualified social protection system but in which health services are organized on the principle of universal access to care, provided by the public sector and financed from the State budget.

These results by country are also surprising because of the lack of relationship between wealth and survival for certain countries known for their high health inequalities. The case of Portugal is striking since it was often pointed out for its health inequalities (van Doorslaer et al., 2004). It is possible, however, that the data used in the research of these authors are too old (1996) and that these inequalities have declined. The relatively small sample size as well as having only one wave of the SHARE survey could also explain the lack of significant results obtained.

[25]If education becomes the variable representing the SES (see Appendix A.6.), this positive and significant result for Denmark disappears. However, having no instrument to address the problem of endogeneity of education, these results may suffer from a potential bias.

1.5 Dependence and socio-economic status

Beyond its impact on mortality and health in general, does socio-economic status also explain the need for care related to dependence among elderly people? The question is important because dependence is also linked to health, at least as far as physical autonomy is concerned. If income or wealth levels are correlated with health status, they can play a determining role in the likelihood of becoming dependent for an elderly person.

Figure 1.3 shows the average probability of being dependent 4 years later, for individuals who were not initially dependent in time t, according to the level of wealth expressed in terciles. As we explain in section 1.2, the probability of becoming dependent and the duration of the dependence are not obtained on the same sample. For people who are still alive, we cannot determine the end of the period of dependence with certainty. Although there are rather large differences between countries in terms of levels, the probability of becoming dependent is always higher for populations in the first tercile of wealth. This probability decreases as you move to the right of the distribution.

Similarly to the subjective probability of survival, we econometrically estimate the relationship between the level of wealth and the probability of becoming dependent with Probit models. The dependent variable is the fact of becoming dependent in $t + 4$ and the explanatory variables, including wealth, are obtained for period t. Table 1.7 presents the results and confirms the effect of

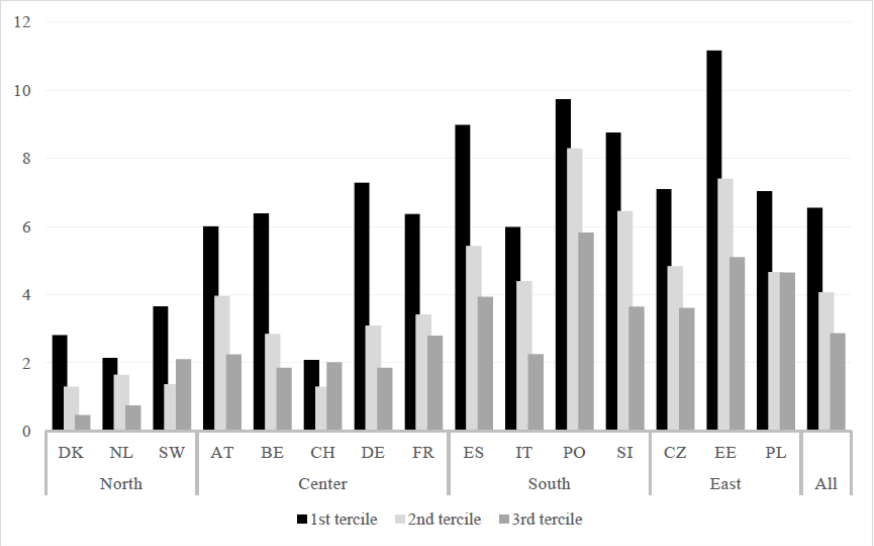


Figure 1.3: Dependence in $t + 4$ by wealth tercile (%)

socio-economic status on the probability of becoming dependent[26]. Finally, we want to study the impact of socio-economic status on the duration of dependence. The question is important because whereas the probability of becoming dependent is lower when the wealth is higher, the probability of dying is also lower. As dependence increases with age and the wealthiest live longer, they may be facing longer periods of dependence. We must remember that dependence as such is not a disease, but a reflection of difficulties to perform tasks of daily living.

While the probability of becoming dependent varies greatly between countries and reveals a North-South/East gradient, the duration of dependence seems fairly homogeneous with an average of 9 months before death (from 8 months in Portugal to 10 months in Germany). It should be noted that the prevalence

[26]We demonstrate in Appendix A.7. the absence of decreasing marginal returns of wealth on dependence and the robustness of this negative impact of SES approximated by education.

Table 1.7: Effects of wealth on dependence in $t+4$ if non-dependent in t

	(1)		(2)		(3)		(4)	
Wealth	-0.055***	(0.004)	-0.040***	(0.004)	-0.025***	(0.004)	-0.026***	(0.004)
Woman	0.012***	(0.002)	0.002	(0.002)	0.006***	(0.002)	0.005**	(0.002)
Marital status								
Single			ref.		ref.		ref.	
Widowed			0.025***	(0.004)	-0.001	(0.004)	-0.003	(0.004)
In couple			-0.004	(0.003)	-0.007**	(0.003)	-0.009***	(0.003)
Married but single			0.008	(0.009)	0.005	(0.008)	0.002	(0.008)
Environment								
Children			0.002**	(0.001)	0.001*	(0.001)	0.002***	(0.001)
Smoker			-0.010***	(0.003)	0.006**	(0.003)	0.007**	(0.003)
Physical Activity			-0.042***	(0.002)	-0.025***	(0.002)	-0.024***	(0.002)
Urban areas			-0.002	(0.002)	-0.002	(0.002)	-0.003	(0.002)
Country Fixed Effects	No		No		No		Yes	
Chronic Disease Binaries	No		No		Yes		Yes	
Age Binaries	No		No		Yes		Yes	
Observations	44284		42124		42093		42093	
R^2	0.019		0.058		0.130		0.146	

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

of dependence is relative here. The question asked to a relative about the time of the dependence concerns only the 12 months preceding the death of the former SHARE respondent. It is very likely that the individual has experienced other periods of dependence previously. It is also possible that the continued duration of dependence before death is longer than 12 months. Unfortunately, the possibilities of answering the question "*Overall, during the last twelve months of [his/her] life, for how long did the deceased receive help*[27]" are limited to "*a. Less than one month, b. One month or more but less than 3 months, c. 3 months or more but less than 6 months, d. 6 months or more but less than a year, e. A full year*". 56% of relatives choose the latter option, which may suggest that the episode of dependence began before. In Table 1.8, we estimate the relationship between the duration of dependence as defined above and the level of wealth.

[27]The help mentioned concerns the help in carrying out the activities of daily living that the individual is no longer able to perform alone (ADLs).

Table 1.8: Effects of wealth on the duration (in months) of the dependence

	(1)		(2)		(3)		(4)	
	OLS		OLS		First Stage 2SLS		Second Stage 2SLS	
Wealth	-0.004	(0.003)	-0.004	(0.003)			-0.008*	(0.005)
Woman	0.471***	(0.175)	0.411**	(0.175)	-3.933***	(0.941)	0.371**	(0.176)
Marital status								
Single	ref.		ref.		ref.		ref.	
Widowed	-0.005	(0.304)	-0.840***	(0.325)	2.487	(1.732)	-0.820**	(0.321)
In couple	-0.784***	(0.290)	-1.108***	(0.300)	5.957***	(1.600)	-1.063***	(0.302)
Married but single	-0.615	(0.740)	-0.849	(0.751)	13.597***	(3.998)	-0.802	(0.744)
Children			0.121**	(0.051)	-0.324	(0.276)	0.119**	(0.051)
Instruments								
Heritage					9.387***	(1.394)		
Owner					37.527***	(1.000)		
Constant	9.350***	(0.298)	8.823***	(2.090)	16593	(11.145)	8.927***	(2.073)
Country Fixed Effects	No		Yes		Yes		Yes	
Chronic Disease Binaries	No		Yes		Yes		Yes	
Age Binaries	No		Yes		Yes		Yes	
F-stat	2.78 (0.000)		9.63 (0.000)		26.88 (0.000)		2.72 (0.000)	
Wald							196.17 (0.000)	
F-test							749.10 (0.000)	
Sargan Test							0.166 (0.684)	
Observations	2486		2481		2423		2423	
R^2	0.019		0.075		0.448		0.074	

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

Similar to the survival probability regressions, we estimate both a simple linear regression model (OLS) and a two-step estimation (2SLS) by instrumental variable to correct potential problems of inverse causality between wealth and dependence. The sample corresponds to the deceased persons for whom we have information on the end of life (via "*exit interviews*"). The control variables are identical to those in Table 1.5, with the exception of physical activity, urban living, and tobacco smoke as they seem less relevant to people who are already in a state of dependence. If the models ((1) or (2)) estimated from ordinary least squares show no significant effect of socio-economic status on the duration of dependence, estimates by instrumental variables show a negative and significant causal effect (albeit weak)[28].

[28]Sargan test on the whole sample does not present evidence against the null hypothesis that the overidentifying restrictions are valid, implying that

These counterintuitive results at first glance, to be confirmed with a bigger sample and richer data, show the existence of what we call a "*double penalty*" experienced by the poorest[29]. While their probability of becoming dependent is greater, the dependence period is also longer[30].

1.6 Conclusion

In this chapter, we are interested in the relationship between mortality, dependence and socio-economic status, approached by household wealth. From representative data of some European countries, we approach the true longevity by the probabilities of subjective survivals. Our results show that longevity and wealth are positively correlated, and this after controlling for a series of explanatory factors but also correcting for the endogeneity

we would not need to reconsider our model or our instruments. If we control for the possibility of decreasing marginal returns of wealth on the duration of dependence and add the square of wealth percentiles (see Appendix A.8.) in an OLS regression, we observe a positive and significant relationship of wealth, potentially concave. When the dependent variable becomes a binary about being dependent for more than 6 months before dying, decreasing marginal returns of wealth also appear and are significant.

[29]Cambois et al. (2011) have already showed on the basis of French data that manual workers, with the exception of farmers, suffer from a double disadvantage, with a shorter life expectancy and more years in poor health and with disabilities.

[30]As the sample we use to analyse the impact of wealth on the duration of dependence deals with the 12 months preceding death, we cannot link these results to recent studies (Friedberg et al., 2014) showing that the state of dependence is not an absorbing state for the wealthiest classes, but only for the less wealthy. We currently work with the 6 available waves of SHARE and track individuals since the first wave to corroborate or not these recent results. First results show that poorest people seem effectively to have lower probability of dying once they become dependent than richest. They would stay longer in a state of dependence.

bias related to the possible inverse causality between the two variables. We observe also that this positive relationship is not verified in all the countries of our sample. These diverging results across countries can be explained, in part, by differences in the institutional framework and the social security and health policies put in place. The strength of this relationship differs according to countries and we observe that in the most Bismarckian countries, wealth explains survival more than in Beveridgian countries.

Results also show that wealth is predictive of the incidence of dependence for elderly people but also of the duration of this dependence period. The richest are less dependent and if they are, the duration of the loss of autonomy is shorter. Our results identify a triple penalty related to socio-economic status, summed up by the fact that the poorest live shorter, are more dependent and for a longer period.

2

Caring for dependent parents: altruism, exchange or family norm?[1]

2.1 Introduction

In assessing the adequacy of the financing and provision of long-term care (LTC), it is important to bear in mind the extent to which countries will be able to rely on the informal provision of care to the elderly in the future. The bulk of long-term care is indeed provided informally. Informal provision has no direct bearings on public finances but it is not clear whether such a situation is desirable or, in any case, will last. Family solidarity is very uneven and its propensity to provide care could diminish due to changes in family structure and growing participation of women in the labour market,

[1] Joint work with Justina Klimaviciute, Sergio Perelman and Pierre Pestieau published in Klimaviciute et al. (2017). All remaining errors are my own.

which may constrain the future provision of informal care within households. Besides the uncertainty of informal care, another issue that has been overlooked for obvious reasons is whether informal care is motivated by either altruism or exchange, or by family norms. The difference between the two is important. Altruistic caring or caring that is based on an implicit exchange contract are voluntary whereas informal caring induced by family norm is constrained and as such does not necessarily bring utility to the caregiver and may even have negative psychological and physical implications. In other words informal caring that is triggered by either altruism or exchange motives has a positive social value and can be encouraged by the government, but when it is founded on a social norm it can have a net negative social value and thus should not be fostered by public action.

There exists a growing literature trying to assess the collateral costs that informal caring can represent for the caregivers. Some, as Pollack (1985), found significant advantages in care given by family members. Tarlow et al. (2004) discovered that most caregivers of persons with dementia perceive their experience of help as positive and satisfying. The feeling of utility and necessity prevails. Moreover, caregiving would enable helpers to better enjoy life and strengthen their relationships with others. Finally, Brown et al. (2003) showed that mortality was significantly reduced for individuals who reported providing instrumental support to friends, relatives, and neighbours, and individuals who reported providing emotional support to their spouse. However, several studies have also highlighted that caregivers bear large opportunity costs because of care responsibilities (e.g. Van Houtven et al., 2013). Furthermore, informal care may have adverse effects on multiple dimensions of health of the caregivers (Schultz et al., 1995; Pin-

quart and Sorensen, 2003; Vitaliano et al., 2003). The detrimental effects related to the physical aspect are generally less intensive than the psychological effects. (Schultz and Sherwood, 2008). Hirst (2005) and Burton et al. (2003) showed that moving into a demanding caregiving role (more than 20 hours per week of help for dealing with basic ADLs) led to an increase of depression and psychological distress, impaired self-care and poorer self-reported health.

A conjecture that would need testing is that those costs depend closely on the motives underlying caring. The purpose of this paper is less ambitious. It is to use the SHARE data to test the motives of informal caring in a number of European countries. To do so we start by sketching simple models of long-term care provision within the family, which results into testable hypotheses regarding caring motives. Then we use the SHARE information regarding the effect of parental and filial resources on two key variables: the level of informal long-term care and the amount of inter-vivos transfers, which the parent may have left to his child. Section 2.2 refers to the existing literature. Section 2.3 presents the theoretical models. Depending on the hypothesis of substitutability or complementarity between informal and formal care, the conclusions vary. Section 2.4 focuses on the presentation of data and sample construction. Some descriptive statistics about the two main explanatory variables (wealth of the parents and education of their children) are explained. Section 2.5 presents the empirical results that determine the type of relationship between parents and children. Findings are presented on the whole sample but also by groups of countries (North, Center, South and East). Tobit models are applied after the two-part models (which allow the separation of behavior into two stages: first, help/transfer or not, and second,

how much conditional on help/transfer) are rejected. It appears, applying empirical results to theoretical models that, depending on the regions analyzed, family norm or moderate altruism play a role in long-term caring motives. This is to be contrasted with Alessie et al. (2014) who stress the importance of exchange motive in intergenerational transfers and do not consider the impact of the social norm. Our empirical results tend to reject the exchange motive. Numerous robustness tests have been carried out. Section 2.6 concludes.

2.2 Literature

Different family transfer models have been widely studied in the literature. According to the real motivations for family solidarity, the emergence of private or public scheme of LTC insurance will have different impacts on transfers (assistance and bequests or inter-vivos gifts). Three main types of motivations are often discussed. Cremer et al. (2012) mention that "*the fairy tale view of children or spouses helping their dependent parents with joy and dedication*" has for a long time been adopted. This is called pure altruism. However, they observe that this solidarity is also often based on social norm or strategic considerations (forced or reciprocal (exchange) altruism). Pure altruism, exchange and family norm are modeled with variations depending on the authors. Strategic self-interest, family constitution or preference shaping are widespread in the literature (Cigno, 1993, Cigno et al., 2006). Beyond the question on family motivations, two types of models of family decision-making are usually considered in economics (Bianchi et al., 2008). The most dominant is the unitary model

where the head of the family makes all decisions and does it in the best interest of the family members (Becker, 1974). Besides, the more recent theoretical literature considers each family member as unique (spouses, parents, siblings, children viewed as having their own preferences/bargaining powers). These are called collective models (Chiappori, 1988). The models proposed in section 2.3 are unitary ones.

In the models of altruism, family members are concerned by other family members' welfare. Pure altruism denotes the willingness to make voluntary transfers of resources (time, money) to another person or other persons, disregarding of own benefit (Schwarze and Winkelmann, 2011). For a transfer to exist, the members of the family have to be separate entities. However, Laferrere and Wolff (2006) highlight the length of the process of separation from parents. Indeed, it takes place gradually with a child who studies, marries, maybe divorces (potentially temporarily goes back to live with parents). In our models, we assume that children are not co-residing with their parents. Our empirical results concern only relationships between children and parents who do not live under the same roof. Pure altruism leads parents to provide more to their less well-off children. Pure altruism implies children take care of their dependent parents, regardless of required time. Cigno et al. (1998) illustrate pure altruism with the example of two people altruistic towards each other. If the same value is given to the consumption of one or the other person by each of them, both will pool their incomes and the poorer of the two will be subsidized by the richer.

Some family members may be altruistic while others would rather be selfish. Glazer and Kondo (2015) illustrate this case by a child

who may want to get a large transfer from his parents, even if that impoverishes his parents and even if the transfer comes at the expense of reduced transfers to his brothers and sisters. The economics literature has highlighted the importance of bequests in challenging the altruism explanation developed by Becker (1974). In reciprocity altruism (exchange), parents could give a larger bequest to the most caring child. The exchange model implies interactions where "*each member has his/her own objectives (preferences) and resources (sources of power) and each member can potentially improve his/her well-being by engaging in trades of different goods and services so as to maximize individual well-being*" (Bianchi et al., 2008).

The classic paper by Bernheim et al. (1985) on strategic bequests shows that parents can threaten to disinherit their children to force them to take care of them, presupposing that the dependent elderly has sufficiently good cognitive skills (Cremer et al., 2012). Parents can thus voluntarily try to buy children's attention. Even if Perelman and Pestieau (1992) proved that bequest motives influence the composition of household's wealth, bequests can also arise only because of uncertainty about life expectancy (Laferrere and Wolff, 2006). By contrast and not accidentally (especially since the vast majority of parents do not disinherit their children), inter-vivos gifts are always voluntary and allow more redistribution, although they are generally smaller and not always registered. Hence the choice of considering inter-vivos transfers in our theoretical and empirical analyses. It is not necessary that the transfers are reciprocated at the same time (Bianchi et al., 2008). Transfers can be compensated at a much later date and in different ways. For instance, parents pay tuition fees for their children or help them to buy an apartment, and in return expect regular visits and assis-

tance in their old days in case of dependence. The last potential motive of transfers is family norm (forced altruism). Canta and Pestieau (2014) focus on the case where care is provided to dependent parents by children out of some norm inculcated during their childhood. Children have the feeling they are compelled to take care of their parents (beyond the legal rules enacted in different countries).

Empirical tests of family motivations are abundant and varied. Based on data on Italian households, Cigno et al. (1998) reject the altruistic and the simple exchange models as well as the one based on the preference-shaping utility. The strategic self-interest model is not rejected by the data. Schwarze and Winkelmann (2011) propose a direct measure of altruism between parents and children using German data (GSOEP). This measure is based on self-reported happiness as a proxy for utility. They find evidence for interdependent preferences. Alessie et al. (2014), using SHARE data, investigate the motives of intergenerational inter-vivos time and money transfers. The empirical evidence rejects pure altruism in favor of exchange. However, Laferrere and Wolff (2006) conclude that transmission practices are more in accordance with the existence of family demonstration or education mechanisms. Children help their parents if the latter have themselves provided care to their own parents (see Laferrere and Wolff (2006) for a large review of the empirical US and European literature). The objective of our research is to bring new results to the question of motivation, with the idea of continuing opening the family black box.

Indeed, depending on intergenerational support reasons, impacts of public policies can widely vary. A well-known implication of al-

truism is that redistribution is ineffective since public transfers will crowd out private transfers (Becker, 1974). Alessie et al. (2014) discuss the effectiveness of formal care provision as a substitute for informal care and the impact of taxation. As the exchange motive seems to prevail, they conclude that a higher tax rate on intergenerational monetary transfers is likely to increase the demand for formal care (because of the potential decrease of informal care), thus increasing public spending on health care. Glazer and Kondo (2015), in the case of altruism, show that governmental transfers restricting reallocations from a person who saves much to the one who saves little reduce the effect of the so-called Good Samaritan Dilemma and lead to a Pareto-superior outcome than the equilibrium without government taxation and transfers. Cigno et al. (1998), highlighting the strategic self-interest motive in intergenerational agreements, advocate that a modest redistribution programme could be effective to address credit issue.

Others study family solidarity in a dynamic world. Canta and Pestieau (2014) develop an OLG model with traditional and "*modern*" agents. They find two reasons for public action: redistribution and correction for the inefficiency in the child's choice. Finally, Ponthiere (2013) shows that the crowding out effect is not certain when State provides LTC to dependent persons who cannot rely on their children. Even if some models can be simplistic and lead to contradictory conclusions in terms of public policies, their different predictions can be testable to a certain extent. While we are in a crisis of both family (see section 2.1 of the chapter) and public transfers, it is essential to understand the motives of interactions within the family.

2.3 Simple models

There exist many ways of modelling intergenerational transfers. Here we choose unitary models wherein a parent interacts with a child. The parent can offer some financial benefit whereas the child can provide informal care. The substitutability or complementarity between informal and formal care matters for the comparative statics. We consider three motives for caring: altruism, exchange and family norm. As it will appear, it is not always possible to discriminate their predictions.

2.3.1 Altruism

We assume a two-sided altruism with partial altruism of the child. The child's own utility depends on a single argument, c, his private consumption. It is represented by a strictly concave function: $u(c)$ where

$$c = (1 - a)w + b$$

w is the wage rate;
a, the time spent caring;
b, the transfer from the parent;
$1 - a$, the labor supply.

The parent's own utility is represented by a quasi-concave utility function $H(m, a)$ with two arguments: m, formal care and a, informal care. Formal care comprises the parent's wealth, y, minus b. We can now write the full utility of both the child and the parent:

$$U_c = u((1-a)w + b) + \alpha H(y-b, a)$$

$$\text{and } U_p = H(y-b, a) + \beta u((1-a)w + b)$$

where α and β are respectively the child's and the parent's altruism parameters with $0 < \alpha \leq 1$ and $\beta = 1$ as the parent is assumed to be perfectly altruistic. In other words, we assume that the parent is always perfectly altruistic whereas the child might or might not be a perfect altruist. We will discuss these two cases separately where relevant.

We assume that the parent moves first and chooses b. Then the child chooses a. Moving backward, we first look at the first order condition of the child's choice:

$$\text{FOC:} \quad \Delta = \partial U_c / \partial a = -u'(c)w + \alpha H_a(m, a) = 0$$

From this, we obtain the effect of b on a:

$$da/db = \frac{-u''(c)w - \alpha H_{am}(m,a)}{-\Delta_a}$$

where Δ_a is the second order condition of the child's choice.

One easily checks that $da/db > 0$ if $H_{am} \leq 0$, that is, if formal and informal care are substitutes or independent of each other. In case of complementarity, namely if $H_{am} > 0$, we could have $da/db < 0$.

The intuition for these results is as follows. The first term in the numerator of da/db is always positive and calls for increasing a when b increases. Indeed, when b increases, the child becomes

wealthier (and can consume more) and therefore values less the consumption lost due to an additional hour of care provision. The second term reflects the fact that the child cares about the utility of the parent and its sign depends on whether formal and informal care are substitutes or complements. An increase in b lowers the parent's wealth available to pay for formal care. If formal and informal care are substitutes, a decrease in formal care calls for increasing the amount of informal help and thus the second term is positive just like the first one. The overall effect is therefore clearly an increase in a. We also have a clear increase in a if formal and informal care are independent of each other, in which case the second term is zero and the result is driven only by the first term. On the other hand, if formal and informal care are complements, a decrease in formal care due to an increase in b calls for reducing informal care as well. The second term in the numerator is then negative and the overall effect is ambiguous. Thus, both $da/db > 0$ and $da/db < 0$ are possible.

Turning to the parent's decision, we obtain the first order condition:

$$\Lambda = -H_m + u'(c) + [H_a - u'(c)w]da/db = 0$$

or, taking into account the child's first order condition,

$$\Lambda = -H_m + u(c) + [(1-\alpha)H_a]da/db = 0$$

Note that if the child is perfectly altruistic (i.e. $\alpha = 1$), the third term in the parent's first order condition disappears. Indeed, if $\alpha = 1$, both the parent and the child maximize exactly the same utility function (which is the sum of their individual utilities) and

therefore the child's choice of informal care is exactly the same as the one wanted by the parent. There is thus no need for the parent to "*correct*" the child's choice by using his transfer. In that case, the parent simply chooses the transfer so as to equalize his child's and his own marginal utilities. On the other hand, if the child is imperfectly altruistic (i.e. $0 < \alpha < 1$), his chosen level of informal care is lower than wanted by the parent since the parent's utility is not fully taken into account. In that case, the parent wants to "*correct*" the child's choice and thus chooses his transfer accordingly. For instance, if $da/db > 0$, the parent chooses a higher transfer than he would choose if the child was perfectly altruistic since now the transfer has an additional role, that is, to foster informal care. In contrast, if $da/db < 0$, informal care is fostered by choosing a lower transfer.

We now use Δ and Λ and the second order conditions $\Delta_a < 0$ and $\Lambda_b < 0$ to obtain the following comparative statics:

$$da/dw = \frac{-u'(c) - wu''(c)(1-a)}{-\Delta_a} \gtrless 0$$

$$da/dy = \frac{\alpha\, H_{am}(m,a)}{\text{-}\Delta_a} \gtrless 0 \ (> 0 \text{ if } H_{am} > 0, < 0 \text{ if } H_{am} < 0 \text{ and } = 0 \text{ if } H_{am} = 0)$$

$$db/dw = \frac{(1-a)u''(c) + (1-\alpha)\, H_a \frac{d(da/db)}{dw}}{-\Lambda_b} \gtrless 0$$

$$db/dy = \frac{-H_{mm} + (1-\alpha)\, H_{am} \frac{da}{db} + (1-\alpha) H_a \frac{d(da/db)}{dy}}{-\Lambda_b} \gtrless 0$$

Let us now discuss these results. The impact of an increase in the child's wage rate on the amount of caregiving (da/dw) can be decomposed into two effects. The first effect (reflected by the first term in the numerator) is the substitution effect: an increase in the wage rate is an increase in the child's opportunity cost of

caregiving (every additional hour of care provision now costs more in terms of what is lost by not working on the labour market), and this pushes the child to provide less care. The first term in the numerator is thus negative. The second effect (reflected by the second term in the numerator) is the income effect: an increase in the wage rate means that, at any given level of labour supply, the child now earns more than before. This allows him to reduce his labour supply and thus to increase care provision. The second term in the numerator is therefore positive. Taken the two effects together, it is not clear which one of them prevails, which means that the total impact can be positive or negative, or even zero if the two effects compensate each other.

The way the child's caregiving is affected by an increase in the parent's wealth (da/dy) depends on whether formal and informal care are substitutes, complements or independent of each other. When the parent becomes wealthier, he can afford buying more formal care. If formal and informal care are complements, he then also values more the informal care provided by his child. Since the child cares about the utility of the parent, the increase in the parent's valuation of informal care induces him to enhance his caregiving. On the other hand, if formal and informal care are substitutes, a rise in the parent's wealth and thus in the amount of formal care decreases the parent's valuation of informal help, which induces the child to reduce his care provision. Finally, if formal and informal care are independent of each other, an increase in formal care does not change the parent's valuation of informal aid and thus the child does not adjust his caregiving.

Let us now turn to the impact of an increase in the child's wage rate on the parent's transfer (db/dw). The first term in the numerator of

db/dw is negative: since the child starts earning more, there is less need for the parent's financial support and this pushes for lowering the transfer. If the child is perfectly altruistic (i.e. $\alpha = 1$), this is the only effect that an increase in w has on b, which means that the sign of db/dw is clearly negative. However, if the child is imperfectly altruistic (i.e. $0 < \alpha < 1$), another effect comes into play as well. Since, as discussed above, in that case the parent wants to "*correct*" the child's choice of informal care, it has to be considered that an increase in the child's wage rate also affects the way in which the child adjusts his caregiving in response to the parent's transfer (i.e. da/db also depends on w). It can be verified that the sign of $\frac{d(da/db)}{dw}$ is generally ambiguous and therefore different situations are possible. If $\frac{d(da/db)}{dw} < 0$ (i.e. an increase in the child's wage rate induces him to increase his caregiving by less (if $da/db > 0$) or to decrease it by more (if $da/db < 0$) when the parent's transfer goes up), the second term in the numerator of db/dw is negative and pushes for lowering the transfer.

Indeed, if an increase in w makes the transfer less successful (or more unsuccessful) in fostering informal care, the transfer should be reduced. In that case, the overall sign of db/dw is clearly negative. On the other hand, if $\frac{d(da/db)}{dw} > 0$ (i.e. an increase in the child's wage rate induces him to increase his caregiving by more (if $da/db > 0$) or to decrease it by less (if $da/db < 0$) when the parent's transfer goes up), the second term in the numerator is positive and pushes for a higher transfer. In that case, the overall sign of db/dw is ambiguous. If the positive effect on da/db is large enough (i.e. if an increase in w makes the transfer sufficiently more productive (or sufficiently less unproductive) in eliciting care from the child) and/or the degree of the child's altruism is sufficiently low (so that "*correcting*" his choice of caregiving is considerably

important for the parent), the second term might outweigh the first one and the sign of db/dw might turn positive.

Finally, let us look at how the parent's transfer is impacted by an increase in his wealth (db/dy). If the child is perfectly altruistic, there is only one effect playing a role: a wealthier parent can afford giving more financial support to his child and he thus increases his transfer. This is reflected by the positive first term in the numerator of db/dy. If the child is not perfectly altruistic, then the fact that his caregiving is insufficient needs to be taken into account and this results in additional effects coming into play. First, an increase in the parent's wealth changes his appreciation of informal care: a wealthier parent can afford more formal care and, depending on whether formal and informal care are substitutes or complements, his marginal utility of informal aid either decreases or increases.

The effect on his transfer then also depends on whether the child's caregiving is increasing or decreasing in the amount of the transfer. This effect is reflected by the second term in the numerator. For instance, if formal and informal care are substitutes (i.e. $H_{am} < 0$), the child's caregiving is always increasing in the transfer (i.e. $da/db > 0$), which means that the second term is negative and pushes for lowering the transfer: since the parent's valuation of informal care decreases, he has less need to use the transfer for eliciting the child's aid. If formal and informal care are complements, both $da/db > 0$ and $da/db < 0$ are possible (see the discussion above), which means that the second term might be positive or negative. In addition to this, an increase in the parent's wealth also affects da/db, and this is reflected by the third term in the numerator. The sign of $\frac{d(da/db)}{dy}$ is generally ambiguous and, similarly to the discussion of $\frac{d(da/db)}{dw}$, different situations are possible.

Thus, overall, when the child is not perfectly altruistic, the sign of db/dy is not clear and both $db/dy > 0$ and $db/dy < 0$ are possible, while with perfect altruism we clearly have $db/dy > 0$.

2.3.2 Exchange

We now assume that there is a market for assistance at price p. The parent and the child behave like agents who respectively demand and supply a. The child maximizes

$$u(w(1-a)+pa)$$

This gives an infinitely elastic supply function for a at $p = w$.

The parent maximizes

$$H(m,a) = H(y-pa,a)$$

This yields the FOC:

$$-H_m p + H_a = 0$$

From this condition, one obtains a demand function $a(p)$ such that

$$da/dp = \frac{-H_m + H_{mm}pa - aH_{am}}{-\Delta_a}$$

The first two terms in the numerator unsurprisingly push for lowering the demand for assistance when its price goes up. The sign of the third term depends on whether formal and informal care

are substitutes or complements. It can be easily checked that $da/dp < 0$ if $H_{am} \geq 0$. Indeed, an increase in the price of the child's assistance leaves the parent with fewer resources to buy formal care. If formal and informal care are complements, a decrease in formal care also pushes for a decrease in informal help and thus the third term in the numerator goes in the same direction as the first two terms. If $H_{am} < 0$, the third term is positive since a decrease in formal care calls for increasing informal aid. Then the expression is generally ambiguous. For it to turn positive, however, we would generally need a very large absolute value of H_{am} (that is, a very high degree of substitutability between formal and informal care), which does not seem to be very likely. We thus expect $da/dp < 0$ to hold.

Nevertheless, to give the model all its chances and not to miss any possibilities, we keep the case of $da/dp > 0$ under consideration as well. Quite clearly the equilibrium price is$p = w$. We can obtain from the FOC the impact of y and w on a and b. Note that here b is simply the amount paid for a, namely $b = wa$.

For the impact of y we get:

$$da/dy = \frac{-H_{mm}p + H_{am}}{-\Delta_a} > 0 \text{ if } H_{am} \geq 0 \text{ (otherwise ambiguous)}$$

$$db/dy = w(da/dy) > 0 \text{ if } H_{am} \geq 0 \text{ (otherwise ambiguous)}$$

When the parent becomes wealthier, he can afford buying more care from the child. This is reflected by the positive first term in the numerator of da/dy. However, at the same time, he can also afford more formal care. If formal and informal care are complements, an increase in formal care increases the parent's valuation of informal aid and thus reinforces his demand for the child's assistance (da/dy

is clearly positive). On the other hand, if formal and informal care are substitutes, the valuation of informal aid is decreased and thus pushes for demanding less assistance. In that case, the overall sign of da/dy is not clear.

It is important to note that, since b here is simply a linear function of a, the sign of db/dy directly depends on the sign of da/dy, which means that in this model the two signs always coincide. This will appear to be crucial for the interpretation of our empirical results.

For the impact of w, we should first note that a change in w changes the equilibrium price of informal care. The equilibrium quantity of a is then equal to the parent's demand at this price. Therefore, the impact of w on a coincides with the impact of p derived above, that is,

$$da/dw = da/dp < 0 \text{ if } H_{am} \geq 0 \text{ (otherwise ambiguous)}$$

The impact on b is then as follows:

$$db/dw = a + w(da/dw) \gtrless 0$$

On the one hand, an increase in the price of informal care means that the parent has to pay more for the amount of care he buys (the first term of db/dw); on the other hand, the demand for informal care is reduced (the second term). It is thus overall not clear whether the parent's total payment increases or decreases when the child's wage rate goes up.

2.3.3 Norm

We now assume that the child has to provide an amount of care $\bar{a}$ that is determined by the tradition and the culture of the social environment, by some family norm. It is likely that this level is higher than what he would freely choose. Unsurprisingly, we clearly have that:

$$(d\bar{a})/dw = 0$$

$$(d\bar{a})/dy = 0$$

As to the parent, his objective is to maximize

$$U_p = H(y - b, \bar{a}) + \beta u((1 - \bar{a})w + b)$$

The parameter β reflects the extent of descending altruism. If $\beta = 0$, $b = 0$. In other words, if the parent is not altruistic, he will not make any transfer since his transfer has no effect on the child's aid which is determined by the norm. In that case, all the comparative statics will simply be equal to zero.

If $\beta > 0$, namely the parent is concerned by the welfare of his child, then the first order condition is:

$$\Lambda = -H_m(y - b, \bar{a}) + \beta u'((1 - \bar{a})w + b) = 0$$

Hence,

$$db/dw = \frac{\beta(1-\bar{a})u''(c)}{-\Lambda_b} < 0$$

$$db/dy = \frac{-H_{mm}(m,\bar{a})}{-\Lambda_b} > 0$$

The signs of db/dw and db/dy in this case actually coincide with their signs in the model of altruism when the child is perfectly altruistic. As in that case, the parent decreases his support when the child starts earning more and increases it when he himself becomes wealthier. This is, however, different from the case of an imperfectly altruistic child where, as discussed before, the parent needs to make "*corrections*" of the child's caregiving choice. Such "*corrections*" are not made neither in the case of the norm nor in the case of a perfectly altruistic child, but for slightly different reasons. When the child is perfectly altruistic, he chooses exactly the amount of care the parent wants and there is thus no need for the parent to "*correct*" it. In the case of the norm, the child's caregiving is determined by the social environment and therefore is not affected by the parent's transfer. The amount of care determined by the norm might or might not be the one which is optimal for the parent.

Table 2.1: Summary of theoretical models

	Child's help side		**Parent's transfer side**	
	da/dy	da/dw	db/dy	db/dw
Altruism	> 0 if comp < 0 if subs = 0 if indep	≷ 0	> 0 if α=1 ≷ 0 if 0<α<1	< 0 if α=1 ≷ 0 if 0<α<1
Exchange	> 0 if comp or indep ≷ 0 if subs (but same as db/dy)	< 0 if comp or indep ≷ 0 if subs	> 0 if comp or indep ≷ 0 if subs (but same as da/dy)	≷ 0
Family Norm	= 0	= 0	> 0 (P altruist)	< 0 (P altruist)
			= 0 (P not altruist)	= 0 (P not altruist)

The findings of the theoretical models are summarized in Table 2.1. In particular, Table 2.1 summarizes the comparative statics

da/dy, da/dw, db/dy, db/dw predicted by each of the models. The aim of the empirical part of our paper will be to test empirically the signs of these four derivatives in order to verify which of the theoretical models is the most compatible with the data.

As it can be seen from Table 2.1, the predictions of the theoretical models are not always unambiguous and the signs of some derivatives might coincide for several models. For this reason, our strategy primarily consists in considering each model "*as a whole*", that is, considering together both the parent's and the child's side and requiring compatibility between the theoretical and empirical signs for all the four derivatives in question as well as paying a particular attention to verifying whether no contradictions arise. As it will be seen in the analysis, this will appear to be particularly important in the case of the model of exchange where the model's predictions might (to some extent) be compatible with the empirical results if the parent's and the child's decisions are analyzed separately but as soon as the two sides are considered together, it becomes evident that the empirical findings in fact contradict the model.

We are able to consider the models as a whole since, as will be explained below, we use a single sample where the information about children and their parents is linked, which is not the case in Alessie et al. (2014) who use separate samples for children and for parents.

2.4 Data and sample

SHARE, the Survey of Health, Ageing and Retirement in Europe, is a free-access database created in 2002 in order to study the phenomenon of Ageing in Europe. The survey, inspired by HRS & ELSA (USA & UK counterparts), brings together many disciplines (epidemiology, economics, sociology, psychology and demography). The survey is large (more than 85,000 individuals aged 50+ interviewed in the first four waves) and longitudinal. We use in this paper the 6th release of the second wave of the survey, conducted in 2007[2]. We do not use a more recent wave[3] because only wave 2 links information on informal care and financial transfers between adult children and their parents. In addition, the information relative to the amount of informal care (hours per month) provided by children is available for this second wave[4]. Table 2.2 summarizes the two relevant questions. We are now able to know exactly if a child has taken care of his (her) parents and if a child has received or not financial transfers from his (her) parents.

[2]This paper uses data from SHARE Waves 1, 2, 3 (SHARELIFE), 4, 5 and 6 (DOIs: 10.6103/SHARE.w1.610, 10.6103/SHARE.w2.610, 10.6103/SHARE.w3.610, 10.6103/SHARE.w4.610, 10.6103/SHARE.w5.610, 10.6103/SHARE.w6.610), see Borsch-Supan et al. (2013) for methodological details. (1) The SHARE data collection has been primarily funded by the European Commission through FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARELIFE: CIT4-CT-2006-028812) and FP7 (SHARE-PREP: N°211909, SHARE-LEAP: N°227822, SHARE M4: N°261982). Additional funding from the German Ministry of Education and Research, the Max Planck Society for the Advancement of Science, the U.S. National Institute on Aging (U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04-064, HHSN271201300071C) and from various national funding sources is gratefully acknowledged (see www.share-project.org).

[3]The 6th wave ended at the end of 2015.

[4]Data are also available for the first wave of SHARE conducted in 2004 but this wave contains fewer observations and fewer countries, hence the decision to study only the second wave.

Table 2.2: Interest variables from SHARE wave 2 questionnaire

Key variables	Question
Informal Care	Now please think of the last twelve months. Has any family member from outside the household, any friend or neighbour given you (or your partner) any kind of help? (*1. Dressing, bathing or showering, eating, getting in or out of bed, using toilet; 2. With home repairs, gardening, transportation, shopping, household chores; 3. Filling out forms, settling financial or legal matters.*)
Financial Transfer	Now please think of the last twelve months. Not counting any shared housing or shared food, have you (or your partner) given any financial or material gift or support to any person inside or outside this household amounting to 250 euro (in local currency) or more?

2.4.1 Sample selection criteria

SHARE questions people aged 50 and over. Their partner is also interviewed if agreed but some questions (financial and children issues for instance) are only posed to one of the two. The reason is to avoid wasting time and to have higher response and retention rates. Whereas Alessie et al. (2014) used two different samples[5] , we created only one sample from information obtained on respondents' children. Our base sample therefore consists of respondents' children for whom accurate information about their age, gender, location, marital status, employment status, level of education and number of siblings is available[6]. In the main models, we duplicated the information about children, help and transfer to the partner

[5]They built two different samples: the one in which they consider the respondents as parents (the "*young*" sample) and the one in which they consider the respondents as children (the "*old*" sample). They use the young sample to analyze financial transfers from parents to their children and the old sample to analyze services provided by each child to parents.

[6]Among the 33,132 respondents considered in Wave 2, 29,655 declare having at least one child while 3,178 report not having one. There are 299 missing values (due to a refusal to answer). In addition, this complete information is available on up to four children in a household. That represents 93.3% of households for which complete information on all their children is available.

not interviewed on these issues[7]. Indeed, it seemed reasonable to assume that the aid received will benefit the entire household and that financial transfers are a common decision. However, monthly hours of help and the total amount of gifts were shared equally among partners in order to not overestimate the ascending and descending flows.

Regarding the informal support received and financial transfers made by parents from/to their children, three people[8] are potentially nameable by respondents in each case. In SHARE, information regarding the amount of informal care received (financial transfers given) is collected for only up to three potential informal caregivers (receivers). So, if the respondent has more than three caregivers (receivers), it is possible that our variable of informal care (financial transfer) underestimates the amount of informal care (financial transfer) provided (given) by (to) all the children (and the children's spouse and their children). Of the 33,132 respondents (parents in our model), 29.7%[9] reported having made a financial donation of more than 250 euros in the last 12 months. 11,704 children received a transfer from their parents, which is equivalent to 74.4% of all recipients[10]. Looking into informal help, 20.9%[11] of the 33,132 respondents declared having received help from outside the household. 5,067 children provided informal help

[7]As explained previously, only one household member is interviewed about the children and/or step-children, financial transfers and help received to reduce the duration of the interview.We also focus our analysis on single respondents in order to not have this duplication issue. See section 2.5.4: Robustness tests.

[8]That can be children, but also partner, other relatives, friends, and so on.

[9]412 respondents refused or did not know the answer (1.2%). 69.1% declared not having made a transfer.

[10]The other transfers recipients are: Family for 21.4% and other relationships 4.2%

[11]258 respondents refused or did not know the answer (0.8%). 78.3% declared not receiving informal help.

to their parents, which is equivalent to 49.2% of all suppliers[12]. Finally, information about the health, education, gender, age, marital status of respondents and the presence of cohabiting child in the household is collected at the individual level while wealth is collected at the household level. A panel of children is now built and allows testing both ascendant (help) and descendant (gift) flows on this unique children-file, bringing symmetry to the issue we try to address.

The questions and answers to these questions in SHARE are very specific; we know exactly which child helped his parent and which child received a transfer from his parent. The sample is now composed of the children of the respondents, with some who help their parents, others who receive transfers from them, some who help and who receive money and a majority who does not help and does not receive anything. There are 69,069 children in the sample (from 19,852 households) but since the goal of the research relates in part to informal care and because the population aged 65 or older is more at risk of dependence (OCDE, 2013), the sample selected will be the entirety of children whose at least one parent is more than 65 years old. There remain 32,637 children in the sample from 10,216 households. We also drop from the sample the children still living with their parents in order to conduct our analyses only on non-cohabiting children. This corresponds to 2,377 children now withdrawn from the sample. However, we keep the information on the presence of a cohabiting child in the household.

Once we remove the children for whom the information is not

[12]The other care suppliers are: Family other than children (nephew, niece, uncle, etc.) for 20.3%, children-in-law 6.9% (unfortunately, no complete information on their characteristics is available) and other relationships 23.6%.

complete[13], our final sample consists of 28,780[14] children (from 9,471 households) coming from 13 countries: Austria (AT), Germany (DE), Sweden (SW), Netherlands (NL), Spain (ES), Italy (IT), France (FR), Denmark (DK), Greece (GR), Switzerland (CH), Belgium (BE), Czech Republic (CZ), Poland (PL). 3,455 children received a financial gift from a parent (12.0%) while 3,109 children provided informal help to a parent (10.8%). There are differences in the propensity to help or to receive money and the intensity of these actions depending on countries.

2.4.2 Variables and descriptive statistics

As mentioned above, the aim of the empirical analysis is to test the signs of four relationships predicted by the theoretical models. In these relationships there are two dependent variables, namely, the child's informal help and the parent's financial transfer (a and b in the theoretical models). In the empirical analysis, we focus on the ascending help and downward transfers that cover a year of respondents' life (last 12 months in the question). Even if our results are thus like a window into people's life, we suppose that the size of the sample (more than 28,000 children) allows thinking that many circumstances of life are encountered and evoking long-term behavior.

Table 2.3 details the information on the two dependent variables.

[13] 1107 children with missing information about age, 446 with employment status, 380 with education level, 121 with siblings, 231 with location, 652 with level of parent education, 58 with health status of parent.

[14] The sum of missing information is not equal to the difference between 32,235 and 31,416. Indeed, the sum is equal to 2,995 when the difference is only 1,480. This is because some missing information relates to the same child.

Table 2.3: Informal Help (hours per month) & Transfers (PPP euros)

		Help (%)	**Informal help given by a child to a parent if help (Hours by month)**				*Transfer (%)*	**Transfer received by a child from a parent if transfer (PPP euros)**			
			Mean	***50th***	***90th***	***95th***		***Mean***	***50th***	***90th***	***95th***
North	**SW**	9.1	10.8	2.0	13.0	30.4	19.3	2814	830	6459	18453
	DK	10.0	4.1	0.8	12.0	17.4	16.4	2398	1211	4845	8576
	NL	4.9	7.3	1.2	15.2	17.4	10.7	2572	982	5891	9818
Center	**AT**	10.1	23.2	6.5	60.8	89.0	15.4	1942	590	4916	7374
	DE	12.5	17.0	4.1	30.4	60.8	16.1	2312	722	4812	9625
	FR	7.3	22.0	5.0	60.8	91.2	11.0	5054	1170	13201	24001
	BE	10.5	15.8	4.3	30.4	45.6	12.3	7067	1195	15890	35846
	CH	6.4	11.5	2.1	30.4	34.7	11.2	7194	1802	11266	32446
South	**ES**	7.3	33.7	6.5	121.6	173.6	2.6	1817	662	5199	6631
	IT	8.2	33.6	7.6	91.2	152.1	12.9	3249	481	4810	9619
	GR	15.1	37.6	8.7	91.2	152.1	7.6	1535	678	3515	5859
East	**CZ**	30.3	24.0	6.5	60.8	91.2	9.1	840	332	1824	3316
	PL	10.4	20.7	6.5	45.6	60.8	9.3	536	243	1375	2188
All		10.8	21.2	4.3	60.8	91.2	12.0	3166	721	6760	11949

Source: SHARE Wave 2 release 2.6.0, own computations

The first column **Help (%)** gives the percentage of children caring while the column **Transfer (%)** indicates the proportion of children receiving inter-vivos transfers. Parents are once assistance beneficiaries, once financial donors. We can note the heterogeneity of the propensity for aid and transfer between countries. 30.3% of Czechs children declare helping their parents when they are only 4.9% in the Netherlands. 2.6% of Spanish children received a transfer from their parents when they are almost 20% in Sweden. Besides, we note that in the southern and eastern countries, the intensity of care (in hours) seems more important once we consider children who help. While Danish or Dutch children helpers support their parents less than 11 hours per month on average, Italian, Spanish and Greek caregivers spend more than 33 hours per month on average caring for their parents. The North/South-East gradient is present. The countries of central Europe (France, Germany, Belgium, Austria and Switzerland) are in between, as

the eastern ones. For the amount of financial transfers, the gradient appears to exist but it is less clear than for informal care. Indeed, Italian parents approach the French behavior while Swiss and particularly Belgian parents seem more "*generous*" than their counterparts from northern Europe. This first look at raw data seems to be confirmed when we dwell on medians and last deciles conditional to a transfer. We note also that the average is greater than the median, meaning many children help a few hours and many parents make low financial transfers.

The explanatory variables involved in the relationships to be tested are the parent's and the child's endowments, namely, the parent's wealth (y) and the child's wage rate (w). To use the first variable in the first part of empirical analysis (Descriptive figures 2.1 & 2.2), quartiles of parents' wealth were created by country on the initial base sample (50+). As far as the second variable is concerned, we use the child's education as a proxy for his/her wage rate. For the level of education of children, ISCED[15] 1997 classification is used in order to create 3 categories. The lowest one corresponds to children with at best a lower secondary degree. The medium level of education corresponds to ISCED 3 (upper secondary education) while the highest level matches post-secondary degrees[16].

Table 2.4 provides some descriptive statistics of the two key explanatory variables as well as of some other independent variables

[15]ISCED: International Standard Classification of Education was created by UNESCO in order to facilitate comparisons of educations statistics and indicators across countries.

[16]"*Low*" is from ISCED 0 (pre-primary education) to 2 (lower secondary or second state of basic education) through 1 (primary education or first stage of basic education) when "*High*" ranges from ISCED 4 (post-secondary non-tertiary education) to 6 (second stage of tertiary education) through 5 (first stage of tertiary education).

that will be used in the econometric analysis for control. The first part of the table focuses on the characteristics of the parents (potential financial donors) in terms of average and median wealth, health limitations, age, gender, presence of a cohabiting child and couple status. The second part provides information concerning children (potential care providers) in terms of education, age, gender, employment status and distance from parent. Significant differences appear in wealth levels between countries. Children's places of residence also vary widely by country. At a roughly comparable country-scale, Italian, Spanish or Polish children are on average closer (more or less than 70 kilometers) to their parents than German, Swedish or French ones (over 100 km).

Moreover and because of average differences in life expectancy, mothers are more represented (54.2%) in the sample (65+) than fathers while the parents' average age is 74.2 years. Children are 45.2 years old on average and there are almost as many men (50.2%) as women (49.8%) in the sample. The percentage of parents living in a couple varies from 56.0% in Austria to 79.6% in Spain.

Focusing on cohabiting children, we can see that Italian, Polish and Spanish households seem more intergenerational (more than 20% of children still have a sibling living with their parents). The employment status of children varies between countries, with many children without work in the countries of the South and in Poland. In addition, data show that children who are not employed are the ones who help their parents the most (on average more than 6 hours per week versus less than 2 hours for child employed children). Finally, the differences between the education levels of children are very important. Indeed, children from southern and

Table 2.4: Summary statistics of independent variables

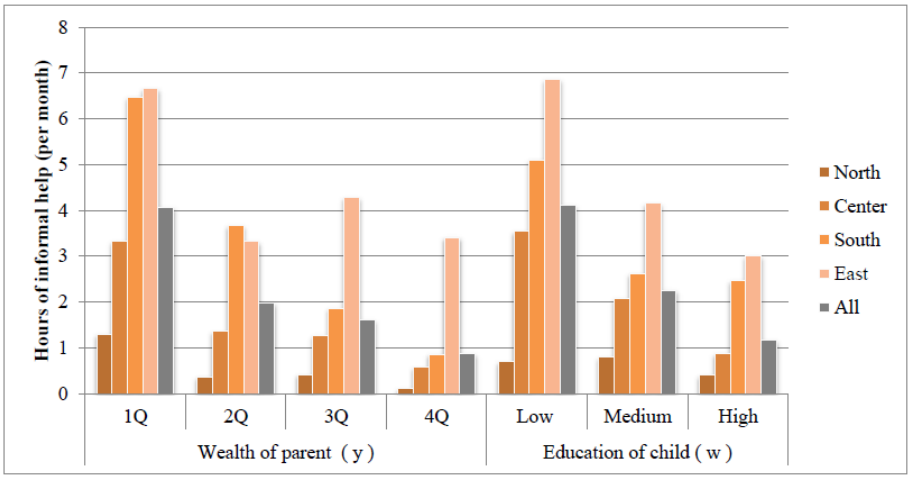
			North			Center					South			East		All
			SW	DK	NL	AT	DE	FR	BE	CH	ES	IT	GR	CZ	PL	
Observations			2,787	2,359	2,475	1,188	2,330	2,465	2,838	1,279	2,046	2,644	2,295	1,929	2,145	28,780
Dependent variables	**Ascending Informal Help**	*Mean (Hours per month)*	0.98	0.41	0.36	2.35	2.13	1.61	1.66	0.74	2.45	2.76	5.68	7.27	2.16	2.29
	Downward Monetary Transfers	*Mean (€ PPP)*	542.2	394.4	274.4	299.2	372.1	553.6	871.6	804.4	47.1	420.2	116.4	76.6	50.0	380.1
Parent	**Net worth in € of the parent**	*Median (€ 1000 PPP)*	131.9	129.8	176.2	100.7	135.1	222.9	215.1	198.3	187.9	155.8	100.8	62.7	30.8	135.3
		Mean (€ 1000 PPP)	274.2	231.4	269.2	165.8	215.8	398.8	300.1	475.2	278.9	260.8	156.5	87.3	52.1	243.8
	Limited in activities because of a health problem	*Severely limited (%)*	16.4	16.1	21.0	16.0	21.1	23.9	20.6	11.2	9.0	21.1	12.6	26.6	44.5	20.3
		Limited but not severely (%)	31.9	28.8	29.5	40.7	37.7	26.7	29.3	29.9	43.1	34.7	32.8	44.7	35.4	33.8
		Not limited (%)	51.7	55.1	49.5	43.3	41.2	49.4	50.1	58.9	47.9	44.2	54.6	28.7	20.1	45.9
	Age	*Mean*	74.3	74.3	74.0	73.5	72.8	74.8	74.6	75.1	74.3	73.5	75.5	73.6	74.3	74.2
	Gender	*(% of woman)*	49.4	55.3	52.5	59.6	52.0	57.2	55.7	55.4	52.2	51.5	58	56.9	53.8	54.2
	Child in HH	*Yes (%)*	1.3	2.0	1.9	7.3	4.2	5.8	6.1	3.1	24.8	19.6	10.3	5.9	28.3	9.24
	Partner	*Yes (%)*	75.2	66.7	73.9	56.0	77.1	65.6	69.4	65.6	79.6	78.8	60.3	61.5	72.2	70.2
Child	**Education (ISCED 1997)**	*Low (0-2) (%)*	17.6	10.8	29.7	8.8	2.7	17.5	16.6	3.6	56.3	41.4	30.2	38.6	11.8	22.7
		Medium (3) (%)	38.2	40.5	33.4	49.2	54.2	42.3	36.5	55.8	23.5	39.1	39.5	41.8	66.4	42.2
		High (4-6) (%)	44.2	48.7	36.9	42.0	43.1	40.2	46.9	40.6	20.2	19.5	30.3	19.6	21.8	35.1
	Employment status	*Full employed (%)*	79.5	81.1	61.1	72.6	68.8	76.2	71.4	66.1	77.6	72.5	74.5	85.3	69.3	73.7
		Partially employed (%)	9.3	5.4	22.9	12.6	14.3	5.1	10.8	21.1	2.1	4.2	3.5	0.9	1.8	8.5
		Not employed (%)	10.2	10.3	13.2	14.4	15.7	16.4	15.2	11.7	19.8	23.2	21.7	12.5	24.1	16.1
		Disabled (%)	1.0	3.2	2.8	0.4	1.2	2.3	2.6	1.1	0.5	0.1	0.3	1.3	4.8	1.7
	Age	*Mean*	45.1	46.0	44.5	45.2	44.1	45.8	46.0	45.1	43.6	43.9	45.7	46.8	46.4	45.2
	Gender	*(% of woman)*	50.0	50.7	50.9	49.6	49.9	51.4	49.8	52.5	47.8	49.5	49.4	52.4	50.2	50.2
	Partner	*Yes (%)*	79.5	78.2	83.6	78.5	79.5	78.6	83.2	78.0	88.8	89.1	85.6	86.8	88.4	83.1
	Siblings	*Mean*	1.88	1.99	2.33	1.87	1.82	2.10	2.24	2.07	2.45	2.01	1.60	1.43	2.39	2.02
	Distance from parents	*Mean (in kilometers)*	132.8	96.6	70.6	83.4	103.7	154.4	44.0	81.7	66.7	70.8	88.0	52.4	70.1	86.9

SW: Sweden, DK: Denmark, NL: Netherlands, AT: Austria, DE: Germany, FR: France, BE: Belgium, CH: Switzerland, ES: Spain, IT: Italy, GR: Greece, CZ: Czech Republic, PL: Poland

Source: SHARE Wave 2 release 2.6.0, own computations

eastern Europe have a low level of education. The reverse holds in northern and central Europe.

If we have a first look at the relationship between informal care and the two explanatory variables, the descriptive statistics shown in Figure 2.1 seem to confirm the altruism of children in care provision. The poorer the parents are, the more care they receive from their children. This negative link between aid received and wealth of parents holds for all regions[17] except in the East where the link is not continuous. In parallel, first descriptive results suggest that the more educated the children, the less help they provide to their parents, which depending on our theoretical model can illustrate either altruism or exchange, not a norm.



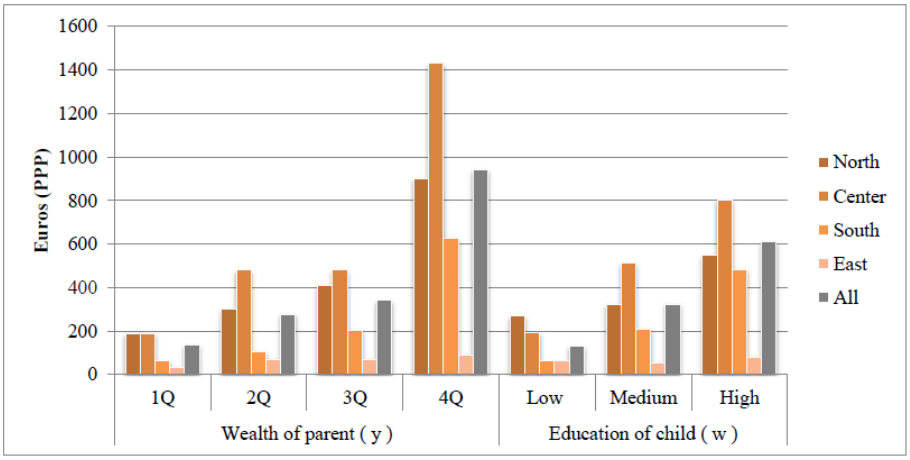
Source: SHARE Wave 2 release 2.6.0, own computations

Figure 2.1: Informal help from children to parents

If we have a first look at the question of financial inter-vivos downward transfers, the descriptive statistics in Figure 2.2 seem to confirm, at first view, altruism or the role of the family norm for

[17]The negative link appears also when we only look at the people who have received help even if it is less strong.

parents. The poorer the parents, the less money they transfer to their children. This positive link between transfer received and wealth of parents holds for all regions[18]. The exchange motive cannot be confirmed as the first descriptive results seem to be contrary to the proposed theoretical model. Indeed, the theoretical model of exchange implies the same type of relationship (either positive or negative) both between aid and the parents' wealth and between transfer and the parents' wealth, whereas the first descriptive results on the contrary suggest opposite relationships. In parallel, the first descriptive results suggest that the more educated the children, the more they receive from their parents, which according to our theoretical models can only illustrate exchange or altruism (in case where child is not perfectly altruist), not a norm. However, the same remark about the rejection of the exchange model must be mentioned.



Source: SHARE Wave 2 release 2.6.0, own computations

Figure 2.2: Transfers to children from parents

Summing up, depending on the country, altruistic motives may be those behind help and transfers, even if the family norm could be

[18]The negative link appears also when we only look at the people who have made a transfer even if it is less strong.

a secondary driver. These first descriptive results from Figures 2.1 and 2.2 must be confirmed by a rigorous econometric analysis[19].

2.5 Estimation results

The first empirical model consists in analyzing the effect of parents' and children's endowments, represented respectively by parents' wealth and children's education, on informal care provided by the adult children to their parents. Three types of informal care are considered: personal care, practical household help and help with paperwork, as mentioned in Table 2.2. The two-part model introduced by Duan et al. (1983), which applies the separation of behavior into two steps -first, the decision regarding providing informal care to parents (the extensive margin), and second, a decision regarding the level of this help (the intensive margin), conditional on providing any- was considered, but finally dropped since our theoretical models only deal with the intensive margin. That is why we opted for the Tobit model, a model where the dependent variable is continuous but is observable on a certain interval[20]. Thus, these are models that lie halfway between the linear

[19]These initial results are a bit contrasted in the case of a sample of children whose parents have no more / no partner. See Appendix B.1., that is why we analyze this particular sample in a specific way.

[20]The two-part model is a Heckman model that assumes that there is no correlation between the error terms of the selection equation and the "*help/transfer*" equation. Beyond this remark, one could also point out that many zero observations is not a censoring problem but a selection issue. In the two-part models, estimates derived from any one stage may suffer from selection bias. In our case, especially for the analysis on the help side, we definitely face a selection issue since some children do not help their parents perhaps only because parents do not need it. A common approach to addressing selection bias is Heckman's (1976) selection model where conditionality is taken into account using the Mills ratio. Ideally, the correction should be implemented with an exclusion

regression models where the endogenous variable is continuous and observable and the qualitative models.

More formally, if we consider N couples of variables $(X_i,\ Y_i^*)$ where the variable Y_i^* is such that $E[\,Y_i^*|X_i] = X_i\theta$ (where θ is a vector of parameters), the linear model is perfectly adapted to the situation. Unfortunately, and as for qualitative variables, the variable Y_i^* is a latent variable which is not always observable. We can observe it only if its value is higher than a threshold c. It is thus possible to build an observable variable Y_i which is equal to Y_i^* when this one is observable and which is equal to c by convention when Y_i^* is not observable. The Tobit models are censored models: contrary to Y_i^*, we observe X_i for the whole sample[21].

The second model focuses on the impact of parents' and children's endowments on transfers received by adult children from their parents. These financial transfers are higher than 250 euros in the last twelve months. A two-part model was also considered but also dropped because the theoretical models explain the intensive margins. A Tobit model is thus applied. For the two considered

restriction or with a theoretical predictor that is related to the underlying selection process but not to the substantive outcome of interest (here, hours of help or amount of transfers), in order to avoid problems of collinearity. We would have preferred to apply a Heckman model but we met difficulties of identifying quality exclusion variables (for the help and/or the transfer). We so fell back on the Tobit I models capturing the effects of the explanatory variables on both the probability of providing care and the number of hours for children who help their parents. Even if we know that Tobit and Heckman models estimate different things (and so that predictions should differ since Tobit treats no help as zero while Heckman considers no help as unobserved), we keep Tobit models. We could suppose that estimates from Heckman models should be much larger than from Tobit since it is estimating what the help would have been if it were observed. However, it should be noted that we control for the parent's health status in the regressions on the informal help offered by the children.

[21]This property challenges the assumption of linearity and shows that the ordinary least squares are not the relevant method for estimating such a relationship.

models, we take the logarithm of (1+variable) to deal with high values of hours of help and amount of transfers and the indeterminacy problem of the logarithm of zero (some children do not help their parents and do not receive financial transfer from their parents).

These two analyses are conducted on the entire sample, but also on groups of countries (northern, central, southern and eastern Europe). Heckman selection model was also considered but no obvious exclusion restrictions were available. Future research should address this problem, as well as the issue of endogeneity. Indeed, the question of simultaneous care and transfers is not directly tackled. We conduct two reduced models and the combination of the results allows us to draw a conclusion about the motives of intergenerational family ties. These empirical analyses are carried out on the whole of the selected sample but also only on the children whose parents are single since descriptive results seem to show differences between the two cases. In the models, the parent's wealth variable is a continuous variable built on wealth deciles while the education of the child variable is also a continuous variable based on 7 categories of ISCED codes (from 1, lowest to 7, highest). In order to perfectly follow the theoretical models, we took the option to run the "*help model*" and then the "*transfer model*" twice. Indeed, in the theoretical models, we look at the comparative statics between the help offered/transfer made and the wealth of the parent when the wage of the child (proxied by education) is fixed and the comparative statics between the help offered/transfer made and the wage of the child when the wealth of the parent is fixed. We adopt exactly the same process in the empirical part, applying Tobit models but with dummies for children's education when we study the effect of the wealth of the

parent on help/transfer and with deciles dummies for the wealth of the parents when we focus on the effect of the education of the child on help/transfer.

2.5.1 Main drivers of providing informal help

As mentioned previously, the first model focuses on drivers of hours of help provided by children to their parents. The dependent variable is the logarithm of (number of hours of help + 1). Table 2.5 summarizes the results in 5 columns when children from all types of households are considered. The results from the first regression (endowments of children are fixed) seem to indicate that the wealthier the parents, the less they will be helped by their children, except in the East where there is no effect. The results from the second regression (endowments of parents are fixed) concern the impact of education of the child, as proxy for his/her wage, and no clear and significant relation appears from the regression, regardless of the region considered. Country dummies are also included in the model; controlling for health, age and education of the parent, employment status, partner and age of the child. Coefficients associated to the covariates may slightly vary but the significativity does not.

Being a woman leads to offering (child side, except in the North) and receiving (parent side, except in the South and the East of Europe) more help. Other studies[22] have already highlighted the preponderant role of daughters in informal support to parents.

[22]Daughters have been shown in numerous studies to be much more likely to provide care to elderly parents than sons, and to provide more care (Mellor, 2001).

And the higher life expectancy of women implies they are more likely to be helped (they are also more numerous in the sample, see Table 2.4). If the child still has a brother or sister who lives with his parents, he will help less.

Table 2.5: Tobit model of informal help (All)

Explanatory variables	**All**	**North**	**Center**	**South**	**East**
Model controlling with children education dummies					
Parent characteristics					
Wealth	**-0.064*** **	**-0.065*** **	**-0.059***	**-0.182*** **	**0.0397**
Woman	0.259**	0.282*	0.368*	-0.060	0.250
Child in HH	-0.972***	0.083	-0.870**	-0.998***	-1.148***
Partner	-0.988***	-0.589***	-1.175***	-1.255***	-0.849***
Children characteristics					
Education	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**
Woman	0.500***	0.061	0.464***	1.273***	0.372*
Location	-0.648***	-0.450***	-0.709***	-0.797***	-0.555***
Siblings	-0.195***	-0.152***	-0.169***	-0.261***	-0.206**
Log likelihood	-12,047.2	-2,294.6	-3,769.6	-2,921.4	-2,909.7
Model controlling with parents wealth deciles dummies					
Parent characteristics					
Wealth	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**
Woman	0.267**	0.299*	0.388**	-0.060	0.241
Child in HH	-0.975***	0.079	-0.929**	-1.003***	-1.152***
Partner	-1.018***	-0.633***	-1.181***	-1.289***	-0.861***
Children characteristics					
Education	**0.022**	**0.016**	**-0.038**	**0.103**	**0.066**
Woman	0.494***	0.074	0.458***	1.259***	0.373*
Location	-0.652***	-0.464***	-0.714***	-0.808***	-0.552***
Siblings	-0.193***	-0.159***	-0.170***	-0.274***	-0.221***
Log likelihood	-12,040.8	-2,284.4	-3,767.9	-2,905.1	-2,912.2
Observations	28,780	7,621	10,100	6,895	4,074

*Notes: Country dummies are also included in the model; controlling for health, age and education of the parent, employment status, partner and age of the child; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$*

Source: SHARE Wave 2 release 2.6.0, own computations

Looking more specifically at the characteristics of parents more likely to be helped, age influences positively receiving care[23] while having a partner decreases it. The partner would be the first supplier of informal care. The level of help also seems to depend

[23] As dependence increases with age (OCDE, 2013), it seems normal that help received raises with age.

on the age of the caregiver. The older the child, the more care is provided. Finally, the location distance of potential caregivers and the fact that they have siblings (substitutes) negatively impacts the help offered.

2.5.2 Main drivers of downward financial transfers

The second model focuses on the drivers of transfers received by adult children from their parents in the last twelve months. These financial transfers are higher than 250 euros. The dependent variable is the logarithm of (amount of downward transfers + 1). As above, a Tobit model is applied. The intensive margins resulting from the five regressions are presented in Table 2.6, summarizing the results in 5 columns when children from all types of households are considered. The results from the first regression (endowments of children are fixed) seem to indicate that the wealthier the parents, the more the children receive from their parents, except in the East where there is no effect. The results from the second regression (endowments of parents are fixed) concern the impact of education of the child, as proxy for his/her wage, and no clear and significant relation appears from the regressions, except when we consider all regions together. Country dummies are also included in the model; controlling for health, age and education of the parent, employment status, partner and age of the child. Coefficients associated to the covariates may slightly vary but the significativity does not.

Being a daughter leads to receiving more transfer when North

Table 2.6: Tobit model of downward transfers (All)

Explanatory variables	**All**	**North**	**Center**	**South**	**East**
Model controlling with children education dummies					
Parent characteristics					
Wealth	**0.686*** **	**1.010*** **	**0.752*** **	**0.562*** **	**0.144**
Woman	-0.457*	-0.518	0.151	-1.190*	-0.816
Child in HH	-1.557***	-2.375	0.191	-2.205**	-1.764*
Partner	-0.148	-2.428**	1.228**	-0.581	1248
Children characteristics					
Education	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**
Woman	0.165	0.936*	-0.331	-1.233*	1.346*
Location	0.046	0.377**	0.225*	-0.349*	-0.443*
Siblings	-1.490***	-1.398***	-1.586***	-2.002***	-0.959***
Log likelihood	-19,277.4	-6,361.9	-7,315.9	-3,308.7	-2,177.6
Model controlling with parents wealth deciles dummies					
Parent characteristics					
Wealth	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**
Woman	-0.431	-0.470	0.175	-1.271*	-0.805
Child in HH	-1.511***	-2.472	0.359	-2.152**	-1.742*
Partner	-0.241	-2.677***	1.165*	-0.778	1174
Children characteristics					
Education	**0.237***	**0.195**	**0.121**	**0.412**	**-0.036**
Woman	0.177	0.955*	-0.350	-1.223*	1.375*
Location	0.045	0.357**	0.231*	-0.352*	-0.451**
Siblings	-1.494***	-1.406***	-1.568***	-1.998***	-0.918***
Log likelihood	-19,253.6	-6,355.5	-7,304.6	-3,284.2	-2,165.4
Observations	28,780	7,621	10,100	6,895	4,074
*Notes: Country dummies are also included in the model; controlling for health, age and education of the parent, employment status, partner and age of the child; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$*					

Source: SHARE Wave 2 release 2.6.0, own computations

and East regions are considered. It is the opposite in the South. Mothers are less likely to make gifts. Results are now driven by southern countries in view of the non-significance of the results for the countries of central, northern and eastern Europe. The older one is, the less one receives (as an adult child, results driven by northern and central Europe) or the smaller financial transfer one makes (as a parent, results driven by southern Europe). Being in a couple seems to have different impacts on the decision to give according to the region considered (significant differences exist between northern -negative effect- and central -positive effect-

countries) while the distance from the parents influences positively the amount of financial transfers, except in the South and in the East. Finally, transfers decrease with the number of siblings[24], and particularly once one of them still lives with parents, and the fact of having a partner.

2.5.3 Summary of empirical findings

Table 2.7 illustrates the results from the empirical analyses by applying two Tobit models which take into account the fact that several observations of hours of help/amount of transfers are zero. Four key variables interact in the models: a, the care provided by adult children to parents; b, the financial inter-vivos transfer from parent to child; y, the wealth of the parent and w, the wage of the child, proxied here by the level of education.

Table 2.7: Summary of empirical findings (All)

Countries	*All HHs sample (28,780)*	**Child's help**		**Parent's transfer**	
		da/dy	*da/dw*	*db/dy*	*db/dw*
SHARE		<0	$=0$	>0	>0
North		<0	$=0$	>0	$=0$
Center		<0	$=0$	>0	$=0$
South		<0	$=0$	>0	$=0$
East		$=0$	$=0$	$=0$	$=0$

Having determined empirically the signs of the four key relationships, namely, da/dy, da/dw, db/dy and db/dw , we can now return to the comparative statics derived in the theoretical models of section III and verify which models best match the empirical findings. As mentioned before, to conclude that a model is compatible with

[24]For sibling rivalry, see Buchanan (1983), Bernheim et al. (1985), Behrman (1997) and Chang and Luo (2015).

the data we will require compatibility between the theoretical and empirical signs for all the four relationships in question and we will pay a particular attention to verifying whether no contradictions arise. We will proceed by considering each model in turn.

Let us begin with the model of exchange. This model provides an interesting case which highlights the importance of making sure that no contradictions arise. Indeed, if one compares the theoretical signs presented in Table 2.1 to the empirical ones indicated in Table 2.7 and simply counts the number of relationships that in the model of exchange could be compatible with the empirical findings, one might be tempted to conclude that there is a possible compatibility of all of them. However, if we consider the model as a whole (and in particular, consider together the child's and the parent's sides), we note that the theoretical model of exchange implies da/dy and db/dy always having the same sign (whether under the hypothesis of complementarity or of substitutability between formal and informal care), while we clearly see from Table 2.7 that for all SHARE countries together as well as for all regions separately, except for the East, the empirical signs of da/dy and db/dy are actually opposite. This clearly indicates that the exchange model does not apply to these countries. As far as the East is concerned, $da/dy = db/dy = 0$ could be compatible with exchange, but then another contradiction arises. In particular, it can be easily verified that in the model of exchange it is not possible to have $da/dy = 0$ and $da/dw = 0$ at the same time: $da/dy = 0$ implies that $da/dw < 0$ should hold[25]. Thus, the exchange model cannot apply to the eastern countries either.

[25]In particular, if we have $da/dy = (-H_{mm}p + H_{am})/(-\Delta_a) = 0$, it must be that $H_{am} = H_{mm}p$. Using this, we get $da/dw = da/dp = (-H_m)/(-\Delta_a) < 0$.

Let us now turn to the norm model. It is straightforward to see that this model is not compatible with the empirical findings for all SHARE countries together and all regions separately, except for the East, since empirically we have $da/dy < 0$ whereas the child's aid should be constant according to the model of the norm. For the eastern countries, on the other hand, the situation is substantially different: all the four empirical signs are zero indicating a strong compatibility with the version of the norm model in which the parent is not altruistic. Finally, let us consider altruism and let us first look at the case of the model where the child is perfectly altruistic ($\alpha = 1$), i.e. the case of perfect two-sided altruism since, as mentioned in section 2.3.1, in the model of altruism the parent is always assumed to be perfectly altruistic. It can be seen from Table 2.1 that in this case we have unambiguous theoretical signs $db/dy > 0$ and $db/dw < 0$. Comparing this to Table 2.9, we see that the theoretical sign of db/dy is compatible with the empirical one for most of the regions, but the sign of db/dw is not compatible for any. We thus conclude that the model of perfect two-sided altruism cannot be validated.

Let us now inspect the case of an imperfectly altruistic child ($0 < \alpha < 1$). In that case, as discussed in section 2.3.1, the theoretical signs of db/dy and db/dw are generally ambiguous and different situations are possible. Moreover, the signs of da/dy and da/dw are generally ambiguous as well. Comparing the results in Tables 2.1 and 2.7, it can be seen that for all SHARE countries together and all regions separately, except for the East, all the four theoretical signs can be compatible with the empirical findings if we assume substitutability between formal and informal care. In addition to this, no contradictions seem to arise. Therefore, for these groups of countries, the altruism model with an imperfectly

altruistic child and substitutability between formal and informal care seems to be compatible with the data. Due to the ambiguity of the theoretical signs, it would be somewhat too strong to assert that this model is the model underlying intergenerational transfers between parents and children, but rejecting this model is not possible either. On the other hand, for the eastern countries, for which all the four empirical signs are zero, the altruism model seems to be contradicted by the data. Indeed, it can be seen from the results in section 2.3.1 that $da/dy = 0$ can only be compatible with altruism if formal and informal care are independent of each other (i.e. $H_{am} = 0$). However, if that is the case, it can be verified that db/dy must be positive[26], which is not the case empirically. It therefore seems that the prevalent motive in the eastern countries is the norm, as discussed above.

2.5.4 Robustness tests

We performed robustness tests to verify that the results obtained were valid for different samples. Looking at the negative relationship between the child's support and the fact the parent has a partner; we felt it was essential to analyze the case where the parent was alone, widow(er) or single, in the household. We first used exactly the same method as for the analyses with the complete sample. Table 2.8 summarizes in 5 columns the results for informal help when children whose parents are single are considered. The results from the first regression (endowments of children are fixed) seem to indicate no effect of the wealth of the parents on help provided by the child. The results from the second

[26]It can be verified that if $H_{am} = 0$, db/dy reduces to $(-H_{mm})/(-\Lambda_b) > 0$.

regression (endowments of parents are fixed) concern the impact of education of the child, as proxy for his/her wage, and no clear and significant relation appears from the regression, regardless of the region considered.

Table 2.8: Tobit model of informal help (single parent households)

Explanatory variables	**All**	**North**	**Center**	**South**	**East**
Model controlling with children education dummies					
Parent characteristics					
Wealth	**0.015**	**0.026**	**-0.017**	**-0.057**	**0.087**
Woman	0.366*	0.250	0.644*	-0.171	0.491
Child in HH	-1.522***	-0.511	-1.260**	-1.920***	-1.569***
Children characteristics					
Education	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**
Woman	0.900***	0.032	0.826***	1.623***	1.263***
Location	-0.736***	-0.461***	-0.809***	-0.946***	-0.558***
Siblings	-0.340***	-0.155*	-0.372***	-0.511***	-0.333***
Log likelihood	-5,587.6	-1,079.7	-1,945.7	-1,263.1	-1,228.4
Model controlling with parents wealth deciles dummies					
Parent characteristics					
Wealth	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**
Woman	0.382*	0.307	0.668*	-0.216	0.409
Child in HH	-1.512***	-0.602	-1.286**	-1.885***	-1.748***
Children characteristics					
Education	**-0.033**	**0.039**	**-0.110**	**0.093**	**-0.171**
Woman	0.893***	0.068	0.813***	1.581***	1.218***
Location	-0.740***	-0.466***	-0.816***	-0.937***	-0.539***
Siblings	-0.335***	-0.154*	-0.367***	-0.523***	-0.326***
Log likelihood	-5,584.5	-1,075.4	-1,943.4	-1,255.9	-1,229.1
Observations	8,563	2,123	3,213	1,887	1,340
*Notes: Country dummies are also included in the model; controlling for health, age and education of the parent, employment status, partner and age of the child; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$*					

Source: SHARE Wave 2 release 2.6.0, own computations

Table 2.9 summarizes in 5 columns the results for downward transfers when children whose parents are single are considered. The results from the first regression (endowments of children are fixed) seem to indicate that the wealthier the parent, the more the children receive from their parents, except in the South and in the East where there is no effect. The results from the second regression (endowments of parents are fixed) concern the impact of education of the child, as proxy for his/her wage, and no clear

and significant relation appears from the regressions, regardless of the region considered.

Table 2.9: Tobit model of downward transfers (single parent households)

Explanatory variables	**All**	**North**	**Center**	**South**	**East**
Model controlling with children education dummies					
Parent characteristics					
Wealth	**0.614*** **	**1.067*** **	**0.747*** **	**0.016**	**-0.115**
Woman	-2.705***	-3.146***	-0.863	-3.672*	-4.629**
Child in HH	-1.029	-2.050	2.942	-1.521	-4.404*
Children characteristics					
Education	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**
Woman	0.154	-1.583*	0.369	1.956	3.573*
Location	-0.234	0.219	-0.468	-0.218	-0.625
Siblings	-1.373***	-0.951**	-1.823***	-2.475***	-0.909
Log likelihood	-4,559.7	-1,691.2	-1,609.8	-669.0	-514.6
Model controlling with parents wealth deciles dummies					
Parent characteristics					
Wealth	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**
Woman	-2.571***	-2.774***	-0.654	-3.559*	-4.826**
Child in HH	-0.817	-2.371	3.168	-0.578	-4.515*
Children characteristics					
Education	**0.286**	**0.429**	**0.314**	**-0.485**	**-0.193**
Woman	0.188	-1.408	0.484	1.868	3.707**
Location	-0.220	0.243	-0.489	-0.234	-0.512
Siblings	-1.307***	-0.862**	-1.771***	-2.240***	-0.652
Log likelihood	-4,543.5	-1,683.9	-1,599.6	-660.4	-511.5
Observations	8,563	2,123	3,213	1,887	1,340
*Notes: Country dummies are also included in the model; controlling for health, age and education of the parent, employment status, partner and age of the child; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$*					

Source: SHARE Wave 2 release 2.6.0, own computations

Table 2.10 clearly summarizes these results. It can first be noticed from Table 2.10 that the results for the eastern countries remain the same as when all households are considered. The norm model with a non-altruistic parent thus seems to be the underlying model for single parent households as well. Interestingly, this model now also becomes relevant for the southern countries, for which the results of single parent households are the same as those for the East. Thus, while in the case of all households the findings for the South are compatible with altruism, single parent households rather exhibit norm related behavior.

Table 2.10: Summary of empirical findings (single parent households)

Countries	*Singles HHs sample (8,563)*	**Child's help**		**Parent's transfer**	
		da/dy	*da/dw*	*db/dy*	*db/dw*
SHARE		= 0	= 0	> 0	= 0
North		= 0	= 0	> 0	= 0
Center		= 0	= 0	> 0	= 0
South		= 0	= 0	= 0	= 0
East		= 0	= 0	= 0	= 0

This seems to be quite intuitive since in the case of the parent being alone, children might be more obliged to help him/her than in the case where the two parents have each other. If the parent is alone, taking care of him might become more a necessity than a choice of the child. Likewise, an elderly person living alone might be obliged to be more cautious and to think more about himself/herself, which could explain the underlying model with a non-altruistic parent.

The results for the other regions and for all SHARE countries together also seem to become somewhat closer to the norm in the sense that the child's caregiving becomes invariant with respect to the parent's wealth. However, overall, the model of the norm cannot be validated in these cases since the signs of db/dy and db/dw are not coherent with this model neither assuming an altruistic nor a non-altruistic parent. The model of exchange is also rejected since da/dy and db/dy do not have the same sign, while perfect two-sided altruism cannot be compatible either due to a "*wrong*" sign of db/dw. However, just like considering all households, the altruism model with an imperfectly altruistic child cannot be rejected. Nevertheless, it is interesting to note that now this model can be compatible with the data only if we assume that formal and informal care are independent of each other (i.e. $H_{am} = 0$), whereas with all households they had to be substitutes. This seems

to make sense since one can expect informal care to be more valuable and less substitutable for parents who are alone than for those who live in a couple and thus always have a relative close to them.

Up to now, the empirical method used was to report separately the results obtained, assuming either given parents' endowments, either children's endowments, differentiating the case of single parents. Conceptually, we follow our theoretical model and we are partially tackling the potential problem of the correlation of the error terms of children of the same parent, i.e. siblings. However, we perform other and complementary robustness tests in order to deal with the potential bias in the estimated coefficients. We decided to test our models using the Mundlak (1978) methodology. As Alessie et al. (2014) where units of observation in their "*transfer sample*" are respondents' children, we treat the dataset as a panel, where the units dimension is given by the different households, while the "*longitudinal*" one represents children within the same households. This procedure allows us to control for correlated household-specific effects. The wealth characteristics of the parent do not vary within households but well only between households. That prevents us to use household fixed effect and lead us to consider "*random*" effects.

Mundlak (1978) provides an alternative estimation procedure overcoming disadvantages of random effects. His approach may be used when the errors are heteroskedastic or have intragroup correlation and consists to add the averages within-groups of the regressors. This is the reason why we added averages by household of children's education, location, age, gender and partnership. We decided also to include the average of age and education of the parents by household when we consider the whole sample in order

to take into account heterogeneity inside the household since we duplicate information about help they receive and transfers they can give. We remove these last two averages considering single parent households. It should be noted that for this first "*Mundlak approach*" method, we use only one regression where the two main explanatory variables are continuous (deciles of wealth (y) and ISCED codes of education(w)).

The last method was the combination of the first method (report separately the results obtained, either assuming given parents' endowments, either children's endowments) and the second one ("*Mundlak approach*" correction). The summary of these two alternative methods as robustness tests is presented in Appendix B.6. We will discuss the implications of the two changes (w.r.t to our own methodology) in section 2.5.5. Complete tables of the regressions' results are given in Appendixes B.2.-B.6. Beyond these two important tests, if we change our two main explanatory variables (from deciles to percentiles for the wealth of the parent, from a continuous variable to three categorical variables for the education of the child), the results remain identical.

2.5.5 Discussion

To summarize, our results suggest that the underlying model for the eastern countries and the single parent households in the South is that of family norm (and in particular, its version with a non-altruistic parent), whereas for the other regions and all SHARE countries together, the only compatible model seems to be the one of altruism with an imperfectly altruistic child and either substitutability (when all households are considered) or

independence (when only single parent households are considered) between formal and informal care. It should be noted that very similar conclusions can be made if we consider the empirical signs obtained using Mundlak correction and the combination of the two methods. The only differences in these cases are that 1) with the combination of the two methods, for the central countries we expect independence between formal and informal care also when all households are considered, and 2) with both Mundlak correction and the combination of the two methods, the norm model is rejected for the eastern countries when all households are considered (and no other model seems to be compatible for these countries), but remains valid when only single parent households are analyzed.

One of our main results is also the rejection of the model of exchange. Thus, our findings are opposite to those of Alessie et al. (2014) who, also using SHARE data, on the contrary conclude in favour of exchange and reject altruism. An important reason for these differences is our strategy to adopt a "*global*" view of the results, that is, to consider the results from the parent's and the child's sides together and to verify whether no contradictions with the theoretical models arise. This way, as explained above, we identify a contradiction which allows us to reject the model of exchange.

It is interesting to note that in the theoretical model of exchange of Alessie et al. (2014), as in ours, the parent's transfer and the child's aid also change to the same direction when the parent's wealth increases. Empirically, Alessie et al. (2014) find that the parent's transfer increases with his wealth, but their results for the child's aid are mostly insignificant (thus showing no change)

or showing a negative relationship with the parent's wealth. This would seem to contradict the model of exchange. However, Alessie et al. (2014) do not make such a conclusion since they do not adopt this "*global*" point of view and, using separate samples for children and for parents, rather look separately at the aid and the transfer sides. Their conclusion in favour of exchange is made on the basis of the comparative statics with respect to the child's education.

It should, however, be noted that the "*global*" approach is not the only reason why our conclusions differ from those of Alessie et al. (2014). Another reason is the difference in the theoretical models considered, especially those concerning altruism. Alessie et al. (2014) consider a bargaining model in which the parent is assumed to have all the bargaining power and thus a control over all choice variables.

We rather opt for a two stage game between the parent and the child in which at first the parent chooses his transfer and then the child determines his aid. Among the differences between our models there is also the fact that in Alessie et al. (2014) the exogenous variable characterizing the child (empirically proxied by the child's education) is his income which in their model is independent of the child's caregiving time, whereas our exogenous variable (also proxied by education) is the child's wage rate. The child's income in our model is endogenous and depends on the time spent providing care to the parent. Our model thus captures the fact that better educated children not only earn more but also face a higher opportunity cost of providing care.

2.6 Conclusion

The purpose of this paper was to test three alternative models of long-term caring motives: pure altruism, exchange and family norm. For the design of LTC public policy but also for that of private insurance contracts this distinction is extremely relevant. Depending on the prevailing motives, the extent of crowding out of informal care will vary and this will affect the desirability of either private or public insurance. Our database is the second wave of SHARE which provides for each family comprising elderly parents and their children a full range of information concerning financial transfers and informal care and the characteristics of the family members. The main result is the rejection of the exchange model while the empirical figures seem to lean towards family norm in the eastern and, for single parent households, also in the southern countries. For the other regions, the only compatible model seems to be that of moderate altruism, especially if we assume that informal and formal care are substitutes.

3

Long term care and strategic spend-down[1]

3.1 Introduction

The needs for long-term care (LTC) are expected to increase gradually due to an aging population in Europe and in the United States. The population aged 65 or older, which is more at risk of dependency, will more than double by 2050 according to the forecasts of the European Union (Pestieau and Ponthiere, 2010). In 2015, 12 million people in the United States have some level of need, half of which are considered to have a high level of need which is characterized by two or more limitations in activities of daily living (ADLs) or severe cognitive impairment requiring assistance (ASPE, 2015; Kaye et al., 2010). By 2050, the number of people who need

[1]The Members of the Doctoral Jury provided helpful comments. Bernard Lejeune and Mathieu Lefebvre also made valuable remarks. All remaining errors are my own.

assistance due to a high need is projected to approach 15 million (Nordman, 2016). Brown and Finkelstein (2007) explain LTC expenditures are one of the largest uninsured financial risk facing the elderly in the United States. Brown and Finkelstein (2008) estimate that about one-third of 65-year olds will enter a nursing home. The length of the nursing home stay is mostly less than twelve months. They show however that 12 percent of men and 22 percent of women will spend more than 3 years at a nursing home. The financial cost for these stays is quite high: in 2002, the average cost for a year in a nursing home was $50,000 for a semiprivate room, and even more for a private room (MetLife Mature Markets Institute, 2002). The associated cost of care correlates with the need for help. Estimates of 2015 suggest that annual costs in a nursing home are roughly $85,000 and home care approximately $25,000 (Genworth Financial, 2015). These LTC costs increase faster than inflation. Recent studies (ASPE, 2015) estimate the average of future dependency costs at $138,000 (the half being paid out of pocket) for an American turning age 65 today.

Looking at the assets of Americans, almost half of the population has less than $10,000 in non-housing assets saved for retirement while only less than one-third of individuals have more than $70,000 (Nordman, 2016). Concerning adults aged 65 and older, in 2014, the value of median financial assets is $76,000 while median home equity is only $80,000 (Jacobson et al., 2015). Taking into account the increasing likelihood of lengthy stay in nursing home (or use of skilled nursing care in the home), the related costs could lead individuals become dependent on spending their lifetime savings. The consumption of their savings has two major implications. First, individuals could finish their lives utterly impoverished (an issue especially for married couples) and com-

pletely dependent on the government or on their families (Miller, 2003). Second, leaving bequests to children might prove to be unfeasible for individuals. One solution to avoid this vanishing of assets could be an "*artificial impoverishment*" in order to qualify for Medicaid by giving one's patrimony to family members. Indeed, there are some criteria of income, wealth and health to have access to Medicaid, a public program providing funded medical assistance for the poorest people. In order to achieve "*artificial impoverishment*", an individual would need to go below a certain threshold to become eligible (this is explained in more detail in section 3.2). If executed successfully, it could preserve disabled elderly person's quality of life/estate. 70% of nursing home residents rely on Medicaid (Bobroff, 2002). For these 1.6 million elderly residents (Pargoff, 2012), three scenarios are possible: they were poor to begin with; they spent down their assets; they voluntary impoverished themselves (the spend-down is strategic in this third case).

Voluntary impoverishment defeats Medicaid's purpose and preserving peoples' inheritances does not justify diversion of government resources (Miller, 2003). This behavior could also bankrupt the system and discourages individuals from purchasing insurance to pay for LTC costs. Before 2006, when one applied to Medicaid, any gifts or transfers made to your relatives within three years (36 months) of the date of application were subject to penalties. There was no transfer penalty for transfers to a spouse because such transfers generally do not avoid spend down (Miller, 2015). Miller gives an example of a typical way to calculate the transfer penalty: *"to divid[e] the fair market value of the transferred asset by the statewide monthly average lowest semiprivate room rate for Medicaid certified nursing facilities calculated annually."* The result of

this division gives the number of days of ineligibility caused by the gifts given in that month. Indeed, "*Medicaid Planning*", advised by some lawyers to their clients[2], is considered by American Congress as a crime for both citizens and (wo-)men of law[3].

In order to tackle this behavior or at least reduce it to ensure the long-term financing of the welfare state, the Medicaid Reform and the Deficit Reduction Act was signed by President Bush on February 8, 2006. The goal of this law is to reduce the "*Medicaid fraud*" by increasing the look-back period of transfers to relatives to five years (60 months). Nevertheless, some lawyers are still specialized in supporting their clients for access to Medicaid through the technique of voluntary strategic impoverishment[4]. Thus, this phenomenon seems to be present in the United States. In order to assess that this strategic spend-down behavior is significant, we use this date of February 8th, 2006 as boundary (3 versus 5 years of look back period). If this strategic behavior exists on a large scale, an increase of transfers to children should appear after 2006. The idea is the following: the increased look-back period means that individuals and families must plan five years before a health care crisis. Short of a crystal ball, no one knows if he or she will

[2]Planning, as that term is used by lawyers in the tax, trusts and estates, and business fields, is the "*art of achieving the client's goals in the face of rules designed to obstruct the path*" (Miller, 2003).

[3]Even though the anger over this "*Granny Goes to Jail*" Act led the Congress to amend the statute.

[4]See the websites of these attorneys for examples of Medicaid Planning advises:
http://www.genserlaw.com/content/medicaid-reform-and-deficit-reduction-act-2005-what-attorneys-need-know;
http://www.eldercarelawyer.com/articles/medicaid/medicaid-benefits-misconceptions.html;
https://www.frankelderlaw.com/medicaid-planning-for-maryland-family-lawyers/;
https://www.elderlawofpgh.com/2015/07/05/why-use-an-elder-law-attorney-to-help-you-qualify-for-medicaid/

need long-term care. The plan would then be to quickly dispose of assets in order to be qualified for Medicaid once dependent. We should also observe a decrease in the applications to Medicaid. Data from Health and Retirement Survey are used in order to test the first effect: earlier transfers from parents to children.

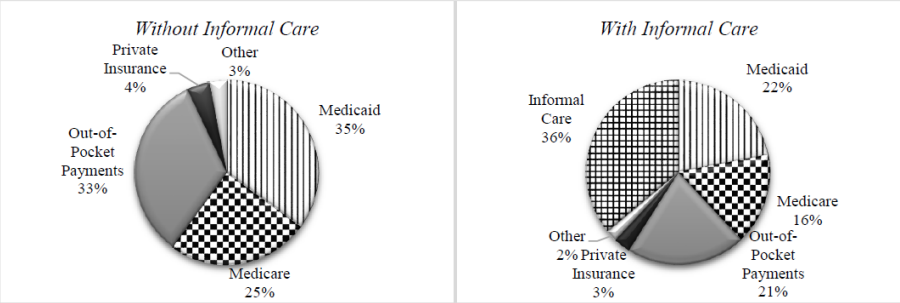
Section 3.2 summarizes the services provided by Medicaid, the criteria for eligibility and the share of this state welfare program in the US in long-term care. Section 3.3 explains the 2006 reform and gives examples of penalties for voluntary impoverishment ("*Medicaid Planning*"). Using HRS data, section 3.4 verifies that Medicaid is correctly applied (access for poor and ill people) when section 3.5 gives first longitudinal descriptive results. An empirical strategy to identify a potential strategic spend-down is explained in this section 3.5 where the impact of the reform is analyzed in a difference-in-differences framework. We observe a significant increase in the probability of making a transfer for those affected by the reform after 2006. We do not find any significant effect on the amount of this transfer. Section 3.6 discusses the arbitration left by the government allowing this behavior. Simple extrapolations are made at the national level on the additional billions transferred as a result of the reform. Section 3.7 concludes.

3.2 Medicaid

3.2.1 Medicaid and the other sources of care in US

Medicaid started in 1965 as part of the Social Security Act of that year. It is a cooperative federal-state program funded in large part

by the federal government and administrated by the states (Miller, 2003). The program provides funded medical assistance for certain people, including the elderly and disabled that have income and assets below specified standards (Miller, 2015). Medicaid is not only for seniors, however we are focusing on the access to Medicaid LTC services in the framework of this research. Medicaid's LTC program covers the cost of LTC in a professional care facility for those eligible and expected to remain in the facility for at least 30 days (Konnoth et al., 2012). Nursing homes, where 1.6 million individuals reside, are the institutions most often associated with LTC (Pargoff, 2012). 70% of nursing home residents rely on Medicaid (Bobroff, 2002). However, Medicaid is not the only source of care. Estimates of LTC costs coverage are summarized in Figure 3.1 (percentages from CBO, 2004). It illustrates the well-known situation of care mainly provided by relatives, especially spouses and children (Van Houtven et al., 2015; Bolin et al., 2008; Klimaviciute et al., 2017; Bonsang, 2009).



Source: CBO (2004)

Figure 3.1: Distribution of LTC costs coverage

In 2013 alone, Reinhard et al. (2015) assess that family and friends contributed an estimated 37 billion hours of unpaid LTC corresponding to a value of $470 billion. In contrast, 2012 Medicaid

expenses were worth $220 billion. Although, informal provision of care has no direct bearings on public finances, it is unclear whether such a situation is desirable or, in any case, will last. Family solidarity is very uneven and its propensity to provide care could diminish due to changes in family structure and growing participation of women in the labour market. This may result in the constraint of the future provision of informal care within households (Klimaviciute et al., 2017).

The companion program, Medicare, provides nearly universal acute care health insurance for those sixty-five and older, but it does not cover custodial care such as the care one might receive in a nursing home (Miller, 2015)[5]. In 2004, 25% of LTC costs were covered by this no means-tested program.

The first generation of private LTC insurance options appeared in 1975 in the United States, but the market did not start developing until 1985 (SCOR, 2012). This market has operated for over 30 years now. It could be considered as mature even if only about 10% of the population aged over 50 is privately insured and it covers only 4% of LTC expenses (CBO, 2004). Pestieau & Ponthiere (2010) focused on the causes of the "*LTC insurance puzzle*". They explain how six particular factors (excessive costs -loading factors and adverse selection-, social assistance acting as a Good Samaritan, trust into family solidarity, unattractive rule of reimbursement -lump sum-, myopia or ignorance, denial of heavy dependence) may contribute to the underdevelopment of

[5]According to Nordman (2016): *"Medicare will pay small amounts of supportive service so long as they are accompanied by a skilled care need. For example, it will pay medically necessary home health services but only for home-bound beneficiaries. It will not cover supportive non-skilled home care services for those who need care due to functional impairment, frailty or cognitive impairment."*

the LTC insurance market. Brown and Finkelstein (2008) provide empirical evidence of Medicaid crowd out of demand for private LTC insurance. Pauly (1990) developed a theoretical framework highlighting the importance of children in the rationale for the non-purchase of LTC insurance due to intra-family moral hazard. If parents prefer receiving care from children, they are less likely to opt for a LTC insurance.

The last source of financing LTC is lifetime savings. According to CBO (2004), out-of-pocket payments accounted for 33% of the expenses. If we assume that shares of the LTC costs coverages have not changed too much since 2004, this was roughly 200 billion in 2013.

To summarize, formal care is financed over 60% by public funds (Medicaid and Medicare) and 40% by individuals. In addition, the federal share of Medicaid spending was about 1.2% of GDP in 1999 and CBO (2004) estimates to this will increase to 3.7% in 2040, partially due to the aging population.

3.2.2 Costs of LTC at the individual level and eligibility criteria to Medicaid

At the individual level, different figures about the costs of nursing home care exist in the literature. As previously stated in the introduction, the cost of nursing home care was estimated to be $85,000 in 2015. Pargoff (2012) writes that on average, nursing home care costs are approximately *"$5,000 to $8,000 or more*

a month"[6]. In 2017, looking at the Genworth's website[7], a private company selling LTC insurance, we see that there are huge variations of costs among states. The annual median cost for a semi-private room in nursing home care is $85,775 and the median private room costs $97,455. Home health care charges $47,934 while adult day health care prices are $18,200 per year. But the median cost of a semi-private room reaches $292,000 in Alaska, $94,900 in Florida and only $67,525 in Utah. Same differences are observed for the other LTC services between states.

Whatever the state, we see that the cost of dependence is substantial. It is for this reason that it can be interesting to be able to benefit from government-subsidized benefits, particularly Medicaid since it covers the costs of nursing home care in excess of the amount that a Medicaid-eligible is capable of paying (Pargoff, 2012). Eligibility criteria have been put in place to ensure the sustainability of the program. The goal of Medicaid is to take care of poorest people. Stone (2002) showed that people with disabilities are more likely to be poor than individuals without disabilities and consequently more likely to rely on Medicaid for their health coverage than on private health insurance. Lefebvre et al. (2018) also demonstrate with European data that the probability of becoming dependent is higher for the poorest people[8]. In order to qualify for Medicaid, there a three major criteria. The first one is obviously linked to the health status of the applicant. The two other standards are financial ones, w.r.t to income and assets of the applicant. When an application is submitted for an individual aged

[6]Between $60,000 & $96,000 per year. That confirms figures of Genworth, a private company selling LTC insurances.

[7]Website visited on 14/08/2018 :
https://www.genworth.com/about-us/industry-expertise/cost-of-care.html

[8]In the first chapter, we show that their dependence period is also longer.

65 or more, the applicant must provide information regarding *"the income, resources, and household expense of the applicant in addition to any medical services being received by the applicant"* (Miller and Roepke, 2016).

Health requirements

The categories of people who could benefit from Medicaid are: individuals 65 or older, certain disabled individuals, parents and children, and pregnant women (Frolik, 2006). For this research, we focused on the criteria needed in order to be eligible for LTC. Eligibility requires the applicant to need substantial assistance with two or more of activities of daily living (ADLs): eating, bathing, toileting, ambulation, transfer, positioning and medication management (Miller, 2015) for at least 30 days.

Financial requirements

Financial eligibility involves meeting both asset and income tests, even if there are some special rules for couples. Statutory requirements have been established by the government regarding income (defined as anything an individual receives during a month[9]). Miller (2015) explains than in 39 states, eligibility is automatic when an individual qualifies for Social Security disability benefits. For LTC services, the threshold was too low because of costs of nursing home stays. In Idaho, like in some other states, for a

[9]Anything that can be used meet food or shelter needs, including cash, wages, pensions, in-kind payments, inheritances, gifts, awards, rent, dividends, interest, or royalties (Miller and Roepke, 2016)

single applicant seeking LTC benefits, the individual's income limit is three times the basic Federal SSI benefit for a single person ($2,199 in 2016). It concerns people who reside in nursing homes or other medical care institutions or who are eligible for certain long-term care services offered in the community. However these income thresholds are very diverse across different states.

As for assets[10], the applicant cannot have more than $2,000 in non-exempt resources[11]. Resources are valued according "*to the fair market value of the applicant's equity interest in the resource, minus any debt encumbering the property*" (Miller and Roepke, 2016). Common examples of ineligibility are vacation property; boats; recreational vehicles; stocks, bonds and certificates of deposit; insurance policies and funds in retirement accounts.

Medicaid is designed to protect the income and assets of one spouse known as "*the community spouse*". In order to avoid the impoverishment of the non-dependent spouse, an allowance (CSA) could be assigned if he or she does not receive a certain level of income per month. For assets, if the non-dependent spouse continues to live in the house, the applicant does not have to convert the resource (in this case, their house) to cash and the

[10]Anything as cash, personal property, real property and notes receivable (Miller and Roepke, 2016).

[11]Miller (2015) enumerates the exempt resources: *"The applicant's home (including a mobile home or a condominium) is exempt if the applicant or the applicant's spouse is residing in the home or the applicant (or his or her representative) states that he or she intends to return home. The home equity limit does not apply if the home is occupied by a spouse or by a disabled child, blind child, or child under twenty-one. This limit also does not apply to the value of home equity owned by the spouse of an applicant. A home includes all contiguous property, even if this includes several lots, legal descriptions or tax parcels, and includes related "out-buildings" on the property."* See also Miller and Roepke (2016) for more details (for instance on the first vehicle, regardless of value and household goods).

community spouse has the legal right to continue to live in it. If both spouses are applying for long-term care benefits and live together in the same room at the nursing home for a period of six months, the couple's resource limit is $3,000 (Miller and Roepke, 2016; Stone, 2002) and the threshold income eligibility is linked to the federal SSI benefit for a couple (one and a half the amount of individual SSI benefit).

It must be pointed out that Medicaid could also cover elderly and disabled persons who are not poor and who may have income in excess of SSI welfare standards through options in Medicaid law that allow states to take charge of people who need help with significant medical expenses. Moreover, after having spent down their assets, middle class individuals become eligible to the program. Indeed, nursing home care is so costly that "*many middle-class elderly who reside in nursing homes are driven into poverty,*" thus rendering them Medicaid-Eligible (Stone, 2012).

While conditions on health and assets are quasi-identical at a national level, the measure of income threshold can vary according to states. Looking at data, it is very difficult to differentiate people below or above these variant thresholds. However, the strategy of the empirical part of this research implies we do not need to consider these incomes. We will come back on this issue in sections 3.4 and 3.5.

3.3 Medicaid Planning and 2006 Reform

3.3.1 Medicaid Planning

Medicare does not pay for custodial care which is regarded as a matter of personal responsibility. Information about costs of nursing homes was mentioned above stating that charges may exceed $8,000 per month. Disabled residents become impoverished over time and as explained in the previous section, they may become eligible for Medicaid that will pay for the excess LTC costs (Miller and Roepke, 2016). Most of Medicaid beneficiaries do not start their dependency period impoverished. Most residents end up on Medicaid through a natural process referred to as "*spend down*" (Miller and Roepke, 2016). Disbursing for LTC leads inexorably into poverty, quickly or not depending on the initial resources.

However, the well advised elderly people have many ways to enhance the financial disruption to applicants, their spouses and their families caused by the cost of LTC disability (Miller & Roepke, 2016). This is the idea of "*Medicaid Planning*" where potentially future dependent parents transfer their resources to their loved ones to meet the financial eligibility criteria of the Medicaid program. To sum up: nursing home residents benefiting from Medicaid public subsidies can experience three different cases: they were poor to begin with; they spent down their assets without any strategy; they voluntary impoverished themselves. This third case is particularly problematic because this behaviour could bankrupt the system and discourages purchasing insurance to pay for LTC costs (Miller, 2003). The goals of the people of the third group are two-fold (Miller, 2003): *"first, preserve assets in order to supplement*

Medicaid and thereby maintain the elder person's quality of life until the very end, and, second, to assure that the person's life savings are passed on to loved ones rather than consumed by long-term health care costs". However, preserving peoples' inheritances does not justify diversion of government resources, especially since this strategic method is more likely to be understood and applied by wealthier and more sophisticated persons rather than persons with less wealth and sophistication (Miller, 2003). This would lead to a potential increase of inequalities which is the opposite goal of Medicaid.

There are several techniques of voluntary impoverishment: creation of trusts (Stone, 2002; Miller, 2003), purchase or improvement of a home, paying off a mortgage, buying a cemetery lot, pre-paying for funeral services (Fliegelman et al., 1997), divorce (Miller, 2015) and outright gifts to children (Miller, 2003). This research will focus on this last technique which meets the asset protection goal. It may fail to meet the quality of life goal but we assume the donee cooperates with the donor.

3.3.2 Look-Back Periods

Before 2006, outright gifts more than three years before one applied for Medicaid were disregarded for eligibility purposes (Miller, 2003). A simple and widely used technique of asset protection plan is to give substantial resources to one's children or other loved ones well in advance of the actual Medicaid application in order to avoid the look back period and estate recovery rules[12]. Indeed,

[12]Again, this technique favours the more affluent person who can afford to give away assets early on before there is any immediate concern about long-term

Medicaid's transfer of asset rules delay eligibility for nursing home coverage for a period of time (Frolik, 2006). The purpose of the transfer penalty rule is to deter the potential strategic behaviour. The typical example is a transfer of property to the transferor's child or a large gift of cash (Miller, 2015). As explained above and in the context of protecting the spouse, there are no penalties in cases of transfers to the partner.

Before explaining in more detail the possible sanctions faced by people who donate during the look-back period, evidence of lawyers' advice are given to show that this phenomenon exists (see Appendix C.1.). Takacs et al. (2002) mention that attorneys' participation in Medicaid Planning allows middle-class and even upper-class Americans to transfer the costs of LTC to the government. Markovic (2016) explains that lawyers are often reluctant to discuss Medicaid Planning but Congress was sufficiently alarmed about the practice that "*it criminalized Medicaid-related asset transfers in 1996*". The law, known as "*Granny Goes to Jail Act*" was quickly repealed under the pressure of the people. There are many determents that would discourage attorneys from involving themselves in Medicaid planning. For example, attorneys who backdate transfers of assets can be disbarred. In addition, it is forbidden to assist with Medicaid Planning when clients who suffer from some form of diminished capacity are urged by potential heirs (Markovic, 2016). Nevertheless, some law firms have become specialists in Medicaid Planning[13]. However, Soltermann (1993) reminds that *"Americans do not have a right to Medicaid benefits,*

care. Another approach available to an affluent person is to make gifts of assets while retaining enough property to pay for long-term care until look back period rules no longer apply (Miller, 2003).

[13]Even strategies that do not run afoul of current ethics rules may be unethical (Markovic, 2016).

and it is unclear why attorneys should be able to assist clients to engage in transactions that have no purpose other than Medicaid qualification".

3.3.3 2006 Reform: Deficit Reduction Act & Penalties

Given the existence of the phenomenon, highlighted by the offer of planning by law firms, the federal government wanted to tighten the conditions of access to this system whose objective is to help poor households and not preserve the heritage of the elderly and dependent parents. It was on February 8, 2006, that President George W. Bush signed the Deficit Reduction Act (DRA) of 2005. The federal law, whose purpose was to reduce Medicaid fraud, restricts Medicaid eligibility for the elderly and disabled by changing the Medicaid asset transfer laws. Miller (2003) summarizes the reasons why prevention of this strategic behavior is necessary:

1) Voluntary Impoverishment defeats Medicaid's purpose;
2) Preserving peoples' inheritances does not justify diversion of government resources;
3) Voluntary Impoverishment could bankrupt the system;
4) Voluntary Impoverishment discourages purchasing insurance to pay for LTC costs while interpersonal financing schemes allow some pooling of the risks and are overall more efficient alternatives to self-insurance (Barr, 2010; Costa-Font, 2010).

The two major changes made by the DRA are:

1) An increased look-back period, from 36 to 60 months for

transfers to loved ones;
2) Some changes to the homestead exemption (under prior law, the homestead was an exempt asset. The reform states that if people have equity in a home exceeding $500,000, they will be automatically ineligible for Medicaid benefits).

As mentioned above, transfers within the look-back period are subject to transfer penalty. Penalties are calculated according to this rule (Miller, 2015): *"to divid[e] the fair market value of the transferred asset by the statewide monthly average lowest semiprivate room rate for Medicaid certified nursing facilities calculated annually.*" The result of the division gives the number of days of ineligibility. Appendix C.2. gives three examples of calculation methodology.

There are some transfers that do not suffer the Medicaid asset transfer law and therefore do not result in an ineligibility period. Among other cases, transfers to spouse or to a child under age 21 are not concerned by the look-back period and the resulting penalties. To our knowledge, the scientific literature about Medicaid Planning is essentially covered in law journals. According to Costa-Font (2010), there is limited empirical evidence of this strategic "*spend-down*" (Norton, 1995). In addition, the research of Lee et al. (2006) shows that familial wealth transfers do occur before changes in Medicaid eligibility in a small number of cases. They use HRS data but only look at transfer up until 2002, 4 years before the DRA reform. Combining 8 waves of the HRS survey and the 2006 reform, we contribute to the research on Medicaid Planning by trying to empirically check this phenomenon, which appears to be prevalent among American lawyers. Using panel data analysis and difference-in-differences framework, we can observe

a strategic behavior from some Americans of the middle/upper class in order to preserve their resources and be able to leave a heritage to their loved ones.

3.4 Data on Eligibility, Medicaid Access and Financial Transfers

In this section we attempt to explore the relationships between eligibility and access to Medicaid and financial transfers in United States. To this end, we use data from the Health and Retirement Study (HRS), which is a longitudinal project sponsored by the National Institute on Aging and the Social Security Administration in the United States. The survey is a public resource for data on aging in America since 1990. More than 37,000 people older than 50 have been interviewed since the start of the study. Respondents are visited on a biannual basis and questioned about health, socio-economic status (income, assets, and insurances), relationships with family (visits, care, financial transfers) and everyday activities. Data from wave 4 (1998) to wave 11 (2012) is used for the analysis. Wave 8 starts in March 2006, just after the DRA reform impacted Medicaid eligibility.

Figure 3.2 illustrates the evolution of financial transfers to children and access to Medicaid from 1998 to 2012. The older the people, the more they have access to Medicaid and the less they make transfers to children[14]. Parents make more transfers between 50

[14]We focus our empirical analysis on the evolution of transfers to children. We should observe a decrease in Medicaid application after the reform if a strategic behaviour is assumed.

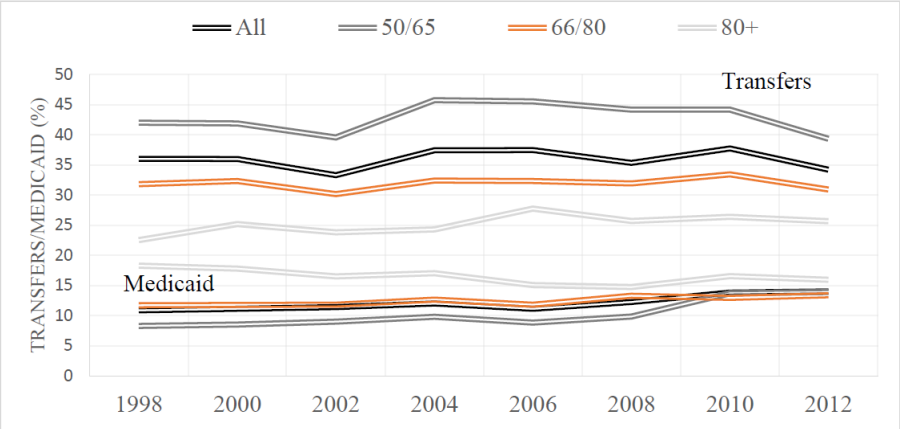


Figure 3.2: Evolution of Medicaid Beneficiaries and downward inter-vivos transfers (%)

and 65 years old. Despite the probability of transferring dropping after the 2008 crisis, the DRA reform of 2006 does not seem to have any clear impact.

Table 3.1 summarizes the main variables used in the analysis. We build our final database by keeping all the respondents aged 50 or older. Information about transfer, income and wealth is collected at the household level. Since single persons and couples are present in the sample, income and the different types of assets were shared equally among partners in order to not overestimate the socio-economic status of respondents with a partner. For the transfer, information about the transfer (0/1) and the amount of the transfer is available. The same procedure was applied for the amount of the transfer (divided in two) but it seemed reasonable to assume that financial transfers are a common decision.

Data is collected from 1998 to 2012 denoting that we observe 4 periods before and 4 periods after the 2006 reform (data start to be collected in March 2006 for the wave 8 of the HRS survey). The

rate of transfer is high (just under 40%) and fairly constant until the financial crisis. We note also that the average is greater than the median, meaning many parents make low financial transfers. There are excessively high inter-vivos transfer values exceeding $ 1 million. Given the longitudinal nature of the survey (they try to follow people as much as possible over time), it is normal for the percentage of people with Medicaid coverage to increase slightly over time. They are aging and their likelihood of dependence and therefore access to Medicaid is increasing.

In Table 3.1, regarding non-housing assets which are one of the three eligibility criteria for Medicaid, the average is greater than the median. We observe a significant decrease in 2010 and 2012 due to the financial crisis. The median value is almost divided by 2 and respondents lost on average more than $ 65,000 per person in non-housing assets. This has a direct implication on the eligibility for Medicaid for 2010 and 2012 where respectively 27.1% and 26.5% of respondents meet the criteria for wealth ($2,000 / $3,000, see Table 3.2 for a summary). As explained in the section 3.2, while the criteria in terms of non-financial assets are very similar between states, the income criteria may differ a bit more.

For a single applicant seeking LTC benefits in nursing home, the individual's income limit is three times the basic Federal SSI benefit for a single person ($2,199 in 2016). We use this scale for the income criteria (see Table 3.2). Since financial eligibility involves meeting both asset and income tests, we use the both criteria and roughly 4% of respondents no longer meet the eligibility criteria (w.r.t to looking only at assets, for instance in 2012, from 26.5 to 21.2%).

Table 3.1: Summary statistics

	Year	1998	2000	2002	2004	2006	2008	2010	2012
Transfers	% (HH level)	37.9	37.9	35.1	39.3	39.3	37.1	39.6	36.0
	HH Average Amount if transfer	$8,603	$9,963	$10,951	$10,373	$11,578	$11,762	$12,070	$11,702
	HH Median Amount if transfer	$3,000	$3,000	$3,300	$3,703	$4,000	$4,000	$4,000	$4,000
	Max amount	$780,000	$700,000	$2,000,000	$650,000	$905,000	$1,103,000	$1,065,000	$3,600,000
Medicaid	Percentage (%)	7.9	8.2	8.4	8.8	8.2	8.9	9.9	10.3
Non-Housing Assets	HH Average	$224,924	$252,027	$253,077	$279,652	$330,186	$331,225	$264,703	$268,972
	HH Median	$45,000	$53,500	$55,000	$54,000	$57,300	$60,000	$33,700	$33,000
Income	HH Average	$48,381	$51,742	$51,811	$58,932	$63,505	$67,145	$62,330	$64,642
	HH Median	$30,075	$31,482	$31,894	$34,942	$36,600	$38,557	$38,394	$38,772
Eligibility	% (only assets)	21.2	20.7	19.9	20.8	20.5	21.2	27.1	26.5
Eligibility	% (+ income)	17.8	17.3	16.8	16.6	16.7	17.1	21.0	21.2
LTCI	Percentage (%)	9.3	9.5	11.1	11.4	12.0	12.4	12.1	11.6
Dependence	Percentage (%)	9.5	9.4	9.8	9.2	9.9	9.9	10.7	10.3
Sex	Female (%)	57.0	57.9	58.4	57.6	58.3	58.8	57.3	57.9
Age	Average	66.8	67.8	68.9	67.5	68.7	69.7	66.6	67.6
Education	Average years	11.9	12.00	12.1	12.3	12.4	12.4	12.6	12.6
In couple	Percentage (%)	66.3	65.2	64.0	64.2	63.6	62.6	61.8	61.7
Children	HH without child	7.6	7.2	6.8	7.0	6.8	6.5	7.3	7.2
Observations		20,568	19,026	17,758	19,280	17,939	16,862	21,042	19,864

From now on, eligibility for Medicaid will only concern the criterion of non-housing financial assets for two reasons: the first is that without access to data about the state in which respondents live (Idaho, Washington, etc.), we cannot diversify the income thresholds according to the state. The second is that we are interested in observing a possible increase in financial transfers to children that would allow parents to dive below a poverty line (in terms of non-housing assets). The idea behind Medicaid Planning principally concerns assets. Lastly, Table 3.1 summarizes the other variables of interest. We see a decrease of people who have a partner as years go by. The average years of education is around 12. A bit more than 10% of respondents have a private LTC insurance. Because of the life expectancy differential, there are more women than men in the sample when 7% of respondents do not have children. These respondents are dropped from the sample for the various analyses about eligibility and transfers to children.

The variable *Dependence* indicates the number of people with 2 ADLs or more. It is the third criterion for eligibility to Medicaid, the health one. Around 10% of the 50+ seem to need help in their everyday activities. The older you are, the more likely you become dependent. Table 3.2 summarizes the criteria of eligibility to Medicaid and the respondents' self-declared access to Medicaid benefits. We have already highlighted the increase of reported Medicaid benefits in 2010 due to the financial crisis but the main point is that there is a low percentage of non-eligible Medicaid recipients (between 1.6% in 1998 to 3.0% in 2012). We explained in the former section that public aid can be granted in cases of excessively high care costs (which relate more to health problems than to dependency). We control then for people with less than 2

diseases[15]. Roughly 0.5% (25% of 2%) could benefit from Medicaid when they should not. The system would not work perfectly even if the elements of fraud seem tiny. Finally, the analysis of Table 3.2 reveals that the number of people that have access to Medicaid, if they are dependent, is stable (around 30%).

The numbers concerning dependent, and eligible individuals that have access to Medicaid are surprising since they are lower than for the whole sample. Indeed, we would have expected access to Medicaid to have been higher for eligible respondents since poorer people become dependent sooner than high SES persons (Lefebvre et al., 2018).

[15]The eight included diseases are: high blood pressure, diabetes, cancer, lung disease, heart disease, stroke, psychiatric problems, and arthritis.

Table 3.2: Criteria of Eligibility to Medicaid and Access to Medicaid

Eligibility criteria	Year	1998	2000	2002	2004	2006	2008	2010	2012
Annual Income (max)	Single or if one of the Couple is dependent	$17,784	$18,468	$19,620	$20,304	$21,708	$22,932	$24,264	$25,128
	If both of Couple are dependent	$26,676	$27,684	$29,412	$30,456	$32,544	$34,416	$36,396	$37,728
Assets (others than housing)	Single or if one of the couple is dependent	Less than $2,000 per person							
	If both of Couple are dependent	Less than $3,000 for the couple							
Dependence	All	2 ADL or more							
Eligible in the sample (%)	All	21.2	20.7	19.9	20.8	20.5	21.2	27.1	26.5
Access to Medicaid even if not eligible (%)	All	1.6	1.8	1.9	2.3	2.1	2.6	2.7	3.0
	% with less than 2 conditions	30.9	29.8	26.6	22.7	26.1	21.5	22.0	21.5
Access to Medicaid if dependent (%)	All	28.9	29.2	29.8	31.7	28.6	30.0	31.5	31.8
	% in Eligible	24.9	26.3	26.2	26.9	24.6	24.6	27.1	27.0

3.5 Strategic spend-down

Few fraud elements have been detected looking at cross-section data (from 1998 to 2012, each year separately). Therefore, Medicaid seems to cover people who are eligible. However, until now, we did not mention the possibility of strategic behavior. Indeed, it is interesting to see if people have acted in order to become eligible, "*strategically*" impoverishing themselves. In the last section, we will discuss ambiguous signals from the government that allow this behavior all the while repressing it through the look-back period and the penalties. In order to verify or refute this idea of strategic behavior, we need to follow the different respondents and we therefore transform our cross-sectional database into a panel database. Two samples are studied. A balanced panel and an unbalanced panel in which there is at least one observation before and after the 2006 reform. The unbalanced panel exists since some respondents have not answered in all the waves (deaths, attrition). The balanced panel concerns respondents who are present in the 8 waves studied.

3.5.1 Impact of transfers to children on eligibility and access to Medicaid

In a first step, we look at relationships between having executed a financial transfer to a child and eligibility/access to Medicaid. Table 3.3 gives the percentages of people eligible to Medicaid (on the only criterion of assets as explained above) according to transfers made in *t, t-2, t-4* and *t-6*. We distinguish respondents eligible in *t* and respondents eligible in *t* if they were not eligible

in previous period of transfer. We apply the same methodology for the access to Medicaid (which is the potential logical continuation of eligibility).

We look at these percentages on the unbalanced and the balanced panel. The numbers are similar regardless of the panel chosen. The percentages are higher for people who were not eligible (or not Medicaid beneficiaries) in time of transfer. This could potentially suggest a strategy behind these inter-vivos donations. For the unbalanced panel and regarding the question of eligibility, 20.8% of people who made a transfer in *t-2* are eligible in *t* while 30.4% of people who made a transfer in this same period and were not eligible in *t-2* are now eligible in *t*.

Table 3.3: Eligibility and Medicaid in *t* according to current and previous transfers

	Eligible in *t*		Eligible in *t* if no eligible in period of transfer		Medicaid in *t*		Medicaid in *t* if no Medicaid in period of transfer	
	N	%	N	%	N	%	N	%
Unbalanced Panel								
Transfer in t	29,658	18.7	-	-	11,346	11.7	-	-
Transfer in t-2	22,711	20.8	7,048	30.4	9,092	12.7	3,244	18.9
Transfer in t-4	16,632	21.6	6,306	31.7	6,984	13.3	3,185	19.8
Transfer in t-6	12,638	23.0	5,378	32.7	5,450	15.1	2,894	21.3
Balanced Panel								
Transfer in t	11,291	18.1	-	-	4,407	10.7	-	-
Transfer in t-2	9,905	20.5	3,208	30.6	3,996	12.0	1,431	18.9
Transfer in t-4	8,523	21.8	3,280	32.2	3,546	13.4	1,581	20.1
Transfer in t-6	7,141	23.4	3,041	33.1	3,035	15.2	1,558	21.6

These first descriptive statistics have to be confirmed by a rigorous econometric analysis. We start by a classic panel analysis where financially eligibility to Medicaid in *t* is explained by financial transfers to children in *t* (models (1), (2) and (3)) and in *t, t-2, t-4* and *t-6* for the model (4). Pooled linear probability models

are used and results are given in Table 3.4[16]. From model (1) to (2), we add environment and health variables. We follow Poterba et al. (2011) to build our health index, predicted from Principal Component Analysis (PCA). This is a statistical procedure that uses orthogonal transformation to convert a set of 7 different objective and subjective health measures[17], possibly correlated into a set of linearly uncorrelated variables called principal components. Built at each period, the higher the index, the better the health. Help from children and the fact of living in a nursing home add controls for the health and the presence of informal help (potentially substitutable or complementary to formal help).

Table 3.4: Financial Eligibility to Medicaid

	(1)		(2)		(3)		(4)	
Transfer in t	-0.101***	(0.003)	-0.091***	(0.003)	-0.086***	(0.003)	-0.053***	(0.004)
Man	ref.		ref.		ref.		ref.	
Woman	0.072***	(0.008)	0.056***	(0.008)	0.054***	(0.008)	0.052***	(0.010)
Couple	-0.141***	(0.007)	-0.121***	(0.007)	-0.126***	(0.007)	-0.110***	(0.009)
Age	-0.005***	(0.000)	-0.007***	(0.000)	-0.006***	(0.000)	-0.005***	(0.000)
Education	-0.036***	(0.001)	-0.031***	(0.001)	-0.030***	(0.001)	-0.028***	(0.001)
Children (#)	0.016***	(0.001)	0.015***	(0.001)	0.016***	(0.001)	0.015***	(0.001)
Environment & Health								
Help fr. children			0.148***	(0.008)	0.122***	(0.008)	0.132***	(0.011)
Health Index			-0.206***	(0.008)	-0.244***	(0.009)	-0.217***	(0.012)
Living in NH			0.202***	(0.019)	0.305***	(0.035)	0.239***	(0.052)
Shocks								
Unem. Rate					0.019***	(0.001)	0.014***	(0.001)
Health shock					0.022***	(0.005)	0.029***	(0.006)
NH shock					-0.152***	(0.037)	-0.089	(0.056)
Marital shock					-0.107***	(0.007)	-0.107***	(0.009)
Previous Transfers								
Transfer in t-2							-0.028***	(0.003)
Transfer in t-4							-0.021***	(0.003)
Transfer in t-6							-0.023***	(0.004)
N	134314		121010		107265		58567	
R^2	0.192		0.209		0.221		0.209	

Robust standard errors in parentheses (clustered at HH); $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

[16]Pooled Probit models give similar coefficients in terms of value and significance.

[17]We exclude the ADL variable in this index since we want to see explicitly the impact of ADL shock

From model (2) to (3), we add variables representing shocks experienced by respondents. Health shock is a binary variable taking the value 1 if the individual has experienced a health shock in the last period of two years. The health shock is defined as moving from 0 to more than one limitation or more in activities of daily living (ADL). The Nursing Home (NH) shock takes the value 1 if the individual moved to nursing home in the last period of two years. The idea is identical with regard to the marital shock. These are individuals who have moved from being married to being single (widowed or divorced). Finally, we control for unemployment rates as the time range of the data includes the 2008 financial crisis. These unemployment rates are taken at the census division level and for each time period observed[18].

We cluster the standard errors at the household level because we observe repeated observations on individuals in data. We use the household level because issues about eligibility and access to Medicaid take into account household income and assets. In addition, financial transfers concern both parents if they are still in couple. Clustered standard errors allow for intragroup correlation, relaxing the usual requirement that the observations be independent. That is to say, the observations are independent across groups (clusters) but not necessarily within groups. The major conclusion to draw from this table is the negative relationship between transfer and eligibility, even if we look at 6-year transfers. Results are similar whether we look at the balanced sample or the unbalanced sample (see Appendix C.4.).

[18]Census Divisions are groupings of states and the District of Columbia that are subdivisions of the four census regions. There are nine census divisions: New England, Middle Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain and Pacific. Puerto Rico and the Island Areas are not part of any census region or census division.

These models are controlled for socio-economic information. It is difficult to explain the unexpected signs of coefficients of age (the older you are, the less you are financially eligible to Medicaid) but the other coefficients have the expected signs. The higher the education level, the less you are eligible. Since education is an excellent proxy for SES, these results make sense. Besides, we distinguish between single individuals (men and women) and couples. The reference category in the different regressions is being a single man. If you are a woman, you are more likely to be eligible when being in couple reduces this probability. The coefficient related to the health index implies that people in good health are less likely to be eligible than people in poor health[19].

The number of children and the receipt of help from them is positively associated with eligibility. After having looked at the impact of transfers on eligibility, we continue the analysis focusing on the impact of these transfers to children on access (reported by respondents) to Medicaid. Once again, respondents' statements are trusted. Results are very similar to the eligibility ones. The major conclusion to draw from Appendix C.3. is the negative relationship between transfer and access to Medicaid, even if we look at 6-year transfers. Results are similar whether we look at the balanced sample or the unbalanced sample (see Appendix C.4.). The signs of the coefficients of other explanatory variables are also identical.

However, we could think that there are omitted variables, and these variables are correlated with the variables in the model(s). Then fixed effects models may provide a means for controlling

[19]Results make sense according to huge literature about links between health and SES. See Cutler et al. (2011) for an overview of the studies carried out on the topic.

for omitted variable bias. Fixed effects (FE) models control for, or partial out, the effects of time-invariant variables with time-invariant effects (Wooldridge, 2002). Using FE, we assume that something within the individual or the household may impact or bias the predictor. An other important assumption of the FE model is that those time-invariant characteristics are unique to the individual and should not correlated with other individual characteristics. Columns (1) and (3) of Table 3.5 present results of FE regressions on eligibility and access to Medicaid. We observe that the effect of age becomes now significantly positive for both eligibility and access. The variable of interest, the transfer to children, becomes statistically insignificant for access to Medicaid.

If we assume that the variation between individuals is random and uncorrelated with the predictor or independent variables included in the model, linear probability models with random effects are used to deal with time issues (colums (2) et (4)). This allows for time-invariant variables to play a role as explanatory variables (education in the models). Education could be considered as essential to the analysis since this potential strategic impoverishment concerns essentially people from middle and middle upper class. The same effects are found as in the case of pooled LPM with clustering. The transfer is negatively linked to eligibility and access to Medicaid.

Despite low values of R^2 for fixed effects models, Hausman tests[20], respectively 2161.8 ($p=0.000$) and 2795.5 ($p=0.000$) for eligibility and access to Medicaid, make us opt for fixed effects models.

[20]To decide between fixed or random effects, we run two Hausman tests where the null hypothesis is that the preferred model is random effects vs. the alternative the fixed effects (see Greene, 2008). It basically tests whether the unique errors are correlated with regressors, the null hypothesis is they are not.

Table 3.5: Financial Eligibility and Access to Medicaid: Fixed vs Random Effects

	Eligibility				Medicaid			
	(1) FE		(2) RE		(3) FE		(4) RE	
Transfer in t	-0.024***	(0.002)	-0.046***	(0.002)	-0.002	(0.002)	-0.013***	(0.001)
Man	ref.		ref.		ref.		ref.	
Woman	0.033***	(0.008)	0.058***	(0.006)	-0.005	(0.006)	0.020***	(0.004)
Couple	-0.003	(0.008)	-0.085***	(0.005)	-0.018***	(0.005)	-0.048***	(0.004)
Age	0.002***	(0.000)	-0.005***	(0.000)	0.003***	(0.000)	-0.001***	(0.000)
Education	-		-0.037***	(0.001)	-		-0.019***	(0.000)
Children (#)	-0.006***	(0.002)	0.013***	(0.001)	0.002	(0.001)	0.008***	(0.001)
Environment & Health								
Help fr. children	0.032***	(0.005)	0.065***	(0.005)	0.015***	(0.003)	0.039***	(0.003)
Health Index	-0.021***	(0.007)	-0.119***	(0.006)	-0.003	(0.004)	-0.063***	(0.004)
NH Living	0.207***	(0.024)	0.260***	(0.021)	0.262***	(0.016)	0.266***	(0.015)
Shocks								
Unem. Rate	0.003***	(0.001)	0.015***	(0.001)	-0.000	(0.000)	0.006***	(0.000)
Health shock	0.009***	(0.004)	0.012***	(0.004)	-0.001	(0.002)	-0.000	(0.002)
NH shock	-0.087***	(0.025)	-0.130***	(0.024)	-0.126***	(0.018)	-0.130***	(0.016)
Marital shock	-0.023***	(0.005)	-0.077***	(0.005)	-0.008**	(0.003)	-0.037***	(0.003)
N	107265		107265		106693		106693	
R^2	0.038		0.209		0.016		0.136	

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

We note effectively there are some major differences in the coefficients for the fixed and random effects models, which might reflect the importance of omitted variable bias in the latter[21].

Until now, no evidence of strategic impoverishment could be demonstrated. Indeed, if we had found a significant relationship between previous transfers and eligibility/access to Medicaid, we could have concluded that the economic agents were acting strategically. Results show the opposite sign for the different mod-

[21] If we assume that our dependent variable is affected by unobservable variables that systematically vary across groups in your panel, then the coefficient on any variable that is correlated with this variation will be biased (Wooldridge, 2002). Unless our different variables have been randomly assigned (and they never will be with observation data (Angrist and Pischke, 2009), it is usually fairly easy to make the argument for omitted variables bias. We may be able to control for some of the omitted variables with a good list of control variables, but as strong identification is our number 1 goal, even an extensive list of controls can leave room to doubt about the results. This why we prefer fixed-effects models, as Hausman tests prove it.

els tried (except for access to Medicaid with FE where we do not find any effect of transfer). However, we saw in Table 3.3 that people could become eligible to Medicaid after having done a transfer in previous periods. Therefore, we decided to move to a differential-in-difference analysis using the 2006 reform as a buffer date.

3.5.2 Difference-in-differences method

As explained in section 3.3, before 2006, outright gifts more than three years before Medicaid application were disregarded for eligibility purposes (Miller, 2003). A simple and widely used technique of asset protection plan was to give substantial resources to one's children or other loved ones well in advance of the actual Medicaid application in order to avoid the look back period and estate recovery rules. The reform of 2006 increased this look-back period, from 36 to 60 months for transfers to loved ones.

Our hypothesis is that we would see an increase in transfers after 2006 for the people concerned by the reform to preserve their resources and to be able to leave a heritage to their loved ones. The difference-in-differences (DD) method allows us to test this postulate allowing parents to dive below a poverty line, making them eligibile for Medicaid[22]. Indeed, the DD method recognizes that in the absence of random assignment, treatment and control groups are likely to differ for many reasons (Angrist and Pischke, 2015). Sometimes, however, treatment and control outcomes move in parallel in the absence of treatment. Angrist and Pischke

[22]The underlying purpose being the preservation of the heritage that they would like to bequeath to children.

(2009) or Wooldridge (2002) assume that when they do (moving in parallel), the divergence of a post-treatment path from the trend established by a comparison group may signal a treatment effect.

DD estimates and their standard errors most often derive from using OLS in panel of data on individuals in treatment and control groups for several yeats before and after a specific intervention (Bertrand et al., 2004). Formally, let Y_{ist} be the outcome of interest for individual i in group s (such a state, an age group) by time t (such a year) and I_{st} be a dummy for whether the intervention has affected group s at time t. We estimate the following regression using OLS:

$$Y_{ist} = \alpha_s + \beta_t + \gamma\, I_{st} + c\, X_{ist} + \epsilon_{ist}$$

where α_s and β_t are fixed effects for states (age group) and years respectively, X_{ist} are relevant individual controls and ϵ_{ist} is an error term. The estimated impact of intervention is then the OLS estimate $\hat{\gamma}$.

In our specification, the dependent variable is the fact of having done a financial transfer to children. The variable *Treat* (whose estimate is α_s) is a variable taking the value 1 if people are concerned by the reform and 0 if they are not. The estimate α_s is the difference in average probability of transfer between the treatment group and control group. The variable *Post* is a time dummy variable equal to 1 after 2006 and 0 before. The estimate β_t is the difference in average probability of transfer before and after the reform. Ideally, we would like to combine positive features of each single difference estimator since cross-sectional estimator avoided omitted common trends and time-series estimator avoided omit-

ted cross-sectional differences. Thankfully, this is precisely what the DD estimator does because $\hat{\gamma}$ avoids the two threats (cross-sectional and time-series differences) by differencing away any permanent differences between the groups and any common trend affecting both groups (Imbens and Wooldridge, 2007) . This estimator subtracts the difference in average probability of transfers for treatment and control before the reform from the difference in average probability of transfers for treatment and control after the reform.

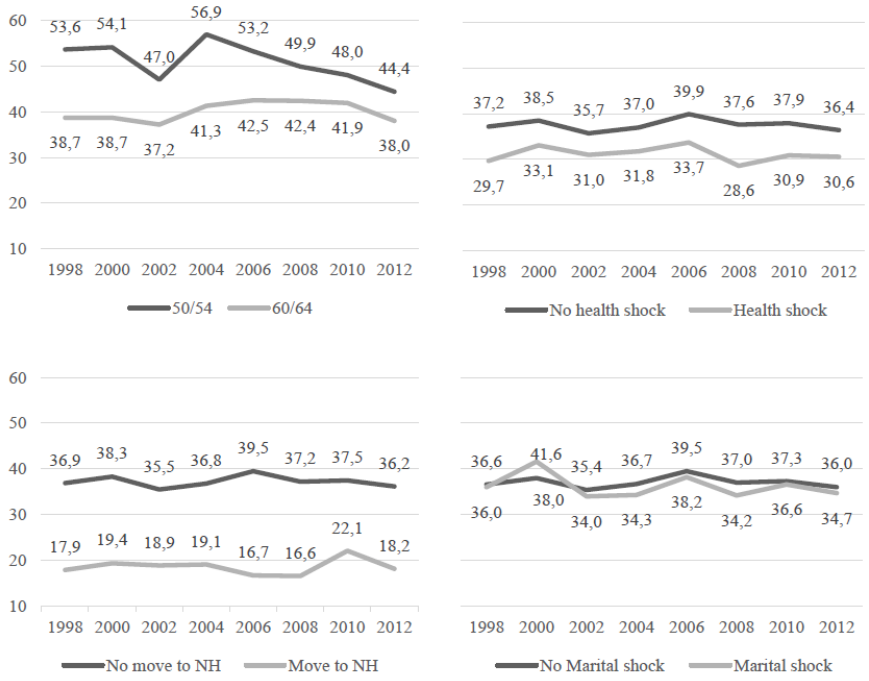


Figure 3.3: Parallel trends of probability of transfers for control and treated groups

The expected coefficient $\hat{\gamma}$ is positive if there is a strategic behaviour from the respondent. People would like to transfer quicker assets to children in order to qualify for Medicaid. Because of the increase of the look-back period which lengthens the duration of

the observation of financial transfers for access to Medicaid (from 3 to 5 years), parents would anticipate the risk with potentially altruistic reasons. c represents coefficients of control variables, which are basically the same as in previous regressions. We remove only the age because we determine the control and treatment groups to study the impact of the 2006 reform based on age. Indeed, Medicaid is accessible to people aged 65 or more. Our hypothesis is that the reform concerns people close to 65 years old. The treated group will be people aged 60 to 64. The second hypothesis is that younger people are a priori not affected by the reform. Not because of myopia or denial of potential dependence. Just because they are younger and are less (in our setting: not yet) concerned by future potential Medicaid applications. The control group is then the 50 to 54 years old.

Looking at Figure 3.3, with the exception of the year 2002, the assumption of parallel trends before intervention seems to hold. We discuss later the three other graphs concerning different potential control and treatment groups. We explained previously how these variables were constructed.

3.5.3 Results of DD estimations

Table 3.6 summarizes results of four OLS regressions where are added, step-by-step, the SES, environment and health variables. Finally, column (4) refines the estimate by adding a temporal trend. This is why the *Post* coefficient is no longer statistically significant. As the dependent variable is a binary (transfer or not), these are

Table 3.6: Reform impact on probability of financial transfers to children (50-54 vs. 60-64)

	(1)		(2)		(3)		(4)	
Treat	-0.147***	(0.010)	-0.119***	(0.010)	-0.116***	(0.010)	-0.110***	(0.010)
Post	-0.038***	(0.014)	-0.039***	(0.013)	-0.039***	(0.014)	-0.005	(0.018)
Treat * Post	0.061***	(0.017)	0.038**	(0.016)	0.038**	(0.017)	0.042**	(0.017)
Man	ref.		ref.		ref.		ref.	
Woman			-0.093***	(0.017)	-0.090***	(0.017)	-0.090***	(0.017)
Couple			-0.012	(0.016)	-0.028*	(0.016)	-0.028*	(0.016)
Education			0.037***	(0.001)	0.036***	(0.001)	0.036***	(0.001)
Children (#)			-0.000	(0.002)	0.001	(0.002)	0.001	(0.002)
Environment & Health								
Help fr. children					-0.007	(0.018)	-0.006	(0.018)
Health Index					0.118***	(0.017)	0.121***	(0.018)
NH Living					-0.376***	(0.038)	-0.367***	(0.036)
Unem. Rate					-0.003	(0.002)	0.007	(0.005)
Year Dummies	No		No		No		Yes	
N	28281		27861		25627		25627	
R^2	0.014		0.073		0.076		0.077	

Robust standard errors in parentheses (clustered at HH level); * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

pooled linear probability models (LPM)[23]. We cluster the standard errors at the household level[24], allowing for intragroup correlation. The major conclusions are the negative and statistically significant signs of α_s and β_t and the positive and statistically significant sign of $\hat{\gamma}$. The sign of α_s means that older people (60-64) make less transfers than the 50-54. The sign of β_t indicates that people make less transfers after 2006. Financial crisis could be the reason for this observation. We control for unemployment rates by census division[25].

However, if we look at $\hat{\gamma}$, we observe that the coefficient is positive and significant meaning that people concerned by the reform

[23]We follow the explanation by Puhani (2008) stating that "*researchers carrying out DID estimates in nonlinear models like probit, logit or tobit are correct to focus their attention on the coefficient of the interaction term of the group and time dummy*" in looking at $\hat{\gamma}$ in pooled Probit models for which we do not present the results because they are very similar.

[24]For the reasons explained previously (transfer given by the HH). However, when we cluster standard errors at the individual level, results hold.

[25]Yearly figures found on https://www.bls.gov/

have executed more transfers on average after the reform than people not concerned by the reform. According to the framework explained above, it seems that we observe a strategic behaviour of artificially impoverishment for the treated. They transfer their assets more rapidly to their children in order to qualify for Medicaid due to the increase of the look-back period. They anticipate the risk of assets spend-down due to dependence.

The positive sign of the health index confirm that people in good health make more transfers to their children in average. The same behaviour is observed for the more educated people of the sample. We do not observe links between the number of children and the help provided by them on the transfers. In contrast, marital status and sex of respondents indicate that single women and individuals in couples make less transfers than single men. Being in nursing home decreases the probability of transfer, certainly because of the high costs mentioned previously.

In order to test the validity of age as an instrument of distinction between those considered to be affected by the reform and those who are not, we implement a placebo test. By assigning the treatment to those aged 53-55 and setting the control group as those aged 56-58, the coefficient $\hat{\gamma}$ is no longer statistically significant. Table 3.7 shows results of the same previous specifications (pooled LPM). Once we control for SES, health and environment, age does not seem to play a role and the main results obtained in Table 3.6 could be considered as not biased.

The results so far concern the extensive margin with a 4.2% increase in the probability of transfer due to the reform for 60-64 year olds. The same analyzes were done on the amount of trans-

Table 3.7: Reform impact on probability of financial transfers to children (53-55 vs. 56-58)

	(1)		(2)		(3)		(4)	
Treat	-0.058***	(0.010)	-0.048***	(0.010)	-0.050***	(0.010)	-0.048***	(0.010)
Post	-0.024*	(0.014)	-0.026*	(0.014)	-0.024*	(0.014)	0.012	(0.038)
Treat * Post	0.028*	(0.016)	0.020	(0.015)	0.025	(0.016)	0.024	(0.016)
Man	ref.		ref.		ref.		ref.	
Woman			-0.095***	(0.023)	-0.082***	(0.023)	-0.081***	(0.023)
Couple			-0.022	(0.021)	-0.033	(0.021)	-0.031	(0.021)
Education			0.043***	(0.002)	0.042***	(0.002)	0.042***	(0.002)
Children (#)			-0.002	(0.003)	0.000	(0.003)	0.001	(0.003)
Environment & Health								
Help fr. children					-0.033	(0.024)	-0.034	(0.025)
Health Index					0.111***	(0.022)	0.111***	(0.023)
NH Living					-0.192	(0.135)	-0.191	(0.144)
Unem. Rate					-0.009***	(0.003)	-0.010	(0.007)
Year Dummies	No		No		No		Yes	
N	17038		16775		15491		15491	
R^2	0.002		0.074		0.077		0.078	

Robust standard errors in parentheses (clustered at HH level); $^{*}p<0.1$, $^{**}p<0.05$, $^{***}p<0.01$

fers. We cannot prove a causal effect of the reform on the amount transferred (Appendix C.5.). Moreover, trends about amount of financial transfers do not seem parallel (see Appendix C.6.). Coefficients of $\hat{\gamma}$ for (1) and (2) (unconditional amount of transfers) are not statistically significant, just like the coefficiens of columns (3) and (4) (amount conditionnal to a transfer). These two results concerning intensive ($\simeq$) and extensive ($+$) margins hold when we focus on the balanced sample (Appendix C.7.). Appendix C.8. confirms the robustness of this causal impact of the reform on the probability of transfer to children once broadened the age limits of those considered treated and controlled (60-67 vs. 50-57).

3.5.4 Trigger points?

Until now, our treatment and control groups have been build based on age thresholds. The hypothesis, perhaps strong, is that older

people (here 60-64) are affected by the reform because they are more likely to become dependent than younger individuals[26] (here 50-54) and because access to LTC Medicaid assistance begins at age 65. We could test if the reform combined with moments when individuals experience some shocks (at the health or household level) triggers a response. In the DD framework, we could assume that people who suffer health shocks could further anticipate transfers to their children after the reform. They will compose the treatment group, defined as moving from 0 to more than one limitation or more in activities of daily living (ADL) in the last period of two years.[27]

Table 3.8: Reform impact on probability of financial transfers to children: trigger points?

	(1) Health shock		(2) Move to NH shock		(3) Marital shock	
Treat	0.019**	(0.009)	0.082*	(0.048)	0.058***	(0.012)
Post	-0.080***	(0.020)	-0.024**	(0.010)	-0.026**	(0.010)
Treat * Post	-0.022*	(0.012)	-0.026	(0.050)	-0.014	(0.017)
Man	ref.		ref.		ref.	
Woman	-0.105***	(0.010)	-0.105***	(0.010)	-0.102***	(0.010)
Couple	-0.018*	(0.009)	-0.018*	(0.009)	-0.010	(0.010)
Education	0.034***	(0.001)	0.034***	(0.001)	0.034***	(0.001)
Children (#)	-0.006***	(0.001)	-0.006***	(0.001)	-0.006***	(0.001)
Environment & Health						
Help fr. children	-0.013*	(0.008)	-0.013*	(0.008)	-0.012	(0.008)
Health Index	0.093***	(0.011)	0.091***	(0.011)	0.091***	(0.011)
NH Living	-0.144***	(0.019)	-0.187***	(0.028)	-0.144***	(0.019)
Unem. Rate	0.008**	(0.003)	0.008**	(0.003)	0.008**	(0.003)
Year Dummies	Yes		Yes		Yes	
N	103635		103635		103635	
R^2	0.070		0.070		0.070	

Robust standard errors in parentheses (clustered at HH level); * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Column (1) of Table 3.8 indicates a statistically significant negative impact of the reform. This result could be explained by the fact

[26] See Lefebvre et al. (2018), Stone (2002) among a multitude of studies demonstrating the links between age and dependence.

[27] The three other cases (from "*no ADL*" to "*no ADL*", "*ADL*" to "*no ADL*" or "*ADL*" to "*ADL*") are considered as the control group.

that it may already be too late to make a transfer once health starts to deteriorate (because of the look-back period).

Table 3.9: Effects of the interaction of age groups and shocks

	Age		Age * Health shock		Age * Move to NH		Age * Marital shock	
Treat	-0.110***	(0.010)	0.010	(0.021)	0.086	(0.067)	0.029	(0.031)
Post	-0.005	(0.018)	0.044***	(0.014)	0.043***	(0.014)	0.043***	(0.014)
Treat * Post	0.042**	(0.017)	-0.035	(0.033)	-0.104	(0.090)	0.000	(0.045)
Year Dummies	Yes		Yes		Yes		Yes	
N & (Treat N)	25627	(19668)	25627	(977)	25627	(25)	25627	(534)
R^2	0.077		0.070		0.070		0.070	

Robust standard errors in parentheses (clustered at HH level); * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: All regressions take into account environment, health and SES

Other shocks are studied. Column (2) looks at the impact of moving to nursing home in the last period of two years. The idea is identical with regard to the marital shock in column (3) where treated individuals have moved from being married to being single (widowed or divorced). We cannot prove a causal effect of the reform on the probability of transfer for these two last cases. We are tempted to look at the effects of the interaction of age groups and shocks. Table 3.9 summarizes the different results. They are all not statistically significant. It can be potentially explained by the low number of cases where the interaction value is equal to 1.

3.6 Extrapolations and Discussion

The above section highlighted the existence of strategic behaviours indicated by increase of the probability of transfers from parents to their children in order to qualify for Medicaid, and this for the group of people impacted by the 2006 reform. Some simple extrapolations are done in order to see the magnitude of the impact

of the reform in terms of additional billions. Strong assumptions are made. Since the amount of transfers is not affected by the reform according to previous results, we take the weighted average sum of transfers from the 8 observed years according to two treated age groups (60-64 and 60-67). We then multiply this average amount by the statistically significant increase of probability of transfers and by the number of inhabitants (by age group). We obtain figures around $ 8 billion, that is more or less 1.5% of public spending by Medicaid. Table 3.10 illustrates this simple extrapolation. However, these figures do not say anything about the amount that could have been saved by Medicaid

Table 3.10: Extrapolations on increasing transfers

Treated group (age)	Increase of probability of transfers (1)	Average amount of transfer if transfer (2)	USA inhabitants 2015 (by age group) (3)	Extrapolation (1)*(2)*(3)	Medicaid 2015	% of Medicaid 2015
60-64	4.2%	9840	18986357	7,846,681,621	552 billion	1.42%
60-67	3.0%	10040	28437080	8,565,248,496		1.55%

Throughout previous sections, we assumed that the respondents' statements were true. The hypothesis about actual data is done through empirical analysis. If we assume that there could be hidden or bigger transfers, the effect observed could be even larger than recorded. Beyond these considerations, we observe ambiguous signals from the government that allow this behavior while repressing it through the look-back period and the penalties. The ability to make transfers to children undermines the effectiveness of means-testing. Observing the parent 's wealth is then not sufficient to determine the actual ability to pay for long-term care. Cremer and Pestieau (2017) note it is particularly true when parents are altruistic since *"from the parent's perspective a suitably timed inter vivos transfer then has a "double dividend". First, it*

anticipates on the bequest they want to leave anyway and second, it puts them in a position to qualify for the means-tested program".

However, it seems that there is a kind of arbitration left by the government allowing this behavior. Indeed, this implicit tax (difficult access to Medicaid) to late transfers implies that government could seek in some way to accelerate these transfers in order to boost the economy by placing money in the hands of economic agents likely to spend it (and prevent wealth from sleeping in a bank account). But since this strategic impoverishment concerns essentially parents from the middle or upper class, the Matthew Effect appears (Merton, 1968). This effect refers, in a very general way, to the mechanisms by which the most advantaged tend to increase their advantage over others. This could be a way to win the favor of this part of the population.

However, Miller (2003) summarizes the reasons why voluntary impoverishment should be avoided (see section 3.3 on Medicaid planning). Cremer and Pestieau (2017) present two solutions to tackle this issue. The first solution is the establishment of audits which disclose strategic impoverishment that can be used as a *"(partial) substitute to the degradation of public care which is other necessary to properly target the benefits (in a self-selecting way)"*. The second idea is taxation of inter vivos gifts that can mitigate strategic impoverishment by preventing "*an undue use of LTC benefits by wealthy altruistic parents.*" The authors mention that the cost of distorting inter vivos gifts may outweigh the benefits, making the proposal not desirable.

3.7 Conclusion

Few researchers have been interested in studying the empirical presence of a strategic behavior to qualify for public aid in United States (Stone, 1995). After the presentation of the means-tested program of public aid called Medicaid and the various penalties incurred in case of late transfers, we have demonstrated the presence of this strategic behavior (extolled by some lawyers) of impoverishment through an average increase in the probability of transfers for people concerned by the 2006 reform that extends the look-back period of financial transactions. These transfers to children allow parents to dive below a poverty line, making them eligible for Medicaid. Although these results have yet to be confirmed by other research and perhaps other methods, we believe we have brought forth interesting conclusions. Furthermore, we report extrapolations of additional billions in transfers due to the 2006 reform and two solutions (from Cremer and Pestieau, 2017) to counter this phenomenon that could bankrupt the system and that defeats Medicaid's initial purpose of helping the poorest.

4

What is behind the purchase decision of long term care insurance? A dynamic discrete choice approach[1]

4.1 Introduction

The needs for long-term care (LTC) are expected to increase gradually due to population ageing in Europe and in United States. The population aged 65 or older, which is more at risk of dependence, will more than double by 2050 according to the forecasts of the European Union (Pestieau and Ponthiere, 2010). The trend is similar in North America. LTC is mainly provided by the family. This type of care has no direct impact on public finances but it is not clear if

[1]Joint work with Joe Tharakan. The Members of the Doctoral Jury provided helpful comments. All remaining errors are my own.

such a situation is desirable because of health and job opportunity costs met by informal caregivers (e.g. Van Houtven et al. 2013, Pinquart and Sorensen, 2003; Vitaliano et al., 2003). The propensity to provide care could decrease in the future due to changes in family structure and the growing participation of women in the labour market, which may constrain the future supply of informal care provision within the family (Pestieau and Ponthiere, 2010).

In United States, in 2015, upwards of 12 million people have some level of need, and among those, 6.3 million have high need because they have limitations in two or more activities of daily living (ADLs) or are severely cognitively impaired and require help (ASPE, 2015; Kaye et al., 2010). By 2050, the number of people who need assistance due to a high need is projected to approach 15 million (Nordman, 2016). Brown and Finkelstein (2007) explain LTC expenditures are one of the largest uninsured financial risk facing the elderly in the United States. In 2001, estimates suggest that the cost of one-year stay in a nursing home averages between $40,000 and $50,000 in United States while a 65-year-old has 39 per cent chance of entering a nursing home (Mellor, 2001). In 2012, the average price of a private room at a nursing room was $74,800 when the average price of a home care aide was $21 per hour (Kaiser, 2012). Estimates of 2015 suggest that annual costs in a nursing home are roughly $85,000 and home care approximately $25,000 (Genworth Financial, 2015).

These LTC costs seem to increase faster than inflation. Recent studies (ASPE, 2015) estimate the average of future dependence costs at $138,000 (the half being paid out of pocket) for an American turning age 65 today. This results in the possible disappearance of all the savings of a lifetime during the first months of depen-

dence. That has two major implications. First, individuals could finish their lives utterly impoverished and so completely dependent on the government or their families (Miller, 2003). Second, dependent parents are not able to pass on some of their wealth to children.

Alongside these out-of-pocket payments, there are two public programs that help people who are dependent in the US. An universal (Medicare) program for all people over 65 years old and an other means-tested (Medicaid) program to support poor elderly Americans in case of limitations in everyday activities. However, Medicare was originally created to fund the health care of social security beneficiaries. The intention has never been to make it a dependence insurance program. The conditions to qualify for it are very restrictive and in most cases Medicare does not cover the entire dependence expenses (SCOR, 2012). But a series of necessary medical care over a relatively short period can be supported (maximum 90 days) but it does not cover custodial care such as the care one might receive in a nursing home (Miller, 2015). Medicaid is a cooperative federal-state program funded in large part by the federal government and administrated by the states (Miller, 2003). The program provides funded medical assistance for certain people, including the elderly and disabled, with income and assets below specified standards (they have to spend down their non-housing assets until having less than $2,000).

Since there is some uncertainty about the LTC expenditures, and in particular the very "*long tail*" of potentially catastrophic financial outcomes, standard economic models suggest that risk-averse individuals should place a high value on the ability to insure against these risks (Brown and Finkelstein, 2009). Indeed, interpersonal

financing schemes allow some pooling of the risks and are overall more efficient alternatives to self-insurance (Barr, 2010). Facing this lack of public coverage and/or the high costs of dependence, a potential solution could be the development of private insurance market for long-term care. This alternative depends on the availability of a market solution for this type of insurance. United States, France, Japan, Germany and Israel are the countries where this market insurance is the most present (Colombo et al., 2011). Recent market developments in some OECD countries suggest that insurance providers are moving more and more towards private LTC indemnity policies (Colombo et al., 2011). These insurance policies cover individuals who are generally not sick in the traditional sense, but instead, are unable to perform the basic activities of daily living (ADLs) such as dressing, bathing, eating, toileting, continence, transferring (getting in and out of a bed or chair), and walking.

However, previous research (Brown and Finkelstein, 2007; 2009) has established that even though this insurance exists, since 40 years in the US for example, only a small share of individuals take this insurance. This is part of the so-called long-term care puzzle. In this paper, using dynamic discrete choice, we establish the determinants of the individual insurance purchase decision in a context where the individual's future health evolution is uncertain. Indeed, a rational individual considers the effect of his decision on his current utility but also the effect of his decision on his future (expected) utility. We show that the difference in intertemporal utility between taking or not the insurance is not explained by difference in health, income, gender or education level. This means that insurance choice is related to other unobserved characteristics. As expected, we find negative difference in current utilities, the

result of the immediate negative effect of the insurance premium on disposable income. Finally, the difference in continuation value measures the difference in expected benefit in the next period of having made the decision to buy the insurance in t. We estimate that less educated value less the LTC insurance than the educated.

This chapter is organized as follows. The first part of section 4.2 summarizes the literature about LTC insurance puzzle, highlighting the limits in terms of demand of private insurance. The last part of section 4.2 evokes the latest techniques used to solve dynamic discrete choice models. Section 4.3 exposes a simple theoretical model of a rational individual deciding whether or not to purchase a long-term care insurance. Section 4.4 explains how we can modify and generalize the simple model and the methodology used (dynamic discrete choice without strong normalization) to establish the determinants of the individual insurance purchase decision in a context where the individual's future health evolution is uncertain. Section 4.5 presents the data on LTC insurance demand and highlights main results from estimates based on the Health and Retirement Survey in US when section 4.6 concludes.

4.2 Literature

The first generation of products appeared in 1975 in the United States, but the market did not start developing until 1985 (SCOR, 2012). This market operates for over 30 years now. It could be considered as mature but only about 10% of the population aged over 50 is privately insured, leaving much LTC expenditure risk uninsured (Brown and Finkelstein, 2009). According to a report

from the Congressional Budget Office (CBO, 2004), only 4% of LTC expenditures are paid by private insurance policies whereas one-third are paid for out of pocket (to contrast to health sector as a whole where 35% of expenditures are paid by private insurance and only 17% for out of pocket). In 2010, there were roughly 7 to 7.7 million LTC insurance policies in force in the United States (AHIP, 2010; LIMRA, 2010). According to Brown and Finkelstein (2011), of all new long-term care insurance sold in 2009, 79 percent of premiums (of a total of about $600 million) and 58 percent of contracts (of a total of about 365,000) were sold in the individual market; of policies in force in 2009, 82 percent of premiums and 67 percent of contracts were individual (LIMRA, 2010).

Johnson and Park (2011) estimate that 12.4 % of adults aged 65 and older hold LTC insurance policies (compared to 4% of adults over 40). They found differences of rate of take-up of these LTC insurances according to income and wealth levels. For people aged 55 with incomes of $100,000 and above, 19.3% hold a LTC insurance policy. There were only 3.3% for individuals of the same age with an income of $20,000 and below. Frank (2012) describes the typical LTC insurance policy as a long-term contract with a fixed premium, but with wide variation in detailed benefits. The median benefit involves three years of coverage at a maximum benefit level of $150 per day (adjusted annually for inflation). People with an elevated risk of LTC are usually precluded from purchasing insurance as a response to adverse selection incentives. Estimates from the American Association of Long-Term Care Insurance (www.aaltci.org) suggested that 14% of applicants aged 50 to 59 were denied coverage (23% for 60 to 69 and 45% for 70 to 79) in 2011.

Table 4.1: Characteristics of Policies Selling in the Market: 1990-2015

Policy Characteristics	*Average for 2015*	*Average for 2010*	*Average for 2005*	*Average for 2000*	*Average for 1995*	*Average for 1990*
Policy Type						
Nursing Home Only	<1%	1%	3%	14%	33%	63%
Nursing Home & Home Care	99%	95%	90%	77%	61%	37%
Home Care Only	<1%	4%	7%	9%	6%	---
Daily Benefit Amount for NH Care	$159	$153	$142	$109	$85	$72
Daily Benefit Amount for Home Care	$152	$152	$135	$106	$78	$36
Policy Deductible Period	93 days	90 days	81 days	47 days	46 days	20 days
Nursing Home Benefit Duration	3.8 years	4.8 years	5.4 years	5.5 years	5.1 years	5.6 years
Inflation Protection	75%	74%	76%	41%	33%	40%
Annual Premium	$2,772	$2,283	$1,918	$1,677	$1,505	$1,071

Source: Nordman (2016), p. 18

Giese and Schmitz (2015) estimated that the annual premium for a policy with a $180 daily benefit, inflation protection of 3 percent per year compounded, and a three-year benefit period would be $2,159 if first purchased at age 45 and $4,496 if purchased at age 65. The Table 4.1 summarizes the evolution of the market since 1990. To qualify for LTC insurance benefits, you must be recognized as unable to perform 2 or more ADLs. A nurse employed by a third party administrator uses to conduct these ADL limitations evaluations (Frank, 2012). Exactly like for Medicaid.

However, despite the uncertainty about the LTC expenditures (due to the unknown probability of dependence and its duration), only a small share of individuals take this LTC insurance whereas standard economic models suggest that risk-averse individuals should place a high value on the ability to insure against these risks (Brown and Finkelstein, 2009). They should use interpersonal financing schemes. This is especially true if we consider the very "*long tail*" of potentially catastrophic financial outcomes, illustrated by the Table 4.2. Almost 15% of people turning 65 in 2015-2019 will experience a dependence episode of more than 5 years. How

can we explain that the market for long-term care insurance is so small? Pestieau and Ponthiere (2010) and Brown and Finkelstein (2009) distinguish between supply and demand issues in this so-called "*LTC insurance puzzle*". Some of the causes are the same as those of the classic annuity puzzle.[2] Brown and Finkelstein (2007) present evidence of supply side market failures. They focus on premiums marked up substantially above expected benefits and limited coverage relative to the total expenditure risk. In the next section, we focus on the demand side of the LTC puzzle.

Table 4.2: Lifetime Need for LTC for Persons Turning 65 in 2015-2019 by Gender and Income

	% with LTC Need	*Average Years of High LTC Need*	*Average Years with Paid LTC*	*Distribution of need (% of cohort)*				
				None	*< 1 Year*	*1-1.99 Years*	*2-4.99 Years*	*>= 5 Years*
Gender								
Men	46.7	1.5	0.7	53.3	18.4	7.4	11.1	9.8
Women	57.5	2.5	1.3	42.5	19.4	8.1	12.3	17.8
Income Quintiles								
Lowest	55.3	2.7	1.2	44.7	17.6	7.1	11.7	18.9
Second	53.2	2.3	1.2	46.8	16.8	7.0	12.7	16.7
Middle	53.9	2.2	1.1	46.1	18.7	8.1	12.4	14.7
Fourth	49.7	1.8	0.9	50.3	19.5	7.4	10.6	12.2
Highest	51.1	1.5	0.8	48.9	20.7	8.7	11.6	10.1
Total	52.3	2.0	1.0	47.7	18.9	7.8	11.7	13.9

Source: ASPE (2015)

4.2.1 Three reasons for low insurance demand

Besides excessive insurances costs, three widespread arguments are mainly proposed to explain the LTC insurance puzzle: social assistance acting as Good Samaritan, the trust and preference into

[2]High annuity prices due to adverse selection, bequests motive, families as substitutes for private annuity markets, high discount rates or underassessment of life expectancy (Pestieau and Ponthiere, 2010)

family solidarity and the myopia and/or denial of heavy dependence (Pestieau and Ponthiere, 2010).

The first argument is that social assistance would crowd out private insurance. This is only the case when the State is politically and financially stable. Brown and Finkelstein (2008) show that the provision of even very incomplete public insurance can crowd out more comprehensive private policies by imposing a large implicit tax on private insurance benefits. With a important effect on individual welfare by potentially increasing overall risk exposure for them. Pauly (1990) has established the qualitative result that Medicaid (social assistance in the US, see chapter 3 for a description of the system) has the potential to reduce substantially demand for private LTC insurance, even among the nonpoor. Moreover, Brown and Finkelstein (2008) show there exists redundancy of contributions to private insurance with Medicaid (respectively 60 and 75% for men and women with median assets). There could be some strategic use of Medicaid (people spend all their resources when they are young and healthy because they know the State will not drop them and/or elderly people strategically pass their assets to children or loved relatives to benefit from means tested resources such as Medicaid, see chapter 3 for an empirical evidence of this phenomenon). On the other hand, Brown et al. (2006) tend to mitigate the importance of this crowding effect and conclude there must necessarily be other forces driving the LTC insurance puzzle.

Regarding the trust in family solidarity, Pauly (1990) developed a theoretical framework highlighting the importance of children in the rationale for the non-purchase of LTC insurance due to intra-family moral hazard. If parents prefer receiving care from children, they are less likely to opt for LTC insurance. Indeed, buying a LTC

insurance is the best way to be sent to a nursing home (Pestieau and Ponthiere, 2010). Mellor (2001) tested this hypothesis of parents relying on child-provided care in old-age in United States: while education, income and wealth impact positively on LTC insurance ownership (consistent with Brown and Finkelstein (2007)), she found no evidence of a significant link between the availability of informal caregivers and insurance ownership. Thanks to the 1st Wave of SHARE in France, Courbage and Roudaut (2011) showed that LTCI is purchased to protect families, in order to prevent children from heavy tasks given the evidence about potential negative effects associated with the caregiving burden. On the other hand, Bonsang and Schoenmaeckers (2015) show that the availability of potential informal caregivers, i.e. the children, decreases the probability of purchasing private voluntary LTC insurance in SHARE countries. Mommaerts (2016) estimates that the availability of informal care in U.S. lowers the demand for insurance by 14 percentage points overall. Van Houtven et al. (2015) show that family factors that may indicate future caregiver supply are negatively associated with purchase of LTC insurance. Actually, whether the parent is altruistic or not matters a lot (Pestieau and Ponthiere, 2010). From the helper side, it is important to note that the fact of providing informal aid should not necessarily be equated to the presence of altruism since caregiving can also be driven by other motives such as exchange or family norms. However, it seems that altruism is the prevailing motivation in many countries (see Klimaviciute et al., 2017).

The explanations discussed so far, whether it is related to costs of insurance or demand, do not presuppose any particular behavorial imperfection of agents on the LTC insurance market: it is rational that in the anticipation of the risk of dependence, private insur-

ance is not widespread. (Pestieau and Ponthiere, 2010). However, the third and last argument deals with some kind of behavioral imperfections. The purchase of LTC insurance could reveal how elderly persons perceive the risk of old-age dependence. Their perception is not necessarily the actual probability of becoming dependent. Whereas it is not easy to measure subjective beliefs, Finkelstein and McGarry (2003) report overoptimistic assessments about probability of institutionalization in individuals' future life. In the introduction, we gave figures on probabilities to enter in nursing home. These estimates coupled with the large cost of LTC should lead the population at risk to buy an insurance policy. Finally, Pestieau and Ponthiere (2010) remind that heavy dependence, like death, generates anxiety and "this may imply the possibility of denial of dependence-relevant information, interacting with intertemporal choices." Such a denial or myopia and ignorance about dependence state in old age are likely to lead to time-inconsistent decisions such as not taking a LTC insurance.

4.2.2 Dynamic Discrete Choice Models

Meier (1999) explains that people who purchase long-term care insurance usually postpone their decision until they reach the age of retirement. It can be seen as rational if there is uncertainty about the costs of disability. He concludes that individuals with a low risk of becoming disabled before retirement may prefer to buy insurance late in order to avoid losses in disposable income.

More generally, many discrete decisions are made with an eye towards how they will affect future outcomes (Arcidiacono and Ellickson, 2011). We can analyze the effects of these dynamic

decisions by using descriptive empirical methods. Besides methods using randomization or quasi-randomization, structural models offer the possibility to understand the decisions by formally modeling the dynamic discrete choice (DDC) process. Under certain assumptions, Rust (1987, 1988) showed that the numerical solution to such problems is equivalent to the computation of a fixed point to a differentiable contraction mapping. Researchers had to compute the valuation function using backwards recursion, not just once, but every time the parameters were evaluated in the estimation routine. Hotz and Miller (1993) developed a method for estimating the structural parameters of these dynamic problems while reducing the computational burden of estimating such models. The conditional choice probability (CCP) estimators provide simpler ways of estimating DDC problems. Basically, Hotz and Miller (1993) showed how the intertemporal utility could sometimes be expressed as simple functions of the probabilities that particular choices occur, given the observed state variables. Arcidiacono and Ellickson (2011) list the 3 main advantages of CCP techniques:

- it is easier to implement than previous techniques of DDC which compute the valuation function using backwards recursion, not just once, but everytime the parameters are evaluated in the estimation routine,

- it is possible to handle both complex problems and rich specifications for unobserved state variables,

- it makes problems feasible that would otherwise be out of reach (non-stationary environments in which the full time horizon is not covered in the data).

With dynamic discrete choice models, individuals make decisions over multiple time periods, taking into account how their decisions impact the value of making subsequent decisions tomorrow (Arcidiacono and Ellickson, 2011). These models use the Bellman equation, assuming rationality of the agent. The CCP is based on a new representation of the valuation function which is expressed in terms of utility payoffs, choice probabilities, and probability transitions of choices and outcomes that remain feasible in future periods (Hotz and Miller, 1993).

We could simply use CCP technique to determine the difference in intertemporal utility and confirm or not that on average individuals do not find it optimal to take an LTC insurance. This negative difference in intertemporal utility would imply a positive value to wait and people purchasing LTC insurance would do so for idiosyncratic reasons. Our research goes further than this first interesting result. We want to decompose this difference in intertemporal utility between difference in current utility and difference in continuation values. We expect that the difference in current utility of purchasing an insurance could be negative since the goal is to cover oneself for a long-term risk. The immediate effect is a decrease in disposable income and hence current utility is decreasing. However, for high incomes, this difference in current utility could be not significant if the premium is relatively small compared to total income. Regarding the continuation value, it could be negative, positive or neutral.

In order to estimate the continuation values, we use the approach developed in Chou (2016). He proposes a method which makes it possible to estimate this difference of current utility, using an exclusion variable and weak normalization. By determining this

difference in current utility, we can thus obtain the difference of continuation value since it is simply the difference of intertemporal utility and current utility, divided by the discount factor. It is hence possible to determine whether some individuals value insurance more than others even if they do not take it. Chou (2016) shows that the identification of the DDC model is equivalent to the identification of a linear system, and provides a list of identification results under various restrictions. In particular, he shows a way to identify the DDC models without normalizing the per period utility associated to one action. After clarifying the identification of the model, he shows that the DDC model can be estimated by simple linear estimators. In section 4.4, we summarize the approach developed in Chou (2016).

4.3 Theoretical Model

In this chapter, we try to explain what are the reasons for purchasing (or not) the long-term care insurance. We try to establish why so few people take long-term care insurance: is it because they do not value the insurance or because they find it too expensive?

To illustrate our ideas, we propose a simple theoretical model of a rational individual deciding whether or not to purchase a long-term care insurance. When optimising over time, a rational individual considers the effect of his decision on his current utility but also the effect of his decision on this future (expected) utility.

The current utility function, $u\left(C_t, H_t\right)$, has two arguments, where C_t is consumption and H_t indicates the individual's health level

and can take values 0, 1 or 2 (if $H_t = 0$ then the individual is dependent).

Each individual lives 3 periods. In period 2 and period 3 with a certain probability π_t, the individual sees his health decreasing by one level from period $t-1$ to period t. w_1 is the initial wealth. In periods 1 and 2, the individual has to decide whether to take insurance ($d_t = 1$) or not ($d_t = 0$) and how much to save (variable s_t). If an amount s_t is saved in period t, this leads to a total return in period $t+1$ of $R_{t+1}s_t$. If the individual becomes dependent, there are costs to be incurred (by assumption, a fixed amount M). Only a non-dependent individual can purchase a long-term care insurance. By assumption, this insurance fee is a fixed fee F. If an individual has previously subscribed to an insurance and becomes dependent at time t, he receives an amount $F\lambda/\pi_t$ with $\lambda < 1$.

Hence the individual maximises the following intertemporal utility function:

$$\begin{aligned} U(d_1, d_2, s_1, s_2) &= u(w_1 - s_1 - d_1 F, 2) \\ &\quad + \delta\pi_2 \begin{bmatrix} u(s_1 R_2 - s_2 - d_2 F, 1) \\ +\delta\pi_3 u(s_2 R_3 + d_2 F\lambda/\pi_3 - M, 0) \\ +\delta(1-\pi_3)\, u(s_2 R_3, 1) \end{bmatrix} \\ &\quad + \delta(1-\pi_2) \begin{bmatrix} u(s_1 R_2 - s_2 - d_2 F, 2) \\ +\delta\pi_3 u(s_2 R_3, 1) \\ +\delta(1-\pi_3)\, u(s_2 R_3, 2) \end{bmatrix} \end{aligned}$$

where π_t is the probability of health decreasing one level, $1-\pi_t$ is the probability of staying healthy and δ the discount factor.

The individual maximises his utility by choosing whether or not he buys insurance in each period and how much he saves in each

period:

$$\max_{d_1,d_2,s_1,s_2} U\left(d_1,d_2,s_1,s_2\right)$$

This maximisation programme can be written as

$$\begin{array}{rl} & \max\limits_{d_1,d_2}\left[\max\limits_{s_1,s_2} U\left(d_1,d_2,s_1,s_2\right)\right] \\ = & \max\limits_{d_1,d_2} U\left(d_1,d_2,s_1^*\left(d_1\right),s_2^*\left(d_2\right)\right) \end{array}$$

That is, the current period optimal savings depends on the period's decision about taking insurance or not.

The model is solved by backward induction. In period 1, the individual will make an optimal decision regarding insurance, knowing that in the second period he will optimally choose insurance again. This can be written as

$$\begin{array}{rl} & \max\limits_{d_1,d_2} U\left(d_1,d_2,s_1^*\left(d_1\right),s_2^*\left(d_2\right)\right) \\ = & \max\limits_{d_1}\left[\max\limits_{d_2} U\left(d_1,d_2,s_1^*\left(d_1\right),s_2^*\left(d_2\right)\right)\right] \\ = & \max\limits_{d_1} U\left(d_1,d_2^*,s_1^*\left(d_1\right),s_2^*\left(d_2^*\right)\right) \end{array}$$

The full expression for U is given by

$$U\left(d_1,d_2^*,s_1^*\left(d_1\right),s_2^*\left(d_2^*\right)\right) = u\left(w_1-s_1^*\left(d_1\right)-d_1F,2\right)$$

$$+\delta\pi_2\left[\begin{array}{c} u\left(s_1^*\left(d_1\right)R_2-s_2^*\left(d_2^*\right)-d_2^*F,1\right) \\ +\delta\pi_3 u\left(s_2^*\left(d_2^*\right)R_3+d_2^*F\lambda/\pi_3-M,0\right) \\ +\delta\left(1-\pi_3\right)u\left(s_2^*\left(d_2^*\right)R_3,1\right) \end{array}\right]$$

$$+\delta\left(1-\pi_2\right)\left[\begin{array}{c} u\left(s_1^*\left(d_1\right)R_2-s_2^*\left(d_2^*\right)-d_2^*F,2\right) \\ +\delta\pi_3 u\left(s_2^*\left(d_2^*\right)R_3,1\right) \\ +\delta\left(1-\pi_3\right)u\left(s_2^*\left(d_2^*\right)R_3,2\right) \end{array}\right]$$

The optimal choice in period 1 can be written in a more compact way as

$$\begin{array}{l} \max\limits_{d_1} u\left(w_1-s_1^*\left(d_1\right)-d_1F,2\right) \\ +\delta\pi_2 C_{2L}\left(d_1\right) \\ +\delta\left(1-\pi_2\right)C_{2H}\left(d_1\right) \end{array}$$

where $C_{2L}\left(d_1\right)$ (respectively $C_{2H}\left(d_1\right)$) is the future expected utility in the second period if the individual's health decreases (respectively, stays the same) having made choice d_1 in period 1. We can rewrite this as

$$\begin{array}{l} \max\limits_{d_1} u\left(w_1-s_1^*\left(d_1\right)-d_1F,2\right) \\ +\delta E\left[C_2\left(d_1\right)\right] \end{array}$$

d_1 can take only two values: 0 or 1.

Define

$$\begin{aligned} u_1^0 &\equiv u\left(w_1-s_1^*\left(0\right)-0\times F,2\right) \\ u_1^1 &\equiv u\left(w_1-s_1^*\left(1\right)-F,2\right) \end{aligned} \tag{4.1}$$

which are the period 1 current utility levels when deciding not to purchase insurance (u_1^0) and to purchase insurance (u_1^1).

Define also

$$\begin{aligned} V_1^0 &= u_1^0 + \delta E\left[C_2\left(0\right)\right] \\ V_1^1 &= u_1^1 + \delta E\left[C_2\left(1\right)\right] \end{aligned} \tag{4.2}$$

which are the intertemporal utility levels in period 1 when not purchasing (V_1^0) and purchasing the insurance (V_1^1).

The optimal decision in period 1 is given as follows

$$\max_{d_1 \in \{0,1\}} U\left(d_1, d_2^*, s_1^*\left(d_1\right), s_2^*\left(d_2^*\right)\right) = \max\left\{V_1^0, V_1^1\right\} \tag{4.3}$$

If $V_1^1 > V_1^0 \Leftrightarrow V_1^1 - V_1^0 > 0 \Rightarrow d_1^* = 1$;
if $V_1^0 > V_1^1 \Leftrightarrow V_1^0 - V_1^1 > 0 \Rightarrow d_1^* = 0$.

Define

$$\begin{aligned} dv_1 &= V_1^1 - V_1^0 \\ &= u_1^1 + \delta E\left[C_2\left(1\right)\right] - \left[u_1^0 + \delta E\left[C_2\left(0\right)\right]\right] \\ &= \left[u_1^1 - u_1^0\right] + \delta\left[E\left[C_2\left(1\right)\right] - E\left[C_2\left(0\right)\right]\right] \\ &= \left[du_1\right] + \delta\left[dc_1\right] \end{aligned}$$

Clearly, we have always $du_1 < 0$ because of the fees. However, dc_1 can be positive or negative. To see this, we can write dc_1 as

$$\begin{aligned} dc_1 &= E\left[C_2\left(1\right)\right] - E\left[C_2\left(0\right)\right] \\ &= \pi_2 C_{2L}\left(1\right) + \left(1-\pi_2\right) C_{2H}\left(1\right) - \left[\pi_2 C_{2L}\left(0\right) + \left(1-\pi_2\right) C_{2H}\left(0\right)\right] \\ &= \pi_2\left[C_{2L}\left(1\right) - C_{2L}\left(0\right)\right] + \left(1-\pi_2\right)\left[C_{2H}\left(1\right) - C_{2H}\left(0\right)\right] \end{aligned}$$

We have that

$$C_{2H}\left(1\right) - C_{2H}\left(0\right) < 0$$

If the individual remains healthy in the second period, there is no benefit in having purchased the insurance in the first period.

While we have

$$C_{2L}(1) - C_{2L}(0) \lesseqgtr 0$$

If

$$C_{2L}(1) - C_{2L}(0) > 0$$

this means that having taken the insurance in the first period gives me a higher expected future utility if my health has decreased in the second period.

On the contrary, if

$$C_{2L}(1) - C_{2L}(0) < 0$$

The value if my health has decreased in the second period and I have taken insurance in the first period ($C_{2L}(1)$) is smaller than if I had not taken the insurance in the first period ($C_{2L}(0)$). For dc_1, we can identify the following possible cases:

- $dc_1 > 0$: if, for example, $C_{2L}(1) - C_{2L}(0) > 0$ and $(1 - \pi_2) \ll \pi_2$. In words, dc_1 is positive if there is a benefit of having the insurance when less healthy and if the probability of becoming less healthy is high. It will also be high even if π_2 is not, if $C_{2L}(1) - C_{2L}(0)$ is sufficiently large.

- $dc_1 < 0$: if, for example, $C_{2L}(1) - C_{2L}(0) < 0$. In words, dc_1 is negative if the benefit of the insurance is negative for those who have a low level of health.

Putting everything together, this means that we can potentially

have $dv_1 < 0$ and $dc_1 > 0$: the individual does not buy the insurance, but values it. In other words, even if we do not observe individuals buying the insurance (that is, $dv_1 < 0$), this not necessarily means that they do not value the insurance (i.e. $dc_1 < 0$). Our theoretical model also shows that a necessary condition for having $dc_1 > 0$ is that $C_{2L}(1) - C_{2L}(0) > 0$, or, in words, in at least one state of nature the individual attaches some positive net value to purchasing the insurance. Notice that the larger is π_3, the larger this difference is.

We can proceed similarly for period 2 to find expressions for dv_2, du_2 and dc_2. Obviously, the optimal choice for d_1 and d_2 will depend on the parameters of the model.

4.4 Dynamic discrete choice estimation without strong normalisation

As it is, the theoretical model presented above is too simple to take it to the data. We now explain how we can modify (and generalize) the simple model and how we implement it empirically.

In our simple model we assumed that the utility function was given by $u(C_t, H_t)$. Hence utility depends on elements such as consumption (which dependent on income and savings) and health. Once consumption has been optimally chosen, utility can be written as $q_t(C_t^*(R_t), H_t, D_t)$ or, even more simply, $q(R_t, H_t, D_t)$, where D_t can take value 0 (the individual does not purchase insurance) or 1 (the individual purchases insurance). We can regroup variables R_t and H_t in a vector Ω_t and write $q_t(\Omega_t, D_t)$. The expression

$q_t(\Omega_t, D_t)$ is a general way of writing (4.1). The vector Ω_t can contain a large number of variables that influence utility. From an empirical perspective, there are variables that we do observe and other variables that we do not observe. We can represent this as $q_t(S_t, \theta_t, D_t)$ where S_t is the vector of variables that we observe and θ_t is the vector of variables that are unobservable. We make the assumption that the unobservable variables take the form of a random variable which depends on the decision. Hence, $\theta_t = \{\varepsilon_t^0, \varepsilon_t^1\}$. We also make the assumption, which is common in the literature, that the unobservable variables have an additive effect on the utility:

Assumption 1: The agent receives instantaneous utility $u_t(\Omega_t, D_t)$ in period t and $u_t(\Omega_t, D_t) = D_t(\mu_t^1(S_t) + \varepsilon_t^1) + (1 - D_t)(\mu_t^0(S_t) + \varepsilon_t^0)$. We call $\mu_t^d(S_t)$ the (structural) per period utility function in period t associated with alternative d.

While in our simple model we assumed that only H_t evolved and that it could only either remain at the same level or decrease by one level, here we will assume that all the elements of vector Ω_t can evolve over time:

Assumption 2: The choice in period t affects the distribution of the next period state variable Ω_{t+1}. Given the current state variable Ω_t and choice D_t, the next period state variable Ω_{t+1} is independent of all previous state variables and choices.

In each period t, the agent makes a choice to maximize the expected remaining lifetime utility in period t, which can be solved by dynamic programming. Unlike our simple theoretical model, we assume here that the discount factor is given by δ. Let $V_t(\Omega)$ be the value function in period t and δ_t be the discount factor in

period t. We define the function

$$V_t^d(\Omega_t) = u_t(\Omega_t, D_t = d) + \delta_t E_{\Omega_{t+1}}[V_{t+1}(\Omega_{t+1})|\Omega_t, D_t = d] \quad (4.4)$$

Expression (4.4) is a general expression corresponding to expression (4.2) in the simple model. As expressed in (4.3), at each period t the individual maximises his utility by choosing a value for D_t (0 not purchasing the insurance, 1 purchasing the insurance) to maximise his lifetime utility. In other words, the optimal choice D_t solves the Bellman equation (4.5):

$$\begin{aligned} V_t(\Omega) &= \max_{d\in\{0,1\}} u_t(\Omega_t, D_t = d) + \delta_t E_{\Omega_{t+1}}[V_{t+1}(\Omega_{t+1})|\Omega_t, D_t = d] \\ &= \max_{d\in\{0,1\}} \mu_t^d + \varepsilon_t^d + \delta_t E_{\Omega_{t+1}}[V_{t+1}(\Omega_{t+1})|S_t, \varepsilon_t^0, \varepsilon_t^1, D_t = d] \end{aligned}$$

So the agent's decision rule is as follows (4.6),

$$D_t = \begin{cases} 1,\ if\ \mu_t^1(S_t) + \\ \delta_t E_{\Omega_{t+1}}[V_{t+1}(\Omega_{t+1})|S_t,\ \varepsilon_t^0,\ \varepsilon_t^1,\ D_t = 1] + \varepsilon_t^1 > \\ \mu_t^0(S_t) + \\ \delta_t E_{\Omega_{t+1}}[V_{t+1}(\Omega_{t+1})|S_t,\ \varepsilon_t^0,\ \varepsilon_t^1,\ D_t = 0] + \varepsilon_t^0 \\ 0,\ otherwise \end{cases}$$

Without further restriction about the state transition distribution, the continuation value $E_{\Omega_{t+1}}[V_{t+1}(\Omega_{t+1})|S_t,\ \varepsilon_t^0,\ \varepsilon_t^1,\ D_t = d]$ is non-separable from the unobserved state variables ε_t^0 and ε_t^1. A third assumption is added, also standard in the literature.

Assumption 3: (i) Let $\varepsilon_t = (\varepsilon_t^0,\ \varepsilon_t^1)^\top$. The sequence of unobserved state variables $\{\varepsilon_t\}$ is independent and identically distributed; (ii) for each period t, $S_t \perp (\varepsilon_t,\ \varepsilon_{t+1})$; (iii) for each period t, $S_{t+1} \perp$

$\varepsilon_t|(S_t,\ D_t)$.

Applying this assumption, it can be verified that

$$E_{\Omega_{t+1}}[V_{t+1}(\Omega_{t+1})|S_t,\ \varepsilon_t,\ D_t] = E_{S_{t+1}}[v_{t+1}(S_{t+1})|S_t,\ D_t],$$

where $v_{t+1}(S_{t+1}) = E_{\varepsilon_{t+1}}[V_{t+1}(S_{t+1}, \varepsilon_{t+1})|S_{t+1}]$ is called the *ex ante value function* in the literature. If we define the *alternative specific value function* (ASVF) $v_t^d(S_t)$ as:

$$v_t^d(S_t) \equiv \mu_t^d(S_t) + \delta_t\ E_{\Omega_{t+1}}[V_{t+1}(\Omega_{t+1})|S_t,\ \varepsilon_t^0,\ \varepsilon_t^1,\ D_t = d],$$

or equivalently $\mu_t^d(S_t) + \delta_t\ E_{t+1}^d[v_{t+1}(S_{t+1})|S_t]$, we can transform the Bellman equation (4.5) in $V_t(S_t,\ \varepsilon_t) = \underset{d\in\{0,1\}}{max}\ v_t^d(S_t) + \varepsilon_t^d$ and the decision rule (4.6) has a now a simpler expression:

$$D_t = \begin{cases} 1,\ if\ v_t^1(S_t) + \varepsilon_t^1 > v_t^0(S_t) + \varepsilon_t^0 \\ \qquad 0,\ otherwise \end{cases} \tag{4.7}$$

By the decision rule (4.7), the conditional choice probability (CCP) $= P(D_t = 1|S_t) \equiv p_t(S_t) = P(\varepsilon_t^0 - \varepsilon_t^1 < v_t^1(S_t) - v_t^0(S_t))$.

Let $G(.,.)$ be the cumulative distribution function (CDF) of the vector of unobserved state variables $\varepsilon_t = (\varepsilon_t^0,\ \varepsilon_t^1)^\top$, and let $\tilde{G}(.)$ be the CDF of $\tilde{\varepsilon}_t = \varepsilon_t^0$-$\varepsilon_t^1$. The CCP can be written as follows:

$$p_t(S_t) = \tilde{G}(v_t^1(S_t) - v_t^0(S_t)) =$$

$$\tilde{G}(\mu_t^1(S_t) - \mu_t^0(S_t) + \delta_t\ E_{t+1}^{1/0}[v_{t+1}(S_{t+1})|S_t]).$$

Even when the CDF is known, the absolute level of the per period utility functions cannot be identified. The fourth assumption tackles these concerns.

Assumption 4: (i) The cumulative distribution function CDF G(.,.) of the unobserved state variables $\varepsilon_t = (\varepsilon_t^0,\ \varepsilon_t^1)^\top$and the CDF $\tilde{G}(.)$ of $\tilde{\varepsilon}_t$ $=\varepsilon_t^0$-ε_t^1 are known. Moreover, $\tilde{\varepsilon}_t$ is a continuous random variable with support $\mathbb{R}$ and the CDF $\tilde{G}(.)$ is strictly increasing; (ii) the observable state variable S_t is discrete with time invariant support S=$\{s_1,...,s_{ds}\}$; (iii) (normalization), for every period t, let $\mu_t^0(s_1) = 0$. We will come back on the point (iii) of this fourth assumption later. By assuming a discrete state space (ii), the structural per period utility functions $\mu_t^0(S_t)$ and $\mu_t^1(S_t)$, the CCP $p_t(S_t)$, the ASVF $v_t^0(S_t)$ and $v_t^1(S_t)$ and the ex ante value functions $v_t(S_t)$ are all finitely dimensional. We note that Chou's identification results (proved below) hold for any finite number of states ds. Let $f_{t+1}(S_{t+1}|S_t,\, D_t)$ be the conditional probability function of S_{t+1} given S_t and D_t. Let F_{t+1}^d be the state transition matrix describing the transition probabilities from state S_t to S_{t+1} when choice $D_t = d\ \in \{0, 1\}$:

$$F_{t+1}^d \equiv \begin{bmatrix} f_{t+1}(s_1|s_1,\ D_t = d) & \cdots & f_{t+1}(s_{ds}|s_1,\ D_t = d) \\ \vdots & \vdots & \vdots \\ f_{t+1}(s_1|s_{ds},\ D_t = d) & \cdots & f_{t+1}(s_{ds}|s_{ds},\ D_t = d) \end{bmatrix}$$

In the sequel, the following notation for the state transition matrices will be used: $F_t^{1/0}$= F_t^1-F_1^0.

Because of assumption 4.(i), the CDF is known and strictly increasing, its inverse $\tilde{G}^{-1}$ is also known. Let $\phi(.) = \tilde{G}^{-1}(.)$ denotes the inverse. So we have $\phi(p_t(S_t;\theta)) = v_t^1(S_t) - v_t^0(S_t),\ t = 1, ...,$T where θ is the structural parameter. It follows from the definition of the ex ante value function $v_t(S_t)$ and the Bellman equation that:

$$v_t(S_t) = v_t^0(S_t) + \psi(p_t(S_t;\theta))$$

where

$$\psi(p_t(S_t;\theta)) = \int max\{\varepsilon_t^0,\ \phi(p_t(S_t;\theta)) + \varepsilon_t^1\}\ dG(\varepsilon_t)$$

ψ depends only on the CDF of the utility shocks and replacing v_t^0 with its definition, we have a recursive expression for the ex ante value function (4.8):

$$v_t(S_t) = \mu_t^0(S_t) + E_{t+1}^0[v_{t+1}(S_{t+1})|S_t] + \psi(p_t(S_t;\theta)), \quad t < T$$

$$v_T(S_T) = v_T^0(S_T) + \psi(p_T(S_T;\theta)).$$

Finally, given the above results, we have the following system of equations:

$$p_t(S_t) = p_t(S_t;\theta) = \tilde{G}(\mu_t^{1/0}(S_t) + \delta_t\ E_{t+1}^{1/0}[v_{t+1}(S_{t+1})|S_t]),$$

$$t = 1, ..., T-1, \forall S_t \in S,$$

$$p_T(S_T) = p_T(S_T;\theta) = \tilde{G}(v_T^1(S_T) - v_T^0(S_T)), \quad \forall S_T \in S,$$

with

$$v_t(S_t) = \mu_t^0(S_t) + \delta_t\ E_{t+1}^0[v_{t+1}(S_{t+1})|S_t] + \psi(p_t(S_t;\theta)),$$

$$t = 2, ..., T-1, \forall S_t \in S,$$

$$v_T(S_T) = v_T^0(S_T) + \psi(p_T(S_T;\theta)), \quad \forall S_T \in S.$$

In the system of equations, the known objects are the CCP and state transition matrices hidden in the conditional expectation operators; the unknowns are per period utility functions, ex ante

value functions, the two ASVF v_T^0 and v_T^1 and the discount factors. Structural parameters are identified if and only if the above system of equations has a unique solution for it. Using the invertibility of the CDF $\tilde{G}$, the identities $\{p_t(S_t,\, \theta) = p_t(S_t) : \quad t = 1,\, ...,\, T\}$ and the fact that v_T^0 and v_T^1 are uniquely determined by v_T, the above system has the same solution for $(\theta_1, ..., \theta_{T-1}, v_T)$ as the following system (ID),

$$\begin{cases} \phi(p_t(s_t)) = \mu_t^{1/0}(s_t) + \ \delta_t \, E_{t+1}^{1/0} \left[v_{t+1}(S_{t+1}) | s_t \right], \\ \quad t = 1,\, ...,\, T-1, \forall S_t \in S, \\ \psi(p_t(s_t)) = v_t(s_t) - \mu_t^0(s_t) - \delta_t \, E_{t+1}^{1/0} \left[v_{t+1}(S_{t+1}) | s_t \right], \\ \quad t = 2,\, ...,\, T-1, \forall S_t \in S, \end{cases}$$

and the unknowns are hence the following:

$$\left\{ \mu_1^{1/0},\, ...,\, \mu_{T-1}^{1/0}, \mu_2^0,\, ...,\, \mu_{T-1}^0,\, v_2,\, ...,\, v_T,\, \delta_1,\, ...,\, \delta_{T-1}) \right\}$$

that is $(2T-3) * ds$ equations with $(3T-4) * ds + (T-1)$ unknowns if we do not impose restrictions, with ds the number of values of state variables. The unknowns are the following:

- $(T-1)$ discount factors,
- $(T-1)$ $\mu_t^{1/0}$,
- $(T-2)$ μ_t^0,
- $(T-1)$ v_t ,

with the last 3 multiplied by the number of state variables (ds). Fixing a priori the discount factors, that is eliminating $(T-1)$ unknowns, leads to $(3T-4) * ds$ unknowns.

This system of equations ID is linear in all the other unknowns if discount factors δ_t are given, leading to the fact that the uniqueness of solution is very easy to check. If we use the notation of $F^0_{t+1}$and $F^{1/0}_{t+1}$, we can rewrite the equation ID as follows (ID'):

$$\begin{cases} \phi(p_t) = \mu_t^{1/0} + \ \delta_t \, F^{1/0}_{t+1} \, v_{t+1}, & t = 1, \ ..., \ T-1, \forall S_t \in S, \\ \psi(p_t) = v_t - \mu_t^0 - \delta_t \, F^{1/0}_{t+1} \, v_{t+1}, & t = 2, \ ..., \ T-1, \forall S_t \in S, \end{cases}$$

This represents $(T-1) + (T-2) = (2T-3)$ equations. Each equation has to be multiplied by the number of state variables (ds). Hence, at this point, we still have $(3T-4) * ds > (2T-3) * ds$, which means that the system is still not identified, even when eliminating the discount factors. If we introduce the Exclusion Restriction, this reduces the number of unknowns. The Exclusion Restriction assumes the vector of observable state variables S_t has two parts X_t and Z_t. The state variables X_t influence the utility of individuals while the state variables Z_t do not. The variables Z_t only influence the transition probabilities. Let $S_t = (X_t, Z_t)$, where $X_t \in \{x_1, ..., \ x_{dx}\}$ and $Z_t \in \{z_1, ..., \ z_{dz}\}$. Hence, there are now dx utility items, instead of ds utility items. This means that the number of equations stays the same but the number of unknowns decreases with the Exclusion Restriction. It decreases because per "utility item" and per period *t*, there are now dx unknowns rather than ds unknowns. If we define our variables of interest as below,

- x= non-exclusion state variables (number of values: dx),
- z= exclusion state variables (number of values: dz),
- s= all state variables (number of values: ds),

then $ds = dx * dz$.

Consequently, using the Exclusion Restriction, we have

$$(2T-3) * dx + (T-1) * ds + (T-1)\, unknowns$$

(including the discount factors) instead of

$$(3T-4) * ds + (T-1)\, unknowns.$$

The number of unknowns can now be recalculated:

- $(T-1)$ discount factors
- $(T-1)$ $\mu_t^{1/0}$ [multiplied by dx]
- $(T-2)$ μ_t^0 [multiplied by dx]
- $(T-1)$ v_t [multiplied by ds, because influenced by both x and z].

This leads to a new system of equations (4.9):

$$\begin{cases} \phi(p_t(X_t,\ Z_t)) = \mu_t^{1/0}(X_t) + \ \delta_t\, E_{t+1}^{1/0}\,[v_{t+1}(S_{t+1})|X_t,\ Z_t], \\ \qquad\qquad t = 1,\ ...,\ T-1 \\ \psi(p_t(X_t,\ Z_t)) = v_t(X_t,\ Z_t) - \mu_t^0(X_t) - \delta_t\, E_{t+1}^{1/0}\,[v_{t+1}(S_{t+1})|X_t,\ Z_t], \\ \qquad\qquad t = 2,\ ...,\ T-1 \end{cases}$$

We focus on the identification with known discount factors. Let $\bar{v}_{t+1}(S_{t+1}) = \delta_t\, v_{t+1}(S_{t+1})$ be the discounted ex ante value function. For each period $t = 2, ..., T-1$, we show how to solve the unknowns $(\mu_{t-1}^{1/0}, \mu_t^{1/0}, \mu_t^0, v_t,\ v_{t+1})$ from the following equations:

$$\begin{cases} \phi(p_{t-1}(X_{t-1},\ Z_{t-1})) = \mu_{t-1}^{1/0}(X_{t-1}) + \\ \qquad \delta_{t-1}\ E_t^{1/0}\left[v_t(S_t)|X_{t-1},\ Z_{t-1}\right], \quad \forall (X_{t-1},\ Z_{t-1}) \in S, \\ \phi(p_t(X_t,\ Z_t)) = \mu_t^{1/0}(X_t) +\ E_{t+1}^{1/0}\left[\bar{v}_{t+1}(S_{t+1})|X_t,\ Z_t\right], \\ \qquad \forall (X_t,\ Z_t) \in S, \\ \psi(p_t(X_t,\ Z_t)) = v_t(X_t,\ Z_t) - \mu_t^0(X_t) - \\ \qquad E_{t+1}^0\left[\bar{v}_{t+1}(S_{t+1})|X_t,\ Z_t\right], \quad \forall (X_t,\ Z_t) \in S. \end{cases} \tag{4.10}$$

or equivalently

$$\begin{cases} \phi(p_{t-1}) = \mu_{t-1}^{1/0} \otimes 1_{dz} + \delta_{t-1} F_t^{1/0} v_t\ , \\ \phi(p_t) = \mu_t^{1/0} \otimes 1_{dz} + F_{t+1}^{1/0} \overline{v}_{t+1}\ , \\ \psi(p_t) = v_t - \mu_t^0 - F_{t+1}^0 \overline{v}_{t+1}\ . \end{cases} \tag{4.11}$$

The first step is to solve v_t and v_{t+1}. To this end, we firstly eliminate for each t the unknown per period utility functions $\mu_{t-1}^{1/0}$, $\mu_t^{1/0}$andμ_t^0 by considering the following differences:

$$\begin{cases} \phi_{t-1}(i,j) - \phi_{t-1}(i,j+1) = \delta_{t-1} E_t^{1/0}[v_t(S_t)|x_i, z_j] - \\ \qquad \delta_{t-1} E_t^{1/0}[v_t(S_t)|x_i, z_{j+1}]\ , \\ \phi_t(i,j) - \phi_t(i,j+1) = E_{t+1}^{1/0}[\overline{v}_{t+1}(S_{t+1})|x_i, z_j] - \\ \qquad E_{t+1}^{1/0}[\overline{v}_{t+1}(S_{t+1})|x_i, z_{j+1}], \\ \psi_t(i,j) - \psi_t(i,j+1) = v_t(x_i, z_j) - v_t(x_i, z_{j+1}) - \\ \qquad E_{t+1}^0[\overline{v}_{t+1}(S_{t+1})|x_i, z_j] - E_{t+1}^0[\overline{v}_{t+1}(S_{t+1})|x_i, z_{j+1}] \end{cases} \tag{4.12}$$

$$\text{for all } i = 1, ..., d_x \text{ and } j = 1, ..., d_z - 1.$$

We can organize this equation (4.12) as a linear system of equations:

$$A_t \begin{bmatrix} v_t \\ \overline{v}_{t+1} \end{bmatrix} = b_t.$$

where A_t is a $[3 * dx * (dz - 1)] * (2ds)$ matrix,
and b_t is a $[3 * dx * (dz - 1)]$-dimensional vector :

$$A_t \equiv \begin{bmatrix} MF_t^{1/0} & 0 \\ 0 & MF_{t+1}^{1/0} \\ M & -MF_{t+1}^{0} \end{bmatrix} \text{ and } b_t \equiv \begin{bmatrix} \delta_{t-1}^{-1} M\phi(p_{t-1}) \\ M\phi(p_t) \\ M\psi(p_t) \end{bmatrix} \tag{4.13}$$

with M the matrix $\begin{bmatrix} 1 & -1 & 0 & 0 \\ 0 & 0 & 1 & -1 \end{bmatrix}$.

By the use of the Moore-Penrose pseudoinverse A_t^+, we can solve v_t and v_{t+1} by splitting A_t^+ into two parts:

$$\begin{bmatrix} v_t^+ \\ \overline{v}_{t+1}^+ \end{bmatrix} = \begin{bmatrix} A_{t,u}^+ b_t \\ A_{t,l}^+ b_t \end{bmatrix}$$

where u and l concern respectively upper and last rows of matrix A_t^+.

According to lemma A.2 in Chou (2016), page 50, if the rank of A_t= 2.$(d_s - 1)$, the set of equations has a solution :

$$\left\{ \begin{bmatrix} v_t^+ + c_t \times 1_{ds} \\ v_{t+1}^+ + c_{t+1} \times 1_{ds} \end{bmatrix} : \; c_t, \; c_{t+1} \in \mathbb{R} \right\} \tag{4.14}$$

The final step is then to identify the per period utility functions $\mu_{t-1}^{1/0}, \mu_t^{1/0}$ and μ_t^0. With the results (4.14) and (4.11), the system becomes:

$$\begin{cases} \mu_{t-1}^{1/0} \otimes 1_{dz} = \phi(p_{t-1}) - \delta_{t-1} F_t^{1/0} v_t^+ \,, \\ \mu_t^{1/0} \otimes 1_{dz} = \phi(p_t) - F_{t+1}^{1/0} \overline{v}_{t+1}^+ \,, \\ \mu_t^0 \otimes 1_{dz} = v_t^+ - F_{t+1}^0 \overline{v}_{t+1}^+ - \psi(p_t) + (c_t - c_{t+1}) \times 1_{ds} \,. \end{cases} \tag{4.15}$$

Using the matrix $W \equiv I_{dx} \otimes (\frac{1}{dz}.1_{dz})^\top$, and if we normalize $\mu_t^0(x_1)$= 0 (4.(iii) assumption), the difference of constants is determined and then $\mu_t^0 = WL(v_t^+ - F_{t+1}^0 \overline{v}_{t+1}^+ - \psi(p_t))$ is identified also. We have unique solution for $\mu_{t-1}^{1/0}$, $\mu_t^{1/0}$ and μ_t^0,

$$\begin{cases} \mu_{t-1}^{1/0} = W(\phi(p_{t-1}) - \delta_{t-1} F_t^{1/0} v_t^+) \,, \\ \mu_t^{1/0} = W(\phi(p_t) - F_{t+1}^{1/0} \overline{v}_{t+1}^+ \,,) \end{cases} \tag{4.16}$$

Proposition: (From the second proposition of Chou (2016), identification with the Exclusion Restriction, known discount factors and $T \geq 3$). *In addition to Assumptions 1-4, suppose the Exclusion Restriction holds, the discount factors are known and $T \geq 3$. For $t = 2, ..., T-1$, let the matrix A_t and the vector b_t be defined by equation (9). If rank $A_t = 2.(ds-1)$, then the per period utility functions $\mu_{t-1}^{1/0}$, $\mu_t^{1/0}$and μ_t^0 are identified. Moreover, we have:*

$$\begin{bmatrix} \mu_1^{1/0} \\ \vdots \\ \mu_{T-1}^{1/0} \end{bmatrix} = (I_{T-1} \otimes W) \left(\begin{bmatrix} \phi(p_1) \\ \vdots \\ \phi(p_{T-1}) \end{bmatrix} - (\tilde{A}^{-1} \otimes \, I_{ds}) \, F_{2:T}^{1/0} \, A_{1:T}^+ \, b_{1:T} \right),$$

where

$$A_{1:T} = \begin{bmatrix} (I_{T-1} \otimes M) \, F_{2:T}^{1/0} \\ (I_{T-2} \otimes M) \, \check{F}_{3:T}^0 \end{bmatrix}; \text{ and}$$

$$b_{1:T} = \begin{bmatrix} (I_{T-1} \otimes M)(\tilde{\Lambda} \otimes I_{ds}) \begin{bmatrix} \phi(p_1) \\ \vdots \\ \phi(p_{T-1}) \end{bmatrix} \\ (I_{T-1} \otimes M)(\tilde{\Lambda} \otimes I_{ds}) \begin{bmatrix} \psi(p_2) \\ \vdots \\ \psi(p_{T-1}) \end{bmatrix} \end{bmatrix}; \text{ and}$$

$$\Lambda = diag(\delta_1, \prod_{r=1}^{2} \delta_r, ..., \prod_{r=1}^{T-2} \delta_r); \text{ and}$$
$$\tilde{\Lambda} = diag(1, \delta_1, \prod_{r=1}^{2} \delta_r, ..., \prod_{r=1}^{T-2} \delta_r).$$

4.5 Estimation

We can estimate these identified structural parameters by replacing population parameters by sample estimates of the closed form solutions. There are two steps for the estimation. First, we estimate the CCP and the transition matrices. Second, we estimate the structural parameters using the closed form solutions of the linear system under two identifying restrictions. In our case, we use the Exclusion Restriction and known discount factors. For the first step, we use data from HRS to build CCPs and transition matrices. The second step is to insert the estimated CCPs and transition matrices in the linear system proposed by Chou (2016).

4.5.1 Data from Health and Retirement Survey

In this chapter, we attempt to explore how does evolution of income and health of individuals affect their purchase of private

LTC insurance in United States. To this end, we use data from the Health and Retirement Study (HRS), which is a longitudinal project sponsored by the National Institute on Aging and the Social Security Administration in the United States. The survey is a public resource for data on aging in America since 1990. More than 37,000 people older than 50 have been interviewed since the start of the study. Respondents are visited on a biannual basis and questioned about health, socio-economic status (income, assets, and insurances), relationships with family (visits, care, financial transfers) and everyday activities. Data from wave 3 (1996) to wave 12 (2014) is used for the analysis. We want to follow the evolution of income, health and insurance over 5 periods of time. Concretely, we follow an individual on 5 consecutive waves. 6 cohorts form our total sample in which individuals are 55-56 years old in the first period. In $t = 5$, so they are all 63-64 years old.

Table 4.3: Sample by Cohorts: 55-64 years old

Cohorts	Years	N	Men with low education	Men with high education	Women with low education	Women with high education
Cohort 1	[1996;2004]	793	22.6%	20.0%	38.7%	18.7%
Cohort 2	[1998;2006]	610	19.3%	17.9%	39.2%	23.6%
Cohort 3	[2000;2008]	463	18.8%	17.5%	38.2%	25.5%
Cohort 4	[2002;2010]	514	16.9%	21.4%	34.8%	26.9%
Cohort 5	[2004;2012]	542	14.2%	26.7%	33.4%	25.7%
Cohort 6	[2006;2014]	527	16.3%	23.7%	29.4%	30.6%
Total	[1996;2014]	3449	18.4%	21.1%	35.9%	24.6%

Table 4.3 gives the number of individuals and summarizes the exclusion variable by cohort. The first line of Table 4.3 means that we are able to follow 793 persons aged 55-56 during 5 consecutive periods, from 1996 to 2004 (in this case, they are part of the "*cohort 1*"). The total number of individuals we can follow from 55-56 to 63-64 years old and for whom we have all the information about their LTC insurance, their level of health and their

income is 3449 people. This age group from is seen as the "*most appropriate subpopulation for marketing LTC insurance*" (Meiners, 2012). According to a 2010 retirement study by the Society of Actuaries (SOA), this "*middle mass*" represents 83 percent of the target market for LTC insurance because these individuals are most at risk for catastrophic LTC costs due to their low ability to fund this expense out-of-pocket, but their higher possibility of being able to afford insurance (Meiners, 2012). We excluded from the sample individuals who are or become dependent (defined as having 2 ADLs or more) during the period, as well as the deceased, because dependent people are no longer allowed to purchase an insurance since the insurance companies do not sell contracts to individuals already in need.

From HRS, we obtain individuals' income and several variables referring to health. To measure the general state of health of the respondents, we build a health index based on the first principal component identified from a principal component analysis (PCA) depending on eight measures taking the value 1 in case of bad health, 0 otherwise. Table 4.4 lists the components of this health index. We follow the methodology proposed by Poterba et al. (2010). This health index is also not completely objective; it is just a different and more complex measure than SRH, based on self-reported medical diagnosis. Like Jurges (2007), we used different self-reported physical conditions. Besides severe conditions, self-perceived health and objective measures of health (mental health, under/overweight and smoking behaviour), we added three measures of functional limitations: those inactivities of daily living (ADL), in instrumental activities of daily living (IADL) and in mobility (Mobility) following Poterba et al. (2010).

Table 4.4: Health Index Components

Measures	List of "options"	Value (0/1)
Conditions	High blood pressure, diabetes, cancer, lung disease, heart disease, stroke, psychiatric problems, arthritis	1 if at least 2 diseases
Self-Perceived Health	"Excellent," "very good," "good," "fair," and "poor"	1 if "fair" or "poor"
Mobility	Walking several blocks, walking one block, walking across the room, climbing several flights of stairs and climbing one flight of stairs	1 if at least 1 limitation
ADL	Bathing, eating, dressing, walking across a room, and getting in or out of bed.	1 if at least 1 limitation
IADL	Using a telephone, taking medication, handling money, shopping, preparing meals	1 if at least 1 limitation
Mental Health	CESD score is the sum of five "negative" indicators minus two "positive" indicators.	1 if at least score of 3
Smoking	Currently smoking or not	1 if smoker
BMI	Body Mass Index	1 if different from [18.5/25]

Like the latter, we chose the method of first principal component to build our index whereas Jurges (2007) calculated weights for each condition or impairment from a generalised ordered probit model. The first principal component synthesises the above 8 measures (see Table 4.4). This is a statistical procedure that uses orthogonal transformation to convert a set of 8 different objective and subjective health measures, possibly correlated into a set of linearly uncorrelated variables called principal components. We predict a value for each individual and rescale the predicted values by normalising (1 = "*best observed health*", 0 = "*worst observed health*"). Built for all cohorts together, the higher the index, the better the health.

HRS provides the individual net income. As our sample is people aged 55 to 64, they are all potentially still in the labor market. Information about private LTC insurance is also available for each wave. The Table 4.5 summarizes these three variables no longer by cohort but by age (synonym of t).

Table 4.5: Summary of Variables by Age

Variables		Ages				
		55-56	57-58	59-60	61-62	63-64
LTC Insurance	%	9.4	10.7	11.5	12.4	13.6
Income	mean	36543	37396	37085	36904	39002
	median	25000	25000	24000	23000	23808
Health Index	mean	0.84	0.83	0.81	0.81	0.79
	median	0.90	0.85	0.85	0.85	0.85

We observe a constant increase in the holding rate of private LTC insurance with age, from 9.4% when they are 55-56 old to 13.6% for the 63-64. This rate is to be compared with the index of health which deteriorates with age, from 0.84 to 0.79. This decrease is significant since a bit more than 75% of the sample is ranked between 0.70 and 1 for $t = 5$ (these thresholds are even closer for $t = 1$ with more than 75% of the sample between 0.77 and 1). The evolution of average income is not constant with age. Table 4.5 gives the raw figures but we need to categorize these data for the application of the Chou's methodology (2016). Then for each age t and each individual i, we construct three variables H_{it} ($H_{it} = k$, if individual i's health index in age t is between the $(k-1)$-th and k-th tercile), I_{it} ($I_{it} = k$, if individual i's income in age t is between the $(k-1)$-th and k-th tercile), and GE_{it} ($GE_{it} = 1$ if individual i's is a man with low education (less than 14 years of education), 2 if he is a man with high education, 3 if she is a woman with low education and 4 if she is a woman with high education). If GE_{ic} is so invariant in t, H_{it} and I_{it} may not be.

Table 4.6 gives an idea of the paths taken with age for the variables H_i and I_i according to the created terciles from $t = 1$ to $t = 5$ (from 55-56 to 63-64). Individuals are not all on the diagonal and we so observe changes of health or income states. It should be

Table 4.6: Evolution of Health/Income with age

Health Evolution from t=1 to t=5		63-64 (t=5)		
		Q1	Q2	Q3
55-56 (t=1)	Q1	76.7%	21.6%	1.7%
	Q2	29.4%	65.2%	5.4%
	Q3	13.9%	37.8%	48.3%

Income Evolution from t=1 to t=5		63-64 (t=5)		
		Q1	Q2	Q3
55-56 (t=1)	Q1	61.3%	30.1%	8.6%
	Q2	18.6%	56.1%	25.3%
	Q3	8.3%	25.2%	66.5%

noted that this figure does not show the variety of different paths taken in terms of health and income. We also observe individual i's private LTC insurance choice D_{it}. Table 4.7 shows the evolution of private LTC insurance from when they are 55-56 old to 63-64. We see that owning a private LTC insurance is not an absorbing state since almost 50% of the respondents who had a policy when they are 55-56 years old do not have it anymore at 63-64. This table also proves that some people decide to purchase insurance during this 10-year period. 10.1% of people without insurance at 55-56 own a policy at age 63-64. Let $s_{it} = (H_{it},\ I_{it},\ GE_{it})$ be the vector of state variables, in which GE_{it} (the combination of gender and level of education) is used as the exclusion variable for identification. We note that s_{it} can take 36 different values (ds= 3*3*4, dx = 3*3 and dz = 4). We let individual i's per period utility depend on H_{it}, I_{it} and D_{it} but not on GE_{it}.

Table 4.7: Evolution of private LTC insurance

LTC Insurance Evolution from t=1 to t=5		63-64 (t=5)	
		No	Yes
55-56 (t=1)	No	89.9%	10.1%
	Yes	52.8%	47.2%

We do not assign any parametric specification for the per period

utility functions. In the estimation, we let the discount factor be a constant over time. We test different values of discount factors to see the impact of the value given to the future on the differences of current utilities.

4.5.2 Conditional Choice Probabilities and Transition Matrices

In order to estimate these identified structural parameters, we need to calculate the CCP $\{p_t(S_t) : t = 1, ..., T-1\}$ and the transition matrix F^d_{t+1} for each alternative d and each period t.

For a small state space S, the estimator of CCP $p_t(S_t)$ could simply be the proportion of $D_t = 1$ in data for each state S_t. Since the support of S_t is large in our case, we estimate these probabilities by a logit and the predictions that follow from it. Indeed, since the variable insurance can take only two values (0/1), this variable has been regressed on the health and income variables taken in continuous value and on the binaries of the gender and education variables taken separately. Table 4.8 summarizes the 36 possible states and associated CCPs for the 5 ages. We see the probability of purchasing the insurance increases with age but also with income (and education).

Similarly, for a small state space S, an estimator of F^d_{t+1} could simply be the empirical frequency table of the transitions from S_t to S_{t+1} given $D_t = d$.

When the support of S_t is large, a smoothed approach may be preferable to avoid the issue of empty cells and these transitions

Table 4.8: Conditional Choice Probabilities

H	I	GE	55-56	57-58	59-60	61-62	63-64	H	I	GE	55-56	57-58	59-60	61-62	63-64
1	1	1	0,04	0,04	0,04	0,04	0,04	2	2	3	0,07	0,08	0,09	0,08	0,10
1	1	2	0,07	0,08	0,09	0,11	0,10	2	2	4	0,12	0,15	0,17	0,20	0,22
1	1	3	0,05	0,05	0,06	0,05	0,06	2	3	1	0,08	0,09	0,08	0,08	0,10
1	1	4	0,09	0,10	0,11	0,13	0,13	2	3	2	0,15	0,16	0,17	0,19	0,21
1	2	1	0,06	0,05	0,05	0,05	0,05	2	3	3	0,10	0,11	0,11	0,10	0,13
1	2	2	0,10	0,10	0,11	0,13	0,12	2	3	4	0,17	0,20	0,21	0,23	0,27
1	2	3	0,07	0,07	0,07	0,06	0,07	3	1	1	0,04	0,05	0,07	0,08	0,09
1	2	4	0,12	0,13	0,14	0,15	0,16	3	1	2	0,08	0,10	0,14	0,20	0,19
1	3	1	0,08	0,07	0,07	0,06	0,07	3	1	3	0,05	0,07	0,09	0,10	0,11
1	3	2	0,14	0,14	0,14	0,14	0,16	3	1	4	0,09	0,13	0,17	0,23	0,24
1	3	3	0,10	0,10	0,09	0,07	0,09	3	2	1	0,06	0,07	0,08	0,10	0,11
1	3	4	0,16	0,18	0,17	0,17	0,20	3	2	2	0,11	0,14	0,17	0,22	0,23
2	1	1	0,04	0,05	0,06	0,06	0,06	3	2	3	0,07	0,10	0,11	0,11	0,14
2	1	2	0,08	0,09	0,11	0,15	0,14	3	2	4	0,13	0,18	0,21	0,26	0,29
2	1	3	0,05	0,06	0,07	0,07	0,08	3	3	1	0,09	0,10	0,10	0,11	0,14
2	1	4	0,09	0,12	0,14	0,18	0,17	3	3	2	0,15	0,18	0,20	0,25	0,29
2	2	1	0,06	0,06	0,07	0,07	0,08	3	3	3	0,10	0,13	0,13	0,13	0,18
2	2	2	0,11	0,12	0,14	0,17	0,17	3	3	4	0,17	0,23	0,25	0,29	0,35

Note: The variables H and I, the health and income of individuals, can take the values 1, 2 or 3. This corresponds to the terciles in which the individuals were ranked. Being in the first tercile means being in poorer health or having a lower income. The variable GE is time-invariant and corresponds to the combination of gender and education of individuals. GE=1 if individual is a man with low education (less than 14 years of education), 2 if he is a man with high education, 3 if she is a woman with low education and 4 if she is a woman with high education.

are estimated by a multinomial logit on data pooled on the 4 periods where transition is observed. We pooled observations from age 55-56 to age 61-62 and we predict the transitions for the four values of dz from the multinomial logit using binary coefficients for the different ages for each of the two choices about private LTC insurance. That implies that transitions are time-variant and are calculated separately for men and women with low or high education. Indeed, it is impossible for a person to go from state "Man low educated" to "Woman high educated" since we assume that gender and level of education do not vary with time. Our transition matrices have therefore the following format ($ds * ds$ or 36(3*3*4)*36(3*3*4) in our case) where $\bullet = f_{t+1}^{1/0}$. Table 4.9 illustrates the standard matrix.

We are now in the conditions of the Proposition, that is to say we

Table 4.9: Transition Matrices $F_{t+1}^{1/0}$.

$$\begin{bmatrix}
\bullet & 0 & 0 & 0 & \bullet & 0 & 0 & 0 & \cdots & \bullet & 0 & 0 & 0 \\
0 & \bullet & 0 & 0 & 0 & \bullet & 0 & 0 & \cdots & 0 & \bullet & 0 & 0 \\
0 & 0 & \bullet & 0 & 0 & 0 & \bullet & 0 & \cdots & 0 & 0 & \bullet & 0 \\
0 & 0 & 0 & \bullet & 0 & 0 & 0 & \bullet & \cdots & 0 & 0 & 0 & \bullet \\
\bullet & 0 & 0 & 0 & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \vdots \\
0 & \bullet & 0 & 0 & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \vdots \\
0 & 0 & \bullet & 0 & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \vdots \\
0 & 0 & 0 & \bullet & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \vdots \\
\vdots & \vdots & \vdots & \vdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \vdots \\
\bullet & 0 & 0 & 0 & \cdots & \cdots & \cdots & \cdots & \cdots & \bullet & 0 & 0 & 0 \\
0 & \bullet & 0 & 0 & \cdots & \cdots & \cdots & \cdots & \cdots & 0 & \bullet & 0 & 0 \\
0 & 0 & \bullet & 0 & \cdots & \cdots & \cdots & \cdots & \cdots & 0 & 0 & \bullet & 0 \\
0 & 0 & 0 & \bullet & \cdots & \cdots & \cdots & \cdots & \cdots & 0 & 0 & 0 & \bullet
\end{bmatrix}$$

suppose the Exclusion Restriction holds, the discount factors are known and $T \geq 3$. As the rank $A_t = 2.(ds-1)$, then the per period utility functions $\mu_{t-1}^{1/0}$, $\mu_t^{1/0}$ and μ_t^0 are identified.

4.5.3 Differences of alternative specific value functions, current utilities and continuation values

Using HRS data, we estimate empirically the values for dv_t, du_t and dc_t. We have seen that theoretically $du_t < 0$, but the sign for dv_t and dc_t can be either positive or negative. With the data, we are constrained in that we observe only a certain number of periods and not the individuals' complete lifetimes. Hence we observe, for example, only periods 1 and 2, but not period 3. During this observation window, we observe the decisions d_t of the individuals and their health levels H_t. We also observe the probability that

health changes π_t. With these elements, we are able to estimate values for dv_t and du_t, and hence also dc_t since $dc_t = dv_t - du_t$.

We defined in section 4.3 the alternative specific value function (ASVF). An ASVF is given by $v_t^d = u_t^d + \delta E_t^d(v_{t+1}|s_t)$. That means that a difference of alternative specific value function is given by $v_t^1 - v_t^0 = u_t^1 - u_t^0 + \delta[E_t^1(v_{t+1}|s_t) - E_t^0(v_{t+1}|s_t)]$. This difference of alternative specific value functions can be decomposed into a difference of current utilities $du \equiv u_t^1 - u_t^0$ and a difference of future and discounted expected utilities $dc \equiv \delta E_t^1(v_{t+1}|s_t) - \delta E_t^0(v_{t+1}|s_t)$, which are called continuation values. Thus, the difference of ASVF (dv) is the sum of du and δdc: $dv = du + \delta dc$.

Results for current utilities differences

The difference in current utilities $du_t \equiv u_t^1 - u_t^0$ measures the immediate benefit of buying an insurance. Our estimates show that this difference is always negative and significant for $\delta \geq 0.50$, for all values of the non-exclusion state variable X. This means that buying an insurance leads to an immediate disutility, which is logical considering that their income is reduced by the amount of fees.

Figure 4.1 represents the values of the difference of current utilities, according to different ages (55-56 vs. 63-64) and a discount factor (δ) = 0.97. The meaning of the figure on the left is that the healthier and the richer you are, the negative value of the utility difference between taking insurance or not, decreases. For levels of income 1 and 2, we see the higher the health, the less the difference of utility is negative. No clear relation can be done for

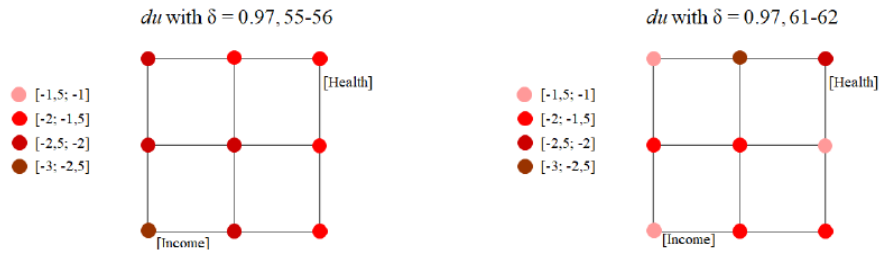


Figure 4.1: Differences in current utilities for 55-56 vs. 61-62, $\delta = 0.97$

the third level of income. The same is true for ages 57-58 and 59-60. For the age 61-62, results differ and no clear relation in terms of ranking can be established. However, differences are still significant and negative. The results are similar for other δ (for instance 0.80, see Appendix D.1) until $\delta = 0.5$.

Results for differences in alternative specific value functions

Applying the Hotz-Miller inversion (1993), we use the estimated CCP to compute this difference of the alternative specific value functions. For all 5 periods, this difference is on average negative and statistically significant. In other words, for all ages and for all states (ds), i.e. for all income, health and education levels as well as for both genders, on average individuals do not buy the insurance. If they do buy the insurance, it is for idiosyncratic reasons, as measured by the random term. Figure 4.2 shows for the age 63-64, the last age observed, that higher health and higher income, whatever gender and level of education, are associated with smaller differences in alternative specific value functions. Deltas are not considered in the calculation of these ASVF. For the other ages, the results are similar. We also calculate the difference

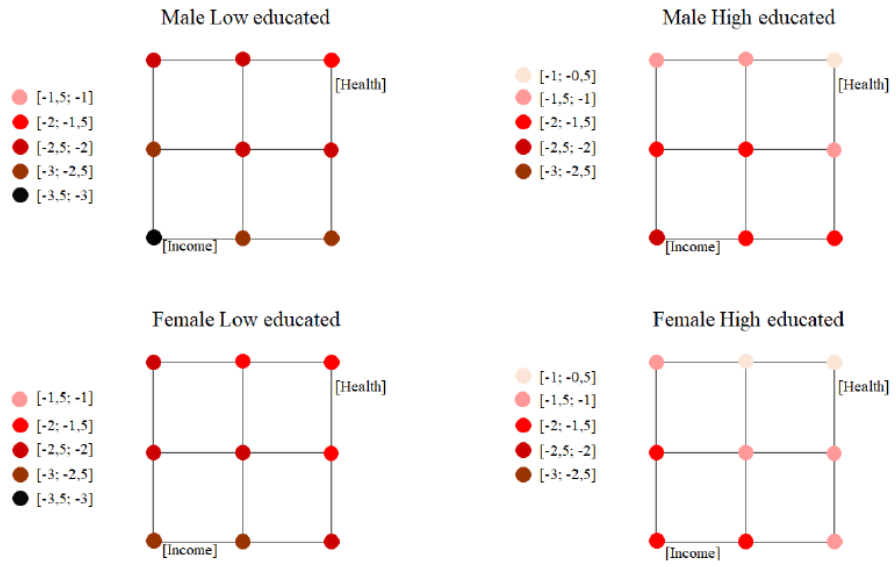


Figure 4.2: Differences in ASVF for 63-64, by gender and level of education (Z)

between ASVF at the age of 63-64 and age 55-56 and except for the low educated men in the first tercile of health and in the second and third terciles of income, the differences are positive, meaning that negative value of taking a private LTC insurance decreases with age (as theoretically shown by Meier, 1999).

This difference, which can be viewed as an option value to wait (see Dixit-Pindick, 1994) and which is always strictly positive in our case, decreases with age. At each period t, the individual has the choice between two possibilities: insurance or no insurance. He will choose the alternative giving the highest value. The value obtained by this individual at each time t is the maximum of the two possibilities: $v_t = max\{v_t^1, v_t^0\}$. We can subtract v_t^1 from both sides of the equality: $v_t - v_t^1 = max\{v_t^1 - v_t^1, v_t^0 - v_t^1\} = max\{0, v_t^0 - v_t^1\}$. The lefthandside measures the value above v_t^1

that the individual obtains above the value he obtains when he chooses the insurance possibility. Given the maximum operator on the RHS, this value is either strictly positive or zero. The fact that v_t can be higher than v_t^1 is due to the fact that the individual does not necessarily have to purchase the insurance at time t, but can wait an additional period. Let $\Lambda_t = v_t - v_t^1$, then $v_t - v_t^1 = max\{0, v_t^0 - v_t^1\}$ or $\Lambda_t = max\{0,\ u_t^0 - u_t^1 + \delta[E_t^0(v_{t+1}|s_t) - E_t^1(v_{t+1}|s_t)\}$. This means that the value of the option to wait can be decomposed into a sum of $-du$ and $-\delta\, dc$.

Results for differences in continuation values

Given that we have estimates for alternative specific value functions and for differences in current utilities, we can estimate the differences in continuation values as $\delta\, dc = dv - du$. This dc measures the difference in benefit in the next period of having made the decision to buy the insurance in *t*. We have seen theoretically that this value can be either positive or negative. We find that highly educated people have positive and significant values for dc for some state values.

We see that gender does not seem to play a role (particularly if we extend the threshold of significance to 75% because states (H1, I2), (H1, I3) and (H2, I1) would become significantly negative). In 2 cases out of 9 for highly educated men and women, we have so $dv < 0$ and $dc > 0$. Differences are not significant for the seven other cases. For low educated people, the three elements ($dv,\ du,\ dc$) are negative or not significant.

We now go over to the interpretation of the results for dc. We

observe individuals over a certain number of years. None of the observed years is a final decision-making year: the individual still has the possibility to postpone his decision to purchase an insurance. This corresponds to period 1 in our simple theoretical model. Empirically, we have shown that in some states $dc > 0$ while in other states $dc < 0$.

As we have seen in the model above, a condition for dc_1 to be positive is that $C_{2L}(1) - C_{2L}(0) > 0$. This difference is given by

$$\begin{aligned}
&C_{2L}(1) - C_{2L}(0) \\
&= \pi_3 u\left(s_2^*\left(d_2^*\right) R_3 + F\lambda/\pi_3 - M, 0\right) + (1-\pi_3)\, u\left(s_2^*\left(d_2^*\right) R_3, 1\right) \\
&\quad -\left(\pi_3 u\left(s_2^*\left(d_2^*\right) R_3 - M, 0\right) + (1-\pi_3)\, u\left(s_2^*\left(d_2^*\right) R_3, 1\right)\right) \\
&= \pi_3 u\left(s_2^*(1) R_3 + F\lambda/\pi_3 - M, 0\right) + (1-\pi_3)\, u\left(s_2^*(1) R_3, 1\right) \\
&\quad -\left(\pi_3 u\left(s_2^*(0) R_3 - M, 0\right) + (1-\pi_3)\, u\left(s_2^*(0) R_3, 1\right)\right) \\
&= \pi_3 u\left[\left(s_2^*(1) R_3 + F\lambda/\pi_3 - M, 0\right) - u\left(s_2^*(0) R_3 - M, 0\right)\right] \\
&\quad + (1-\pi_3)\left[u\left(s_2^*(1) R_3, 1\right) - u\left(s_2^*(0) R_3, 1\right)\right]
\end{aligned}$$

Hence a priori $\Delta C_{2L} \equiv C_{2L}(1) - C_{2L}(0)$ can be positive or negative. For the first term of ΔC_{2L} to be positive, we required that $s_2^*(1) R_3 + F\lambda/\pi_3 > s_2^*(0) R_3$. In words, this means that individuals believe that if they are insured and become dependent, they would have more financial resources than if they were without insurance. For ΔC_{2L} to be positive, either $s_2^*(1) R_3 + F\lambda/\pi_3 - s_2^*(0) R_3$ is large and/or the probability π_3 is high. In words, we can only obtain a positive value for dc if individuals believe that if they become dependent it is beneficial for them and if they believe that there is a non-neglible probability of becoming dependent in their lifetime.

Similarly, only if they believe that the difference $s_2^*(1) R_3 + F\lambda/\pi_3 - s_2^*(0) R_3$ is small and/or the probability π_3 is low, can dc be nega-

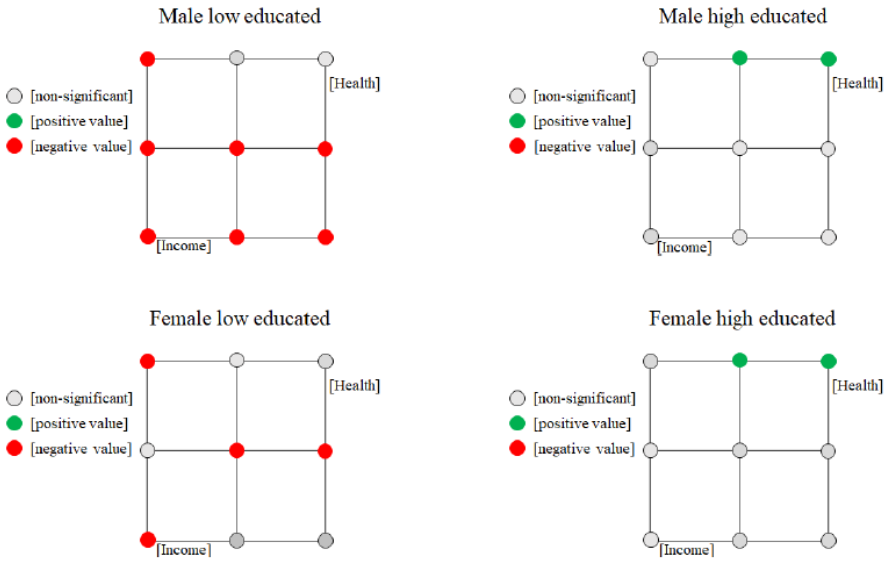


Figure 4.3: Differences in continuation values for 61-62, $\delta = 0.97$, by gender and level of education (Z)

tive.

From this we can infer that obtaining a positive value for dc means that individuals "*value the insurance*" (in the sense that either $s_2^*(1) R_3 + F\lambda/\pi_3 - s_2^*(0) R_3$ is large and/or the probability π_3 is high). Similarly, obtaining a negative value for dc can be seen as individuals "not valuing insurance" (in the sense that either the difference $s_2^*(1) R_3 + F\lambda/\pi_3 - s_2^*(0) R_3$ is small and/or the probability π_3 is low).

Empirically, we obtain that dc is positive for the educated while negative for the less educated. This means that the less educated value less the insurance than the educated. This might be an indication that less educated individuals are less informed about the probability of becoming dependent and/or the cost of being

dependent.

Table 4.10: Evolution of significant continuation values from 55-56 to 61-62, $\delta = 0.97$, by gender and level of education (Z)

ds	H	I	GE	55-56	57-58	59-60	61-62	ds	H	I	GE	55-56	57-58	59-60	61-62
1	1	1	1	-0,59	-0,65	-0,36	-1,88	19	2	2	3	-0,55	-0,34	0,11	-0,68
2	1	1	2	0,04	0,08	0,44	-0,85	20	2	2	4	0,08	0,39	0,90	0,35
3	1	1	3	-0,42	-0,35	-0,08	-1,67	21	2	3	1	-0,66	-0,64	-0,23	-1,15
4	1	1	4	0,22	0,39	0,71	-0,64	22	2	3	2	-0,03	0,09	0,57	-0,13
5	1	2	1	-0,63	-0,72	-0,49	-1,38	23	2	3	3	-0,48	-0,34	0,05	-0,94
6	1	2	2	0,01	0,02	0,30	-0,35	24	2	3	4	0,15	0,40	0,84	0,08
7	1	2	3	-0,45	-0,41	-0,22	-1,17	25	3	1	1	-1,05	-0,73	-0,15	-1,17
8	1	2	4	0,18	0,32	0,57	-0,14	26	3	1	2	-0,41	0,01	0,64	-0,15
9	1	3	1	-0,85	-0,63	-0,80	-1,04	27	3	1	3	-0,87	-0,42	0,12	-0,96
10	1	3	2	-0,22	0,11	-0,01	-0,01	28	3	1	4	-0,24	0,31	0,91	0,06
11	1	3	3	-0,68	-0,32	-0,53	-0,83	29	3	2	1	-1,16	-0,73	0,14	0,50
12	1	3	4	-0,05	0,41	0,26	0,20	30	3	2	2	-0,52	0,01	0,93	1,53
13	2	1	1	-1,00	-0,69	-0,16	-1,08	31	3	2	3	-0,98	-0,42	0,41	0,71
14	2	1	2	-0,37	0,04	0,63	-0,05	32	3	2	4	-0,35	0,31	1,20	1,74
15	2	1	3	-0,83	-0,39	0,11	-0,87	33	3	3	1	-0,77	-0,57	-0,02	0,27
16	2	1	4	-0,20	0,35	0,90	0,16	34	3	3	2	-0,14	0,16	0,77	1,30
17	2	2	1	-0,73	-0,65	-0,16	-0,88	35	3	3	3	-0,59	-0,27	0,25	0,48
18	2	2	2	-0,10	0,09	0,63	0,14	36	3	3	4	0,04	0,46	1,05	1,51

Note: The variables H and I, the health and income of individuals, can take the values 1, 2 or 3. This corresponds to the terciles in which the individuals were ranked. Being in the first tercile means being in poorer health or having a lower income. The variable GE is time-invariant and corresponds to the combination of gender and education of individuals. GE=1 if individual is a man with low education (less than 14 years of education), 2 if he is a man with high education, 3 if she is a woman with low education and 4 if she is a woman with high education.

We see in Table 4.10 that with age the number of states for which differences in continuation values become significative (colored cells), whether positive (green) or negative (red), increases. This could be due to an increase in the information available. As people get older, they begin to face major health problems and / or have to take care of their dependent parents. Appendix D.2 gives these differences in continuation values for a $\delta = 0.80$. Regarding results for $\delta = 0.80$, we observe that for low educated people in the 3rd tercile of health and the 2nd of income.

Here we can make a link with the ignorance argument advanced in the literature. If we consider ignorance as being a situation in which the individual do not see the value of the insurance

when they are dependent or that they consider the probability that they eventually will become dependent as negligible, then we can interpret the negative sign that we estimated for *dc* for the less educated as being a sign that they are "*ignorant*." On the other hand, we have shown that for educated individuals we obtain a positive value for *dc*. This would imply that educated individuals are "*not completely ignorant*": they realize that they do have a non-negligible probability of becoming dependent and they associate at least some value to having an insurance. However, as it was the case with less educated individuals, they do not, on average, purchase the insurance: whatever positive expected benefit they associate to having an insurance, this is not sufficient to compensate for the current cost of paying the insurance fee.

The fact that, controlling for income, health and gender, we obtain different results for educated and less educated individuals is interesting. This might indicate that the non-purchase of a LTC insurance is linked to a problem of information. Our results show that less educated individuals do not value the insurance while Brown and Finkelstein (2008) or Barr (2010) indicate that it is for all individuals. This is even more surprising given the fact that less educated individuals have a higher probability of becoming dependent and hence we would expect them to associate a higher value to the insurance. More educated individuals do seem to attach a value to the insurance, but potentially still not a sufficiently high value. An immediate policy implication is that more should be done in terms of informing the population about the probability of dependence and the costs associated to dependence.

4.6 Conclusion

In this chapter, using dynamic discrete choice estimation, we establish the determinants of the individual insurance purchase decision in a context where the individual's future health and income evolution is uncertain. Indeed, a rational individual considers the effect of his decision on his current utility but also the effect of his decision on his future (expected) utility. After the presentation of a theoretical model of LTC insurance purchase by a rational individual, we expose the Chou's approach, which allows the continuation values to be calculated using current utility differences based on weak normalization and exclusion variable. We need to estimate CCPs and transition matrices for 36 state values (differentiating by health, income, gender, and education).

We show that difference in intertemporal utility between taking or not the insurance is not explained by difference in health, income, gender or education level. This means that insurance choice is related to other unobserved characteristics. As expected, we find negative difference in current utilities, the result of the immediate negative effect of the insurance premium on disposable income. Finally, the difference in continuation value measures the difference in expected benefit in the next period of having made the decision to buy the insurance in t. We estimate that less educated value less the LTC insurance than the educated. This might indicate that the non-purchase of a LTC insurance is linked to a problem of information. We see that ageing leads to value the insurance, perhaps because of more available information. However, the option value to wait is always strictly positive. Chou's approach should allow us to go further and estimate the coefficients of utility parameters

(and not only the of differences in utility). Future research could explore this possibility and address the issue of the relatively small number of values of state variables.

Conclusion and Perspectives

In the last decades, life expectancy at birth has sharply risen in all European countries and North America. This increasing life expectancy is definitely accompanied by an improvement of the health's state of elderly people. But an ageing population also leads to an increase in the number of dependent people.

In the first chapter, with SHARE data, we profiled the people who were most likely to become dependent. We showed that the poorest individuals are those who are more likely to become dependent but also those with longer period of dependence.

Historically, LTC was mainly provided by the family. In the second chapter, with the impact on informal care of setting up insurance (whether private or public) as background, we tried to establish long-term caring motives inside the family in European countries. We always rejected exchange model when we found that family norm prevailed in the Eastern and, for single parent households, also in the Southern countries. For the other regions, the only compatible model seemed to be that of moderate altruism, especially if we assumed that informal and formal care were substitutes.

Depending on the prevailing motives, the extent of crowding out

of informal care will vary and this will affect the desirability of either private or public insurance. In the United States, this public insurance has been in place since 1965 with the Medicaid program. In the third chapter, we tested empirically the possibility of a strategic behavior allowing elderly people to benefit from the public aid whereas they would have the financial means to buy this care on the market with their own resources. We found evidence of this phenomenon, called "*strategic spend-down*".

As the US government puts in place legal and administrative arrangements to reduce this type of behavior and as these caring activities are quite expensive in the private market, some people should therefore take an insurance which would cover their dependence costs in the future. These policies exist in the US since forty years. In the fourth chapter, we showed that the non-purchase of a LTC insurance might be linked to a problem of information. We found that educated individuals are *"not completely ignorant"* : they associated at least some value to having an insurance and realized that they do have a non-negligible probability of becoming dependent. Unlike the less educated.

Beyond the solutions evoked to counter the strategic behaviors of spend-down and the importance of a better information that would reduce the ignorance around the probability of dependence in the old days, three types of public policy are conceivable at the global level (WHO, 2003):

1) A desire to support the poor, and provide programs only for the poor;
2) A desire to support the poor as a primary goal, but financing through frameworks that include the non-poor;

3) A desire to support both the poor and the non-poor, as a primary goal.

They differ according to the answer to these two questions: "*What is the responsibility of the individual or his family to use his own income and assets? What is the responsibility of the spouse and family to provide the care directly?*" (WHO, 2003).

As WHO (2003) explains, "*the choice among these options is often presented in terms of the choice between selective (or means tested) and universal approaches to social service provision. Support for the poor is obviously based on a concern for their inability to purchase these services and can lead to an exclusive focus on this group (option 1)*". Even if support for the poor is the primary goal, this approach can lead to a strategy that supports the non-poor as we have shown in chapter 3. "*Including them in a more universal program might be the best way to mobilize support for the poor, and avoid the stigma associated with programs devoted exclusively to the poor, such as low quality (option 2)*". Finally, there might also be interest in "*assisting the non-poor*" as a primary goal (option 3).

These three main orientations correspond to different public policies, from the paradigm of a program focused on the poor and financed through general taxation on a non-entitlement basis to an opposite approach with support for the broader population on an entitlement basis and contributory finance.

These four chapters have shown that there are still many issues to be addressed. We must check over a longer period the links between the duration of the dependence and the socio-economic status. We can think of a longitudinal analysis of the motives of relations between parents and children. We need to refine our

research on the strategic spend-down and the purchase of LTC insurance and try to track individuals from the moment they are still in the labor market until they die. Moreover, we analyzed almost exclusively the three actors of LTC, without possible interactions between them. Besides, we could be interested in looking at cross-effects between family, state and private insurance. Databases such as HRS or SHARE are essential for these issues. It is fundamental that the public authorities continue to promote these researches by funding them.

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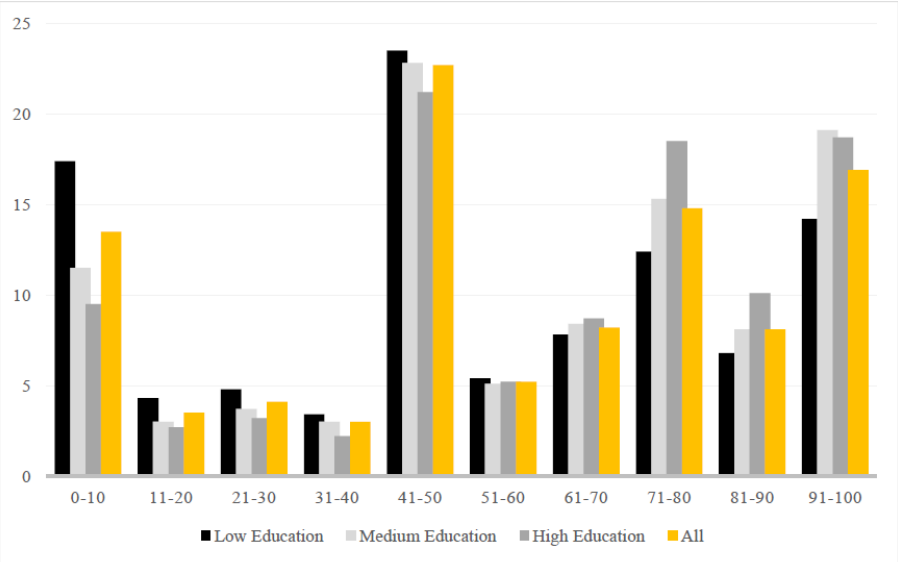
Appendix A

Who needs help?

A.1. Subjective probabilities of survival & education levels



A.2. Effects of wealth on the subjective probability of survival (robustness tests)

	(1)		(2)	
Wealth (1st tercile)	ref.			
Wealth (2nd tercile)	2.194***	(0.326)	-	
Wealth (3rd tercile)	4.746***	(0.335)		
Wealth (percentiles)	-		0.061***	(0.018)
Wealth² (percentiles)			0.000	(0.000)
Woman	1.544***	(0.277)	1.563***	(0.277)
Marital status				
Single	ref.		ref.	
Widowed	-1.631**	(0.531)	-1.676**	(0.531)
In couple	-0.418	(0.402)	-0.594	(0.402)
Married but single	-1.435	(1.171)	-1.494	(1.171)
Environment				
Children	0.318***	(0.098)	0.334***	(0.098)
Smoker	-3.686***	(0.346)	-3.599***	(0.346)
Physical Activity	4.053***	(0.279)	3.977***	(0.279)
Urban areas	-1.438***	(0.272)	-1.494***	(0.272)
Dependence	-8.270***	(0.653)	-8.219***	(0.653)
Constant	65.605***	(1.225)	64.534***	(1.264)
Observations	44187		44187	
R^2	0.234		0.234	

Standard errors in parentheses; $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Note: All regressions contain binaries by country, age, and chronic disease.

A.3. Effects of education on the subjective probability of survival (robustness tests)

	(1)		(2)		(3)	
Education (ISCED)	0.931***	(0.101)	1.348***	(0.384)	-	
Education² (ISCED)	-		-0.069	(0.062)		
Low Education					ref.	
Medium Education	-		-		2.012***	(0.331)
High Education					3.262***	(0.363)
Woman	1.623***	(0.278)	1.629***	(0.278)	1.625***	(0.278)
Marital status						
Single	ref.		ref.		ref.	
Widowed	-1.119**	(0.532)	-1.120**	(0.532)	-1.135**	(0.532)
In couple	0.613	(0.395)	0.605	(0.395)	0.615	(0.395)
Married but single	-1.166	(1.173)	-1.161	(1.173)	-1.141	(1.173)
Environment						
Children	0.312***	(0.099)	0.320***	(0.099)	0.304***	(0.099)
Smoker	-3.935***	(0.346)	-3.946***	(0.346)	-3.938***	(0.346)
Physical Activity	4.282***	(0.278)	4.278***	(0.278)	4.294***	(0.278)
Urban areas	-1.015***	(0.276)	-1.013***	(0.276)	-1.032***	(0.276)
Dependence	-8.321***	(0.655)	-8.304***	(0.655)	-8.368***	(0.655)
Constant	64.941***	(1.244)	64.528***	(1.296)	65.994***	(1.226)
Observations	44147		44147		44147	
R^2	0.232		0.232		0.232	

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

Note: All regressions contain binaries by country, age, and chronic disease.

A.4. Effects of wealth on the subjective probability of survival (instruments: HPIR and growth rate of HPIR)

	(1) HPIR in t		(2) HPIR in t		(3) HPIR Growth from t to $t+4$	
	First Stage 2SLS	Second Stage 2SLS	First Stage 2SLS	Second Stage 2SLS	First Stage 2SLS	Second Stage 2SLS
Wealth		3.756***		-0.093		-0.328
		(1.186)		(0.286)		(0.504)
Woman	-1.478***	6.669***	-1.546***	1.318**	-1.541***	0.589
	(0.275)	(2.055)	(0.276)	(0.522)	(0.276)	(0.809)
Marital status						
Single	ref.		ref.		ref.	
Widowed	4.476***	-18.745***	4.560***	-0.952	4.542***	-0.545
	(0.527)	(5.656)	(0.528)	(1.405)	(0.528)	(2.319)
In couple	16.559***	-61.270***	16.916***	2.178	16.905***	6.281
	(0.389)	(19.670)	(0.393)	(4.849)	(0.393)	(8.343)
Married but single	6.483***	-25.992***	6.396***	-0.397	6.428***	0.350
	(1.165)	(8.853)	(1.165)	(2.186)	(1.165)	(3.493)
Environment						
Children	-1.070***	4.226***	-1.094***	0.152	-1.094***	-0.108
	(0.097)	(1.312)	(0.098)	(0.328)	(0.098)	(0.545)
Smoker	-7.243***	22.526***	-7.339***	-4.808**	-7.325***	-6.957*
	(0.343)	(8.660)	(0.343)	(2.123)	(0.343)	(3.656)
Physical Activity	5.756***	-16.879**	5.800***	4.946***	5.813***	6.723**
	(0.273)	(6.932)	(0.276)	(1.685)	(0.276)	(2.927)
Urban areas	0.645**	-3.325***	0.709***	-1.343***	0.722***	-0.806*
	(0.264)	(1.246)	(0.271)	(0.344)	(0.271)	(0.425)
Dependence	-4.417***	7.443	-4.627***	-8.945***	-4.630***	-10.772***
	(0.649)	(5.842)	(0.650)	(1.479)	(0.650)	(2.357)
Instruments						
HPIR (1) & (2) / HPIR Growth (3)	0.058***		0.095***		1.167	
	(0.018)		(0.027)		(3.542)	
Constant	35.385***	-87.830*	30.963***	71.053***	40.309***	81.233***
	(2.090)	(49.222)	(2.885)	(11.578)	(1.215)	(20.880)
Country Fixed Effects	No		Yes		Yes	
Chronic Disease Binaries	Yes		Yes		Yes	
Age Binaries	Yes		Yes		Yes	
F-Stat	10.405 (0.001)		12.649 (0.000)		4.766 (0.029)	
Stock and Yogo (2005)	N/Y/Y/Y		N/Y/Y/Y		N/N/N/N	
Montiel and Pflueger (2013)	N/N/N/N		N/N/N/Y		N/N/N/N	
Observations	44190	44190	44190	44190	44190	44190
R^2	0.117	-10.169	0.120	0.213	0.120	0.077

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

A.5. Cragg-Donald Wald F statistic, Stock and Yogo/ Montiel and Pluefer critical valies, Sargan Tests

		Cragg-Donald Wald F statistic	Stock and Yogo ID test critical values for 2SLS				Sargan Test
			10% (19.93)	15% (11.59)	20% (8.75)	25% (7.25)	
Instruments: Heritage and Ownership							
North	DK	323.8 (0.000)	Yes	Yes	Yes	Yes	3.035 (0.081)
	NL	832.4 (0.000)	Yes	Yes	Yes	Yes	0.163 (0.686)
	SW	242.1 (0.000)	Yes	Yes	Yes	Yes	0.087 (0.767)
Center	AT	2175.2 (0.000)	Yes	Yes	Yes	Yes	22.861 (0.000)
	BE	986.5 (0.000)	Yes	Yes	Yes	Yes	4.022 (0.045)
	CH	811.3 (0.000)	Yes	Yes	Yes	Yes	0.837 (0.360)
	DE	949.9 (0.000)	Yes	Yes	Yes	Yes	0.632 (0.427)
	FR	1360.7 (0.000)	Yes	Yes	Yes	Yes	6.894 (0.008)
South	ES	266.7 (0.000)	Yes	Yes	Yes	Yes	10.060 (0.001)
	IT	715.9 (0.000)	Yes	Yes	Yes	Yes	1.958 (0.162)
	PO	351.1 (0.000)	Yes	Yes	Yes	Yes	0.025 (0.875)
	SI	266.4 (0.000)	Yes	Yes	Yes	Yes	0.007 (0.935)
East	CZ	1034.6 (0.000)	Yes	Yes	Yes	Yes	3.589 (0.058)
	EE	1375.7 (0.000)	Yes	Yes	Yes	Yes	0.001 (0.970)
	PL	986.1 (0.000)	Yes	Yes	Yes	Yes	2.403 (0.121)
All		11011.1 (0.000)	Yes	Yes	Yes	Yes	22.744 (0.000)
			Montiel and Pflueger ID test critical values for 2SLS				
			5% (2.99)	10% (2.99)	20% (2.96)	30% (2.96)	
			Yes	Yes	Yes	Yes	
Instruments: Growth Rate of House Price to Income Ratio (HPIR) (from *t* to *t+4*)							
All		4.972 (0.026)	Stock and Yogo ID test critical values for 2SLS				-
			10% (16.38)	15% (8.96)	20% (6.66)	25% (5.53)	
			No	No	No	No	
			Montiel and Pflueger ID test critical values for 2SLS				
			5% (37.4)	10% (23.1)	20% (15.1)	30% (12.0)	
			No	No	No	No	
Instruments: House Price to Income Ratio (HPIR) in *t*							
All		12.649 (0.000)	Stock and Yogo ID test critical values for 2SLS				-
			10% (16.38)	15% (8.96)	20% (6.66)	25% (5.53)	
			No	Yes	Yes	Yes	
			Montiel and Pflueger ID test critical values for 2SLS				
			5% (37.4)	10% (23.1)	20% (15.1)	30% (12.0)	
			No	No	No	Yes	

Note: All regressions contain binaries by age, chronic disease, dependence status, and marital status. The environment is also controlled

A.6. Effects of education on the probability of survival by country: the role of institutions?

		OLS		
		Education	Observations	R^2
North	DK	0.438	2348	0.308
		(0.394)		
	NL	0.340	1895	0.230
		(0.404)		
	SW	0.351	2047	0.334
		(0.390)		
Center	AT	1.960***	4189	0.248
		(0.333)		
	BE	1.139***	4627	0.228
		(0.246)		
	CH	0.068	3060	0.204
		(0.411)		
	DE	0.434	1755	0.272
		(0.624)		
	FR	0.912***	4192	0.196
		(0.261)		
South	ES	2.012***	2818	0.227
		(0.427)		
	IT	0.208	3052	0.158
		(0.459)		
	PO	0.453	1293	0.227
		(0.624)		
	SI	2.054***	1921	0.242
		(0.581)		
East	CZ	0.214	4022	0.162
		(0.398)		
	EE	1.070***	5176	0.196
		(0.395)		
	PL	1.077*	1752	0.166
		(0.598)		

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

Note: All regressions contain binaries by age, chronic disease, dependence status, and marital status. The environment is also controlled.

A.7. Effects of wealth and education on dependence in *t+4* if non-dependent in *t* (Probit robustness tests)

	(1)		(2)	
Wealth (percentiles)	-0.043***	(0.013)	-	
Wealth² (percentiles)	0.018	(0.013)		
Education (ISCED)	-		-0.006***	(0.001)
Woman	0.005**	(0.002)	0.004*	(0.002)
Marital status				
Single	ref.		ref.	
Widowed	-0.003	(0.004)	-0.006	(0.004)
In couple	-0.008***	(0.003)	-0.013***	(0.003)
Married but single	0.002	(0.008)	0.001	(0.008)
Environment				
Children	0.002***	(0.001)	0.002***	(0.001)
Smoker	0.007**	(0.003)	0.008***	(0.003)
Physical Activity	-0.024***	(0.002)	-0.025***	(0.002)
Urban areas	-0.003	(0.002)	-0.006***	(0.002)
Observations	42097		42060	
R^2	0.147		0.147	

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

Note: All regressions contain binaries by country, age, and chronic disease.

A.8. Effects of wealth on the duration (in months) of the dependence (robustness tests)

	(1) OLS		(2) Probit + 6 months		(3) Probit + 6 months	
Wealth (percentiles)	-0.217**	(0.109)	-0.005	(0.003)	-0.028**	(0.012)
Wealth² (percentiles)	0.018	(0.011)	-		0.002**	(0.001)
Woman	0.393**	(0.175)	0.045**	(0.019)	0.046**	(0.019)
In couple	-0.392**	(0.195)	-0.047**	(0.021)	-0.042*	(0.021)
Constant	8.532***	(2.081)	-		-	
Observations	2485		2478		2478	
(Pseudo)-R²	0.074		0.047		0.048	

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

Note: All regressions contain binaries by country and by age.

Appendix B

By whom? The Family

B.1: Descriptive statistics for single parent households

	Wealth of parent (y)				Education of child (w)		
	1Q	2Q	3Q	4Q	Low	Medium	High
Hours of provided informal help (Singles HHs)							
North	2.27	0.78	0.40	0.66	1.59	2.31	0.77
Center	5.87	3.24	3.78	2.17	6.82	5.21	2.35
South	12.61	10.40	6.81	1.16	12.21	7.02	9.00
East	11.84	7.04	8.84	10.18	13.40	9.28	5.32
All	7.08	5.17	4.51	2.97	8.82	5.67	3.11
Amount of received financial transfers (Singles HHs)							
North	276	487	713	1334	306	536	513
Center	181	427	357	2600	257	503	752
South	98	70	214	254	77	137	223
East	33	128	125	83	75	80	99
All	171	299	369	1463	168	367	538
Observations	4071	2102	1543	847	2340	3570	2653

Note: SHARE Wave 2 release 2.6.0, own computations.

B.2: Tobit models with Mundlak approach (all)

Help Side					
Explanatory variables	**All**	**North**	**Center**	**South**	**East**
Parent characteristics					
Wealth	**-0.056*** **	**-0.054***	**-0.052***	**-0.169*** **	**0.040**
Woman	0.183	0.242	0.300	-0.229	0.255
Child in HH	-0.951***	0.057	-0.868**	-0.954***	-1.152***
Partner	-0.979***	-0.583***	-1.150***	-1.286***	-0.819***
Children characteristics					
Education	**0.182*** **	**0.135**	**0.103**	**0.266**	**0.276***
Woman	0.519***	-0.005	0.356*	1.745***	0.325
Location	-0.834***	-0.575***	-0.867***	-0.991***	-0.804***
Siblings	-0.223***	-0.169***	-0.180***	-0.317***	-0.250***
Log likelihood	-12,019.3	-2,292.6	-3,763.6	-2,291.8	-2,904.2
Observations	28,780	7,621	10,100	6,895	4,074
*Notes: Country dummies are also included in the model; controlling for health, age and education of the parent, employment status, partner and age of the child; * p < 0.05, ** p < 0.01, *** p < 0.001; applying Mundlak corrections*					
Transfers Side					
Explanatory variables	**All**	**North**	**Center**	**South**	**East**
Parent characteristics					
Wealth	**0.651*** **	**0.985*** **	**0.700*** **	**0.546*** **	**0.135**
Woman	-0.549*	-0.665	0.156	-1.121	-1.236
Child in HH	-1.571***	-2.354	0.182	-2.214**	-1.778*
Partner	-0.268	-2.540***	1.143*	-0.666	1.079
Children characteristics					
Education	**-0.126**	**0.025**	**-0.338**	**-0.071**	**-0.207**
Woman	0.321	0.772	0.044	-1.143	1.478
Location	-0.290**	-0.222	0.000	-0.630**	-0.796**
Siblings	-1.491***	-1.386***	-1.573***	-2.045***	-0.953***
Log likelihood	-19,244.5	-6,347.9	-7,308.7	-3,303.5	-2,170.9
Observations	28,780	7,621	10,100	6,895	4,074
*Notes: Country dummies are also included in the model; controlling for health, age and education of the parent, employment status, partner and age of the child; * p < 0.05, ** p < 0.01, *** p < 0.001; applying Mundlak corrections*					

Note: SHARE Wave 2 release 2.6.0, own computations.

B.3: Tobit models with Mundlak approach (single parent households)

Help Side					
Explanatory variables	**All**	**North**	**Center**	**South**	**East**
Parent characteristics					
Wealth	**0.018**	**0.029**	**-0.014**	**-0.049**	**0.087**
Woman	0.320	0.224	0.635*	-0.304	0.408
Child in HH	-1.511***	-0.569	-1.267**	-1.880***	-1.615***
Children characteristics					
Education	**0.078**	**0.081**	**0.011**	**0.227**	**0.160**
Woman	0.869***	-0.022	0.997***	1.844***	0.738
Location	-0.972***	-0.646***	-0.998***	-1.222***	-0.903***
Siblings	-0.363***	-0.164*	-0.386***	-0.542***	-0.375***
Log likelihood	-5,571.2	-1,073.3	-1,943.2	-1,260.5	-1,226.7
Observations	8,563	2,123	3,213	1,887	1,340
*Notes: Country dummies are also included in the model; controlling for health, age and education of the parent, employment status, partner and age of the child; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; applying Mundlak corrections*					
Transfers Side					
Explanatory variables	**All**	**North**	**Center**	**South**	**East**
Parent characteristics					
Wealth	**0.575*** **	**1.015*** **	**0.698*** **	**-0.043**	**-0.136**
Woman	-2.515***	-2.821***	-0.799	-3.438*	-4.625**
Child in HH	-1.074	-2.297	2.842	-1.285	-4.528*
Children characteristics					
Education	**-0.234**	**-0.043**	**-0.193**	**-1677**	**0.116**
Woman	0.577	0.079	0.753	1.272	1.106
Location	-0.602*	-0.215	-0.662	-1.373*	-0.426
Siblings	-1.364***	-0.901**	-1.833***	-2.498***	-0.940
Log likelihood	-4,542.8	-1,679.7	-1,604.5	-667.5	-511.4
Observations	8,563	2,123	3,213	1,887	1,340
*Notes: Country dummies are also included in the model; controlling for health, age and education of the parent, employment status, partner and age of the child; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; applying Mundlak corrections*					

Note: SHARE Wave 2 release 2.6.0, own computations.

B.4: Tobit models with fixed endowments method and Mundlak approach (all)

Help Side					
Explanatory variables	**All**	**North**	**Center**	**South**	**East**
Model controlling with children education dummies and Mundlak correction					
Parent characteristics					
Wealth	**-0.055*** **	**-0.055***	**-0.049**	**-0.169*** **	**0.040**
Woman	0.184	0.245	0.287	-0.226	0.259
Child in HH	-0.942***	0.084	-0.828**	-0.961***	-1.152***
Partner	-0.983***	-0.589***	-1.160***	-1.288***	-0.818***
Children characteristics					
Education	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**
Woman	0.519***	0.014	0.343	1.729***	0.319
Location	-0.832***	-0.572***	-0.863***	-0.989***	-0.798***
Siblings	-0.218***	-0.166***	-0.181***	-0.305***	-0.236***
Log likelihood	-12,011.6	-2,286.9	-3,757.6	-2,910.7	-2,897.3
Model controlling with parents wealth deciles dummies and Mundlak correction					
Parent characteristics					
Wealth	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**
Woman	0.196*	0.267*	0.314*	-0.228	0.262
Child in HH	-0.946***	0.079	-0.895**	-0.966***	-1.157***
Partner	-1.013***	-0.633***	-1.165***	-1.325***	-0.826***
Children characteristics					
Education	**0.183*** **	**0.142**	**0.269**	**0.277**	**0.271***
Woman	0.514***	0.023	0.347	1.729***	0.334
Location	-0.835***	-0.580***	-0.867***	-0.998***	-0.803***
Siblings	-0.218***	-0.173***	-0.181***	-0.316**	-0.254***
Log likelihood	-12,005.5	-2,276.9	-3,756.2	-2,984.2	-2,898.4
Observations	28,780	7,621	10,100	6,895	4,074
*Notes: Country dummies are also included in the model; controlling for health, age and education of the parent, employment status, partner and age of the child; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; applying Mundlak correction*					

Transfers Side					
Explanatory variables	**All**	**North**	**Center**	**South**	**East**
Model controlling with children education dummies and Mundlak correction					
Parent characteristics					
Wealth	**0.065*** **	**0.989*** **	**0.703*** **	**0.546*** **	**0.135**
Woman	-0.552*	-0.659	0.185	-1.112	-1.243
Child in HH	-1.570***	-2.369	0.214	-2.236**	-1.782*
Partner	-0.288	-2.553***	1.127*	-0.686	1.087
Children characteristics					
Education	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**
Woman	0.326	0.784	0.079	-1.153	1.457
Location	-0.289**	-0.222	0.014	-0.630**	-0.793**
Siblings	-1.488***	-1.390***	-1.583***	-2.012***	-0.953***
Log likelihood	-19,241.9	-6,345.8	-7,303.1	-3,302.3	-2,170.6
Model controlling with parents wealth deciles dummies and Mundlak correction					
Parent characteristics					
Wealth	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**
Woman	-0.518*	-0.608	0.221	-1.206	-1.285
Child in HH	-1.528***	-2.463	0.375	-2.183**	-1.761*
Partner	-0.362	-2.794***	1.062**	-0.884	0.999
Children characteristics					
Education	**-0.127**	**0.026**	**-0.338**	**-0.060**	**-0.187**
Woman	0.332	0.780	0.046	-1.180	1.473
Location	-0.290**	-0.222	0.005	-0.619**	-0.775**
Siblings	-1.491***	-1.399***	-1.563***	-2.009***	-0.909***
Log likelihood	-19,218.8	-6,340.0	-7,292.1	-3,277.7	-2,158.3
Observations	28,780	7,621	10,100	6,895	4,074
*Notes: Country dummies are also included in the model; controlling for health, age and education of the parent, employment status, partner and age of the child; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; applying Mundlak correction*					

Note: SHARE Wave 2 release 2.6.0, own computations.

B.5: Tobit models with fixed endowments method and Mundlak approach (single parent households)

Help Side					
Explanatory variables	**All**	**North**	**Center**	**South**	**East**
Model controlling with children education dummies					
Parent characteristics					
Wealth	**0.019**	**0.028**	**-0.010**	**-0.047**	**0.085**
Woman	0.320	0.221	0.626*	-0.277	0.453
Child in HH	-1.502***	-0.559	-1.201*	-1.854***	-1.599***
Children characteristics					
Education	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**
Woman	0.871***	-0.012	0.965***	1.834***	0.764
Location	-0.970***	-0.645***	-0.995***	-1.230***	-0.906***
Siblings	-0.362***	-0.160*	-0.386***	-0.553***	-0.367**
Log likelihood	-5,567.6	-1,072.6	-1,940.1	-1,258.2	-1,220.1
Model controlling with parents wealth deciles dummies					
Parent characteristics					
Wealth	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**
Woman	0.338*	0.275	0.659*	-0.317	0.378
Child in HH	-1.491***	-0.648	-1.123*	-1.821***	-1.775***
Children characteristics					
Education	**0.080**	**0.085**	**0.010**	**0.226**	**0.165**
Woman	0.867***	-0.005	0.992***	1.824***	0.756
Location	-0.972***	-0.648***	-0.998***	-1.211***	-0.891***
Siblings	-0.357***	-0.160*	-0.382***	-0.564***	0.362**
Log likelihood	-5,565.1	-1,068.1	-1,938.1	-1,251.1	-1,221.0
Observations	8,563	2,123	3,213	1,887	1,340

*Notes: Country dummies are also included in the model; controlling for health, age and education of the parent, employment status, partner and age of the child; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; applying Mundlak correction*

Transfers Side					
Explanatory variables	**All**	**North**	**Center**	**South**	**East**
Model controlling with children education dummies					
Parent characteristics					
Wealth	**0.575*** **	**1.018*** **	**0.703*** **	**-0.009**	**-0.133**
Woman	-2.508***	-2.809***	-0.753	-3.472*	-4.758**
Child in HH	-1.097	-2.069	2.898	-1.309	-4.514*
Children characteristics					
Education	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**
Woman	0.565	0.068	0.690	1.480	1.106
Location	-0.603*	-0.209	-0.645	-1.430*	-0.414
Siblings	-1.378***	-0.907**	-1.865***	-2.581***	-0.971
Log likelihood	-4,540.7	-1,679.0	-1,602.1	-663.7	-510.2
Model controlling with parents wealth deciles dummies					
Parent characteristics					
Wealth	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**
Woman	-2.384***	-2.470**	-0.541	-3.334*	-4.901**
Child in HH	-0.877	-2.338	3.143	-0.450	-4.624*
Children characteristics					
Education	**-0.237**	**-0.046**	**-0.181**	**-1.656**	**0.038**
Woman	0.558	0.060	0.699	1.001	1.175
Location	-0.592*	-0.188	-0.680	-1.319*	-0.388
Siblings	-1.313***	-0.825**	-0.183***	-2.300***	-0.710
Log likelihood	-4,525.3	-1,672.5	-1,592.2	-655.7	-507.5
Observations	8,563	2,123	3,213	1,887	1,340
*Notes: Country dummies are also included in the model; controlling for health, age and education of the parent, employment status, partner and age of the child; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; applying Mundlak correction*					

Note: SHARE Wave 2 release 2.6.0, own computations.

B.6: Summary of empirical findings (Mundlak approaches robustness tests/all vs. single parent households)

Mundlak approach										
Countries	***All HHs sample (28,780)***	**Child's help**		**Parent's transfer**		***Singles HHs sample (8,563)***	**Child's help**		**Parent's transfer**	
		da/dy	***da/dw***	***db/dy***	***db/dw***		***da/dy***	***da/dw***	***db/dy***	***db/dw***
SHARE		< 0	> 0	> 0	= 0		= 0	= 0	> 0	= 0
North		< 0	= 0	> 0	= 0		= 0	= 0	> 0	= 0
Center		< 0	= 0	> 0	= 0		= 0	= 0	> 0	= 0
South		< 0	= 0	> 0	= 0		= 0	= 0	= 0	= 0
East		= 0	> 0	= 0	= 0		= 0	= 0	= 0	= 0
Fixed endowments + Mundlak approach										
Countries	***All HHs sample (28,780)***	**Child's help**		**Parent's transfer**		***Singles HHs sample (8,563)***	**Child's help**		**Parent's transfer**	
		da/dy	***da/dw***	***db/dy***	***db/dw***		***da/dy***	***da/dw***	***db/dy***	***db/dw***
SHARE		< 0	> 0	> 0	= 0		= 0	= 0	> 0	= 0
North		< 0	= 0	> 0	= 0		= 0	= 0	> 0	= 0
Center		= 0	= 0	> 0	= 0		= 0	= 0	> 0	= 0
South		< 0	= 0	> 0	= 0		= 0	= 0	= 0	= 0
East		= 0	> 0	= 0	= 0		= 0	= 0	= 0	= 0

Note: SHARE Wave 2 release 2.6.0, own computations.

Appendix C

By whom? The State

C.1. Examples of advice from different lawyers' websites

"On Feb. 8, 2006, under the guise of "Medicaid Reform", President George W. Bush signed into law the Deficit Reduction Act of 2005. The federal law, purportedly aimed at reducing Medicaid fraud, severely restricts Medicaid eligibility for the elderly and disabled by drastically changing the Medicaid asset transfer laws. The new law, which is expected to save less than the cost of one week of the war in Iraq, will severely impact the most vulnerable of our population and creates a minefield for the unwary practitioner. [. . .] The DRA and the related New York State Administrative Directive (06 ADM-5) severely restrict asset protection planning opportunities and create a very difficult environment in which to counsel clients. Elder Law attorneys have to be more creative than ever in devising plans and strategies to protect assets, such as caregiver contracts and personal care services

agreements, heretofore seldom employed[1]*."*

"[. . .] At Sykes Elder Law, we make it simple to determine if using an attorney for Medicaid planning makes sense in your case. When you first call, you will speak to someone who is trained to ask you the right questions to find out if it makes sense to come in for an appointment. We make appointments only for those clients who appear to be good candidates for benefitting from our expertise. If we believe you would not benefit, we tell you; if we believe you would benefit, we recommend an appointment with a certified elder law attorney. It costs just $385 (at the time of this writing) to have an attorney meet with you, review your circumstances in detail, and make recommendations on how to proceed. Some clients receive great benefit (mentally and financially) from just that one meeting. In many cases, though, clients decide to hire us to help them design and implement a Medicaid qualification and asset protection plan because they have discovered how much more they will save and protect by having professional help[2]*."*

They are many others.

[1]Website visited on 14/08/2018 : http://www.genserlaw.com/content/medicaid-reform-and-deficit-reduction-act-2005-what-attorneys-need-know

[2]Website visited on 01/04/2018: https://www.elderlawofpgh.com/2015/07/05/why-use-an-elder-law-attorney-to-help-you-qualify-for-medicaid/

C.2. Examples of penalties' calculation methodology (Miller and Roepke, 2016)

Example 1:

"Jodi applies for Medicaid on August 1, 2015. She would have been eligible for long-term care services except that she quit claim deeded her home to her son on May 1, 2015. The home was worth $100,000. To calculate the length of the penalty period, divide $100,000 by the private nursing home rate of $7,396; $100,000/$7,396 = 13.52 months. To calculate the number of days she is not eligible, multiply the remainder by 30 days; 30 x .52 = 15 days. Jodi would not be eligible for Medicaid for 13 months, 15 days. The penalty period begins running August 1, 2015, which is the date Jodi would have been eligible for Medicaid."

Example 2:

"Jim gave $4,000 as a gift to his son on May 15, 2015. He applied for Medicaid on June 23, 2015 and would have been eligible as of that date except for the asset transfer. The daily private pay rate in Idaho is $244 per day. Therefore, $4,000/ $244 = 16 days of ineligibility. The penalty period for Jim begins June 1, 2015. Thus, his application for Medicaid can be approved beginning on June 16, 2015."

Example 3:

"Janie applies for Medicaid on June 20, 2015. It has been determined that she transferred a CD worth $50,000 to her daughter on December 15, 2014. She also transferred another CD worth $25,000 to her son on March 31, 2015. Regarding the first transfer; $50,000/ $7,396 = 6.76 months; 30 days x .76 = 22 days. The 6 month, 22

day penalty period for this asset transfer begins June 1, 2015, the date she should have been eligible for Medicaid. Regarding the second transfer; $25,000/ $7,396 = 3.38 months; 30 days x .38 = 11 days. The 3 month, 11 day penalty will begin as soon as the 6 month, 22 day penalty ends."

C.3. Self-reported access to Medicaid (unbalanced panel)

	(1)		(2)		(3)		(4)	
Transfer in t	-0.046***	(0.002)	-0.040***	(0.002)	-0.038***	(0.002)	-0.017***	(0.002)
Man	ref.		ref.		ref.		ref.	
Woman	0.032***	(0.006)	0.026***	(0.005)	0.022***	(0.006)	0.018**	(0.007)
Couple	-0.080***	(0.005)	-0.057***	(0.005)	-0.063***	(0.005)	-0.054***	(0.007)
Age	-0.000***	(0.000)	-0.002***	(0.000)	-0.002***	(0.000)	-0.002***	(0.000)
Education	-0.019***	(0.001)	-0.015***	(0.001)	-0.015***	(0.001)	-0.016***	(0.001)
Children (#)	0.010***	(0.001)	0.009***	(0.001)	0.010***	(0.001)	0.011***	(0.001)
Environment & Health								
Help fr. children			0.112***	(0.007)	0.094***	(0.008)	0.084***	(0.010)
Health Index			-0.122***	(0.006)	-0.142***	(0.007)	-0.118***	(0.009)
NH Living			0.160***	(0.018)	0.257***	(0.039)	0.210***	(0.055)
Shocks								
Unem. Rate					0.009***	(0.000)	0.006***	(0.001)
Health shock					0.001	(0.004)	0.001	(0.005)
NH shock					-0.123***	(0.041)	-0.060	(0.057)
Marital shock					-0.061***	(0.005)	-0.057***	(0.006)
Previous Transfers								
Transfer in t-2							-0.017***	(0.002)
Transfer in t-4							-0.018***	(0.002)
Transfer in t-6							-0.016***	(0.002)
N	147170		132675		106693		58220	
R^2	0.126		0.140		0.148		0.144	

Robust standard errors in parentheses (clustered at HH level); $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

C.4. Eligibility and self-reported access to Medicaid (balanced panel)

	Eligibility				Medicaid			
	(1) LPM		(2) FE		(3) LPM		(4) FE	
Transfer in t	-0.067***	(0.004)	-0.023***	(0.003)	-0.032***	(0.002)	-0.004**	(0.002)
Man	ref.		ref.		ref.		ref.	
Woman	0.061***	(0.013)	0.041***	(0.010)	0.020**	(0.009)	-0.004	(0.007)
Couple	-0.096***	(0.012)	0.005	(0.009)	-0.051***	(0.008)	-0.022***	(0.006)
Age	-0.004***	(0.000)	0.001***	(0.000)	-0.001***	(0.000)	0.003***	(0.000)
Education	-0.029***	(0.001)	-		-0.015***	(0.001)	-	
Children (#)	0.014***	(0.002)	-0.007***	(0.002)	0.010***	(0.001)	0.002	(0.001)
Environment & Health								
Help fr. children	0.143***	(0.014)	0.031***	(0.007)	0.111***	(0.013)	0.012***	(0.005)
Health Index	-0.234***	(0.013)	-0.014*	(0.008)	-0.119***	(0.010)	0.003	(0.005)
NH Living	0.223***	(0.068)	0.209***	(0.036)	0.217***	(0.074)	0.260***	(0.025)
Shocks								
Unem. Rate	0.014***	(0.001)	0.005***	(0.001)	0.007***	(0.001)	-0.000	(0.001)
Health shock	0.024***	(0.007)	0.005	(0.005)	0.007	(0.005)	0.001	(0.003)
NH shock	-0.009	(0.071)	-0.045	(0.040)	-0.063	(0.078)	-0.108***	(0.027)
Marital shock	-0.101***	(0.009)	-0.030***	(0.007)	-0.055***	(0.007)	-0.016***	(0.004)
N	60618		60618		60346		60346	
R^2	0.205		0.033		0.144		0.024	

Robust standard errors in parentheses (clustered at HH level for (1) and (3)); * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

C.5. Reform impact on the amount of financial transfers to children

	(1)		(2)		(3)		(4)	
Treat	-1931.4***	(300.7)	-1050.3***	(311.3)	-1139.1*	(611.3)	266.9	(652.5)
Post	803.8*	(436.6)	611.5	(444.8)	2359.0***	(790.5)	1771.9**	(799.9)
Treat * Post	331.9	(534.0)	-257.1	(582.7)	-141.7	(1068.2)	-999.2	(1200.4)
Man	ref.		ref.		ref.		ref.	
Woman			-1158.9**	(460.3)			-1559.3	(952.4)
Couple			460.8	(472.9)			1234.3	(940.6)
Education			843.3***	(56.9)			1416.2***	(127.8)
Children (#)			1.3	(57.4)			-162.0	(133.8)
Environment & Health								
Help fr. children			1688.9***	(455.5)			3674.4***	(1413.8)
Health Index			2673.0***	(502.5)			4644.8***	(1232.9)
Unem. Rate			-21.5	(94.7)			-22.7	(202.4)
NH Living Dummy	No		Yes		No		Yes	
Year Dummies	No		No		No		No	
N	28281		25627		12523		11406	
R^2	0.003		0.032		0.002		0.033	

Robust standard errors in parentheses (clustered at HH level); * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

C.6. Parallel trends for treat and control groups? About amount of transfers

Control/ Treat		1998	2000	2002	2004	2006	2008	2010	2012
50/54	*Mean if transfer*	9151	8694	9347	11996	11950	12789	12528	13613
60/64		7421	8641	9153	10375	10906	11208	11784	9244
50/54	*Median if transfer*	4000	3750	4000	4500	4000	5500	4500	4500
60/64		3000	3000	3000	3300	4000	3800	3800	3100
50/54	*Mean*	4844	4671	4420	6827	6344	6386	5997	6042
60/64		2797	3276	3392	4276	4627	4738	4938	3514
No health shock	*Mean if transfer*	8350	9519	11018	9829	11662	11575	12180	11507
Health shock		6061	12207	10274	9726	8372	10413	10961	8818
No health shock	*Median if transfer*	3000	3000	3450	3200	4000	4000	4000	4000
Health shock		2000	3000	3600	3000	3000	3000	3500	3000
No health shock	*Mean*	3039	3612	3908	3633	4643	4351	4609	4184
Health shock		1740	3925	3171	3089	2821	2968	3381	2695
No move to NH	*Mean if transfer*	8191	9575	10934	9834	11503	11477	12015	11345
Move to NH		9796	28408	15352	7896	5050	16282	19331	13996
No move to NH	*Median if transfer*	3000	3000	3500	3100	4000	3800	4000	4000
Move to NH		4250	4000	3000	2000	2350	4500	4000	3000
No move to NH	*Mean*	2953	3614	3860	3619	4543	4565	4500	4102
Move to NH		1726	5226	2906	1527	842	2687	4277	2551
No Marital shock	*Mean if transfer*	8085	9491	10947	9656	11436	11488	11621	11366
Marital shock		10678	14442	11421	14544	13172	12032	21403	11302
No Marital shock	*Median if transfer*	3000	3000	3500	3200	4000	3800	4000	4000
Marital shock		3000	3000	4000	3000	5000	4000	5000	3500
No Marital shock	*Mean*	2894	3548	3850	3540	4520	4250	4326	4092
Marital shock		3730	5929	3864	4994	5027	4092	7840	3922

C.7. Reform impact on financial transfers to children (balanced panel)

	(1)		(2)		(3)	
Treat	-0.099***	(0.014)	-919.290***	(323.0)	77.6	(624.5)
Post	-0.103*	(0.053)	1274.3	(1708.7)	3682.8	(3432.3)
Treat * Post	0.068**	(0.033)	-1118.4	(1224.6)	-3387.9	(2443.4)
Man	ref.		ref.		ref.	
Woman	-0.121***	(0.027)	-1196.2**	(574.5)	-1213.3	(1130.1)
Couple	-0.068***	(0.025)	236.5	(565.2)	1355.2	(1045.3)
Education	0.034***	(0.002)	758.2***	(71.9)	1277.7***	(161.9)
Children (#)	0.001	(0.003)	88.1	(83.4)	67.8	(194.9)
Environment & Health						
Help fr. children	-0.034	(0.027)	1809.8***	(660.5)	5081.1**	(2364.9)
Health Index	0.108***	(0.024)	2541.6***	(536.4)	4838.8***	(1322.6)
Unem. Rate	0.006	(0.008)	142.8	(201.4)	168.6	(419.0)
NH Living Dummy	Yes		Yes		Yes	
Year Dummies	Yes		Yes		Yes	
N	14820		14820		6457	
R^2	0.063		0.032		0.037	

Robust standard errors in parentheses (clustered at HH level); * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: (1) LPM: extensive margin, (2) and (3) OLS: intensive margin

C.8. Reform impact on probability of financial transfers to children (50-57 vs. 60-67)

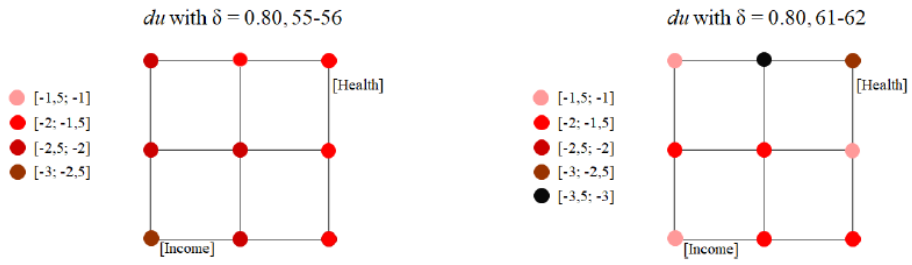
	(1)		(2)		(3)		(4)	
Treat	-0.133***	(0.008)	-0.103***	(0.008)	-0.102***	(0.008)	-0.099***	(0.008)
Post	-0.023**	(0.010)	-0.024**	(0.010)	-0.026**	(0.010)	-0.073**	(0.029)
Treat * Post	0.044***	(0.013)	0.024*	(0.012)	0.025**	(0.013)	0.030**	(0.013)
Man	ref.		ref.		ref.		ref.	
Woman			-0.096***	(0.015)	-0.093***	(0.015)	-0.092***	(0.015)
Couple			-0.014	(0.014)	-0.028**	(0.014)	-0.027*	(0.014)
Education			0.037***	(0.001)	0.036***	(0.001)	0.036***	(0.001)
Children (#)			-0.002	(0.002)	-0.001	(0.002)	-0.000	(0.002)
Environment & Health								
Help fr. children					-0.009	(0.015)	-0.008	(0.015)
Health Index					0.111***	(0.014)	0.113***	(0.015)
NH Living					-0.198***	(0.061)	-0.191***	(0.061)
Unem. Rate					-0.003	(0.002)	0.007	(0.005)
Year Dummies	No		No		No		Yes	
N	49597		48837		44982		44982	
R^2	0.013		0.073		0.076		0.077	

Robust standard errors in parentheses (clustered at HH level); * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix D

By whom? The Market

D.1: Differences of current utilities for 55-56 vs. 61-62, $\delta = 0.80$



D.2: Differences of continuation values for 61-62, $\delta = 0.80$, by gender and level of education (dz)