Essays on Long-Term Care

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To my grannies, Conxa and Isabel.
They are who really taught my what Long-Term Care needs is.

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Abstract

This thesis analyses the effects of expanding public Long-Term Care (LTC) benefits in Spain, using three different approaches. In the first chapter, I estimate the impact of public LTC allowances on the mortality of the beneficiaries. My results suggest that providing care prevents a deterioration in health, such that death is postponed when the level of needs is low or moderate. In the second chapter –with García-Gómez, López-Casasnovas and Vidiella-Martin–, we assess the equity of the access of public LTC. We show that the system is particularly inequitable regarding the form of provision of benefits. This translates into a pro-poor concentration of longer waiting time to access care. Finally, in the last chapter –with López-Casasnovas and Nicodemo–, we investigate the unintended consequences of a non-linear scheme of benefits. We identify that around 3% of the claimants are upgraded to the next level of benefits, increasing the cost for the system. Instead, the proposed linear system of benefits could make the system more egalitarian and minimise the unintended incentives.

Resum

Aquesta tesi analitza els efectes de l'expansió de les prestacions públiques en dependència a l'estat espanyol, des de tres perspectives diferents. En el primer capítol, estimo l'impacte de les prestacions públiques en la mortalitat dels beneficiaris. Els resultats suggereixen que la provisió d'atenció prevé el deteriorament de la salut, fins al punt de posposar la mort quan el nivell de dependència és baix o moderat. En el segon capítol –amb García-Gómez, López-Casasnovas i Vidiella-Martin–, avaluem l'equitat en l'accés als diversos serveis públics per a l'atenció a la dependència. Mostrem que el sistema públic de dependència és especialment inequitatiu en la forma de provisió de beneficis. Això es tradueix en major concentració entre els més pobres del temps d'espera per accedir als recursos públics. Al darrer capítol –amb López-Casasnovas i Nicodemo–, investiguem les conseqüències inintencionades d'un sistema de beneficis no lineal. Identifiquem que entorn el 3% de la gent que sol·licita les prestacions són classificats en nivells de necessitat per sobre dels que els pertoca, fet que incrementa el cost del sistema. És per això, que proposem un sistema lineal de prestacions, que esdevingui més igualitari i minimitzi els incentius perversos.

Preface

Long-Term Care (LTC) embraces all the permanent assistance needed to perform activities of daily living (ADL) required by people with a reduced functional capacity, regardless of its cause. LTC needs have traditionally been handled within the family. However, ageing, socioeconomic trends, and epidemiological transitions have consolidated demand for professional care. This sector accounts for 1.7% of GDP in OECD countries and is expected to double or even triple by 2050. Given this scenario and the rising awareness of the risk of catastrophic LTC expenses, governments in western countries have taken responsibility. Indeed, the welfare states in the majority of western countries have designed public LTC policies to the extent that two-thirds of all LTC expenditure is now public. Yet, the evaluation of this type of intervention is scarce.

This doctoral thesis aims to bridge this gap in the literature. In particular, I shed light on this policy evaluation by analysing three aspects, leading to three research projects (presented as separate chapters herein). In the first chapter, I ask whether LTC allowances affect beneficiaries:

> Long-Term Care (LTC) policies aim to improve the lives of those individuals who have lost their autonomy in activities of daily living and lessen the financial burden they bear. In OECD countries, 50% of adults aged 65 and over are, to some extent, limited in performing daily activities. Indeed, 20% of over 65s are severely limited. This fact translates into an average LTC expenditure of 1.7% of GDP in OECD countries. Yet, little evidence has shed light on the effects of LTC policies on the beneficiaries. This study analyses the effect of public LTC benefits on mortality. The allocation of benefits is based on the level of LTC needs, which are assessed by examiners follow-

> ing official guidelines. To estimate the causal effect of LTC benefits on mortality, I exploit the quasi-random assignment of examiners to LTC applicants in Spain. Given the variation in examiners' leniency (i.e. the tendency to grant greater benefits), applicants assigned to more lenient examiners are more prone to get access to a higher degree of benefits. The estimates based on Spanish LTC beneficiaries (2008-2014) indicate that access to greater benefits can be effective at extending beneficiaries' lives. When the level of LTC needs is moderate, such care is particularly effective at postponing death, as it prevents or delays the impairments worsening. While policymakers tend to prioritise the provision of LTC to individuals with high needs, these findings emphasise the provision of LTC to those at the initial stages of LTC needs.

In the second chapter, with Pilar García-Gómez, Guillem López-Casasnovas, and Joaquim Vidiella-Martin, I test whether the policy succeeds in allocating LTC resources irrespective of the socioeconomic status of the user:

> New public policies targeting the elderly are designed under the proportional universalism criterion (i.e. on a needs basis). Whether these interventions succeed in allocating public resources irrespective of the socioeconomic status of the beneficiary is still unknown. We shed light on this by focusing on Long-Term Care (LTC). We use administrative data from the universe of applicants for LTC public benefits in the north-east Spanish region of Catalonia from 2011 to 2014. These data are unique in two distinct ways in that they include detailed information on both the objective measures of LTC needs and socioeconomic status and the individuals receiving care at home and in nursing homes. Moreover, the time period covers the two years before and after the reform of the system (July 2012) impelled by the fiscal austerity caused by the crisis. Our findings suggest that the system is inequitable, as the types of care services are distributed differently across socioeconomic groups based on criteria other than relative need. In particular, the cash benefits provided to cover informal care costs are pro-rich distributed, especially in the years after

> the reform, while the use of nursing homes is concentrated among the worse-off. Additionally, we identify inequity in the form of provision: while inkind provision is concentrated among the worse-off, the better-off are more likely to receive a voucher to partly subsidise LTC expenses from their preferred provider. This duality in turn leads to further inequity: the worse-off experience the largest waiting times given the capacity constraints of public providers.

In the third chapter, with Catia Nicodemo and Guillem López-Casasnovas, we study the unintended consequences of a scheme used to allocate LTC benefits:

> This study examines the unintended strategic effects of non-linear incentives in public policies. In particular, a system of allowances structured by brackets may lead to opportunism or gaming. We provide new evidence of this by focusing on the strategic action taken by healthcare providers. We show that they upgrade claimants in needs assessments, which enables the latter to access larger allowances. Healthcare providers themselves do not extract any monetary return from this action. By using a natural experimental setting, namely the Spanish long-term care (LTC) system, we show that LTC benefit claimants tend to accumulate after the thresholds. These bunches reveal that healthcare providers exhibit prosocial behaviour, helping claimants jump to a higher degree of benefits without discriminating by health status, residence, or sex. By developing a new estimator, we prove that these adjustments lead to a welfare loss. The additional cost per adjusted claimant is 1000 euro annually on average. We finally propose an alternative continuous system to allocate LTC benefits that could reduce excessive prosocial behaviour of healthcare providers by eliminating the discontinuity in benefits.

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Chapter 1

THE EFFECTS OF LONG-TERM CARE BENEFITS ON MORTALITY

1.1 Introduction

In OECD countries, 50% of adults aged 65 and over –who represent 15% of the population– are to some extent limited in basic and instrumental activities of daily living (ADL) (OECD, 2015).[1] Indeed, 20% of them are severely limited. These needs create demand for Long-Term Care (LTC), which translates into a LTC expenditure of 1.7% of GDP in OECD countries (OECD, 2015). To the extent that two-thirds of this expenditure is publicly financed in Europe, the public role in LTC cannot be ignored.[2] Governments have promoted public LTC systems with a twofold objective. First, interventions aim to ensure that people with LTC needs live longer and with higher quality. Second, policies are meant to protect this segment of the population and their families against catastrophic LTC costs. With these two aims in mind, this study focuses on the former by estimating the causal effects of publicly subsidised LTC on beneficiaries' mortality.

[1] Basic ADL include functional mobility, bathing, dressing, self-feeding, and personal and toilet hygiene. Instrumental ADL include housework, preparing meals, managing money, taking prescribed medicine, transportation within the community, and using the telephone.

[2] European Commission (2016) reports that total (public) LTC expenditure represents 1.6% (1%) of GDP.

Despite the large expenditure on LTC, which is growing at 4% annually in OECD countries, the value of each euro allocated to such care is unknown. Furthermore, LTC demand is expected to soar as the following three trends suggest. First, *ageing* has increased the population at the highest risk of LTC needs, namely the elderly. Second, *socioeconomic changes* have raised the opportunity cost of families' caregiving, mainly because women's labour market participation has reduced the number of wives and daughters available to provide care. Moreover, families have become more vertical, which implies a decline in the total number of potential caregivers. Third, *epidemiological transitions* have also increased the number of potential individuals with LTC needs as well as enlarged the period in which they may require LTC. Yet, the contemporary fiscal austerity has obliged governments to curb public LTC spending.

Considering these facts, measuring the effectiveness of LTC policies is urgent. Still, estimating the causal effect of LTC policies on beneficiaries is difficult because of data limitations, which affect the research design in two ways. First, selection threatens identification. That is, the elderly who receive larger allowances are more likely to experience more severe impairments than those who do not. Thus, these groups cannot directly be compared. Second, information on relevant outcomes is often scarce. These challenges explain the limited evidence on the causal effects of LTC policies.

This study sheds light on the effects of publicly subsidised LTC on beneficiaries' mortality by using data on $124,895$ LTC beneficiaries in Spain. To deal with the selection problem, I exploit the quasi-random assignment of benefits' claimants to LTC needs examiners, who differ in their leniency (i.e. their tendency to grant access to greater benefits). I then construct examiner leniency by using a leave-out mean, a residualised measure based on all other assessments in which the examiner grants greater benefits. This leniency measure is highly predictive of the amount of benefits, but uncorrelated with claimants' observable characteristics. This approach therefore allows me to isolate the exogenous variation in claimants' benefits and thus estimate the causal effect of LTC benefits by using an instrumental variable technique.

Another strength of this framework is presence of the Spanish LTC register, an administrative dataset that contains, apart from sociodemographic and LTC characteristics, an outcome variable, namely mortality. By using this extreme outcome, aside from testing the longevity goal, I can also proxy for beneficiaries' wellbeing. Steptoe et al. (2015), among others, document that longer survival is positively associated with wellbeing. Indeed, life expectancy and mortality are suggested to be valid measures of quality of life.[3]

An estimate based on instrumental variables focuses on the variation in benefits among marginal claimants. However, aside from being those more likely to be affected by a policy change, another advantage of this framework is that allows a comprehensive analysis: the local average treatment effect (LATE) is estimated at three points of the needs distribution (low, moderate, and high). The Spanish LTC system establishes three categories or degrees[4] of benefits depending on the severity of LTC needs. To classify claimants into these degrees, examiners assess their needs by using official guidelines. The assessment is then summarised in a continuous score, ranging from 0 to 100 (with 100 being the highest level of needs). Claimants that score between 0 and 24 points are ineligible for public benefits. The rest of the scores provide applicants with access to one degree of benefits as follows: from 25 to 49, Degree I; from 50 to 74, Degree II; and from 75 to 100, Degree III. Thus, I define three cutoff points (the first at 25, the second at 50, and the third at 75) to study the effects of public benefits at different levels of the needs distribution.

The results at cutoff 1 (25 points) allow me to examine the effect of being eligible for LTC, as I compare the ineligible population with Degree-I claimants. When the level of LTC needs is low, access to public benefits reduces the probability of dying within three years (after application) by 7 percentage points. The results at cutoff 2 (50 points) capture the effect of being eligible for higher bene-

[3]For instance, see Becker et al. (2005) and Maslow (1943).

[4]To be consistent with the literature from Spain in LTC, I use the word degree to describe the categories.

fits when the level of needs is moderate. I find that being classified into Degree II reduces this probability by 13 percentage points. Finally, for individuals with the highest level of needs, the cutoff 3 (75) estimate indicates that greater benefits do not reduce the probability of dying within three years significantly. These results are robust to different time windows (for the probability of death or the probability of reaching a certain age).

While the estimate at cutoff 2 captures the effect of benefits (because all eligible candidates receive a benefit), at cutoff 1 this is simply an *intention to treat* because only 20% of Degree-I claimants receive benefits owing to policy design and reforms.[5] Thus, the expected estimate at cutoff 1 with a fully implemented Degree I is greater than the current effect of cutoff 2. These findings highlight the importance of early intervention for individuals with LTC needs. To explain the preventive value of LTC (mechanisms), I also test for heterogeneous effects, expecting larger effects for the groups that could obtain larger gains. For instance, widows and single recipients could benefit more than married couples because they have less chance of receiving unpaid (and complementary) informal caregiving; similarly, the lowest-income group, who has fewer resources to pay private care, should experience larger gains. I find that not only do these groups have larger effects, but so also do those suffering from health conditions requiring specific care. In sum, the evidence shows that LTC postpones death by enhancing living conditions (e.g. nutrition and hygiene levels), ensuring medical treatment adherence, and providing (safe) mobility. On the contrary, I find no evidence that the type of care chosen matters. However, the lack of significant results for beneficiaries with the highest needs does not imply that the policy is ineffective for this group. Thus, future research should assess other quality of life measures not captured by mortality. Finally, I also analyse all claimants who received benefits before the reform in July 2012, which reduced the benefit amount. The estimated effects for this subsample are stronger (for some cutoffs, they double). This finding implies that not only does receiving benefits matter (extensive margin), but so also does the benefit amount (intensive margin).

[5]See Section 1.2 for more details.

This research contributes to the strand of the literature on the effects of LTC policies. Although Bauer and Sousa-Poza (2015) find that the absence of professional LTC is associated with a family caregiver with a lower level of employment, a lower quality of psychological health, and worse physical health, evidence on the effects of LTC benefits on beneficiaries is limited. Studies of the effects of LTC on recipients in the United Kingdom find a positive association between such care and their quality of life.[6]However, they focus on local interventions (which implement one type of care) and cannot overcome the selection issue. Carslon et al. (2007) and Rapp et al. (2015) identify the positive effects of LTC on beneficiaries through experiments. Although the randomisation of their experiments does address the selection problem, external validity is limited as their research is based on small interventions.[7]The two studies closest to the present work have taken a broader perspective by examining the effects of an LTC system. Barnay and Juin (2016), following an instrumental variable approach, explore the effect of care on beneficiaries' mental health in France, using self-reported survey outcomes. Kim and Lim (2015) examine the effect of the South Korean LTC system by exploiting the discontinuity in its eligibility criterion. These authors find that eligibility affects the take-up of formal care and reduces the intensity of informal care, which in turn reduces medical expenses. Yet, their approach does not address the direct outcomes of beneficiaries, as they measure medical utilisation at the aggregate level.

Methodologically, the instrument used in this study belongs to the growing literature that relies on judge or examiner leniency. The majority of these studies

[6]Van Leeuwen et al. (2014) and Netten et al. (2012) find positive associations between better home accessibility (or adaptation) and nursing home ratings, respectively, with the quality of life of individuals with LTC needs, by using the ASCOT scale to measure individuals' subjective wellbeing. Forder et al. (2014), using survey data, study the effects of home care on the quality of life of people with LTC needs (also using ASCOT questionnaires). Although these studies rely on a specific measure of quality of life, they draw on municipal and small interventions focused on one type of care.

[7]Carlson et al. (2007) exploit a randomised control trial in the provision of *home care* benefits, concluding that a cash provision increases life satisfaction and other quality of life-related measures compared with an inkind provision. By using the PLASA study, Rapp et al. (2015) find that recipients of LTC subsidies have a significantly lower rate of emergency care. Despite the accuracy of the outcome data, however, the external validity of the PLASA intervention has not been proven.

have focused on the effects of the judicial system on criminal and labour outcomes.[8] Among these, the most related studies are French and Song (2014) and Dalh et al. (2014), as they explore the effects of disability benefits on labour market outcomes and intergenerational cultural transmission, respectively. Outside the judicial context, Sampat and Williams (2015) estimate the effects of patents on follow-on scientific research and product development by exploiting the differential leniency of patents' examiners.

These findings are relevant for policymakers in the sense that western countries must reform their current policies given the demographic projections and other expectations. The European Commission (2016) estimates that the share of the population aged 65 or more will climb from 18% to 28% by 2060, while the proportion of over 80s –the cohort at the highest risk of LTC needs– will more than double (from 5% to 12%), becoming as numerous as the younger population (aged 0–14). In addition, *ageing* will threaten the sustainability of LTC policies, as the old-age dependency ratio is expected to reach 50% by 2060. Thus, quantifying the effect of LTC provides insights into the ways in which to allocate public resources more efficiently.

1.2 LTC in Spain: The LTC Act

In December 2006, the Spanish government passed the Act on the *Promotion of Personal Autonomy and Care of Dependent People (Act 39/2006)*, henceforth termed the LTC Act. This Act enabled the establishment of a universal LTC system, as it covers all losses of autonomy regardless of the cause (age, illness, or disability). Before this Act, public provision to meet LTC needs was restricted to poor people without family support who depended on municipal resources. Thus,

[8] Aizer and Doyle (2015) exploit judges' leniency in the juvenile crime context. This distinction allows them to find the exogenous sources of variation in the probability of incarceration as well as its long-run effects (e.g. adults' salaries and future crime). Doyle (2007) uses the rate at which abused children are sent to shelter homes to determine their effects on such children's educational outcomes. Bhuller et al. (2016) and Dobbie et al. (2016) examine judges' leniency in incarceration and pre-trial detention, respectively, on recidivism and employment.

meeting LTC needs remained the responsibility of the family (i.e. informal caregiving).

While the LTC policy is established at the national level, it is implemented at the regional level.[9] The system is funded by public administrations and users.[10] Despite this universal availability, eligibility for LTC benefits depends on a needs assessment conducted by examiners with medical or social services backgrounds. These examiners, organised in local teams, follow official guidelines (Barem de Valoració de la Dependència) to evaluate the degree to which individuals' limitations affect their autonomy in performing ADL.[11] The outcome of the needs assessment is a score that ranges from 0 to 100 (100 represents the highest LTC needs). The regional government then assigns the claimant to an LTC needs degree as follows:

- Scores from 0 to 24: the claimant is ineligible for public LTC benefits.
- Scores from 25 to 49: the claimant has LTC needs of Degree I.
- Scores from 50 to 74: the claimant has LTC needs of Degree II.
- Scores from 75 to 100: the claimant has LTC needs of Degree III.

Degrees I–III provide access to a menu of LTC benefits including tele-assistance (TA), home care (HC), day-care centres(DCC), nursing homes(NH), and subsidies for an informal caregiver (IC).[12] The main difference between *degrees* is the intensity of the benefit, which increases with needs. Thus, there is a discontinuous jump in the amount of benefits by degrees, as shown in Table 1.1, which reports the average monthly benefit by type of care and degree. As this table shows, the average monthly allowance in *Degree I* is 163 euros, in *Degree II* is 412 euros,

[9]The Spanish territory is organised into 17 autonomous communities.

[10]National and regional governments finance LTC expenditure at the same rate; users' funding is made through copayments. Furthermore, for certain types of allowances such as tele-assistance and at-home professional assistance, local authorities also contribute funding.

[11]The official guidelines are regulated in the Royal Decree 504/2007. This scale considers 47 tasks grouped into 10 activities. For more details, see Pena-Longobardo et al. (2016).

[12]Benefits can be directly provided by the government (service provision) or a voucher is made available for the patient to choose a service from selected public providers. The one exception is the use of an informal caregiver, which is compensated by a cash transfer.

and in *Degree III* is 695 euros.

Figure 1.1 summarises the multistep process, which starts with the submission of a personal information form and a medical diagnosis form signed by the GP. The needs assessment is conducted within the degree procedure, which finishes when the regional government issues an statement to notify the claimant the assigned degree. If the claimant becomes eligible for LTC benefits, he or she can choose from the options available in the *degree* to which he or she has been classified, and his or her level of cost-sharing will depend on his or her financial capabilities. This takes place during the programme for individual assistance procedure at the municipal level. Figure 1.2 provides the timeline of this process. Although claimants suffer an average five-month delay before receiving their benefits, they are entitled to receive ex-post compensation. If claimants' health status deteriorates, they can ask for a reassessment.[13] In addition, claimants can change the type of benefit within those available in their assigned *Degree*. However, 78% of beneficiaries stick to the first benefit chosen.

In December 2015, more than a million-and-a-half individuals applied for LTC benefits in Spain. Among these, 55% were 80 years old or over, representing 31% of this 80+ cohort.[14] Of all assessed claimants (93%), 78% are eligible for LTC benefits: 23% in *Degree III*, 30% in *Degree II*, and 25% in *Degree I*. Further, 65% of those eligible have already started receiving benefits.

1.2.1 Assignment of LTC Benefit Claimants to Examiners

In this study, I focus on the region of Catalonia, which houses 16% of the Spanish population and 17% of LTC benefit claimants. Catalonia has 21 local teams in charge of LTC needs assessments, all coordinated by the social services department. These teams comprise nurses, physiotherapists, psychologists, and social workers, typically women in their 40s working under civil servant conditions with

[13] One-quarter (27%) of claimants apply for a reassessment. In this study, I ignore the reassessment outcomes and focus on the first assessment.

[14] Altogether, 3.45% of the Spanish population claim LTC benefits. Of these, 75% are 65 years or over, which implies that 14% of the elderly in Spain have claimed LTC benefits.

a fixed salary. The manager of the local team distributes assessments on a rotational basis based on the date a case is received.[15] Thus, this needs assignment provides a quasi-random variation conditional on the team because claimants are assigned to assessment teams by using the postal code of their residence.

On average, an examiner makes 400 assessments every year. This number varies slightly as assessing in rural areas takes additional commuting time, which reduces the number of daily assessments. The number of examiners in each team ranges from four to 15, and a representative team is formed by eight examiners. There is no specialisation of examiners by type of impairment (functional or cognitive), age, municipality, or other characteristics. Each assessment follows the official guidelines explained earlier. The use of an agreed scale ensures all examiners value the same limitations against the given criteria. In addition, when an examiner marks a limitation, he or she must state the relevant medical diagnosis of the claimant (registered in the NHS records). In other words, if the examiner selects mobility limitations, the claimant must have a mobility-related disease diagnosed and therefore recorded in NHS medical records. Although these features restrict examiners' subjective evaluations, they can still exercise some discretion, adjusting the score by one or two points. Therefore, a key element of this framework is not only that examiners are quasi-randomly assigned, but also that they differ in their propensity to grant higher benefits (or their propensity to adjust LTC needs' scores). This setting allows me to exploit within-team variation in examiner leniency.

Different from judges' decisions that imply multiple treatments (such as the type and duration of the sentence) (Dobbie et al., 2016), examiners' decisions are unlikely to yield multiple treatments, as they do not affect the type of benefit, offer any medical advice, or provide any other sort of information. They only meet the claimant during the hour of the assessment and do not communicate the assessment outcome to him or her. Thus, there is limited scope to influence the

[15]The exception is the LTC needs assessment of children, which can only be conducted by one member of the team with special training. Hence, these cases are not included in this analysis, which focuses on the elderly.

outcome variable (mortality) other than through the channel of granting higher benefits.

1.3 Empirical Strategy and Data

1.3.1 Identification Strategy

This study estimates the causal effects of LTC eligibility on beneficiaries' mortality. An ordinary least squares (OLS) estimation would be biased as the elderly granted higher allowances are more likely to experience more severe impairments than those not and therefore a higher probability of death. To overcome this selection issue, it could be thought that the scheme of benefits provides the ingredients for a regression discontinuity approach: a continuous LTC needs measure (running variable) linked to a discontinuous menu of benefits.[16]

Hernandez-Pizarro et al. (2015) find that the score distribution is not smooth, but rather presents notches around the cutoff points. Figure 1.5 depicts these scores: implementation leads to a manipulation of the running variable (LTC scores) around the cutoff points. However, I can precisely address the selection exploiting this manipulation. As already described, some examiners are systematically more lenient than others. This, combined with the quasi-random assignment of claimants to examiners, allows me to suppose there is an exogenous source of variation in the probability of being granted higher benefits. Therefore, I define an instrumental variable model with a two-equation system:

$$A_{i,c} = \delta Z_{j(i,c)} + \alpha X_{i,c} + \epsilon_i \quad (1.1)$$

$$y_{i,c} = \beta A_{i,c} + \alpha X_{i,c} + u_{i,c} \quad (1.2)$$

where $y_{i,c}$ is the outcome variable (mortality), and $A_{i,c}$ takes 1 if individual i is *Above* cutoff c (i.e. in Degree I at cutoff 1, Degree II at cutoff 2, and Degree III at cutoff 3). $Z_{j(i,c)}$ is examiner j's leniency to which individual i at cutoff c is

[16] This scheme of benefits is not exclusive to Spain; indeed, other European countries have discontinuous degrees of benefits, such as France, Germany, and the Netherlands.

assigned (see the next subsection for the details of the instrument). $X_{i,c}$ is a vector of the (individual) control variables including age, marital status, labour disability acknowledgment, annual income, healthcare diagnosis before the assessment, and time-by-territory fixed effects. $u_{i,c}$ is the error term.

I perform a two-stage least squares (2SLS), with equation (1) as the first stage and equation (2) as the second stage, to estimate the causal effect of LTC benefits. As the system defines three degrees (or menus) of benefits, the three corresponding cutoff points allow us to estimate the benefit's effects at *low, moderate, and high* levels of the needs distribution. Hence, at the first cutoff (25th score), I can identify the effect of having access to LTC benefits when needs are low (ineligible vs. Degree I claimants). Similarly, the existence of the second and third cutoffs (50th and 75th scores) enables me to isolate the effect of a jump in benefits when the level of needs is moderate and high, respectively. On average, Degree-II claimants receive 152% higher benefits than those at Degree I (cutoff 2) and Degree-III claimants receive 68% higher benefits than those at Degree II (cutoff 3). Thus, the 2SLS estimated parameter at cutoff 1 is the average β among claimants classified as Degree I because they were assigned to a more lenient examiner. As only 20% of the individuals in Degree I received the benefits, this estimate could be interpreted as the *'local' intention to treat effect*. This parameter thus captures the effect of early applicants who received the benefit and applicants who reapply to upgrade the degree among these claimants.[17] At cutoffs 2 and 3, the estimated parameter is the LATE, namely the average β among claimants classified as Degree II and Degree III, respectively, because of examiner leniency. As all the claimants included in these regressions received LTC, the estimated parameter is the average effect of such benefits (which also includes any change in benefits and reapplications to upgrade the degree).[18][19] Additionally, I present the estimates of the reduced form of the effect of examiner leniency on beneficiaries'

[17] I may also capture the effect of 'labelling'. As Degree-I claimants are classified as individuals with LTC needs, the claimant or his or her family could also react and provide any type of care to replace the absence of public resources.

[18] Although claimants could still be waiting for benefits in Degrees II and III, the definition of the dependent variable (i.e. probability of death during the first three years) directly excludes all individuals still waiting (those who applied in 2015).

[19] Around 36% of the sample reapply for benefits.

mortality, regressing y on z and x.

1.3.2 Instrumental Variable Calculation

I construct the instrument by using a residualised leave-out examiner leniency measure following Dahl et al. (2014). The leave-out mean is based on the *Above* rate of each examiner at each cutoff. It is important to exclude the outcome of the needs assessment of individual i on examiner leniency, because otherwise it would introduce the same estimation errors on the left- and right-hand sides, producing biased estimates:

$$AR_{i,j,c} = \frac{1}{n_{j,c} - 1} \sum_{k \neq i}^{n_{j,c}-1} A_{k,j,c} \tag{1.3}$$

where AR, the *Above* rate, represents the leave-out mean for individual i examined by j at cutoff c; $n_{j,c}$ are all the assessments carried out by examiner j at cutoff c; k indexes the assessment of examiner j; and A equals 1 if the individual is classified *Above* (i.e. at cutoff 2, A takes 1 if the claimant is in Degree II).

Based on the information of 114 examiners, generating a simple leave-out mean of examiner leniency would be biased as the randomisation takes place at the local level. Furthermore, the LTC Act planned a gradual implementation of benefits, which supposes changes over time. I deal with these factors by defining the instrument ($Z_{i,j,c}$) as the residuals from an OLS equation in which the examiner leniency leave-out mean is regressed on the year-by-local team fixed effects. Thus, the within-cell variation set in the residuals can be interpreted as the propensity to grant higher degree benefits. This approach controls for any differences in the characteristics of claimants and leniency of examiners over time or across territories.

Figures 1.7a-c show the distribution of examiner leniency for cutoffs 1, 2, and 3, respectively. The background in the figures represents the histogram of examiner leniency. At cutoff 2, for instance, the mean is 0, the standard deviation is 0.06, and its distribution ranges from -0.26 to 0.24. The solid lines in the figures represent the first stage, which is the local linear regression of examiner leniency on *Above*, while the dashed lines represent the 95% confidence interval. This plot from a local regression is the flexible analogue of the first-stage regression. The likelihood of being granted higher benefits is shown to be monotonically increasing in examiner leniency and close to linear.

1.3.3 Data

The presented analysis is based on individual administrative data provided by the Catalan government. This micro-level dataset is directly drawn from the Secretary of Social Inclusion and the Promotion for Personal Autonomy (SISPAP).[20] This dataset consists of the records of all individuals who applied for LTC allowances between 2008 and 2015, although for this study I am only interested in the $452,635$ individuals aged 50 or over.[21]

The dataset includes information on applicants' sociodemographic characteristics (age, sex, place of residence, civil status, date of birth, and death), health status (the five main medical diagnoses causing the lack of autonomy based on the International Classification of Disease 9 code), whether the claimant has acknowledged a labour disability and its type, and a variable indicating whether the claimant has cognitive impairments affecting his or her daily decisions. It also includes the LTC process (score, information on the needs assessment, and the benefit such as the type of LTC service, amount of cash transfer or copayment, and period of usage). LTC records do not incorporate information on the examiner. I overcome this limitation by merging the LTC register with the assessment records of each assessment team. The match is accurate as I rely on the file or case code (unique for each applicant). As each assessment team has its own organisation, information for 15 of the 21 teams was available, representing $124,895$ observations that form the baseline sample. Tables 1.2a-c present the summary statistics

[20]Currently, owing to political changes, the SISPAP unit is called 'Direcció General de Protecció Socials (General Division of Social Protection)'

[21]The original dataset contains $501,823$ individuals. Hence, those aged 50 or over represent 90% of the original sample. I also focus only on the first benefits they received. In total, 64% of those individuals eligible for benefits take only one type benefit, while the remaining 36% make up reapplicants, largely because of a worsening health status.

for all the claimants in Catalonia and the restricted subsample for which I could identify the examiner. Although the mean differences for some of the observable variables are significant, the magnitude of these differences is small (three decimal places), which minimises the selection issue.

The mortality information included in the LTC register allows me to test one of the policy goals. Additionally, life expectancy and mortality are suggested as valid measures of quality of life.[22] Maynou et al. (2015) argue that mortality can be a summary measure of the availability of healthcare and social services, among other factors. Therefore, by looking at this extreme outcome, I can indirectly study another goal of the policy, namely enhancing quality of life. While quality of life improvements can postpone death, the absence of reductions in mortality does not necessarily imply that LTC benefits do not enhance quality of life. Hence, any decreases in mortality must result from the substantially large effects of LTC on beneficiaries' wellbeing. The *main* outcome variable takes 1 if an individual died within three years of his or her application for benefits and 0 otherwise. I also construct other measures with different time windows (two, four, and all years). Alternatively, I define another variable that takes 1 if an individual reaches 90 years and 0 otherwise.[23] Figure 1.6 illustrates the positive relation between the mortality rate and monthly average LTC benefits according to the LTC scores.

1.4 Results

1.4.1 Validity of the Instrument

Table 1.4 presents the first-stage regressions by cutoff. For each cutoff, I present three specifications: first, without the covariates and fixed effects (FE); second, with the fixed effects; and third, with the covariates and fixed effects as the 2SLS is specified. The significance and magnitude of the coefficients are almost identical in these three alternatives. Being assigned to a 10% more lenient examiner

[22]For instance, see Becker et al. (2005) and Maslow (1943).

[23]This variable takes a missing value if claimants are sufficiently young that reaching 90 years old within the time period is impossible.

increases the probability of being granted benefits of Degree I and Degree II by 7.8 percentage points and of Degree III by 7.3 percentage points. At cutoff 2, for instance, moving from the least to the most lenient examiner implies a 34 percentage point increase in the likelihood of being in Degree II. These estimates are highly consistent with previous research that uses a similar instrument based on judges' leniency (French and Song, 2014).

Table 1.4, together with the graphical evidence from the first stage (Figure 1.7), provides sufficient evidence of the relevance of the instrument. However, the internal validity of this approach also depends on the identification assumptions: conditional independence (random assignment), an exclusion restriction, and monotonicity. Despite the impossibility of testing these assumptions, I present some testable implications in favour of their plausibility.

First, Table 1.3 provides strong evidence of *random assignment*. Each row is the regression of that covariate on Above) and on examiner leniency. The joint significance test of the variables is reported at the end of the table. While the observable characteristics can predict the probability of being granted higher benefits (see Columns 1, 3, and 4), *random assignment* implies that examiner leniency cannot be predicted by using the observable characteristics (see Columns 2, 4, and 6). Of the 21 variables, only one is significant for cutoffs 1 and 3 and two variables are significant for cutoff 2. Despite their significance, these coefficients are close to zero. Moreover, when I replicate these regressions by year, the significance of these variables is inconsistent over time. Additionally, the inclusion of the covariates in the first-stage regression (Columns 3, 6, and 9 in Table 1.4) does not change the estimated parameters. Altogether, these results offer little evidence against the hypothesis of random assignment.

Second, random assignment is sufficient to interpret the causal effects of the reduced form (i.e. the effect on mortality of being assigned to a more lenient examiner). Interpreting the causal effects of the instrumental variable estimates (i.e. the effect on mortality of being granted higher benefits) also requires an *exclusion restriction*. In other words, the examiners cannot affect mortality by any other channel than the probability of receiving higher benefits. As explained in Section 1.2, they only meet the claimant during the one-hour assessment and never report the outcome. This minimal interaction between the claimant and examiner suggests that the exclusion restriction holds.

Third, if examiners differ only in terms of their degree of leniency and rank applicants similarly, then Imbens and Angrist's (1994) monotonicity assumption is satisfied. The monotonicity assumption implies that claimants classified *Above* by a less lenient examiner will always be classified *Above* by a more lenient examiner. One testable implication is that the first stages of the different subsamples estimate positive and significant coefficients of the instrument. Hence, I create different subsamples according to sex, age, civil status, disability status, and chronic conditions and find that their first-stage estimates are all positive and significant (see Table 1.B.1, in the Appendix). A second testable implication is that if an examiner is lenient with one group (e.g. low-income individuals), he or she would also be lenient with high-income individuals. I test that by using the reverse sample instrument. For example, for the married subsample, I use the rate at which higher benefits are granted from the assessments of all widowed and single individuals. By including the same (sub)groups mentioned before, I again find positive and significant coefficients when using the reverse sample instrument (see Table 1.B.1, in the Appendix).

1.4.2 Effects of LTC Benefits

Tables 1.5a-c show the main results for cutoffs 1, 2, and 3, respectively. In all the tables, Columns 1 and 2 show the OLS results for the whole sample with and without covariates, respectively. The estimated parameters indicate a positive relation between LTC benefits and mortality, as suggested in Figure 1.6. The estimates are similar to those in Column 3 where I add the result of the OLS for the baseline sample (the one with information on the instrument). The stability of these coefficients suggests that restricting the baseline sample does not result in an important selection issue (see Section 1.3). However, all these estimates are biased. Column 4 presents my preferred specification, the 2SLS, and Column 5 the reduced form.

Correcting for selection on the unobservables by using the instrument reverts the sign of the estimated coefficients. This finding proves that public LTC benefits are effective at postponing death.

The larger results when LTC needs are low and moderate (cutoffs 1 and 2) suggest that the early provision of care could serve as a preventive measure. Being eligible for benefits within *Degree II (I)* reduces the probability of dying in the three years after the application date by 13.4 (6.6) percentage points compared with being eligible to *Degree I* (being ineligible for public benefits). The reduction at cutoff 3 is not significant.[24] While the estimate at cutoff 2 captures the effect of the benefit (because most eligible applicants receive benefits), at cutoff 1 this is an *intention to treat* because only 20% of Degree-I claimants receive their benefits because of policy design and reforms (see Sections 1.2 and 1.3).[25] Thus, the expected estimate at cutoff 1 with a fully implemented Degree I should be greater than that at cutoff 2.

To explain the preventive value of LTC mechanisms, I test for heterogeneous effects, expecting larger effects for the groups that could obtain larger gains. According to physicians, LTC can prevent health deterioration in at least three ways: improving living standards (e.g. nutrition, hygiene), ensuring medical treatment adherence, and providing safe mobility. For instance, widows and single households should benefit more than married couples because they have less chance of receiving unpaid informal caregiving; similarly, the lowest-income group, which has the fewest resources to pay for private care, should experience larger gains. I find not only that these groups have larger effects (via the living standards channel), but that those suffering from health conditions do, too (see Table 1.6). On the one hand, for the group for which medical treatment adherence is essential

[24] Similarly, the effect of a 10% more lenient examiner reduces the probability by 0.5% percentage points in Degree I, 1.1% in Degree II, and 0.1% –but insignificantly– in Degree III.

[25] More than 80% of those eligible at Degree II and Degree III received the benefit. Fewer than 10% of those eligible die beforehand; hence, excluding these individuals from the analysis does not alter the estimated coefficients. Additionally, those who died above or below the cutoff point are not significantly different in terms of the observables. The rest are eligible individuals waiting for benefits (the latest claimants). These individuals are excluded given the nature of the dependent variable.

for survival, namely individuals with cardiovascular disease, the effects are larger. On the other hand, for individuals with mental illness, the medical treatment has negative side effects including a reduction in mobility that in turn increases the probability of a trombo-embolic shock (stroke). Indeed, the results for the mental illness subsample are larger than those for the non-mental illness one. LTC could thus mitigate that risk by ensuring safe movements and exercise.

Given the freedom in the choice of care, I test another possible channel: whether being *Above* affects the probability of choosing a particular care option because of the changes in the opportunity cost of each option by degrees. For instance, the voucher to access nursing homes is around 400 euros (per month) in Degree II and 800 euro in Degree III, whereas the cost of private nursing homes does not differ between degrees. Thus, a low-income claimant could be financially constrained if he or she is in Degree II, but not in Degree III. I therefore test whether the type of care chosen matters (see Table 1.C.1, in the Appendix), but the results are insignificant.

The lack of significant results for beneficiaries with the highest needs does not imply that the policy is ineffective for this group. LTC could improve beneficiaries' lives at cutoff 3 in aspects not captured by the mortality measure. My results suggest this to be the case. First, the 95% confidence interval for the main estimate at cutoff 3 (see Table 1.5c, Column 4), (-0.119, 0.031), is relatively large and skewed towards negative values. Second, using alternative measures of mortality and restricting to a given subsample, I identify a significant reduction in mortality at cutoff 3 (see the next subsection).

1.4.3 Robustness Checks

In this section, I provide additional evidence to support the main results. First, I test the sensitivity of the analysis when constructing the dependent variable with other time windows. Table 1.7 replicates the main specification by using other outcomes: the probability of death during the period (which increases the sample), the probability of death during the first two years (which at most implies the effect of one year of benefits, but still increases the sample), and the probability of death in the first four years (which increases the timespan at the expense of the sample size). Additionally, I construct a variable on the probability of reaching 90 years old for claimants that could achieve this age during the studied time period. All these results are consistent with the main ones. They also provide evidence of a modest but significant effect for cutoff 3: being eligible for benefits in Degree II reduces by 6 percentage points the probability of dying during the period.

Second, I test the effects of the benefits for the subsample unaffected by the 2012 reform (see Table 1.8). This exercise is interesting for many reasons. First, before the reform, each degree was split into two levels: the second level of each degree had slightly higher benefits. Thus, I replicate the analysis by using six cutoff points (25, 40, 50, 65, 75, 80, and 90), which offers a broader needs distribution. Second, the reform also reduced the amount of benefits (hours of care and voucher amounts). Third, given the application time of these subsamples, all the individuals included in these regressions received the benefits and the estimates capture the effect of the benefits, rather than of access. Fourth, cutoff 1 enables a "kind" placebo regression because the benefits for Degree-I claimants were never implemented. In other words, only the acknowledgement of LTC needs creates a difference between those of Degree-I claimants and the ineligible population. The estimated effect for cutoff 1 is insignificant (see Column 1), which may prove that receiving the benefits, rather than being eligible for them, is what matters. Additionally, this analysis shows significant effects for claimants with a high level of needs (Columns 5 and 6), suggesting that the benefits for this population are effective. Finally, the increase in the magnitudes of the effects (compared with Table 1.5) indicates that both receiving benefits (extensive margin) and the benefit amount (intensive margin) matter.

Third, I perform a duration analysis. To that end, I create a treatment and a control group by using examiner leniency. I assign to the treatment (control) group all individuals assessed by the 40% more (less) lenient examiners. I also create a second set of treatment and control groups with the 25% more and less lenient examiners, respectively. At first glance, the graphical and non-parametric evidence suggests that the 'treated' have a larger survival rate (see Figure 1.D.1, in the Appendix). The log-rank test for the equality of survivor functions rejects the null hypothesis at the 1% level. The parametric approach is also consistent (see Table 1.D.1, in the Appendix). Following a discrete duration model, I estimate that being 'treated' (i.e. being assigned to the 40% more lenient examiners) reduces the probability of death for all cutoffs.[26]

1.5 Conclusions

This study exploits the variation in leniency across the quasi-random assignment of LTC needs examiners to estimate the effect of publicly funded LTC benefits on mortality. I find that LTC is effective at extending beneficiaries' lives. On average, being eligible for more benefits reduces by 8 percentage points the probability of death throughout the study period. Based on simple back-of-the-envelope calculations, public LTC has postponed the death of 37,444 claimants.[27] By using a value of statistical life (VSL) of 2,892,379 euros, the gains can then be valued around 108,000 million euros.[28] Despite estimating the LATEs under the instrumental variable methodology, the Spanish LTC system further enables me to estimate the LATEs at different points of the needs distribution, which yields a more comprehensive analysis.

The findings highlight the importance of providing care in the initial stages of LTC needs as opposed to only focusing on the provision of LTC for those with the highest needs, something common in LTC policies. Indeed, LTC benefits for

[26]The hazard rate of mortality is negative and significant for the 'treated'.

[27]Of the 473,531 individuals in the whole sample, 249,586 were alive at the end of the period (52.7%). According to the average effects, namely the results of the weighted average of the effects at the different cutoffs, this would be 7.9% percentage points lower (44%) in the absence of LTC benefits, which means that 37,444 of the living individuals would have died in the absence of benefits.

[28]OECD (2012) estimates the VSL to be 4,131,970 euros, similar to Spanish estimates according to Martínez-Pérez et al. (2007). Research has also suggested that the VSL declines with age by between 25% and 50%. Assuming a 30% reduction based on the average values reported by Aldy and Visuci (2008) and Alberini et al. (2004), the VSL for the older population should be almost 3 million euros.

claimants with the lowest level of needs are usually reduced or removed during budgetary restrictions. Although further research on beneficiaries' wellbeing is necessary, these results support the preventive role of LTC. This effect is pursued by the Active Ageing movement promoted by the WHO.[29] In addition, the findings could also be extrapolated, with caution, to developing countries. Some countries in Latin America such as Uruguay and Argentina or Asia such as China have already started to face the ageing population and are urged to design their own LTC policies.

The fact that LTC benefits do not reduce the probability of death within three years does not imply that LTC benefits are not effective for people with a high level of LTC needs. Modest but significant effects are found when restricting the sample or changing the mortality measure. Claimants classified into Degree III have lost most of their autonomy and have a severely deteriorated health status, which makes it unlikely that changes in their quality of life translate into life expectancy gains. Future research should therefore explore less extreme outcomes to identify the effects for this group.

[29] The secondary prevention of LTC needs implies the identification of LTC in the early stages. Early detection can thus slow the causes of LTC needs. Hence, LTC interventions aim to improve quality of life and life expectancy, which are the main goals of Active Ageing according to the WHO.

Tables & Figures

Table 1.1: Monetary value of LTC monthly benefits

	(1) Informal Caregiver (IC)	(2) Nursing Homes (NH)	(3)	(4) Day Care Centre (DCC)	(5)	(6) Home Care (HC)	(7) TeleAssistance (TA)
type of benefit	*cash transfer*	*voucher*	*service*	*voucher*	*service*	*service*	*voucher*
Degree III	431	831	1870-c	409	853-c	537	
Degree II	303	494	1595-c	247	730-c	307	20-c
Degree I	168			171	597-c	211	

Notes: All amounts are in euros. For the benefits in *voucher* or *cash transfers* the reported amount is the average, as the amount depends on beneficiary's financial capability. For benefits of *public services*, the monthly value is defined as the public cost/price of the service minus the copayment (C), which depends on beneficiary's financial capability.

Figure 1.1: Spanish LTC application procedure

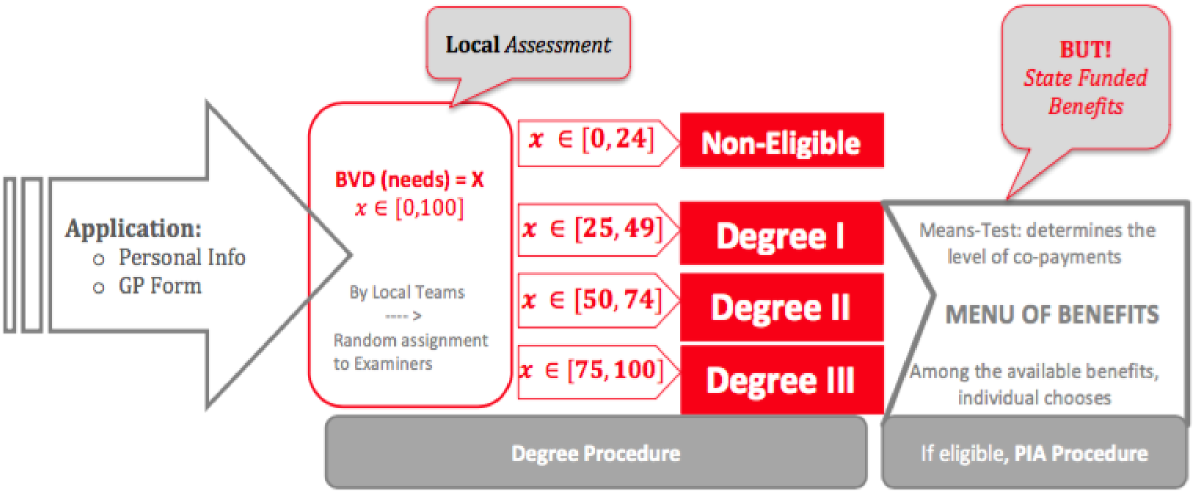


Figure 1.2: Spanish LTC system

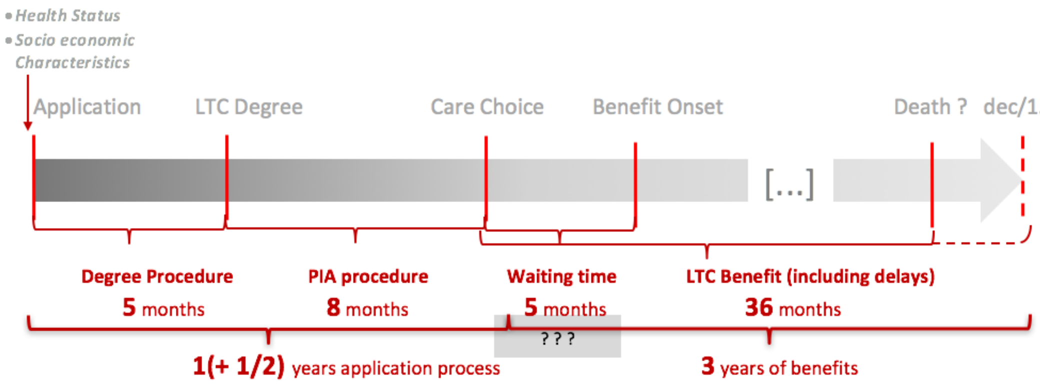
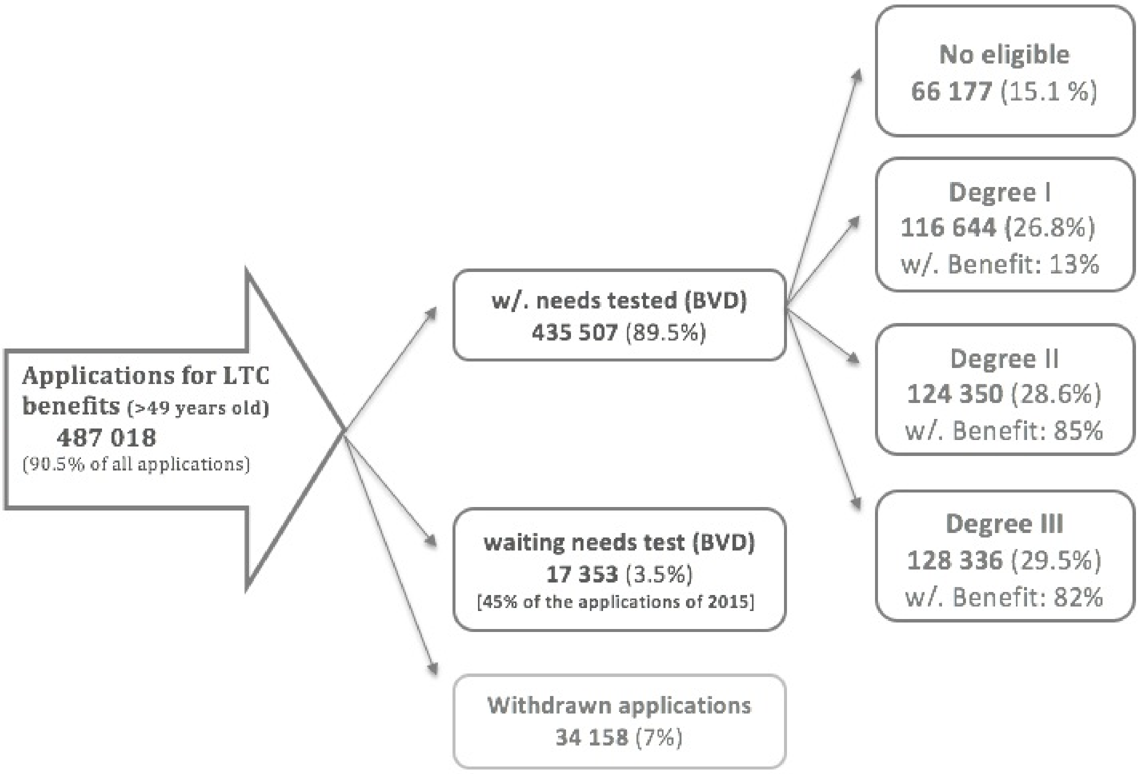


Figure 1.3: Catalan applications



Note: Sample consist of all applicants between June 2007 and December 2015.

Figure 1.4: Average monthly benefit by score

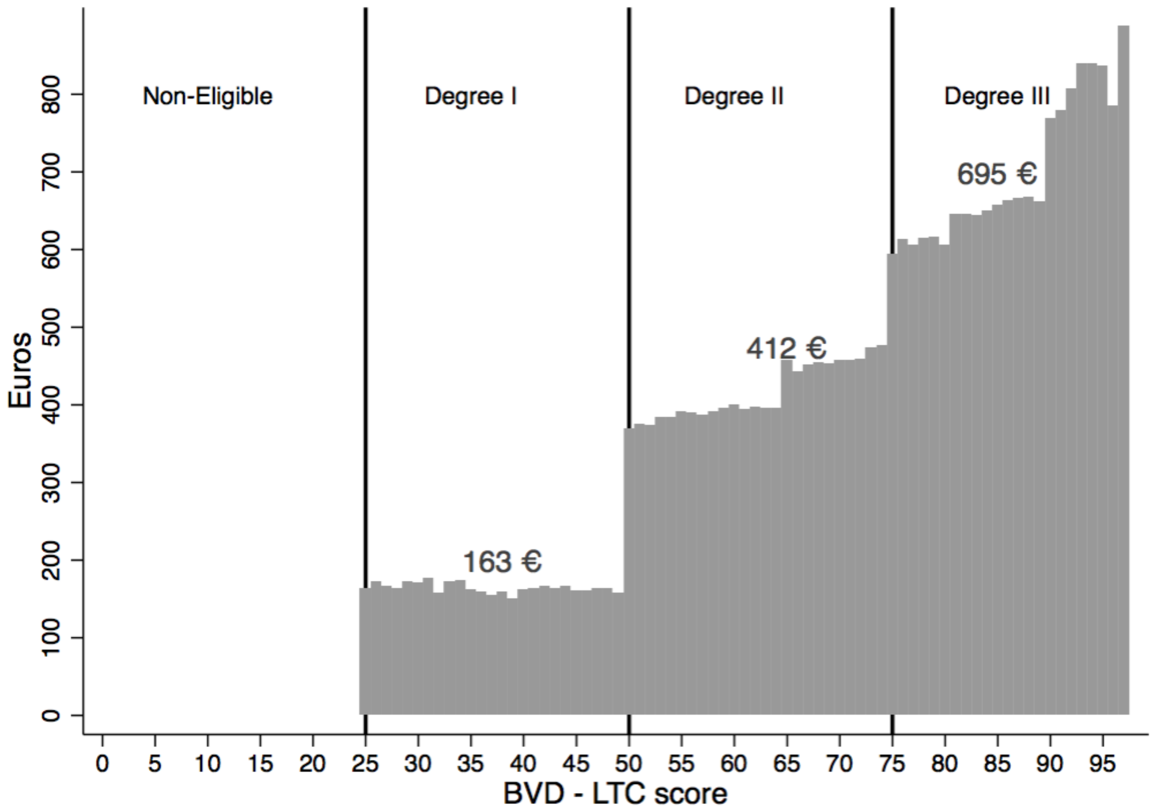


Table 1.2a: Descriptive Statistics at Cutoff 1

	(1)	(2)	(3)
	Excluded Sample mean (sd)	Baseline Sample mean (sd)	Means' Difference (se)
Demographics			
Female	0.662	0.655	0.007**
	(0.47)	(0.48)	(0.00)
Age	77.784	77.795	-0.011
	(9.49)	(9.43)	(0.05)
Married	0.432	0.439	-0.008**
	(0.50)	(0.50)	(0.00)
Widow	0.388	0.390	-0.001
	(0.49)	(0.49)	(0.00)
Disability			
Physical	0.217	0.210	0.008***
	(0.41)	(0.41)	(0.00)
Intellectual	0.023	0.024	-0.001
	(0.15)	(0.15)	(0.00)
Cognitive impaired	0.315	0.267	0.049***
	(0.46)	(0.44)	(0.00)
Ill-Health Conditions (ICD9)			
Circulatory	0.515	0.534	-0.019***
	(0.50)	(0.50)	(0.00)
Digestive	0.030	0.042	-0.012***
	(0.17)	(0.20)	(0.00)
Osteo-Articular	0.512	0.545	-0.033***
	(0.50)	(0.50)	(0.00)
Ear	0.030	0.041	-0.011***
	(0.17)	(0.20)	(0.00)
Eye	0.115	0.129	-0.014***
	(0.32)	(0.34)	(0.00)
Respiratory	0.220	0.226	-0.006**
	(0.41)	(0.42)	(0.00)
Nephro-Urology	0.282	0.274	0.008***
	(0.45)	(0.45)	(0.00)
Mental Disorder	0.260	0.266	-0.006**
	(0.44)	(0.44)	(0.00)
Endo-metabolic	0.391	0.384	0.007**
	(0.49)	(0.49)	(0.00)
Cancer	0.141	0.148	-0.007***
	(0.35)	(0.36)	(0.00)
Hematologic	0.010	0.017	-0.006***
	(0.10)	(0.13)	(0.00)
Demartological	0.001	0.002	-0.001***
	(0.03)	(0.05)	(0.00)
Income			
Annual Earnings	11423.319	11459.262	-35.943
	(6326.39)	(6383.00)	(58.37)
Missing Income	0.674	0.713	-0.039***
	(0.47)	(0.45)	(0.00)

Notes: The excluded sample contains 124 902 observations at cutoff. The baseline sample, restricted to the claimants with the examiner identifier, has 57 918 observations at cutoff 1 (see Section 3.3. for further details). Standard Deviations (cols. 1 & 2) and Standard Errors (col. 3) in parentheses.

*** indicates 1% significance, ** 5% and * 10%.

Table 1.2b: Descriptive Statistics at Cutoff 2

	(1)	(2)	(3)
	Excluded Sample mean (sd)	Baseline Sample mean (sd)	Means' Difference (se)
Demographics			
Female	0.661	0.660	0.001
	(0.47)	(0.47)	(0.00)
Age	79.001	79.133	-0.132**
	(9.64)	(9.51)	(0.04)
Married	0.412	0.422	-0.010***
	(0.49)	(0.49)	(0.00)
Widow	0.417	0.421	-0.004
	(0.49)	(0.49)	(0.00)
Disability			
Physical	0.175	0.174	0.001
	(0.38)	(0.38)	(0.00)
Intellectual	0.031	0.031	-0.000
	(0.17)	(0.17)	(0.00)
Cognitive impaired	0.480	0.438	0.042***
	(0.50)	(0.50)	(0.00)
Ill-Health Conditions (ICD9)			
Circulatory	0.498	0.516	-0.019***
	(0.50)	(0.50)	(0.00)
Digestive	0.025	0.036	-0.012***
	(0.16)	(0.19)	(0.00)
Osteo-Articular	0.462	0.498	-0.036***
	(0.50)	(0.50)	(0.00)
Ear	0.021	0.029	-0.008***
	(0.14)	(0.17)	(0.00)
Eye	0.104	0.114	-0.010***
	(0.31)	(0.32)	(0.00)
Respiratory	0.204	0.211	-0.007***
	(0.40)	(0.41)	(0.00)
Nephro-Urology	0.294	0.288	0.007**
	(0.46)	(0.45)	(0.00)
Mental Disorder	0.267	0.274	-0.007***
	(0.44)	(0.45)	(0.00)
Neurological	0.335	0.373	-0.039***
	(0.47)	(0.48)	(0.00)
Endo-metabolic	0.383	0.376	0.006**
	(0.49)	(0.48)	(0.00)
Cancer	0.130	0.140	-0.010***
	(0.34)	(0.35)	(0.00)
Hematologic	0.008	0.013	-0.005***
	(0.09)	(0.11)	(0.00)
Demartological	0.001	0.001	-0.001***
	(0.03)	(0.04)	(0.00)
Income			
Annual Earnings	11514.963	11427.525	87.439*
	(6454.67)	(6351.66)	(36.41)
Missing Income	0.408	0.380	0.028***
	(0.49)	(0.49)	(0.00)

Notes: The excluded sample contains 167 901 observations at cutoff. The baseline sample, restricted to the claimants with the examiner identifier, has 73 093 observations at cutoff 2 (see Section 3.3. for further details). Standard Deviations (cols. 1 & 2) and Standard Errors (col. 3) in parentheses.

*** indicates 1% significance, ** 5% and * 10%.

Table 1.2c: Descriptive Statistics at Cutoff 3

	(1)	(2)	(3)
	Excluded Sample mean (sd)	Baseline Sample mean (sd)	Means' Difference (se)
Demographics			
Female	0.663	0.658	0.005*
	(0.47)	(0.47)	(0.00)
Age	80.903	81.004	-0.100*
	(9.56)	(9.29)	(0.04)
Married	0.348	0.387	-0.039***
	(0.48)	(0.49)	(0.00)
Widow	0.438	0.462	-0.024***
	(0.50)	(0.50)	(0.00)
Disability			
Physical	0.106	0.117	-0.012***
	(0.31)	(0.32)	(0.00)
Intellectual	0.026	0.027	-0.001
	(0.16)	(0.16)	(0.00)
Cognitive impaired	0.664	0.639	0.025***
	(0.47)	(0.48)	(0.00)
Ill-Health Conditions (ICD9)			
Circulatory	0.470	0.483	-0.014***
	(0.50)	(0.50)	(0.00)
Digestive	0.021	0.033	-0.013***
	(0.14)	(0.18)	(0.00)
Osteo-Articular	0.391	0.426	-0.034***
	(0.49)	(0.49)	(0.00)
Ear	0.012	0.019	-0.007***
	(0.11)	(0.14)	(0.00)
Eye	0.089	0.099	-0.010***
	(0.28)	(0.30)	(0.00)
Respiratory	0.177	0.187	-0.010***
	(0.38)	(0.39)	(0.00)
Nephro-Urology	0.300	0.306	-0.007**
	(0.46)	(0.46)	(0.00)
Mental Disorder	0.247	0.257	-0.009***
	(0.43)	(0.44)	(0.00)
Neurological	0.502	0.543	-0.041***
	(0.50)	(0.50)	(0.00)
Endo-metabolic	0.359	0.350	0.009***
	(0.48)	(0.48)	(0.00)
Cancer	0.112	0.130	-0.018***
	(0.32)	(0.34)	(0.00)
Hematologic	0.005	0.009	-0.004***
	(0.07)	(0.10)	(0.00)
Demartological	0.001	0.001	-0.000*
	(0.03)	(0.03)	(0.00)
Income			
Annual Earnings	11691.779	11641.188	50.591
	(6654.16)	(6553.73)	(38.47)
Missing Income	0.521	0.337	0.185***
	(0.50)	(0.47)	(0.00)

Notes: The excluded sample contains 185 710 observations at cutoff. The baseline sample, restricted to the claimants with the examiner identifier, has 66 976 observations at cutoff 3 (see Section 3.3. for further details). Standard Deviations (cols. 1 & 2) and Standard Errors (col. 3) in parentheses.

*** indicates 1% significance, ** 5% and * 10%.

Figure 1.5: Scores' distribution in 2011

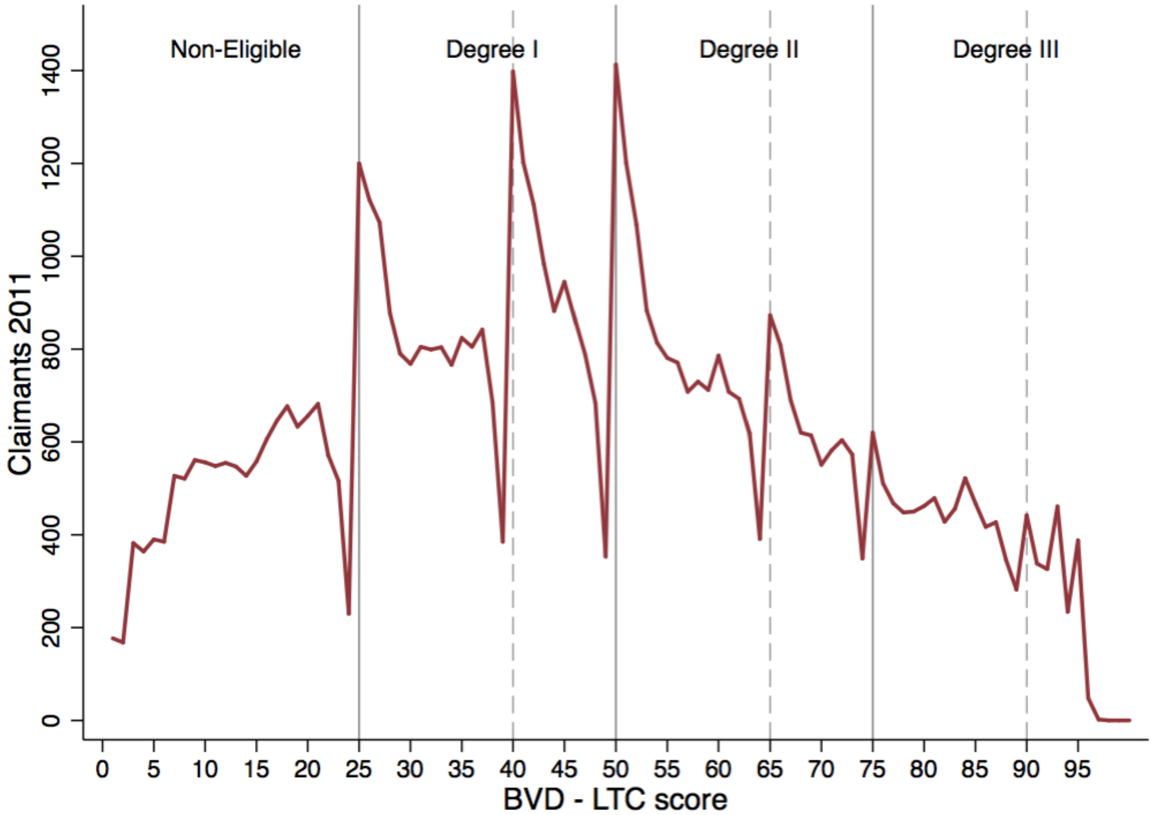


Figure 1.6: Average monthly benefit and mortality rate by score

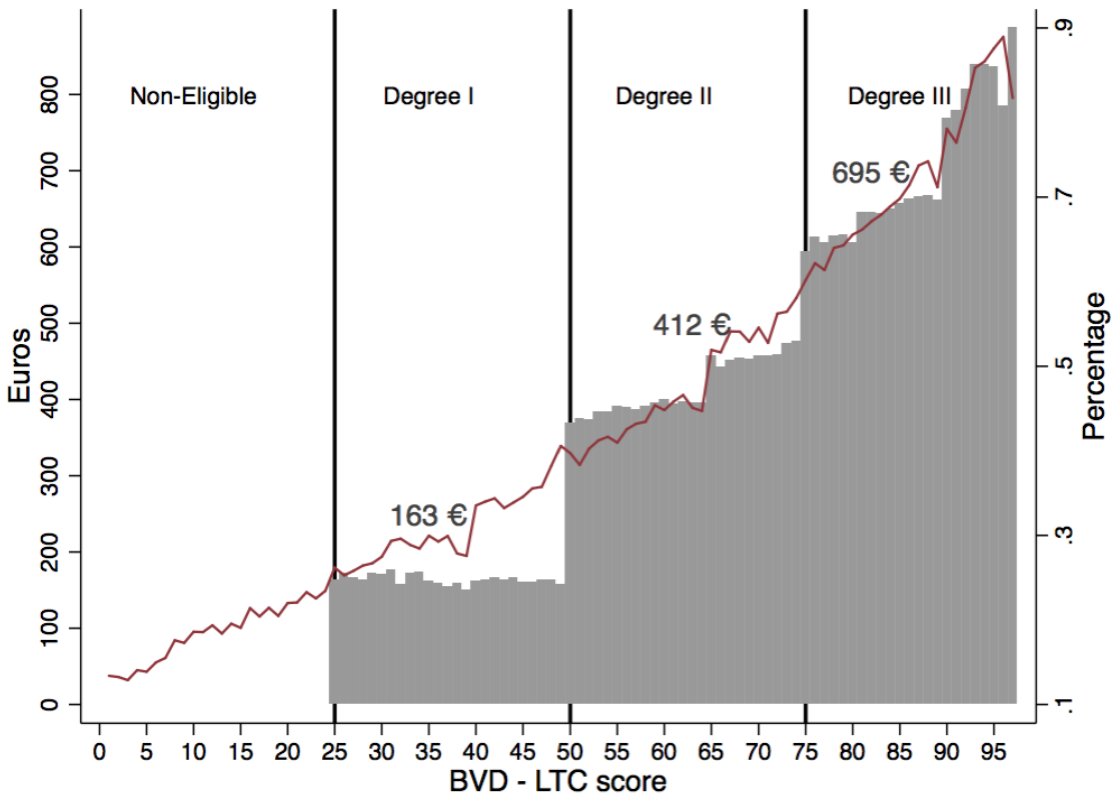


Figure 1.7a: Cutoff 1: Distribution of the examiner leniency measure and first stage

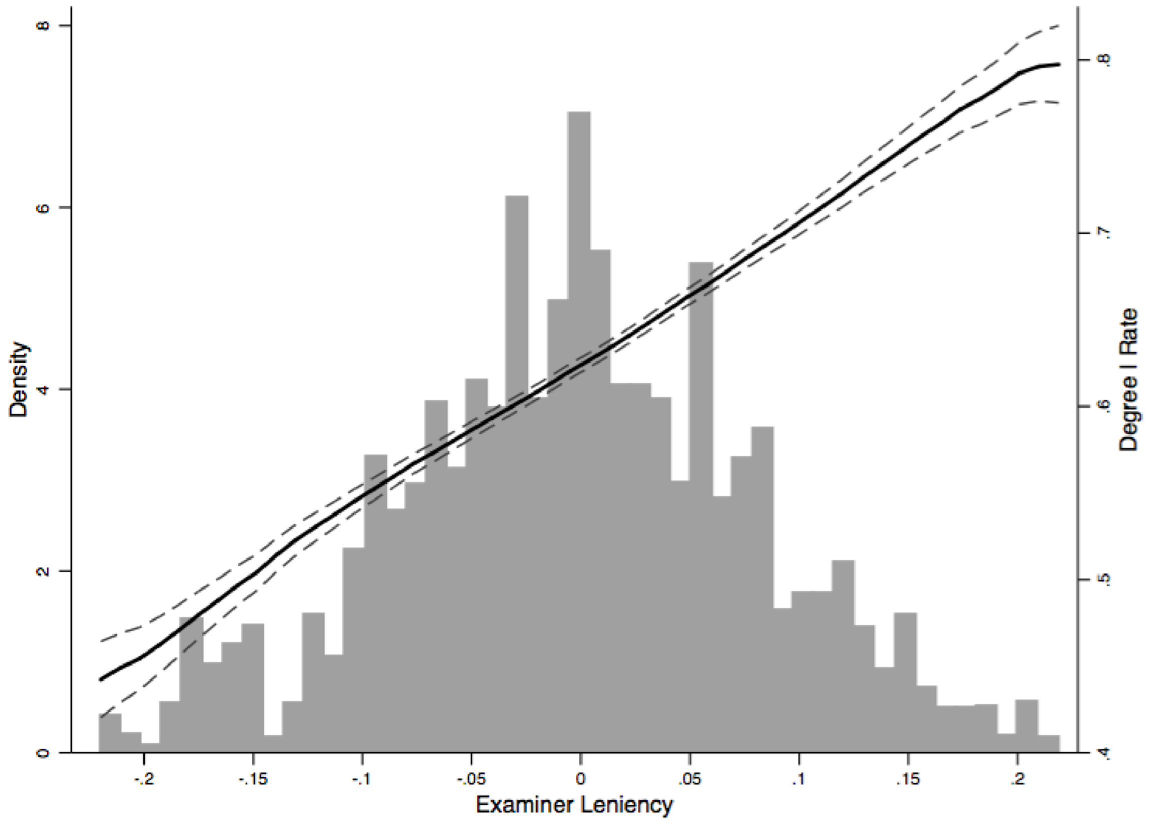


Figure 1.7b: Cutoff 2: Distribution of the examiner leniency measure and first stage

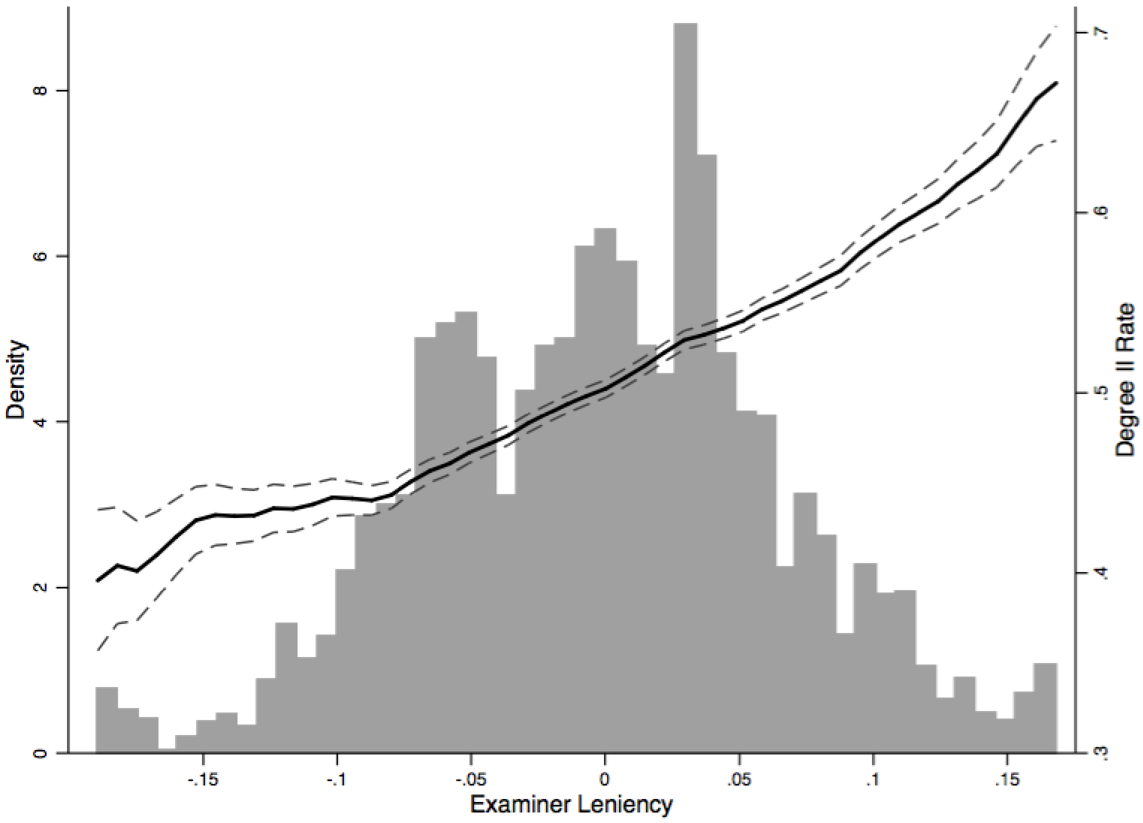


Figure 1.7c: Cutoff 3: Distribution of the examiner leniency measure and first stage

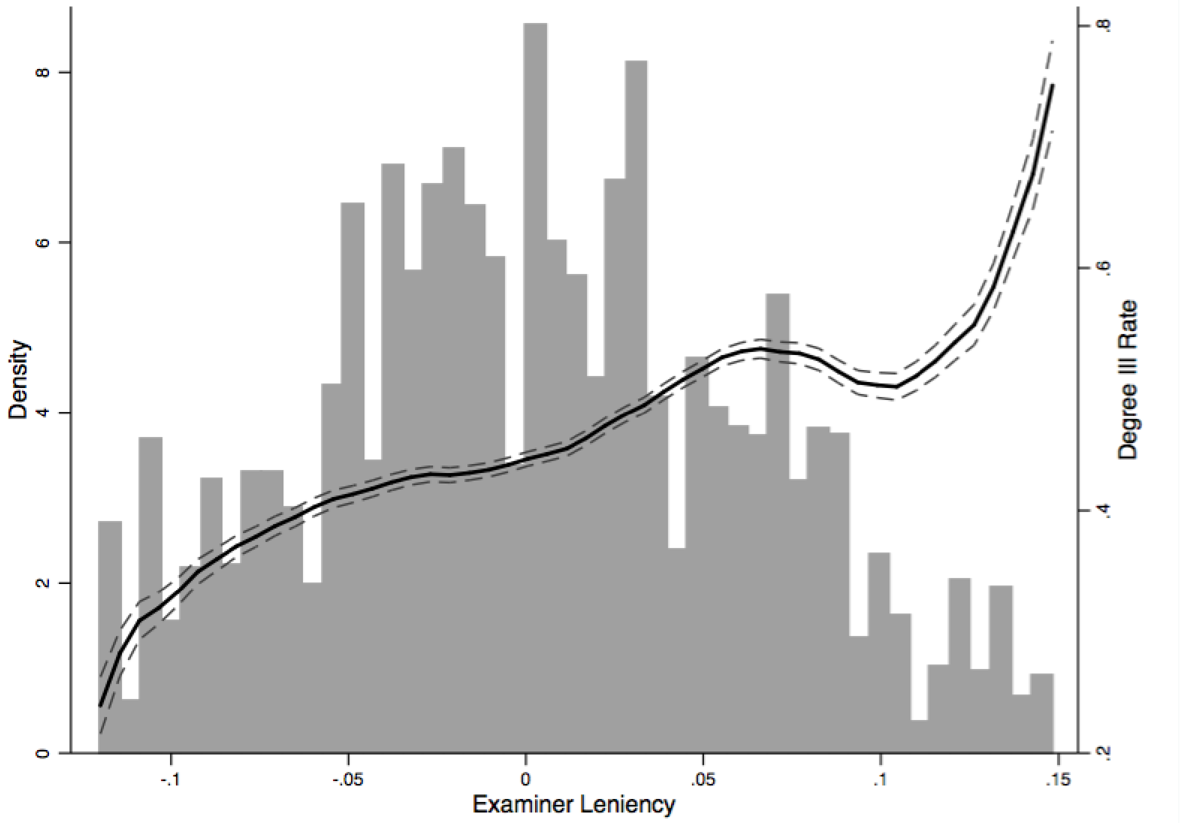


Table 1.3: Testing for Random Assignment of Claimants to Examiners

	Cutoff 1		Cutoff 2		Cutoff 3	
	(1)	(2)	(3)	(4)	(5)	(6)
	P(Degree I)	Examiner Leniency	P(Degree II)	Examiner Leniency	P(Degree III)	Examiner Leniency
Female	0.0355***	-0.0011	-0.0189***	0.0011	0.0162***	-0.0003
	(0.007)	(0.001)	(0.004)	(0.001)	(0.004)	(0.001)
Age	0.0038***	0.0000	0.0044***	-0.0001	0.0069***	-0.0000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Married	-0.0135**	0.0003	-0.0242***	-0.0007	-0.0570***	0.0005
	(0.006)	(0.001)	(0.004)	(0.001)	(0.005)	(0.001)
Widow	0.0434***	-0.0013	0.0287***	-0.0003	0.0604***	0.0001
	(0.006)	(0.001)	(0.004)	(0.001)	(0.005)	(0.001)
Physical	-0.0371***	0.0002	-0.0891***	0.0026	-0.1684***	0.0007
	(0.006)	(0.002)	(0.007)	(0.002)	(0.008)	(0.002)
Intellectual	0.1359***	0.0004	0.0270*	-0.0014	-0.1101***	-0.0028
	(0.016)	(0.003)	(0.014)	(0.002)	(0.018)	(0.004)
Cognitive impaired	0.2135***	0.0001	0.2185***	-0.0063**	0.2308***	-0.0008
	(0.012)	(0.006)	(0.011)	(0.003)	(0.016)	(0.002)
Circulatory	-0.0064	-0.0024	-0.0307***	-0.0022	-0.0395***	-0.0011
	(0.008)	(0.004)	(0.006)	(0.003)	(0.006)	(0.003)
Digestive	-0.0505***	-0.0023	-0.0367***	0.0020	-0.0135	0.0019
	(0.013)	(0.004)	(0.010)	(0.003)	(0.013)	(0.004)
Osteo-Articular	-0.0327***	0.0026	-0.0682***	0.0014	-0.0873***	0.0009
	(0.009)	(0.005)	(0.007)	(0.002)	(0.006)	(0.003)
Ear	-0.1159***	-0.0020	-0.0882***	0.0014	-0.1603***	0.0017
	(0.015)	(0.007)	(0.012)	(0.006)	(0.019)	(0.008)
Eye	-0.0419***	-0.0062	-0.0358***	0.0022	-0.0502***	0.0008
	(0.011)	(0.007)	(0.007)	(0.003)	(0.008)	(0.003)
Respiratory	-0.0158***	0.0007	-0.0311***	-0.0007	-0.0486***	0.0005
	(0.005)	(0.002)	(0.005)	(0.001)	(0.005)	(0.001)
Nephro-Urology	0.0068	-0.0008	0.0281***	-0.0019	0.0185***	-0.0009
	(0.005)	(0.002)	(0.005)	(0.002)	(0.006)	(0.002)
Mental Disorder	0.0213***	-0.0010	0.0030	-0.0023	-0.0508***	-0.0003
	(0.008)	(0.003)	(0.005)	(0.003)	(0.008)	(0.002)
Neurological	0.1604***	-0.0040	0.1706***	-0.0054**	0.2016***	-0.0000
	(0.009)	(0.005)	(0.009)	(0.003)	(0.010)	(0.004)
Endo-metabolic	-0.0009	0.0007	-0.0161***	0.0009	-0.0450***	-0.0003
	(0.006)	(0.003)	(0.005)	(0.002)	(0.005)	(0.002)
Cancer	-0.0260***	-0.0031	-0.0105*	-0.0004	-0.0382***	0.0038*
	(0.007)	(0.002)	(0.006)	(0.002)	(0.007)	(0.002)
Hematologic	-0.0444***	-0.0013	-0.0902***	-0.0032	-0.1116***	-0.0048
	(0.015)	(0.008)	(0.020)	(0.006)	(0.026)	(0.008)
Demartological	-0.0731	-0.0037	-0.1090***	-0.0025	0.0206	-0.0025
	(0.050)	(0.009)	(0.041)	(0.008)	(0.044)	(0.009)
Annual Income	0.0561***	0.0015***	0.0369***	0.0003	-0.0299***	-0.0003
	(0.001)	(0.001)	(0.002)	(0.000)	(0.001)	(0.001)
F-test	169.7	1.640	154	1.460	191	0.395
Prob F	0.000	0.0551	0.000	0.110	0.000	0.990
Observations	57,664		71,865		66,903	

Notes: Each column displays OLS estimates from separate regressions, where the claimant characteristic is regressed on being classified in the upper degree (cols. 1, 3 and 5) and examiner leniency (cols. 2, 4 and 6), by cutoffs. F-statistics are obtained from the OLS estimation on the combined set of all claimants characteristics (the omitted category is male, single, without disability and with ill-health conditions other than those listed). Ill-health conditions are based on ICD9 diagnostic codes. Specifications with time-by-territory fixed effects does not change the results.

Robust standard errors (in parentheses) are clustered at examiner level. There are 114 different examiners.

*** indicates 1% significance, ** 5% and * 10%.

Table 1.4: First Stage

	Cutoff 1			Cutoff 2			Cutoff 3		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	P (Degree I)			P(Degree II)			P(Degree III)		
Examiner Leniency	0.769***	0.769***	0.782***	0.672***	0.672***	0.781***	0.730***	0.730***	0.731***
	(0.081)	(0.035)	(0.031)	(0.069)	(0.047)	(0.049)	(0.136)	(0.036)	(0.034)
Covariates	No	No	Yes	No	No	Yes	No	No	Yes
Territory FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Territory x Year FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Observations	57,664	57,664	53,565	72,842	72,842	64,867	66,903	66,903	53,447
R-squared	0.020	0.048	0.112	0.009	0.046	0.120	0.013	0.094	0.152
Mean (sd) of dependent variable	0.62 (0.48)			0.51 (0.49)			0.45 (0.49)		

Notes: This Table reports first stage results, by cutoffs. The dependent variable is an indicator for being assigned to the upper degree in each cutoff (i.e. Degree I in cutoff 1, Degree II in cutoff 2 and Degree III in cutoff 3). Columns 1, 4 and 7 report results without controls. Columns 2, 5 and 8 include the full set of time-by-territory fixed effects (where region is based on examiners' teams). And Columns 3, 6 and 9 add controls: gender, age, civil status, disability status, whether the claimant has cognitive impairments, the ill-health conditions (based on ICD9 diagnosis groups) and annual income (except for the first cutoff, as this informations was not requested to non-eligible claimants).

Robust standard errors (in parentheses) are clustered at examiner level. There are 114 different examiners.

*** indicates 1% significance, ** 5% and * 10%.

Table 1.5a: Results: Cutoff 1

	All applications		Baseline Sample		
	(1)	(2)	(3)	(4)	(5)
	P(death during the first 3 years after application)				
	OLS	OLS	OLS	2SLS	Reduced Form (OLS)
Degree I	0.0734***	0.0818***	0.0780***	-0.0662**	
	(0.000)	(0.000)	(0.003)	(0.027)	
Examiner Leniency				0.8233***	-0.0545**
				(0.028)	(0.022)
Covariates	No	Yes	Yes	Yes	Yes
Territory FE	No	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes	Yes
Territory x Year FE	No	Yes	Yes	Yes	Yes
Observations	138,785	120,358	36,422	36,423	36,424
R-squared	0.009	0.107	0.108	0.076	0.099
F-Stat				895.32	
Mean Y	0.169			0.166	

Notes: This Table reports the effects of having access to LTC benefits (i.e. being classified in Degree I) on mortality for cutoff 1. First two columns show OLS results for all claimants between 2007-15, *with* and *without* FEs and controls. Columns 3 to 5 present different specifications with the baseline sample. Column 4 reports the preferred model: 2SLS (Examiner Leniency's estimate represents the first stage). Column 5 shows the reduced form. The covariates set includes gender, age, civil status, disability status, whether the claimant has cognitive impairments and the ill-health conditions (based on ICD9 diagnosis groups).

Robust standard errors (in parentheses) are clustered at examiner level (except in columns 1 and 2 where the lack of examiner's identifiers forces a higher level cluster: at team, using wild bootstraped standard errors). There are 114 different examiners.

*** indicates 1% significance, ** 5% and * 10%.

Table 1.5b: Results: Cutoff 2

	All applications		Baseline Sample		
	(1)	(2)	(3)	(4)	(5)
	P(death during the first 3 years after application)				
	OLS	OLS	OLS	2SLS	Reduced Form (OLS)
Degree II	0.0832***	0.0832***	0.0831***	-0.134***	
	(0.000)	(0.000)	(0.004)	(0.031)	
Examiner Leniency				0.8263***	-0.111***
				(0.029)	(0.025)
Covariates	No	Yes	Yes	Yes	Yes
Territory FE	No	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes	Yes
Territory x Year FE	No	Yes	Yes	Yes	Yes
Observations	194,313	157,098	47,412	47,412	47,412
R-squared	0.009	0.133	0.132	0.074	0.124
F-Stat				240.5	
Mean Y	0.239			0.237	

Notes: This Table reports the effects of having access to LTC benefits (i.e. being classified in Degree II) on mortality for cutoff 2. First two columns show OLS results for all claimants between 2007-15, *with* and *without* FEs and controls. Columns 3 to 5 present different specifications with the baseline sample. Column 4 reports the preferred model: 2SLS (Examiner Leniency's estimate represents the first stage). Column 5 shows the reduced form. The covariates set includes gender, age, civil status, disability status, whether the claimant has cognitive impairments, the ill-health conditions (based on ICD9 diagnosis groups) and annual income.

Robust standard errors (in parentheses) are clustered at examiner level (except in columns 1 and 2 where the lack of examiner's identifiers forces a higher level cluster: at team, using wild bootstraped standard errors). There are 114 different examiners.

*** indicates 1% significance, ** 5% and * 10%.

Table 1.5c: Results: Cutoff 3

	All applications		Baseline Sample		
	(1)	(2)	(3)	(4)	(5)
	P(death during the first 3 years after application)				
	OLS	OLS	OLS	2SLS	Reduced Form (OLS)
Degree III	0.194***	0.179***	0.180***	-0.0121	
	(0.000)	(0.000)	(0.006)	(0.031)	
Examiner Leniency				0.7619***	-0.00947
				(0.032)	(0.024)
Covariates	No	Yes	Yes	Yes	Yes
Territory FE	No	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes	Yes
Territory x Year FE	No	Yes	Yes	Yes	Yes
Observations	213,006	135,622	42,301	42,301	42,301
R-squared	0.040	0.162	0.170	0.137	0.141
F-Stat				360.8	
Mean Y	0.377		0.372		

Notes: This Table reports the effects of having access to LTC benefits (i.e. being classified in Degree III) on mortality for cutoff 3. First two columns show OLS results for all claimants between 2007-15, *with* and *without* FEs and controls. Columns 3 to 5 present different specifications with the baseline sample. Column 4 reports the preferred model: 2SLS (Examiner Leniency's estimate represents the first stage). Column 5 shows the reduced form. The covariates set includes gender, age, civil status, disability status, whether the claimant has cognitive impairments, the ill-health conditions (based on ICD9 diagnosis groups) and annual income.

Robust standard errors (in parentheses) are clustered at examiner level (except in columns 1 and 2 where the lack of examiner's identifiers forces a higher level cluster: at team, using wild bootstraped standard errors). There are 114 different examiners.

*** indicates 1% significance, ** 5% and * 10%.

Table 1.6: Heterogeneous Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	P(death during the first 3 years after application)							
Sample	Mental Disorders		Cardiovascular Disease		Married		Low Income	
	Yes	No	Yes	No	Yes	No	Yes	No
Panel A: Cutoff 1								
Degree I	-0.0936***	-0.0517	-0.0577*	-0.0860**	-0.0450	-0.0776**		
	(0.035)	(0.034)	(0.035)	(0.042)	(0.033)	(0.033)		
Observations	16,574	19,848	19,423	16,999	16,042	20,380		
Panel B: Cutoff 2								
Degree II	-0.168***	-0.103	-0.140***	-0.124***	-0.0976**	-0.154***	-0.216**	-0.0568
	(0.037)	(0.000)	(0.040)	(0.045)	(0.043)	(0.041)	(0.090)	(0.037)
Observations	27,784	19,628	24,560	22,852	19,951	27,461	9,457	22,721
Panel C: Cutoff 3								
Degree II	-0.00392	-0.0771	0.0219	-0.0439	0.0286	-0.0411	-0.0111	-0.0607
	(0.034)	(0.077)	(0.044)	(0.050)	(0.045)	(0.031)	(0.071)	(0.047)
Observations	31,874	10,427	20,471	21,830	16,390	25,911	9,335	21,213

Notes: This Table reports the (most preferred specification) 2SLS for different subsamples for different cutoffs. All regressions include controls and time-by-territory fixed effects. Low income subgroup includes all individuals earning less than 8000 euros annually. The covariates set includes gender, age, civil status, disability status, whether the claimant has cognitive impairments, the ill-health conditions (based on ICD9 diagnosis groups) and annual income (except for the first cutoff, as this informations was not requested to non-eligible claimants). The first-stage F-Tests are always significant.

Robust standard errors (in parentheses) are clustered at examiner level. There are 114 different examiners.

*** indicates 1% significance, ** 5% and * 10%.

Table 1.7: Alternative Dependent Variables

	(1)	(2)	(3)	(4)
	P(die)	P(die in 2 years)	P(die in 4 years)	P(reaching 90 years old)
Panel A: Cutoff 1				
Degree I	-0.0709***	-0.0399**	-0.0825***	0.0927*
	(0.027)	(0.017)	(0.031)	(0.049)
Observations	53,565	46,613	29,041	12,192
Panel B: Cutoff 2				
Degree II	-0.103***	-0.0904***	-0.151***	0.0674*
	(0.025)	(0.024)	(0.038)	(0.037)
Observations	64,867	57,477	39,619	19,929
Panel C: Cutoff 3				
Degree III	-0.0593*	-0.00747	-0.0301	0.00621
	(0.033)	(0.031)	(0.029)	(0.039)
Observations	53,447	48,550	37,262	22,040

Notes: This Table reports the (most preferred specification) 2SLS to test alternative measures of mortality by cutoffs. Column 1 reports the probability of death anytime during the analysed period (2007-2015), while Columns 2 and 3 the probability of death within the first 2 and 4 years since application. Finally, Column 4 presents the probability of reaching 90 years old. All regressions include controls and time-by-territory fixed effects. The covariates set includes gender, age, civil status, disability status, whether the claimant has cognitive impairments, the ill-health conditions (based on ICD9 diagnosis groups) and annual income. The first-stage F-Tests are always significant.

Robust standard errors (in parentheses) are clustered at examiner level. There are 114 different examiners.

*** indicates 1% significance, ** 5% and * 10%.

Table 1.8: 2SLS Before the July 2012 Reform (RD 20/2012)

	(1)	(2)	(3)	(4)	(5)	(6)
	P(death during the first 3 years after application)					
	Cutoff 1	Cutoff 2	Cutoff 3	Cutoff 4	Cutoff 5	Cutoff 6
P(Upper Degree)	-0.0309	-0.204*	-0.209***	-0.259***	-0.266***	-0.145*
	(0.161)	(0.108)	(0.075)	(0.078)	(0.101)	(0.079)
	14,038	10,086	20,881	22,185	20,171	16,960

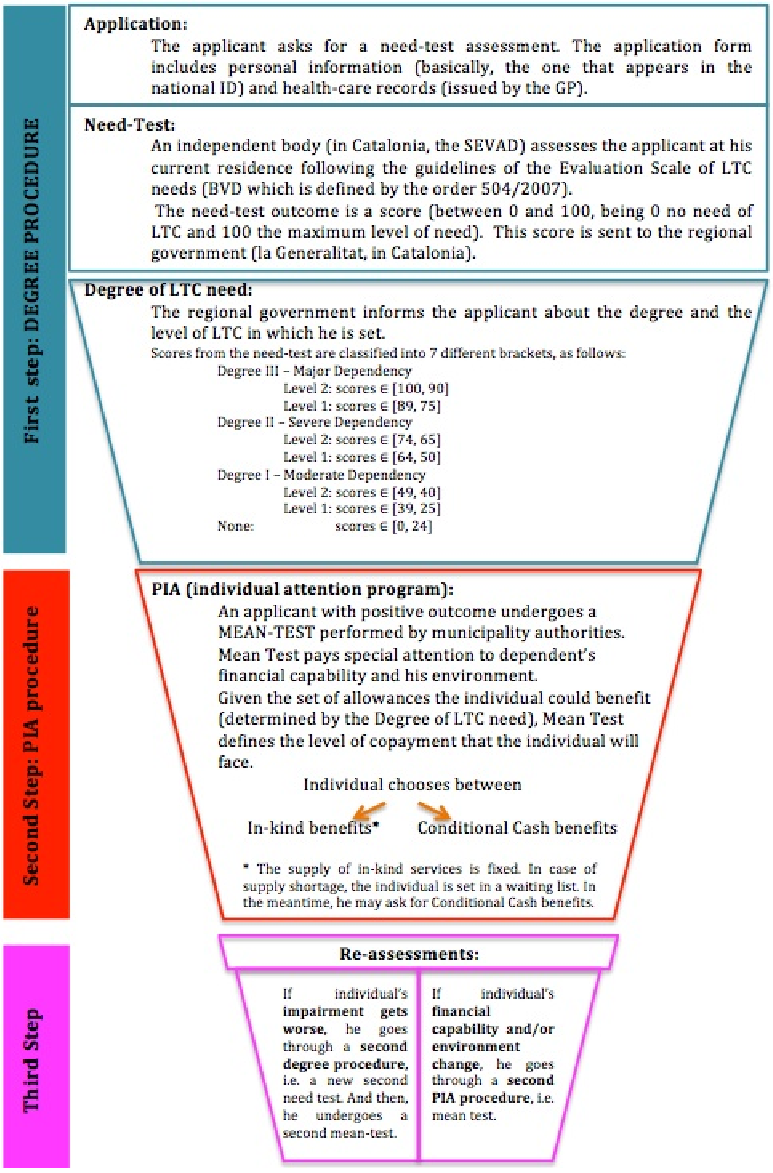
Notes: This Table reports the (most preferred specification) 2SLS for different cutoffs before the reform in July 2012 (RD 20/2012). Before such reform, each degree was split into two levels which suppose 6 cutoff points. The cutoff 1 is at 25 points in the score –coincides with cutoff 1 in main regressions–, the cutoff 2 at 40, cutoff 3 at 50 –the cutoff 2 in the rest of regressions–, the cutoff 4 at 65, the cutoff 5 at 75 –cutoff 3 in the rest of regressions– and cutoff 6 at 90. All regressions include controls and time-by-territory fixed effects. The covariates set includes gender, age, civil status, disability status, whether the claimant has cognitive impairments, the ill-health conditions (based on ICD9 diagnosis groups) and annual income (except for the first cutoff, as this informations was not requested to non-eligible claimants). The first-stage F-Tests are always significant.

Robust standard errors (in parentheses) are clustered at examiner level. There are 114 different examiners.

*** indicates 1% significance, ** 5% and * 10%.

Appendix 1.A Spanish LTC System: Funnel Procedure

Figure 1.A.1: Spanish LTC system: Funnel procedure



Appendix 1.B Monotonicity Testable Implications

Table 1.B.1: Sub-Sample First Stage Estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Gender		Age		Civil Status		Disability		Cognitive Impairment	
	Female	Male	<80 years old	$\geq$ 80 years old	Married	Non-Married	Yes	No	Yes	No
Panel A: Cutoff 1										
EL: baseline instrument	0.7442***	0.4404***	0.6621***	0.6358***	0.6303***	0.6822***	0.5434***	0.7119***	0.4070***	0.7512***
	(0.035)	(0.057)	(0.043)	(0.049)	(0.042)	(0.045)	(0.063)	(0.037)	(0.052)	(0.034)
EL: reverse-sample instrument	0.5843***	0.6060***	0.7234***	0.5781***	0.6531***	0.6176***	0.8477***	0.4639***	0.3954***	0.4157***
	(0.071)	(0.045)	(0.057)	(0.045)	(0.043)	(0.057)	(0.072)	(0.037)	(0.050)	(0.091)
Observations	35,015	18,499	25,987	27,526	23,613	29,892	14,283	39,179	14,226	38,928
Mean Y (Degree I)	0.637	0.602	0.589	0.659	0.617	0.631	0.619	0.627	0.777	0.564
Panel B: Cutoff 2										
EL: baseline instrument	0.7089***	0.3994***	0.5435***	0.6672***	0.5556***	0.6300***	0.4443***	0.7084***	0.6468***	0.6706***
	(0.056)	(0.069)	(0.067)	(0.057)	(0.073)	(0.058)	(0.067)	(0.054)	(0.048)	(0.040)
EL: reverse-sample instrument	0.6060***	0.6822***	0.6584***	0.6027***	0.7618***	0.6337***	0.7390***	0.3841***	0.4512***	0.3758***
	(0.065)	(0.055)	(0.069)	(0.064)	(0.069)	(0.051)	(0.080)	(0.055)	(0.081)	(0.066)
Observations	42,548	22,244	27,572	37,188	27,755	37,053	15,742	48,958	28,380	36,345
Mean Y (Degree II)	0.499	0.518	0.466	0.534	0.491	0.515	0.455	0.521	0.610	0.392
Panel C: Cutoff 3										
EL: baseline instrument	0.6220***	0.4666***	0.5568***	0.5941***	0.5147***	0.5923***	0.3051***	0.6871***	0.6922***	0.3902***
	(0.044)	(0.050)	(0.044)	(0.047)	(0.054)	(0.043)	(0.080)	(0.037)	(0.035)	(0.056)
EL: reverse-sample instrument	0.5428***	0.7036***	0.7663***	0.4743***	0.6734***	0.5919***	0.7278***	0.3937***	0.2976***	0.2685***
	(0.038)	(0.055)	(0.059)	(0.038)	(0.052)	(0.041)	(0.084)	(0.038)	(0.071)	(0.050)
Observations	34,521	18,801	19,005	34,240	21,255	32,073	9,610	42,715	32,976	18,984
Mean Y (Degree III)	0.456	0.439	0.389	0.483	0.415	0.472	0.313	0.479	0.492	0.262

Table 1.B.1: Sub-Sample First Stage Estimates (cont'd)

	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	Cardiovascular Disease		Nephro-Urology Disease		Osteo-Articular Disease		Neurological Disease	
	Yes	No	Yes	No	Yes	No	Yes	No
Panel A: Cutoff 1								
EL: baseline instrument	0.6724***	0.5668***	0.4599***	0.7186***	0.6808***	0.5484***	0.3381***	0.7562***
	(0.046)	(0.044)	(0.061)	(0.037)	(0.045)	(0.053)	(0.062)	(0.033)
EL: reverse-sample instrument	0.6911***	0.6108***	0.7146***	0.5100***	0.7204***	0.5547***	0.4936***	0.5126***
	(0.054)	(0.042)	(0.044)	(0.056)	(0.068)	(0.031)	(0.049)	(0.071)
Observations	28,423	25,102	14,769	38,690	29,403	24,113	13,405	39,844
Mean Y (Degree I)	0.622	0.628	0.630	0.623	0.610	0.642	0.746	0.585
Panel B: Cutoff 2								
EL: baseline instrument	0.6043***	0.5860***	0.4305***	0.6959***	0.6453***	0.5631***	0.5757***	0.6871***
	(0.069)	(0.062)	(0.064)	(0.056)	(0.058)	(0.066)	(0.055)	(0.055)
EL: reverse-sample instrument	0.5976***	0.6381***	0.7195***	0.4024***	0.6414***	0.4830***	0.6357***	0.4461***
	(0.073)	(0.057)	(0.055)	(0.060)	(0.069)	(0.074)	(0.073)	(0.070)
Observations	33,201	31,581	19,003	45,641	32,682	32,108	24,642	40,071
Mean Y (Degree II)	0.490	0.521	0.525	0.497	0.471	0.539	0.612	0.441
Panel C: Cutoff 3								
EL: baseline instrument	0.5497***	0.5654***	0.4574***	0.6251***	0.4723***	0.6408***	0.6313***	0.5422***
	(0.044)	(0.048)	(0.053)	(0.041)	(0.049)	(0.045)	(0.037)	(0.063)
EL: reverse-sample instrument	0.6283***	0.5864***	0.7070***	0.3522***	0.5013***	0.5731***	0.5081***	0.4763***
	(0.045)	(0.053)	(0.051)	(0.043)	(0.049)	(0.061)	(0.066)	(0.044)
Observations	25,589	27,730	17,179	35,994	23,434	29,888	28,164	24,244
Mean Y (Degree III)	0.427	0.467	0.461	0.442	0.397	0.485	0.540	0.338

Notes: This Table reports first stage results for different subsamples. Using the first stage specification (3) in Table 4, the probability of upper degree of each subsample is regressed on (i) the baseline instrument and (ii) the reverse-sample instrument. The baseline instrument is constructing as described in Section 3 but restricting in each case the subsample. The reverse- sample instrument is constructing by calculating examiner leniency in all cases except for those in the specified subsample. *Non-Married* subsample includes widows, singles and other marital status. The low income subsample includes all individuals earning less than 8000 euros annually. Robust standard errors (in parentheses) are clustered at examiner level. There are 114 different examiners. *** indicates 1% significance, ** 5% and * 10%.

Appendix 1.C LTC Choice

Table 1.C.1: LTC Choice

	(1) P(IC)	(2) P(NH)	(3) P(DCC)	(4) P(HC)	(5) P(NH future)
Panel A: Cutoff 2					
Degree II	-0.0435	0.0198	0.121	-0.0521	0.239***
	(0.144)	(0.114)	(0.085)	(0.050)	(0.029)
Observations	30,857	30,857	30,857	30,857	64,867
Mean Y	0.69	0.12	0.11	0.04	0.14
Panel B: Cutoff 3					
Degree III	-0.0529	0.0575	-0.00656	-0.0107	0.163***
	(0.055)	(0.053)	(0.025)	(0.014)	(0.062)
Observations	44,671	44,671	44,671	44,671	53,447
Mean Y	0.61	0.22	0.09	0.03	0.35

Notes: Notes: This Table reports the (most preferred specification) 2SLS to analyse LTC choice by cutoffs. Column 1 reports the first choice of Informal Caregiver (IC, which takes value 1 of individual chooses IC and 0 otherwise), Column 2 of Nursing Home (NH, which takes value 1 of individual chooses NH and 0 otherwise), Column 3 of Day Care Centre (DCC, which takes value 1 of individual chooses DCC and 0 otherwise) and Column 4 of professional Home Care (HC, which takes value 1 of individual chooses HC and 0 otherwise). Column 5 shows whether the individual goes to NH during the observation period (as there are capacity constraints in NH, the individual could choose other service while she is in the waiting list for NH). All regressions include controls and time-by-territory fixed effects. The covariates set includes gender, age, civil status, disability status, whether the claimant has cognitive impairments, the ill-health conditions (based on ICD9 diagnosis groups) and annual income. The first-stage F-Tests are always significant.

Robust standard errors (in parentheses) are clustered at examiner level. There are 114 different examiners.

*** indicates 1% significance, ** 5% and * 10%.

Appendix 1.D   Duration Analysis

Figure 1.D.1: Kaplan-Meier: Survival analysis until December 2015

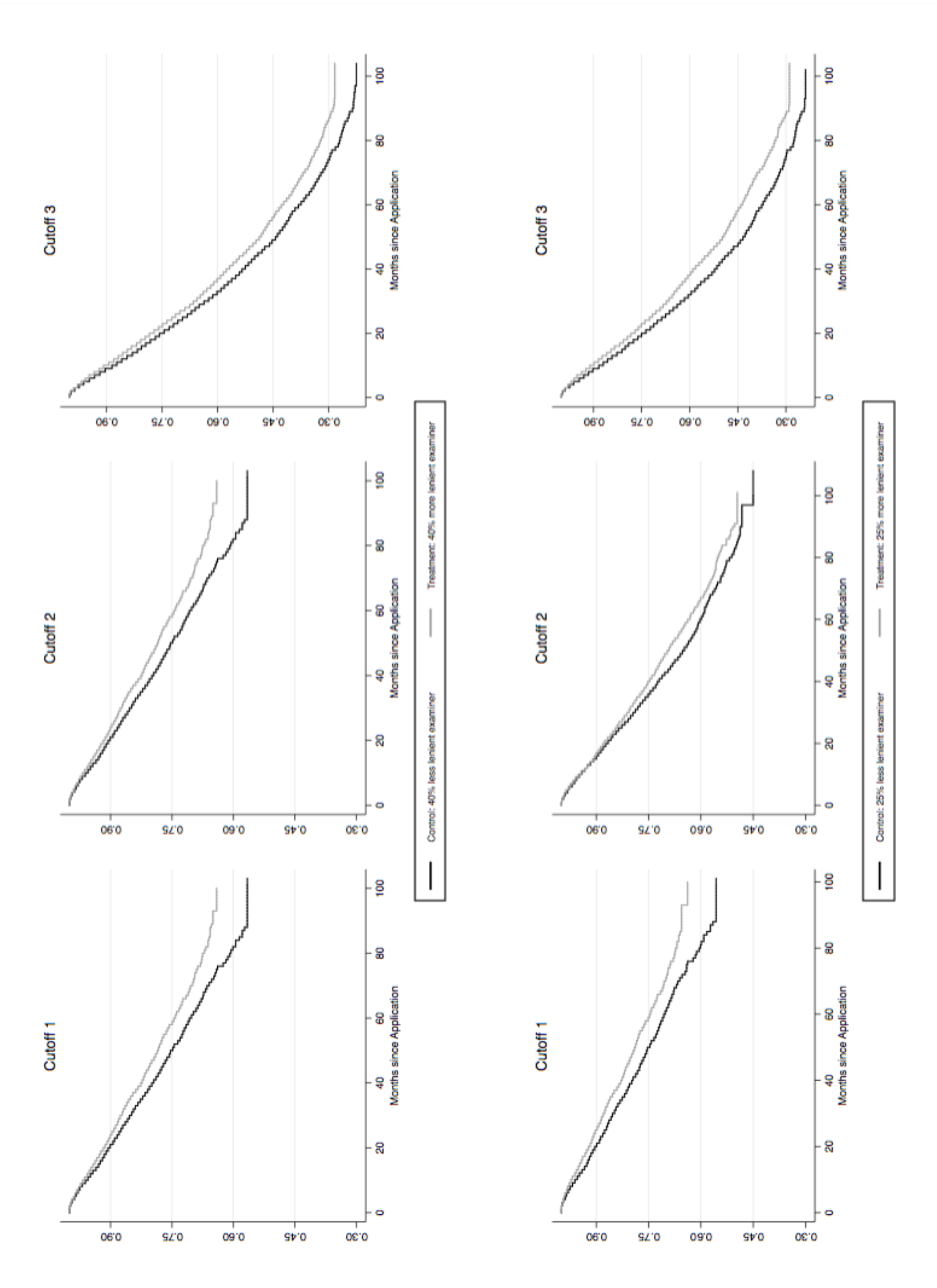


Table 1.D.1: Discrete Duration Model

	Cutoff 1		Cutoff 2		Cutoff 3	
	(1)	(2)	(3)	(4)	(5)	(6)
	Survival Rates		Survival Rates		Survival Rates	
Sample	25% - tails	40% tails	25% - tails	40% tails	25% - tails	40% tails
Treatment: *assigned to most lenient examiners*	-0.2141***	-0.2945***	-0.0933***	-0.1087***	-0.1001***	-0.0920**
	(0.041)	(0.052)	(0.031)	(0.041)	(0.028)	(0.037)
Covariates	Yes	No	No	No	No	No
Territory FE	Yes	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	No	Yes	No	Yes
Territory x Year FE	No	Yes	No	Yes	No	Yes
Observations	449,442	288,397	535,068	336,699	371,226	221,288

Notes: This Table reports the effect of being assign to the 40% (25%) most lenient exminers in Columns 1, 3 and 5 (2, 4 and 6) on moratlity, using a Discrete Duration Model (ML estimation of the discrete time complementary log-log model). From the baseline sample, we select the 40% and 25% tails: the observations of the upper (or left) tail are the *treated* (i.e. those claimants assigned to the most lenient examiners) and the observations of the lower (or right) tail are the *control*. This specification is the analogous of a reduced-form model, where mortality is regressed on the instrument. The model includes a logaritmic functional form for the baseline hazard function. The choice of other functional forms for the baseline hazard function (cubir and quadratic) does not alter the estimated treatment effects. The covariates set includes gender, age, civil status, disability status, whether the claimant has cognitive impairments and the ill-health conditions (based on ICD9 diagnosis groups).

*** indicates 1% significance, ** 5% and * 10%.

Chapter 2

UNRAVELLING THE HIDDEN INEQUITIES IN A UNIVERSAL PUBLIC LONG-TERM CARE SYSTEM

With P García-Gómez, G López-Casasnovas and Joaquim Vidiella-Martin

2.1 Introduction

Welfare state interventions for the elderly (e.g. healthcare and old-age pensions) are traditionally universal. However, new public policies formulated in response to the increasing demands of the ageing population are starting to be designed according to explicit proportional universalism criteria (i.e. on a needs basis). One advantage of this design is that it may improve equity, as the resource allocation depends on accurate and precisely measured needs. This is particularly true for the Long-Term Care (LTC) system.[1] To the best of our knowledge, there is scarce evidence on the extent to which social protection succeeds in allocating LTC resources irrespective of the socioeconomic status of the user. In this study, we bridge this gap in the body of knowledge on this topic by evaluating the level of equity within the Spanish publicly funded LTC system. We focus not only on

[1]Individuals with LTC needs have a reduced functional capacity, which limits their autonomy to perform basic and instrumental activities of daily living (ADL).

the equity in the use of different services, but also in the forms of provision and waiting times, as a measure of access limitation.

In particular, we investigate inequity trends in the use of public LTC in the aftermath of the global financial crisis. The Spanish LTC system provides inkind benefits and vouchers to access professional LTC services as well as cash transfers for informal caregiving.[2] We use administrative data on the universe of applicants for LTC public benefits in the north-east Spanish region of Catalonia. The data used are unique in two distinct ways. First, they contain detailed information on both the objective measures of LTC needs and socioeconomic status. Second, they include both institutionalised individuals living in a nursing home and non-institutionalised individuals receiving care at home.

We first measure inequity in the use of several LTC services, adopting a yearly corrected concentration index (Erreygers, 2009) over 2011 to 2014. By 2011, the Spanish LTC system established in 2007 catered for all levels of needs, except for the least severe. Moreover, our observational time period includes two years before and after the reform of the system (July 2012) impelled by the fiscal austerity caused by the financial crisis. Thus, the present study contributes to the literature by examining the inequity trends during the Great Recession.[3]

Our results contribute to the scarce literature on equity in the use of LTC (García-Gómez et al., 2015; Duell et al., 2016). García-Gómez et al. (2015) analyse inequity in LTC use and unmet needs in Spain before the introduction of the universal LTC system. Their results show that formal care services are

[2]Among the services offered, the system provides medical nursing homes (MNHs), nursing homes (NHs), day-care centres (DCCs), professional home care (HC), and tele-assistance (TA). The difference between NHs and MNHs is the composition of the workforce and therefore type of care provided. MNHs include 24/7 medical doctors and equipment to provide healthcare, generally palliative care. Moreover, in MNHs, the healthcare costs are financed through the National Health System, and the hotel costs and other assistance are covered by the LTC system.

[3]This strand of the literature has focused on healthcare. Coveney et al. (2016) show that the loss of employment and earnings disproportionally affected the health of the young, which in turn reduced health inequalities after the Great Recession in Spain. Abásolo et al. (2017) find that the financial crisis affected access to public health services for the worse-off, notably through reduced access to specialists and lower hospitalisations.

pro-poor distributed, while intensive informal care (IC) provision is pro-poor distributed. My analysis focuses on a period in which the universal LTC system is fully implemented and also includes the institutionalised population. In addition, we analyse inequity among the population of public LTC users as opposed to among the overall population with ADL limitations. Therefore, our estimates provide informative evidence on the extent to which the resource allocation of LTC public services satisfies the equity criteria. Our results contrast with those presented by Duell et al. (2016), who only look at institutional care and find that access to nursing homes is equitable in the public LTC system in the Netherlands. We show that access to public LTC services is not equally distributed across socioeconomic groups, except for the use of day-care centres. In particular, we find that better-off individuals are more likely to receive a cash transfer to cover informal care costs, whereas the use of formal care services (home care and nursing homes) seems to be more concentrated among the worse-off. The degree of the horizontal inequity in access to cash transfers for informal caregiving and nursing homes (the preferred benefits) increased after the reform. Indeed, only the trends of tele-assistance and medical nursing home did not change.

Previous results mask important differences in the form of provision (inkind vs. voucher) across socioeconomic groups. In particular, we find that while services provided inkind are concentrated among the worse-off, the better-off are more likely to receive a voucher to cover LTC expenses from their preferred provider. Thus, this study also contributes to the strand of the literature on the forms of the provision of social goods, which has thus far focused on education and healthcare (Cave, 2001; Culyer, 1997). While there is vast evidence on the implications for the efficiency of the form of provision, research on their equity effects is scarce (Epple et al., 2017).[4] This evidence suggests that the use of vouchers could increase inequity because they might constrain the choices of the worse-off (Quezada-Hoffflinger, 2008). We expect this to be true: the voucher amount added to individual annual income does not cover average LTC costs in

[4]Compared with studies testing the effects of vouchers or inkind in education, only four studies assess social services (Bergman et al., 2016; Blank, 2000; Emanuel and Fuchs, 2005; Hansmann, 1996) and none of these directly investigates LTC.

the absence of savings or external financial support.

This duality in the form of provision can lead to further inequalities (i.e. in the quality of care received and waiting times). In this respect, we argue that inequalities in the quality of care are unlikely to play an important role, as the private providers accessible under the voucher system must be accredited and have achieved certain quality standards. In addition, private institutions can offer private and public services (as the government contracts out to them). Given the lack of full capacity in the private sector, private providers have incentives to convert their services into public ones. However, we investigate inequity in waiting times to access nursing as a result of the existence of capacity constraints.[5] In accordance with the literature on healthcare waiting times (Siciliani, 2016), we find that the coexistence of public and private providers leads to longer waiting times to access care among the poor.

2.2 Institutional Background

In December 2006, the Spanish government passed the Act on the Promotion of Personal Autonomy and Care of Dependent People (Act 39/2006), termed the LTC Act hereafter. Spain's LTC system is universal, covering individuals with all forms of autonomy loss regardless of the cause or age. Before the LTC Act had been introduced, the public provision of such care was restricted to the poor population without family support. Thus, meeting LTC needs remained the family's responsibility for the majority, making informal caregiving the main form of LTC in Spain.

Under national guidelines, the LTC system is implemented regionally.[6] The system defines three dependency degrees (moderate or Degree I, severe or Degree II, and major or Degree III), as the intensity of care depends on the level of

[5] We focus on nursing homes because the dataset does not contain information on waiting times for other services.

[6] See Peña-Longobardo et al. (2016) for further details of the implementation.

LTC needs. The LTC application process consists of two main steps. First, applicants for LTC benefits are assessed against an official scale (BOE, 2007, 2011).[7] The outcome of this assessment determines the dependency category or degree.[8] Second, each degree gives access to a menu of benefits from which the claimant (and/or his or her family) chooses: i) Tele-assistance (TA), ii) Home Care (HC); iii) Day-Care Centre (DCC); iv) Nursing Home (NH); v) Medical Nursing Home (MNH); and vi) cash transfer for Informal Caregiver (IC). All types of care are available for all qualified individuals (one exception is that NHs are unavailable for individuals assigned to Degree I). However, the number of hours of care and cash transfer amount depend on the degree assignment. Different care arrangements may also be combined if the claimant remains at home (e.g. DCCs can be combined with TA or a cash transfer).

The benefits are partially funded by both the national and the regional governments, and the rest of the cost is shared by the beneficiary. In addition, individuals can choose whether to receive the service inkind or use a voucher to select a private provider from a list of authorised suppliers. In the majority of cases, supply constraints affect the choice of LTC. If the applicant prefers a benefit with a long waiting time, he or she can opt for other benefit in the meantime. Finally, applicants can ask for reassessment whenever their functional capacity deteriorates.[9]

In July 2012, against the backdrop of fiscal austerity caused by the Great Recession, the government reformed the LTC system, reducing publicly funded LTC expenditure by 20% per beneficiary.[10] The main changes consisted of a reduction in service intensity (e.g. hours of care, voucher value, and IC cash transfer) and a 70% increase in the beneficiary's contribution through cost-sharing. In addition, eligible Degree-I claimants had to wait until 2015 to receive their benefits instead of starting in 2013. The measures taken did not affect all care options proportion-

[7] RD 504/2007 and RD 174/2011.

[8] Individuals with no or minimal LTC needs are ineligible for LTC benefits.
To be consistent with the literature from Spain in LTC, we use the word degree to describe the categories.

[9] One-quarter (27%) of applicants seek a reassessment. In addition, although individuals can change the type of benefit, 78% stick to the initial choice.

[10] Royal Decree 20/2012 (BOE, 2012).

ally; indeed, the major cuts were concentrated disproportionally among IC cash transfers. First, individuals who opted for IC had to wait two years without any other financial support. Additionally, the cash transfer was reduced by 15% and the social security payment for the caregiver, initially included in the cash transfer, was also removed.

By December 2015, more than a million-and-a-half people had applied for LTC benefits in Spain. Among those, 55% were aged 80 or over, representing 31% of the 80+ cohort.[11] Of all assessed claimants (93%), 78% are eligible for LTC benefits: 23% in Degree II, 30% in Degree II, and 25% in Degree I. Moreover, 65% of those eligible have already started receiving benefits (IMSERSO, 2015).

2.3 Methodology

We follow García-Gómez et al. (2015) by measuring the level of horizontal inequity in LTC using the normalisation of the concentration index (CI) suggested by Erreygers (2009). In particular, the corrected concentration index (CCI) for bounded variables ranging from 0 to 1 as LTC use is calculated as follows (Van de Poel et al., 2012):

$$CCI = 4 * \mu * CI\left(y\right) \tag{2.1}$$

where μ is the average of the LTC variable, y is the measure of LTC use, and *CI(y)* is the conventional CI (Wagstaff et al., 1989).

To measure horizontal inequity, we adjust the CCI (i.e. the measure of inequality in LTC use) for the need variables (Kakwani et al., 1997). We assume that y_i is a linear and additively separable function of the need (x_k) and non-need (z_p) covariates as follows:

$$y_i = \alpha + \sum_k \gamma x_k + \sum_p \delta z_p + \varepsilon_i \tag{2.2}$$

[11]LTC claimants represent 3.45% of the Spanish population. Three-quarters are aged 65 and over, which implies that 14% of the elderly in Spain have claimed such benefits.

where γ and δ are the vectors of the estimated coefficients from a linear probability model.

Then, the CCI can be expressed as (Van de Poel et al., 2012)

$$CCI = 4 * \left[\sum_k \gamma x_k \, CI_x + \sum_p \delta z_p \, CI_z + GC_\varepsilon \right] \tag{2.3}$$

where x_k and z_p represent the means of the need and non-need variables, respectively, while CI_x and CI_z are the CIs of these variables regarding socioeconomic status. GC_ε is the generalised CI for the error term. Lastly, we compute horizontal inequity in LTC use (CHI) by subtracting the contribution of the need variables from the CCI:

$$CHI = CCI - \; 4 * \sum_k \gamma x_k \, CI_x \tag{2.4}$$

The CHI can take values between -1 and 1. A value of 0 indicates no inequity. Negative values indicate that LTC use is concentrated among the worse-off, while positive values represent a pro-rich distribution.

2.4 Data

2.4.1 Sample

We use administrative data on all LTC applicants in Catalonia.[12] We focus on individuals aged at least 50, who represent 90% of all applicants, and the period 2011-2014. We use detailed information on applicants' health status including the degree of autonomy to perform ADL summarised in the needs assessment score and a detailed list of diagnoses coded with the International Classification of Disease (ICD) 9 and cognitive impairments.[13] For each individual, we also observe

[12] According to IMSERSO (2015), Catalonia represents 16% of the Spanish population, 17% of all applications, and 16% of all beneficiaries.

[13] The cognitive impairment status is determined during the needs assessment. If the person is considered to be cognitively impaired (unable to make some daily life decisions) by the assessor, the assessment is extended to examine his or her intellectual capabilities. In the majority of cases, cognitive impairments are caused by a diagnosed mental illness or intellectual disability, but a

the socioeconomic and demographic conditions (annual income, age, sex, marital status, and place of residence) and the result of the LTC application process (selected care, form of provision (public provision or voucher), and waiting time) used as the main outcomes.

We are interested in the evolution of inequity in LTC use within the public system. Therefore, from the sample of applicants, we select those beneficiaries who represent on average 66% of all the individuals in the system each year (see Panel A of Table 2.A.1, in the Appendix).[14] [15] We then delete observations with missing information on either income (44% of the sample of beneficiaries) and any other of the relevant variables (additional 6% of the sample).

One could be concerned that the sample of individuals with information on income is not representative of the overall population of users. We cannot estimate the inequity indices without the income variable as we use this variable to rank individuals. However, we check whether the excluded individuals have different observable characteristics compared with the rest of the sample (see Table 2.A.2, in the Appendix). We find that the observable characteristics are statistically different (probably because of the large sample sizes), whereas the magnitude of such differences is negligible (second and third decimal places). In addition, the lack of reported income is owing to administrative reasons. In some municipalities, annual income was not recorded in the IT system even though it was required to determine the cost-sharing. As a result, the sample can be considered to be representative of the population with LTC needs that applies for public benefits. Thus, our sample consists of an average of 91,400 beneficiaries per year.

specific diagnosis is not necessary to be classified as cognitively impaired.

[14]The other 44% of claimants are (i) ineligible for the benefit (15%), (ii) waiting to receive the benefit (18.5%), (iii) waiting for a needs assessment (3.5%), or (iv) have withdrawn their application (because of death, migration, or other motives) (7%).

[15]We estimate all indices for each different year included in the analysis (2011-2014). To select the service used during the year, we focus on the type of service the individual uses in February. This selection is convenient because we can consider 2011 and 2012 to be the pre-reform period, while 2013 and 2014 are the post-reform period. In addition, the selection of this point in time should not threaten the results, as individuals do not change benefits frequently and remain in the LTC system until they die. We replicate the analysis by using another month, October, and the conclusions do not change.

2.4.2 Variables and Descriptive Statistics

Panel B of Table 2.A.1, in the Appendix, shows the distribution of benefits by year. Each outcome takes 1 if the beneficiary receives that benefit. IC cash transfers are the most common LTC service (more than 50% of users receive this benefit). The second most preferred benefit is NHs (one-fifth of all benefits). HC is the third most selected benefit, while DCCs are only chosen by 5% of beneficiaries. The take-up rates of HC and DCC rise; indeed, the share of beneficiaries that choose these care types doubles after the reform compared with 2011. Finally, TA represents around 10% of the benefits and is often combined with other services (almost 40% of cases).

The remaining variables used in the analysis can be grouped into need and non-need variables. Need variables include the score that determines the level of LTC needs, age, sex, labour market disability status, cognitive impairment, and a detailed list of medical diagnoses.[16] The main non-need variable is the beneficiary's annual income. For those individuals that do not have to pay income tax, annual income is self-reported (e.g. income from old-age or widowhood pensions). Claimants have relatively low incomes: their average annual income, 10,738 euros (see Table 2.1), is only 8% higher than the minimum wage and represents 40% of the average wage (BOE, 2013; DatosMacro, 2017). In addition, only the richest decile has an annual income higher than 18,000 euros). Finally, we consider civil status, region, and year of application to be non-need variables.

Table 2.1 shows the descriptive statistics of the variables.[17] The first column presents all the sample means, while the second to fourth columns provide information on the type of care subsample: IC, NH, and the rest of the services.[18] Beneficiaries are on average 80 years old and 70% are women. Care arrangements differ by sex: while men receive IC, disproportionally more women live

[16] The dataset includes information on the conditions suffered by claimants. These data are provided by the ICD-9. The different diagnoses are grouped into 10 diagnosis groups (see Table 2.A.3, in the Appendix).

[17] See the descriptive statistics by year in Table 2.A.4, in the Appendix.

[18] IC represents 50% of all benefits, with NHs the second most preferred (21%). The other types of care, which individually account for less than 15%, are grouped in the third column.

in an NH. This difference could be driven by the contexts of LTC needs by men and women: women tend to suffer from LTC needs when they are older and widowed, while men become dependent when they are still married (Idescat, 2011). More than 20% of beneficiaries have Labour Disability status. The geographical distribution is representative of the Catalan territory. Finally, the most common conditions suffered by claimants are circulatory, neurological, musculoskeletal, endocrino-metabolic, and genitourinary diseases and mental disorders.

2.5 Results

2.5.1 Determinants of Public LTC Use

First, we analyse which need and non-need factors affect the likelihood of choosing a particular LTC option. Table 2.A.5 in the Appendix reports the estimated coefficients using a linear probability model. We find that the choice of care depends not only on the individual's level of need, but also on the non-need variables associated with the type of service chosen. The estimated coefficients of the non-need variables show the expected signs. Being single increases the probability of using institutional services (DCCs and NHs), while being married is positively associated with HC. Although the widowhood's estimate presents the same sign as the marriage one, the magnitude of the coefficient is substantially different: being married reduces the probability of entering an NH by four times compared with being a widow and increases the chances of using IC by almost three times. The probability that an individual chooses IC, DCCs, or TC (HC, NHs, or MNHs) is significantly and positively (negatively) associated with income, although the magnitudes of these coefficients are very small.

Regarding the need variables, the coefficients of age, sex, disability status, cognitive impairment, and score also have the expected signs. All home care arrangements (HC, IC, TC, and DCCs) are associated with lower scores (i.e. lower needs), while higher scores positively affect the choice of NH services. In addition, NHs are positively associated with age and intellectual disability. On the contrary, physical disability is associated with a higher probability of needing IC.

Women are more prone to formal services, while the probability of IC is larger among men. Despite finding the expected sign of the medical diagnosis categories, the magnitudes and significance levels are modest. This fact is not surprising as LTC needs are rooted in the loss of autonomy to perform basic and instrumental ADL, which is captured by the score. The level of LTC needs can differ widely among individuals with the same medical condition. In this respect, chronic conditions may be insufficient to capture LTC needs.[19]

2.5.2 Inequity in LTC Use

Figure 2.1 presents the evolution of the inequity indices for all types of LTC. The dashed vertical line indicates the introduction of the reform in July 2012. The estimated CIs for inequity and inequality are reported in Table 2.A.7 in the Appendix. First, there is a clear difference between the services that are pro-poor and pro-rich distributed: NH and HC services are more concentrated among the worse-off, while TA and IC are pro-rich distributed. DCCs are equally distributed. Second, horizontal inequity in the use of NHs and IC, which accounts for 70% of the total publicly subsidised care, increases after the 2012 reform. Indeed, only horizontal inequity in TA and MNHs decreases thorough the study period. Third, the contribution of need to inequality in institutionalised care services (NHs, MNHs, and DCCs) is pro-rich (CCI $>$ CHI), while the contribution of need to inequality in care delivered at home (IC, HC, and TA) is pro-poor distributed (CCI $<$ CHI) (see Table 2.A.6 in the Appendix). These differences are driven by the signs of the estimated coefficients of the need variables (see Section 2.5.1).

IC is the main care option, as it is chosen by more than 50% of beneficiaries over the period (see Panel A of Table 2.A.7, in the Appendix). While it is equitably distributed in 2011, it becomes concentrated among the better-off thereafter, following an increasing trend.[20] One plausible explanation of the increased pro-

[19]Once we checked that the presence of the score variable overperforms the inclusion of the chronic condition covariate, we replicated the indices omitting such control variables that increase 6% of the sample size, which improves the accuracy of the estimates. The results are robust to this change.

[20]Unfortunately, information on IC hours is lacking to estimate whether this result remains for more intensive IC or the sign reverses as in Garcia-Gomez et al. (2015). An alternative could

rich distribution of IC is the policy design. IC is the only benefit that provides an unconditional cash transfer. Moreover, after the 2012 reform, individuals who opted for IC had to wait up to two years to start receiving the benefit without any right to recover the amount of benefit during the waiting time. We would therefore expect the better-off to be more able to cover the cost of care during these two years.

NHs became more pro-poor distributed in 2014 compared with the previous years. The inverted U-shaped trend of horizontal inequity over the study period indicates a reverse of the pre-reform trend towards inequity. In addition, it is reasonable to expect that any changes in the distribution of NH use driven by the 2012 reform only appear with some delay given NH waiting lists. On average, a beneficiary has to wait 22 months to access an NH because of capacity constraints. Together with DCCs, the trend of inequity in MNH use does not change after the reform. This is not surprising as individuals are referred to MNHs for recovery after a health shock that requires hospitalisation or for palliative care if terminally ill. All medical costs are thus covered by the healthcare system, while the LTC system only covers the hotel cost.

HC can be provided by a professional assistant or TA. The use of HC is concentrated among the worse-off and the level of inequity increases over the period. Finally, TA is significantly concentrated among the better-off, although it becomes less concentrated over time

2.5.3 Inequity in the Form of LTC Provision

The LTC Act aimed to support claimants with public services inkind, but shortages (or capacity constraints) forced the introduction of vouchers to acquire services in the private sector. These vouchers can only be used with a selection of private providers who meet certain quality standards (DOGC, 2007).[21] Indeed, many

be whether a beneficiary officially combines IC with other types of care (which could imply low intensity). However, few beneficiaries combined IC with other types of care (6%).

[21] Social services authorities check that private providers meet these standards to guarantee the quality of care (see DOGC 12/2007). All the selected providers are officially listed. Indeed, the

of these private centres offer private and public services simultaneously. Therefore, there are minimal differences in care (i.e. quality) for the user regardless of whether he or she receives a service inkind or a voucher. However, whether the service is provided inkind or with a voucher could raise differences in other aspects. First, the total contribution may depend on the individual's socioeconomic status. In particular, the user contribution is higher with a voucher for the worse-off: they have to pay more than 50% of the NH price with the highest voucher, but less than 33% as cost-sharing if the service is provided inkind.[22] Similarly, while the cost-sharing of inkind services directly depends on the beneficiary's financial capability (up to the point that the better-off could pay 100% of the service), the voucher for the better-off is 80% of the amount for the worse-off.[23] Second, the number of public services is fixed, whereas private services eligible for vouchers have fewer capacity constraints. This fact translates into longer waiting times to access a public service compared with a private one.

Considering these facts, we create a variable that takes 1 if care is provided inkind and 0 otherwise (i.e. a voucher or IC cash transfer) to test the existence of horizontal inequity in the form of provision. The use of care provided inkind is concentrated among the worse-off and this concentration increases over time (see Figure 2.2 and Panel B of Table 2.A.7 in the Appendix). Indeed, the magnitude of the inequity index more than doubles between 2011 and 2014.

We then analyse inequity in the form of provision by type of service. In particular, we focus on NHs, DCCs, and HC (i.e. the services that offer such duality). NHs, DCCs, and HC inkind each equal 1 if the beneficiary receives the service inkind and 0 otherwise.[24] Similarly, NHs, DCCs, and HC subsidised by a voucher each equal 1 if the service is subsidised by a voucher and 0 otherwise.

majority of public beds are managed by private providers, with only 15% belonging to public entities.

[22]For HC, the highest voucher does not cover 50% of the service cost. For DCCs, the highest voucher covers a little above 50% of the cost, but these beneficiaries have other monthly living costs at home.

[23]In the absence of vouchers, the better-off could be interested in the public service, although they incur the whole cost/price because the public price (regulated) is below the market price.

[24]By otherwise, we imply that the service is paid for with a voucher or another benefit is received

The results in Figure 2.3 show that the duality in the form of provision of LTC services is mainly driven by the distribution in the form of provision for NHs. In particular, inkind NH usage is concentrated among the worse-off, while vouchers are more often used by the better-off. The pattern of the indices over time is symmetric and inequity increases over time in both cases. Similarly, we find duality in the distribution of HC. Inkind HC is concentrated among the worse-off and the inequity index increases (in absolute value) over time. The estimated CHI for HC subsidised by vouchers is close to zero. However, this indicates a significant, although small, concentration of these vouchers among the worse-off before the reform, which becomes significantly concentrated among the better-off thereafter. Finally, the equitable distribution of DCCs over time remains when we distinguish by type of care. This may be driven by the low demand for this service and/or absence of capacity constraints to receive this service inkind.[25]

The differences found in the type of NH provision could translate into differences in the quality of care or waiting times depending on individuals' socioeconomic status. Unfortunately, we cannot test whether there is inequality in the quality of care. However, different facts suggest that quality differences are not a major concern. First, a voucher does not provide access to the universe of private providers, but only to those that meet certain quality criteria. Second, only 15% of the beds provided inkind are in public institutions, while the remaining 85% are privately managed (RESES, 2016). In the majority of these cases, the same centre provides private (with or without vouchers) and public services (those that receive the service inkind) simultaneously. Regardless of who is the main payer (the government for inkind NHs and the user for NHs subsidised by a voucher), the care received in a centre with these two types of services is the same for all residents (e.g. same meals, same professionals, same space). Third, as not all the beds in private institutions would be occupied by private users, private entities have incentives to provide public services. While this minimises the possibility of cream-skimming by NH providers, inequalities in waiting times to access NHs are likely. We explore these in the next section.

[25] Note that 7% of inkind services in 2015 were not taken (López-Casasnovas et al., 2017).

2.5.4 Inequity in Waiting Time for NHs

For every NH user, we measure the months between the application date and the day the individual receives the benefit (the WTNH variable).[26][27] On average, the individuals in our sample wait 24 months to access an NH via a voucher compared with 28 months inkind. In 2011, the difference between the two waiting lists was less than two months, but this difference has increased over time to the point that it was longer than five months in 2014. Similarly, the median number of months on as waiting list in 2011 was the same for both types of provisions; however, in 2013, the difference was five months (see Table 2.A.8, in the Appendix).

Figure 2.4 shows the horizontal (in)equity indices of waiting times.[28] Except for 2013, longer waiting times are concentrated among the worse-off. In addition, the degree of inequity in 2014 is considerably higher than that in previous years, probably because of the delayed effects of the reform.

[26] Beneficiaries with zero months on a waiting list are excluded. Before the implementation of the Spanish LTC system, social services at the municipal level provided means-tested NHs to elderly citizens with LTC needs. Thereafter, all these individuals were automatically transferred from the old system to the new one without an assessment of their needs or choice of care (i.e. an administrative transfer of records). Therefore, these users appear to have accessed an NH without incurring a waiting time. We thus exclude these individuals as we cannot observe their actual waiting time given the lack of information in the administrative records on the exact procedures in the old system.

[27] We define the waiting time since application as we cannot observe when a beneficiary applies for an NH. We assume that all individuals that enter an NH apply for an NH from the moment they asked for LTC benefits. We therefore overestimate the waiting time for individuals who applied for an NH only when their health further deteriorated within the same degree of need, as we observe changes in the options available driven by a higher degree. Although we cannot provide the number of beneficiaries who delay the choice of NH, we do not expect it to be large as 78% of the beneficiaries sticking to the first benefit. In addition, the long waiting time to access NHs is known by all beneficiaries and social workers always inform them about the average waiting time for the municipality. As enrolling on the waiting list for an NH is free, and the individual can always refuse to go without being penalised, all individuals who want an NH apply for it as their first choice and those who consider the option enrol on the list given the zero cost. Additionally, the WTNH variable only includes beneficiaries who entered an NH. Hence, all individuals on the waiting list were not included as the spell was not finished. If the waiting time has increased, we may underestimate this, too.

[28] This approach does not require CIs such as in Erreygers (2009) because the outcome variables are not bounded between 0 and 1.

2.6 Discussion

In this study, we analyse whether an LTC policy designed under a proportional universalism criterion ensures equal access to care services. The results show that once individuals with LTC needs receive access to public allowances, the IC benefit is pro-rich distributed. This result contrasts with previous evidence for Spain that finds IC, particularly the intensive use of IC, to be pro-rich distributed (García-Gómez et al., 2015). There are different potential explanations for these different results. García-Gómez et al. (2015) analyse inequity in IC among the full population of dependent individuals living at home before the implementation of the universal LTC system. We focus on all the population receiving public benefits. The differences in the sample and definition of IC raise a series of hypotheses for further research. First, the distribution across socioeconomic groups may reverse once individuals become eligible for public support. This would imply that individuals from low socioeconomic groups cover their care needs by using IC when public support is lacking, but resort to professional HC whenever they have access to the public system. The structure of the cash transfers after the reform of IC may incentivise this change, as individuals need to wait two years before receiving the monetary transfer. Therefore, less budget-constrained individuals are more likely to wait for this additional period of time. Second, we cannot rule out that some individuals use the monetary transfer to pay for formal care outside the public system. Similarly, other individuals may complement HC services with unpaid IC. Finally, we can only account for the extensive margin of the informal caregiver. Testing the equity of the intensity of IC would add more insights. The importance of these situations in shaping the distribution of IC remains a question for further research. Despite these caveats, our results show that high socioeconomic groups are more likely to receive public cash transfers after conditioning for need.

The findings also document that the Spanish LTC system became more inequitable after the 2012 reform. Costa-Font et al. (2016) find that low-income groups are highly sensitive to changes in the subsidy amount. Accordingly, the worse-off would be expected to be more sensitive to the disproportional reduction in the IC cash transfer after the reform (compared with the other benefits), which in turn increases the inequity of this type of care. Additionally, the reform imposed a waiting period of two years until receiving the IC cash transfer. This fact implies that individuals have to self-finance their care during the first two years, which could only be affordable for the rich and would increase inequity in the use of IC. With respect to NHs, we also observe an increase in inequity after the reform. Therefore, this formal analysis confirms the hypothesis that the LTC system after the reform does not meet the equity criteria as lower middle-income earners face proportionately more payments (Peña-Longobardo et al., 2016).

Owing to capacity constraints, individuals can choose between services provided inkind or via vouchers to access their preferred provider. Our results show that while inkind services are pro-poor distributed, wealthier individuals are more likely to choose the voucher. This finding provides important insights to policymakers. The richest person can receive 80% of the amount of the poorest's voucher. However, the cost-sharing of a service could be 100% of the cost of the service for the richest. On the contrary, worse-off beneficiaries are granted access to NHs with an inkind benefit (their cost-sharing supposes 84% of their annual income), while they could be financially constrained if they instead received a voucher and had no savings or a family safety net. Our results therefore show that one important consequence of these implicit choice constraints is the longer waiting time for the worse-off. Such a longer waiting time prolongs claimants' suffering and could promote health deterioration (Siciliani et al., 2010).

Notwithstanding the previous caveats and limitations, we unravel hidden inequities in a universal public LTC system, mainly driven by the duality in the form of providing care services. Inkind services are disproportionally more concentrated among the worse-off, while the better-off receive, disproportionally, more vouchers and cash transfers for IC. This duality has important implications in terms of (in)equity in the time to access the service, which could diminish claimants' wellbeing. Thus, if capacity constraints prevent a unique form of provision, policymakers should neutralise incentives to avoid unintended consequences.

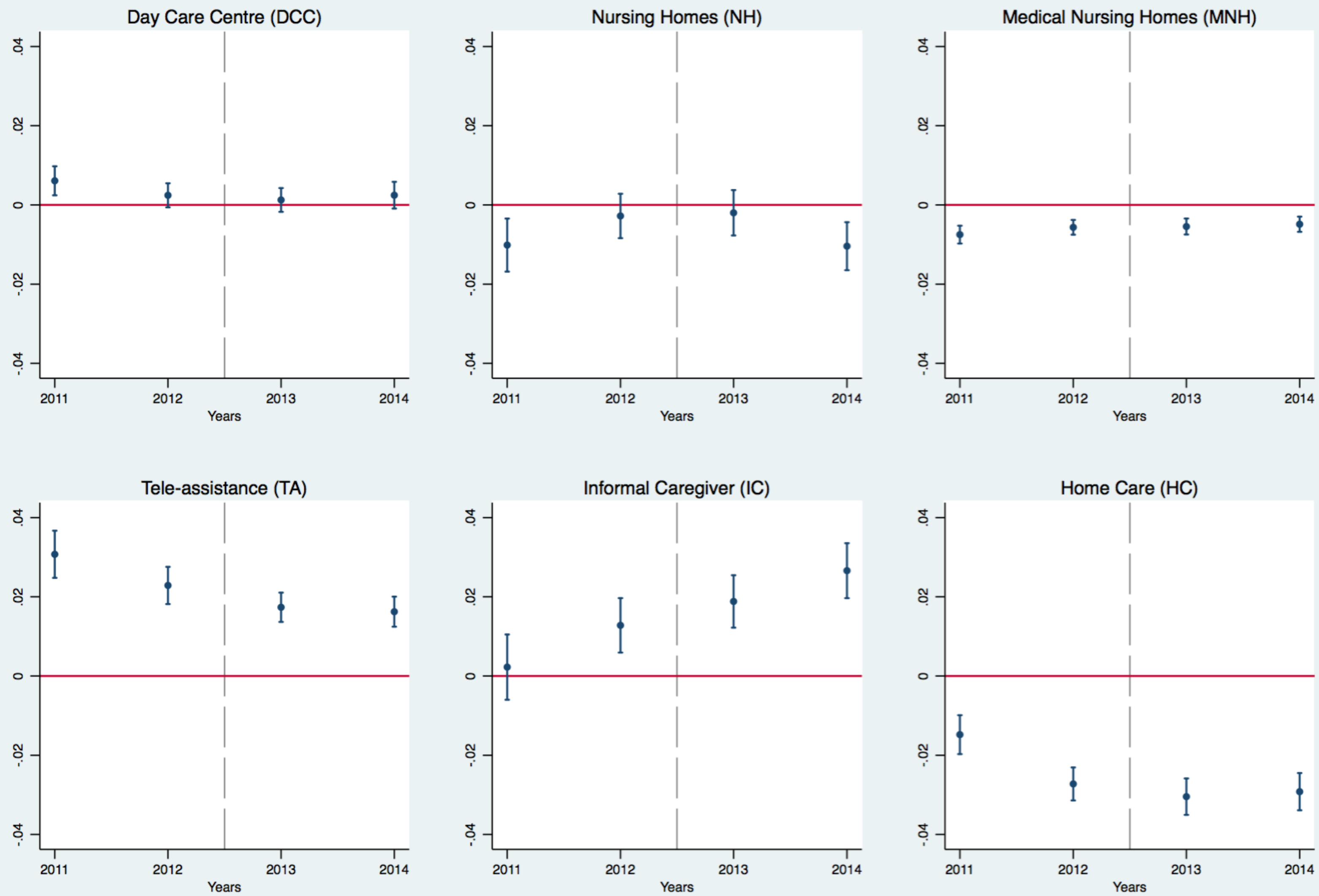
Tables & Figures

Table 2.1: Descriptive Statistics

	(1)	(2)	(3)	(4)
	Sample	IC	NH	Other
Need Variables				
Score	67.91	65.68	74.62	66.49
Age	80.19	79.50	81.81	80.23
Gender (female)	0.70	0.67	0.74	0.70
Physical Disability	0.15	0.18	0.07	0.16
Intellectual Disability	0.03	0.03	0.05	0.03
DG: Neurological	0.49	0.46	0.57	0.49
DG: Circulatory	0.47	0.48	0.44	0.48
DG: Digestive	0.02	0.02	0.02	0.02
DG: Muskuloskeletal	0.43	0.44	0.41	0.46
DG: Endocrino-metabolic	0.37	0.39	0.34	0.37
DG: Eye	0.10	0.10	0.08	0.10
DG: Ear	0.01	0.01	0.01	0.02
DG: Respiratory	0.18	0.20	0.15	0.18
DG: Genitourinary	0.31	0.33	0.29	0.31
DG: Mental	0.27	0.26	0.30	0.26
DG: Development	0.00	0.00	0.00	0.01
DG: Malformations	0.00	0.00	0.00	0.00
DG: Cancer	0.12	0.13	0.09	0.11
DG: Hematological	0.01	0.00	0.01	0.01
DG: Infectious	0.01	0.01	0.01	0.01
DG: Dermatological	0.00	0.00	0.00	0.00
Non-need Variables				
Annual Income	10,738.35	10,803.35	10,753.89	10,569.90
Region: Barcelona (city)	0.27	0.24	0.25	0.36
Region: Barcelonés (county)	0.22	0.20	0.26	0.22
Region: Rest of BCN (province)	0.22	0.23	0.21	0.22
Region: Girona	0.10	0.11	0.09	0.08
Region: Lleida	0.07	0.08	0.08	0.04
Region: Tarragona	0.08	0.08	0.08	0.06
Region: Terres de l'Ebre	0.04	0.06	0.03	0.02
Civil Status: Other	0.09	0.08	0.11	0.08
Civil Status: Married	0.39	0.46	0.19	0.43
Civil Status: Widow	0.44	0.41	0.53	0.42
Civil Status: Single	0.09	0.06	0.16	0.07

Notes: *Other* category accounts for DCC, HC, TA and MNH (all together, they represent less than 28%). The 7 *regions* included corresponds to the 7 "geographical units" used by Social Services Department for organizational purposes. Table A.4, in the Appendix presents descriptive statistics by years.

Figure 2.1: Horizontal inequity in the use of different care services (CHI).



Estimated CHI and 95% confidence interval. Standard errors obtained from bootstrap with 500 replications.

Figure 2.2: Horizontal inequity in the use inkind benefits (CHI).

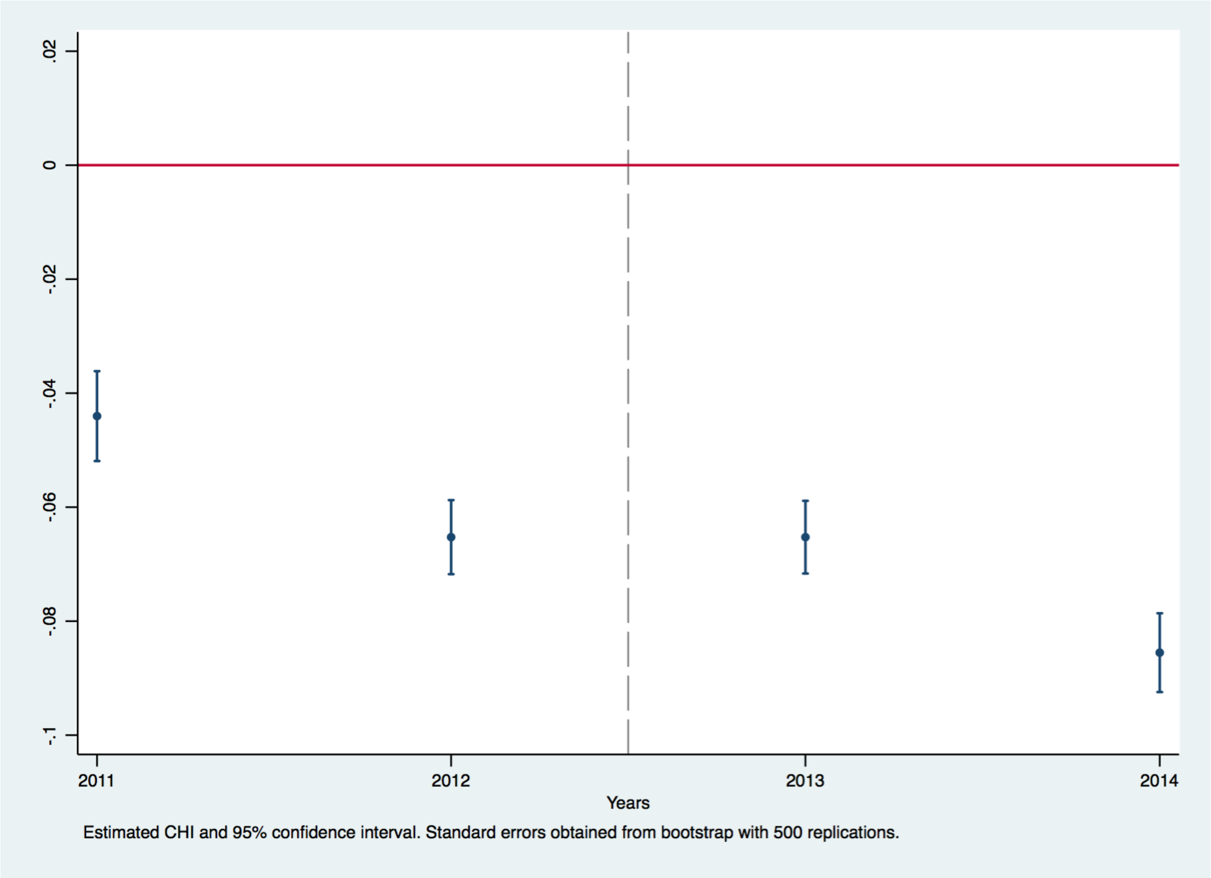
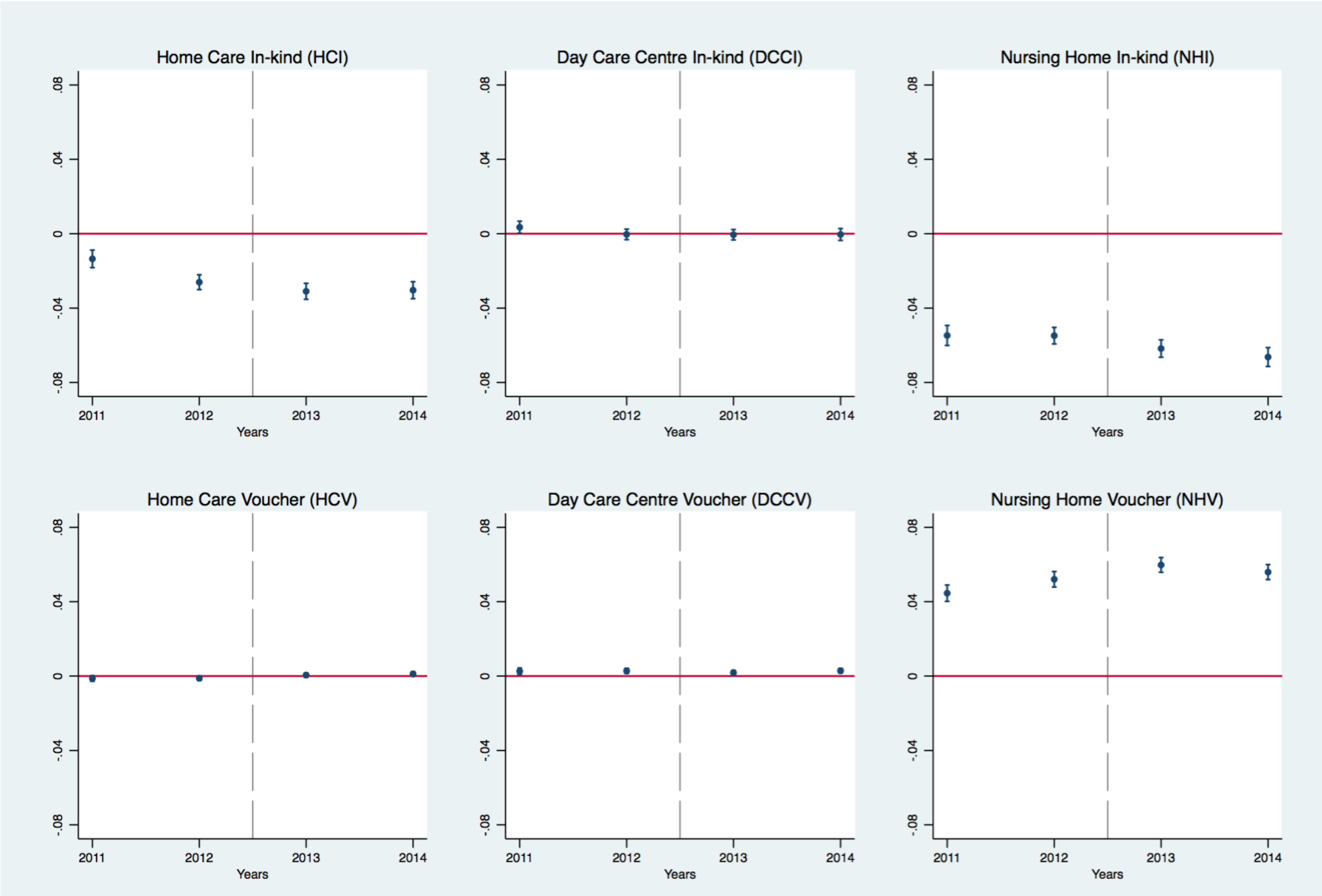
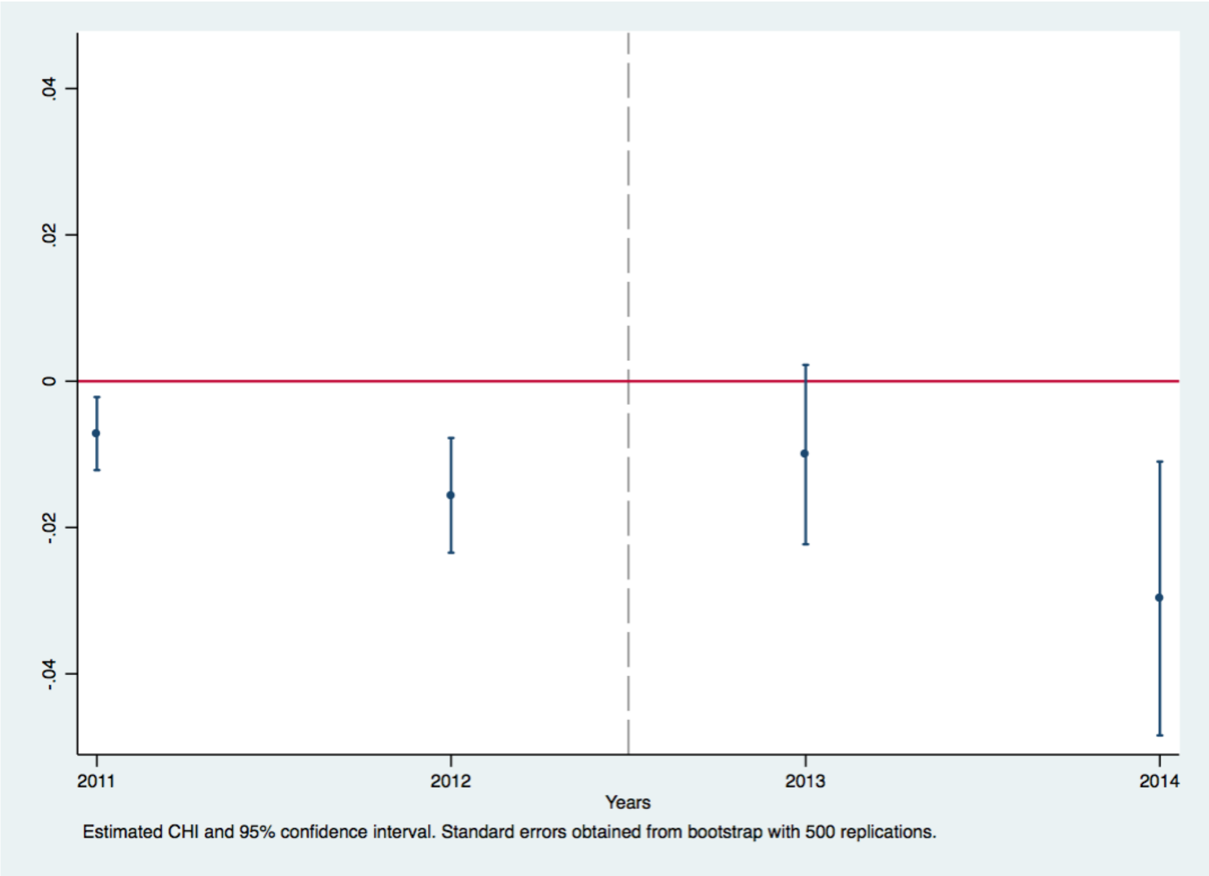


Figure 2.3: Horizontal inequity in the form of provision (inkind vs. voucher) (CHI): NHs, DCCs, and HC.



Estimated CHI and 95% confidence interval. Standard errors obtained from bootstrap with 500 replications.

Figure 2.4: Horizontal inequity for NH waiting times (CHI).



Appendix 2.A Supplementary Tables and Figures

Table 2.A.1: Sample Selection

		(1)	(2)	(3)	(4)
		2011	2012	2013	2014
Panel A: Sample size					
	In the system	225,112	265,131	290,156	308,568
	Claimants with LTC benefits	165,143	188,051	189,825	179,356
	Claimants with benefits: our sample	67,308	94,809	103,413	100,066
	Claimants with benefits: missing income	87,038	81,935	75,728	69,864
Panel B: Distribution by type of care					
IC	Cash Transfer for Informal Caregiving	54 %	55 %	52 %	49 %
HC	(Professional) Home Care	8 %	9 %	1 1%	12 %
DCC	Day Care Centre	4 %	4 %	5 %	6 %
TA	Tele-Assistance	14 %	11 %	8 %	7 %
NH	Nursing Home	18 %	19 %	22 %	24 %
MNH	Medical Nuring Home	2 %	2 %	2 %	2 %

Table 2.A.2: Difference in observables between subsamples

	(1)	(2)	(3)	(4)
	All	Income	No-income	Test
Score	67.91	71.80	66.10	Reject equality
Age	80.19	79.01	80.73	Reject equality
Gender (female)	0.70	0.751	0.670	Reject equality
Physical Disability	0.03	0.034	0.033	Reject equality
Intellectual Disability	0.15	0.142	0.154	Reject equality
Region: Barcelona (city)	0.27	0.305	0.257	Reject equality
Region: Barcelonès (county)	0.22	0.220	0.219	Not reject
Region: Rest of BCN (province)	0.22	0.214	0.225	Reject equality
Region: Girona	0.10	0.091	0.098	Reject equality
Region: Lleida	0.07	0.06	0.081	Reject equality
Region: Tarragona	0.08	0.07	0.078	Reject equality
Region: Terres de l'Ebre	0.04	0.041	0.042	Not reject
Civil Status: married	0.39	0.393	0.383	Reject equality

Note: The 7 *regions* included corresponds to the 7 "geographical units" used by Social Services Department for organizational purposes.

Table 2.A.3: Medical Diagnosis Groups equivalence to International Classification of Disease 9 (ICD9)

Name	International Classification of Disease -9
DG: Neurological	Disease of nervous system
DG: Circulatory	Disease of circulatory system
DG: Digestive	Disease of digestive system
DG: Muskuloskeletal	Disease of muskuloskeletal system and connective tissue
DG: Endocrino-metabolic	Endocrine, nutritional and metabolic diseases
DG: Eye	Disease of Eye
DG: Ear	Disease of Ear
DG: Respiratory	Disease of respiratory system
DG: Genitourinary	Disease of genitourinary system
DG: Mental	Meantal or Behavioral disorders
DG: Malformations	Malformations, deformations and chromosomal abnormalities
DG: Cancer	Neoplasms
DG: Infectious	Infectious and parasitic diseases
DG: Dermatological	Disease of the skin and subcutaneos tissues

Table A.4a: Descriptive Statistics, 2011

	(1)	(2)	(3)	(4)
	Sample	IC	NH	Other
Need Variables				
Score	66.17	64.73	71.29	66.16
Age	80.47	80.00	81.42	80.92
Gender (female)	0.69	0.67	0.72	0.71
Physical Disability	0.14	0.16	0.07	0.16
Intellectual Disability	0.03	0.03	0.06	0.03
DG: Neurological	0.42	0.40	0.48	0.44
DG: Circulatory	0.47	0.48	0.45	0.48
DG: Digestive	0.02	0.02	0.02	0.02
DG: Muskuloskeletal	0.42	0.42	0.39	0.45
DG: Endocrino-metabolic	0.40	0.41	0.39	0.38
DG: Eye	0.09	0.09	0.08	0.10
DG: Ear	0.00	0.00	0.00	0.01
DG: Respiratory	0.20	0.21	0.18	0.19
DG: Genitourinary	0.34	0.34	0.32	0.34
DG: Mental	0.28	0.28	0.33	0.27
DG: Development	0.00	0.00	0.00	0.00
DG: Malformations	0.00	0.00	0.01	0.00
DG: Cancer	0.13	0.14	0.12	0.12
DG: Hematological	0.00	0.00	0.00	0.00
DG: Infectious	0.01	0.01	0.01	0.01
DG: Dermatological	0.00	0.00	0.00	0.00
Non-need Variables				
Annual Income	10,695.25	10,765.16	10,463.39	10,732.85
Region: Barcelona (city)	0.26	0.23	0.21	0.36
Region: Barcelonès (county)	0.22	0.21	0.27	0.23
Region: Rest of BCN (province)	0.23	0.24	0.21	0.23
Region: Girona	0.09	0.10	0.10	0.07
Region: Lleida	0.08	0.08	0.10	0.04
Region: Tarragona	0.07	0.08	0.08	0.05
Region: Terres de l'Ebre	0.04	0.06	0.03	0.02
Civil Status: Other	0.05	0.05	0.07	0.05
Civil Status: Married	0.37	0.43	0.17	0.39
Civil Status: Widow	0.49	0.47	0.57	0.48
Civil Status: Single	0.09	0.06	0.20	0.08

Notes: *Other* category accounts for DCC, HC, TA and MNH (all together, they represent less than 28%). The 7 *regions* included corresponds to the 7 'geographical units' used by Social Services Department for organizational purposes.

Table A.4b: Descriptive Statistics, 2012

	(1)	(2)	(3)	(4)
	Sample	IC	NH	Other
Need Variables				
Score	65.51	63.62	72.29	64.85
Age	80.40	79.94	81.63	80.64
Gender (female)	0.68	0.66	0.73	0.71
Physical Disability	0.16	0.18	0.08	0.17
Intellectual Disability	0.04	0.03	0.06	0.03
DG: Neurological	0.43	0.40	0.50	0.44
DG: Circulatory	0.47	0.48	0.44	0.48
DG: Digestive	0.02	0.02	0.02	0.02
DG: Muskuloskeletal	0.42	0.42	0.40	0.45
DG: Endocrino-metabolic	0.40	0.41	0.38	0.39
DG: Eye	0.09	0.09	0.08	0.10
DG: Ear	0.00	0.00	0.00	0.01
DG: Respiratory	0.20	0.21	0.17	0.19
DG: Genitourinary	0.35	0.36	0.35	0.34
DG: Mental	0.28	0.27	0.33	0.27
DG: Development	0.00	0.00	0.00	0.00
DG: Malformations	0.00	0.00	0.00	0.00
DG: Cancer	0.14	0.15	0.12	0.13
DG: Hematological	0.00	0.00	0.00	0.00
DG: Infectious	0.01	0.01	0.01	0.01
DG: Dermatological	0.00	0.00	0.00	0.00
Non-need Variables				
Annual Income	10,705.72	10,795.04	10,632.57	10,569.33
Region: Barcelona (city)	0.26	0.23	0.22	0.37
Region: Barcelonès (county)	0.22	0.21	0.27	0.22
Region: Rest of BCN (province)	0.22	0.23	0.21	0.22
Region: Girona	0.10	0.11	0.09	0.07
Region: Lleida	0.08	0.08	0.10	0.05
Region: Tarragona	0.07	0.08	0.08	0.05
Region: Terres de l'Ebre	0.04	0.06	0.03	0.02
Civil Status: Other	0.06	0.05	0.07	0.06
Civil Status: Married	0.38	0.44	0.19	0.40
Civil Status: Widow	0.47	0.45	0.56	0.46
Civil Status: Single	0.09	0.06	0.18	0.08

Notes: *Other* category accounts for DCC, HC, TA and MNH (all together, they represent less than 28%). The 7 *regions* included corresponds to the 7 'geographical units' used by Social Services Department for organizational purposes.

Table A.4c: Descriptive Statistics, 2013

	(1)	(2)	(3)	(4)
	Sample	IC	NH	Other
Need Variables				
Score	65.07	63.17	72.01	63.07
Age	80.23	79.69	81.73	80.18
Gender (female)	0.69	0.66	0.73	0.71
Physical Disability	0.18	0.20	0.10	0.20
Intellectual Disability	0.04	0.03	0.06	0.04
DG: Neurological	0.47	0.44	0.55	0.46
DG: Circulatory	0.47	0.47	0.43	0.48
DG: Digestive	0.02	0.02	0.02	0.02
DG: Muskuloskeletal	0.45	0.45	0.42	0.47
DG: Endocrino-metabolic	0.38	0.39	0.36	0.38
DG: Eye	0.10	0.10	0.09	0.10
DG: Ear	0.01	0.01	0.01	0.01
DG: Respiratory	0.19	0.20	0.17	0.19
DG: Genitourinary	0.34	0.34	0.33	0.33
DG: Mental	0.28	0.27	0.31	0.28
DG: Development	0.00	0.00	0.00	0.00
DG: Malformations	0.00	0.00	0.00	0.00
DG: Cancer	0.13	0.13	0.12	0.12
DG: Hematological	0.00	0.00	0.00	0.01
DG: Infectious	0.01	0.01	0.01	0.01
DG: Dermatological	0.00	0.00	0.00	0.00
Non-need Variables				
Annual Income	10,730.35	10,851.38	10,718.26	10,471.95
Region: Barcelona (city)	0.27	0.23	0.23	0.38
Region: Barcelonès (county)	0.22	0.21	0.27	0.21
Region: Rest of BCN (province)	0.22	0.23	0.20	0.22
Region: Girona	0.10	0.11	0.09	0.07
Region: Lleida	0.08	0.08	0.10	0.05
Region: Tarragona	0.08	0.08	0.08	0.06
Region: Terres de l'Ebre	0.04	0.06	0.03	0.02
Civil Status: Other	0.06	0.05	0.07	0.06
Civil Status: Married	0.39	0.45	0.21	0.42
Civil Status: Widow	0.47	0.44	0.55	0.45
Civil Status: Single	0.09	0.06	0.17	0.08

Notes: *Other* category accounts for DCC, HC, TA and MNH (all together, they represent less than 28%). The 7 *regions* included corresponds to the 7 'geographical units' used by Social Services Department for organizational purposes.

Table A.4d: Descriptive Statistics, 2014

	(1)	(2)	(3)	(4)
	Sample	IC	NH	Other
Need Variables				
Score	64.67	62.63	71.52	62.35
Age	79.87	79.20	81.47	79.80
Gender (female)	0.69	0.67	0.74	0.71
Physical Disability	0.20	0.23	0.12	0.22
Intellectual Disability	0.04	0.03	0.06	0.04
DG: Neurological	0.50	0.47	0.58	0.50
DG: Circulatory	0.46	0.47	0.42	0.47
DG: Digestive	0.02	0.03	0.02	0.02
DG: Muskuloskeletal	0.47	0.47	0.45	0.49
DG: Endocrino-metabolic	0.37	0.38	0.34	0.36
DG: Eye	0.11	0.11	0.10	0.11
DG: Ear	0.02	0.02	0.02	0.02
DG: Respiratory	0.18	0.19	0.16	0.18
DG: Genitourinary	0.32	0.32	0.32	0.30
DG: Mental	0.28	0.26	0.31	0.28
DG: Development	0.01	0.01	0.01	0.01
DG: Malformations	0.00	0.00	0.01	0.00
DG: Cancer	0.12	0.13	0.11	0.11
DG: Hematological	0.01	0.01	0.01	0.01
DG: Infectious	0.01	0.01	0.01	0.01
DG: Dermatological	0.00	0.00	0.00	0.00
Non-need Variables				
Annual Income	10,766.19	10,940.33	10,656.72	10,549.62
Region: Barcelona (city)	0.26	0.22	0.24	0.37
Region: Barcelonès (county)	0.22	0.21	0.26	0.22
Region: Rest of BCN (province)	0.22	0.24	0.20	0.22
Region: Girona	0.09	0.11	0.09	0.07
Region: Lleida	0.08	0.09	0.09	0.05
Region: Tarragona	0.07	0.08	0.08	0.06
Region: Terres de l'Ebre	0.04	0.06	0.03	0.02
Civil Status: Other	0.06	0.05	0.07	0.06
Civil Status: Married	0.39	0.46	0.22	0.43
Civil Status: Widow	0.46	0.43	0.54	0.43
Civil Status: Single	0.09	0.06	0.17	0.07

Notes: *Other* category accounts for DCC, HC, TA and MNH (all together, they represent less than 28%). The 7 *regions* included corresponds to the 7 'geographical units' used by Social Services Department for organizational purposes.

Table 2.A.5: Linear Probability Estimates on the probability of a given LTC service

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	HC	DCC	TC	IC	MNH	NH
Anual Income (ln)	-0.00876***	0.00149***	0.000846*	0.0123***	-0.00230***	-0.00407***
	(0.000473)	(0.000332)	(0.000444)	(0.000728)	(0.000205)	(0.000600)
Need variables						
Score	-0.000837***	-0.000154***	-0.00178***	-0.00421***	0.000756***	0.00637***
	(3.18e-05)	(2.24e-05)	(2.98e-05)	(4.90e-05)	(1.38e-05)	(4.03e-05)
Age	0.000325***	-0.000970***	0.00205***	-0.00336***	-0.000528***	0.00296***
	(5.64e-05)	(3.96e-05)	(5.29e-05)	(8.68e-05)	(2.45e-05)	(7.15e-05)
Gender (female)	0.0229***	0.00398***	0.0164***	-0.0236***	-0.00475***	-0.000178
	(0.00105)	(0.000735)	(0.000981)	(0.00161)	(0.000454)	(0.00133)
Physical Disability	0.0157***	-0.00841***	0.0143***	0.0513***	-0.00734***	-0.0635***
	(0.00118)	(0.000828)	(0.00111)	(0.00181)	(0.000512)	(0.00149)
Intellectual Disability	-0.0182***	0.0544***	-0.0157***	-0.0503***	-0.0137***	0.0405***
	(0.00239)	(0.00168)	(0.00224)	(0.00367)	(0.00103)	(0.00302)
DG: Neurological	-0.0160***	0.0366***	-0.00286***	-0.0273***	0.000133	0.0200***
	(0.000938)	(0.000659)	(0.000879)	(0.00144)	(0.000407)	(0.00119)
DG: Circulatory	0.00617***	-0.00208***	0.00640***	0.0132***	-0.00168***	-0.0217***
	(0.000896)	(0.000629)	(0.000839)	(0.00138)	(0.000389)	(0.00113)
DG: Digestive	0.00906***	-0.00791***	-0.000666	-0.000474	0.00552***	-0.00704*
	(0.00299)	(0.00210)	(0.00280)	(0.00460)	(0.00130)	(0.00379)
DG: Muskuloskeletal	0.0105***	-0.00512***	0.0160***	0.00206	-0.00363***	-0.0145***
	(0.000913)	(0.000641)	(0.000856)	(0.00140)	(0.000396)	(0.00116)
DG: Endocrino-metabolic	-0.00115	5.65e-05	-0.000366	0.0105***	-0.00248***	-0.00712***
	(0.000916)	(0.000643)	(0.000858)	(0.00141)	(0.000397)	(0.00116)
DG: Eye	0.00825***	-0.00531***	0.0107***	0.0183***	-0.00387***	-0.0270***
	(0.00145)	(0.00102)	(0.00136)	(0.00223)	(0.000630)	(0.00184)
DG: Ear	0.00561	0.00532**	0.0423***	-0.0237***	0.00720***	-0.0259***
	(0.00380)	(0.00267)	(0.00356)	(0.00584)	(0.00165)	(0.00481)
DG: Respiratory	0.00109	-0.00470***	0.00169	0.0212***	-0.00216***	-0.0194***
	(0.00113)	(0.000791)	(0.00105)	(0.00173)	(0.000488)	(0.00143)
DG: Genitourinary	0.000283	-0.00185***	-0.000934	0.0222***	-0.00417***	-0.0170***
	(0.000943)	(0.000662)	(0.000884)	(0.00145)	(0.000409)	(0.00119)
DG: Mental	-0.00164	0.000485	-0.00206**	-0.0203***	-0.00164***	0.0265***
	(0.00100)	(0.000704)	(0.000940)	(0.00154)	(0.000435)	(0.00127)
DG: Development	0.0390***	-0.000965	0.0202***	-0.0294***	0.0211***	-0.0310***
	(0.00697)	(0.00490)	(0.00653)	(0.0107)	(0.00303)	(0.00883)
DG: Malformations	-0.0210***	0.0449***	0.0136**	-0.00735	-0.0190***	-0.0218**
	(0.00720)	(0.00506)	(0.00675)	(0.0111)	(0.00313)	(0.00913)
DG: Cancer	-0.00862***	-0.00427***	-0.00233*	0.0262***	-0.000535	-0.0142***
	(0.00133)	(0.000932)	(0.00124)	(0.00204)	(0.000576)	(0.00168)
DG: Hematological	0.00355	-0.00345	0.0394***	-0.0205**	0.0197***	-0.0160**
	(0.00608)	(0.00427)	(0.00570)	(0.00935)	(0.00264)	(0.00770)
DG: Infectious	0.0151***	-0.00167	0.0134***	0.0160**	0.00235	-0.0292***
	(0.00437)	(0.00307)	(0.00410)	(0.00673)	(0.00190)	(0.00554)
DG: Dermatological	-0.0271*	-0.0229**	0.0343**	-1.10e-06	0.0550***	-0.0519***
	(0.0157)	(0.0110)	(0.0147)	(0.0242)	(0.00682)	(0.0199)
Non-need Variables						
Region: Barcelona (city)	0.0958***	-0.0136***	0.122***	-0.103***	-0.00989***	-0.0673***
	(0.00178)	(0.00125)	(0.00167)	(0.00274)	(0.000773)	(0.00226)
Region: Barcelonès (county)	0.0313***	-0.00776***	0.0700***	-0.0689***	-0.00801***	0.0114***
	(0.00181)	(0.00127)	(0.00170)	(0.00279)	(0.000787)	(0.00230)
Region: Rest of BCN (province)	0.0472***	-0.0149***	0.0607***	-0.0135***	-0.0163***	-0.0473***
	(0.00182)	(0.00128)	(0.00170)	(0.00279)	(0.000788)	(0.00230)
Region: Girona	0.00852***	-0.0141***	0.0194***	0.0434***	-0.00551***	-0.0526***
	(0.00210)	(0.00148)	(0.00197)	(0.00323)	(0.000911)	(0.00266)
Region: Lleida	-0.0123***	-0.0130***	0.000668	0.0234***	-0.0110***	0.00142
	(0.00219)	(0.00154)	(0.00206)	(0.00338)	(0.000952)	(0.00278)
Region: Terres de l'Ebre	-0.0108***	-0.00793***	-0.0304***	0.166***	-0.0159***	-0.122***
	(0.00260)	(0.00183)	(0.00244)	(0.00401)	(0.00113)	(0.00330)
Civil Status: Married	0.00642***	0.0112***	0.0155***	0.149***	-0.0155***	-0.162***
	(0.00192)	(0.00135)	(0.00180)	(0.00296)	(0.000835)	(0.00244)
Civil Status: Widow	-0.0394***	0.0180***	0.00200	0.0678***	-0.0118***	-0.0396***
	(0.00197)	(0.00138)	(0.00185)	(0.00303)	(0.000855)	(0.00250)
Civil Status: Single	-0.0279***	0.00162	-0.0158***	-0.133***	-0.000577	0.167***
	(0.00232)	(0.00163)	(0.00217)	(0.00356)	(0.00101)	(0.00293)
Observations			518,178			
R-squared	0.028	0.015	0.051	0.092	0.012	0.142

Notes: The 7 *regions* included corresponds to the 7 "geographical units" used by Social Services Department for organizational purposes. Standard errors in parentheses. *** indicates 1% significance, ** 5% and * 10%.

Table 2.A.6: CCI, CHI and corresponding contributions for different LTC

	(1)		(2)		(3)		(4)		(5)	
					Contribution of					
	CCI		CHI		Needs		Non-Needs		Residual	
Day Care Centre (DCC)	0.0029	**	0.0013		0.0012	***	-0.0003	**	-0.0003	
	0.001		1.260		0.000		0.001		0.001	
Nursing Home (NH)	0.0105	***	0.0049	**	0.0056	***	-0.0059	***	0.0108	***
	0.002		0.002		0.001		0.002		0.002	
Medical Nursing Home (MNH)	-0.0052	***	-0.0079	***	0.0027	***	-0.0063	***	-0.0016	**
	0.001		0.001		0.000		0.001		0.001	
Tele-assistance (TA)	0.0159	***	0.0197	***	-0.0038	***	0.0065	***	0.0131	***
	0.002		0.002		0.000		0.001		0.001	
Informal Care (IC)	0.0031		0.0069	**	-0.0038	***	0.0169	***	-0.0100	***
	0.003		0.003		0.001		0.002		0.002	
Home Care (HC)	-0.0294	***	-0.0274	***	-0.0020	***	-0.0149	***	-0.0125	***
	0.002		0.002		0.000		0.001		0.002	

Notes: Number of observations: 138742. This table takes only the first non-missing observation per individual (78% of claimants stick to the first chosen benefit). Bootstrapped standard errors in every second row. *** indicates 1% significance, ** 5% and * 10%.

Table 2.A.7: CCI and CHI per benefit and year

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	2011		2012		2013		2014	
	CCI	*CHI*	*CCI*	*CHI*	*CCI*	*CHI*	*CCI*	*CHI*
Panel A								
Day Care Centre (DCC)	0.0077 ***	0.0061 ***	0.0032 **	0.0024	0.0015	0.0013	0.0033 *	0.0025
	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Nursing Home (NH)	-0.0114 ***	-0.0101 ***	0.0001	-0.0028	0.0064 **	-0.0020	0.0005	-0.0104 ***
	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Medical Nursing Home (MNH)	-0.0059 ***	-0.0075 ***	-0.0045 ***	-0.0057 ***	-0.0038 ***	-0.0055 ***	-0.0028 ***	-0.0049 ***
	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Tele-assistance (T)	0.0284 ***	0.0307 ***	0.0224 ***	0.0229 ***	0.0157 ***	0.0174 ***	0.0137 ***	0.0162 ***
	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002
Informal Care (IC)	0.0024	0.0023	0.0105 ***	0.0128 ***	0.0160 ***	0.0188 ***	0.0211 ***	0.0266 ***
	0.004	0.004	0.004	0.004	0.003	0.003	0.004	0.004
Home Care (HC)	-0.0146 ***	-0.0148 ***	-0.0286 ***	-0.0272 ***	-0.0353 ***	-0.0305 ***	-0.0333 ***	-0.0292 ***
	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002
Observations	65514		95130		103770		100399	
Panel B								
In-Kind (IK)	-0.0461 ***	-0.0440 ***	-0.0673 ***	-0.0653 ***	-0.0854 ***	-0.0653 ***	-0.0860 ***	-0.0855 ***
	0.004	0.004	0.003	0.003	0.003	0.003	0.004	0.004
Nursing Home IK (NHI)	-0.0575 ***	-0.0547 ***	-0.0565 ***	-0.0548 ***	-0.0605 ***	-0.0617 ***	-0.0617 ***	-0.0663 ***
	0.003	0.003	0.002	0.002	0.002	0.002	0.003	0.003
Nursing Home V (NHV)	0.0461 ***	0.0446 ***	0.0565 ***	0.0520 ***	0.0668 ***	0.0598 ***	0.0623	0.0559 ***
	0.0023	0.0022	0.0022	0.0021	0.0020	0.0020	0.0021	0.0021
Day Care Centre IK (DCCI)	0.005	0.003	0.000	0.000	-0.001	-0.001	0.000	0.000
	0.0017	0.0017	0.0014	0.0014	0.0014	0.0014	0.0016	0.0016
Day Care Centre V (DCCV)	0.0031 ***	0.0026 ***	0.0033 ***	0.0028 ***	0.0024 ***	0.0018 ***	0.0035 ***	0.0029 ***
	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Home Care IK (HCI)	-0.0136 ***	-0.0135 ***	-0.0277 ***	-0.0261 ***	-0.0361 ***	-0.0310 ***	-0.0349 ***	-0.0304 ***
	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Home Care V (HCV)	-0.0010	-0.0013 **	-0.0010	-0.0012 **	0.0008	0.0005	0.0017 ***	0.0012 **
	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Observations	65514		95130		103770		100399	
Panel C								
Nursing Home Waiting Time (NHWT)	-0.0134 ***	-0.0072 ***	-0.0252 ***	-0.0156 ***	-0.0172 ***	-0.0100	-0.0348 ***	-0.0297 ***
	0.0026	0.0025	0.0043	0.0040	0.0058	0.0063	0.0087	0.0095

Notes: Bootstrapped standard errors in every second row.

*** indicates 1% significance, ** 5% and * 10%.

Table 2.A.8: Months Waiting to access NH, by years and providers

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	2011		2012		2013		2014	
	In-kind	*Voucher*	*In-kind*	*Voucher*	*In-kind*	*Voucher*	*In-kind*	*Voucher*
Mean	28	26	27	24	28	24	28	22
Median	23	23	20	23	23	18	23	15
Number of Observations	31,815	8,268	32,860	10,549	31,396	11,323	29,475	8,869

Chapter 3

DISCONTINUOUS SYSTEM OF ALLOWANCES: THE RESPONSE OF PROSOCIAL HEALTH-CARE PROFESSIONALS

With G López-Casasnovas and C Nicodemo

3.1 Introduction

Prosocial, altruism and intrinsic motivation, among others, have all been used to recognize that other non-pecuniary aspects of work, jobs, and organizational goals matter in explaining economic behavior. In fact, economists –including Smith (1759), Becker (1974) or Samuelson (1993)– have highlighted that people often care for the wellbeing of others. These unselfish attitudes are responsible for some decisions with important economic consequences. A growing body of literature in behavioral economics explores the specific motivations of individuals in decision making, incorporating many concepts from psychology and neuroscience (Fehr and Falk 2002; Rebitzer and Taylor 2011). It has been broadly documented that professionals in some jobs or economic activities –including Public Workers, Education, Social Services and Health Care– are more prone to respond to nonmarket incentives.[1] In the health-care sector, the utility function of physicians is modeled not only including their net income (profits) but also patients' health status or patient's utility (Ellis and McGuire 1990; Evans 1984; Feldstein 1970; McGuire 2000; Siciliani 2009). More widely, there may also be other arguments in physicians' utility function, such as intellectual stimulation, reputation and/or the intrinsic motivation from doing a good job, that are determinants of their decisions (Fehr and Camerer 2007; Fehr and Falk 2002; Frey 1997; Frey and Jegen 2001, Charness and Haruvy 1999).

In this paper, we provide theoretical and empirical evidence on how prosocial motivation affects health-care providers' (henceforth, HC) decisions in a context of non-linear incentives.[2] Aside from treating patients, HC act as assessors when resources of social support programmes –such as disability insurance or long-term care– are allocated on health status basis. The paper focuses on HC's assessment decisions, when the benefits associated with the assessments are defined by a step function. Step functions (or notch schedules) vary the local incentives around the thresholds (or cutoffs), and this variation may lead to strategic actions. The small changes in behaviour or decisions around the thresholds produce large changes in outcomes (Salle and Slemrod, 2012; Ederer et al., 2013; Gravelle, Sutton and Ma, 2010; and Jürges and Köberlein, 2015). We investigate the consequences of using a notched schedule, common in public policies –taxes, subsidies etc.–, on prosocial agents.

We focus on public workers who grant subsidies for individuals with Long-Term Care (LTC) needs. LTC is required by individuals who have lost the autonomy to perform activities of daily living (ADL), such as cooking or bathing. Usually, LTC policies are step functions as the benefits are allocated on needs basis. In 2006, the Spanish Government approved the Long Term Care Act (39/2006 -December, 14) to promote the personal autonomy and care of people with long

[1] Le Grand (2003) and Perry et al. (2010) survey the empirical literature on workers' motivation in public sector. See Francois and Vlassopoulos (2008) for a review on theoretical research on the motivation of public workers.

[2] Medical literature use HCP as acronym for *health-care provider*. In this paper for being consistent with the subscripts of the theoretical model, we prefer a shorter acronym, HC.

term care (LTC) conditions. The Spanish LTC system classifies the claimants' in six categories or degrees of LTC needs, which entitle them to LTC vouchers, services or cash subsidies for informal caregiving.[3] To classify benefits' claimants, health-care examiners assess claimants' limitations. The assessment is summarized with a score that ranges from 0 to 100, with 100 representing the maximum level of LTC needs. The score allows the classification of claimants into one of the six degrees. The design of the LTC policy, with a jump or step change in benefits by degree, may have induced strategic behavior. Examiners adjust the score of claimants whose LTC needs are close to the cutoff. By upgrading their score claimants get access to greater allowances. In this paper, we study why examiners behave strategically, quantify the consequences of this behaviour and compare their decisions under a different scheme of benefits.

We document the strategic behaviour in the needs assessment, by showing significant bunching in the distribution of scores just above the degree cutoff. The following checks suggest that discretionary power exercised by examiners could have a prosocial motivation. First, we test whether the characteristics of the claimants with scores above and below each cutoff are different. We find no significant difference between claimants scored above and below, which suggests that examiners do not selectively adjust scores. Second, we provide evidence that the adjusting behaviour does not vary geographically across the territory.[4] Third, we exploit a policy reform to show that the behaviour was only driven by the jump in the amount of benefits by degree. In 2012, the number of LTC degrees were reduced from six to three. The reform eliminates the adjusting behaviour around the old cutoff points, and boosts it around the remaining cutoffs. This fact also minimises the likelihood that the heaping phenomenon leads to notches (Bar and Lillard, 2010).[5] Finally, any pecuniary or reputation motives are unlikely to drive this behaviour as discussed in Section 3.3.

[3]To be consistent with the literature from Spain in LTC, I use the word degree to describe the categories.

[4]Both, across Catalan region, from which this paper draws the data, and other Spanish regions, such as the Basque Country.

[5]Heaping is found in a non-smooth distribution with peaks at multiplies of a given number. In general, the tendency to assign round numbers, at multiples of five or ten, producing non-smooth distributions.

In this paper, we model examiners' incentives to adjust scores under a discontinuous scheme of benefits, and show that if adjustment occurs, it concentrates around the cutoff points. The strategic actions of examiners around the local cutoffs is equivalent to a left shift of the cutoff scores. The action increases the number of beneficiaries classified in the higher degree, increasing the cost to the system. To measure this financial cost, we develop a non-parametric econometric model to estimate the counterfactual distribution of scores (i.e. how the distribution of scores would have looked in the absence of adjustments). The key underlying assumption is that, in the absence of adjustment, the distribution would have been smooth. We estimate that 3% of claimants had an adjusted score yearly. This represents an extra cost or distortion around one million euros annually, which is supported by tax-payers.

To minimize the unintended consequence of a discontinuous scheme of benefits, we predict agents' behaviour under a linear model of benefits. In a linear system, the amount of benefits would directly depend on the score. Under this system the predicted adjustment is minimized. HC still add extra points to the score, however these extra points are minimal and are given to all claimants; shifting the whole distribution to the right. To avoid the financial consequence of this shift , we propose to make agents internalise the financial consequence of the adjustments by using a fixed budget. We simulate the linear proposed scheme of benefits, and we find that using the same budget, and assuming the same choice of benefits, resources would have been distributed in a more egalitarian way, increasing total welfare.

This paper contributes to the literature on prosocial motivation. Although theoretical models in health economics have identified these factor for decades, empirical economic works on measuring these is in its infancy. Prosocial motivation has been measured quite well in laboratory experiments (see Levitt and List 2007 for an overview), however only one paper has used medical students in the experiment to measure the degree of altruism, Godager and Weisen (2011). It concludes that altruism was more important than profit.[6] Our paper takes a step further and explores how prosocial motivation interacts with the design of social policies. This leads to a second contribution on the unintended consequences of public policies. So far, research on notches has focused on cases in which the strategic action is taken by the beneficiary. This paper extends it using a framework with a third agent taking the strategic action. The paper also contributes to the methodological literature on the counterfactual estimation in the presence of notches. The majority of papers aiming to recover the counterfactual distribution use a parametric method.

3.2 Public Long-Term Care system in Spain

In 2006, the Spanish Government approved the *Act to Promote Personal Autonomy and Care* (the Act 39/2006 on December, 14) establishing a universal system for Long-Term Care (LTC). LTC is defined as the permanent assistance to perform activities of daily living (ADL) required by persons with a reduced functional capacity.[7] Despite the universality of the coverage, the system allocates resources on a needs basis, setting six intervals or degrees of needs (see Figure 3.A.1, in the Appendix.). Each degree entitles the claimants to a menu of benefits (including institutionalized care, formal home care and informal caregiver subsidies) according to the intensity of their needs. Table 3.1 summarizes the average monthly monetary value of each benefit provided in different degrees. Using an official scale, claimants' needs are assessed by Health Care Providers (henceforth, HC or examiners indistinctly).[8] This scale evaluates the loss of functional capacities in

[6]They examine the marginal rate of substitution between profit and patient health benefits for 42 medical students. Altruism was found to be important and the majority of students placed more weight on altruism than profit. In this vein, other studies have examined heterogeneity in the monetary motivation of physicians in an indirect way by using proxy variables in surveys (see Rizzo and Zeckhauser (2003, 2007), Iversen and Lurås (2000), among others).

[7]Activities of Daily Living consist of *Basic* activities –which comprise eating, dressing, bathing, getting in and out of bed, toileting and continence– and *Instrumental* activities –which include preparing own meals, cleaning, laundry, taking medication, getting to places beyond walking distance, shopping, managing money affairs and using the telephone/internet–.

[8] *The scale is called Barem de Valoració de la Dependéncia*, BVD, and is defined in the Royal Decree 504/2007.

performing 47 tasks grouped into ten activities.[9] The outcome of the assessment is a score, based on the level of limitation in each task examined, accounting for type and frequency of the assistance. Scores are mapped into degrees as follow:

- from 0 to 24 not eligible for public LTC benefits
- from 25 to 39, Degree I-I, giving access to the first menu of benefits
- from 40 to 49 , Degree I-II, giving access to the second menu of benefits
- from 50 to 64, Degree II-I, giving access to the third menu of benefits
- from 65 to 74, Degree II-II, giving access to the fourth menu of benefits
- from 75 to 89, Degree III-I, giving access to the fifth menu of benefits
- from 90 to 100, Degree III-II, giving access to the sixth menu of benefits.

HC are not directly employed by the regional government, they are organized at local level and receive a fixed wage, without any financial incentive based on the quality of the assessments or the number of assessments executed. HC do not have a repeated and personal relationship with claimants (as in the health-care system –for example, with the primary care physicians or specialists– and in social services units). All the limitations, they account for in the needs assessment, have to be medically proven (i.e. the claimant must have a diagnosed disease that can cause each limitation(s) reported, and all the diagnoses must appear in the NHS records). In spite of this, and other regulations in the assessment protocol (Royal Decree 504/2007), there is no systematic auditing. However, HC are expected to act responsibly during the assessment. In addition, claimants do not know the score obtained; only the degree of LTC needs is communicated to them by the regional government, which minimises pressure during the assessment.

[9]The ten basic daily activities are: eating and drinking, control of physical needs, bathing and hygiene, other physical care, dressing and undressing, maintaining one's health, mobility, moving inside the home, moving outside the home, and housework.

3.3 Adjusting scores

3.3.1 Prosocial motivation of HC

Do HC adjust claimants' assessments? Why? These questions arise after observing the distribution of LTC scores in Figure 3.1.[10] The main features of the distribution are the *kinks* above the cutoff scores. Our hypothesis is that HC have pushed applicants below the thresholds above, as a miss mass of observations is found in the scores preceding each cutoff score. This behavior is homogenous across examiners' centres (see Figure 3.2, where the 23 assessment centres report similar patterns). Moreover, this pattern does not only affect the geographic region in which this research is based, but is generalised across Spain. Figure 3.3 presents the score distribution in the Basque Country, where notches are also found around cutoff points. Thus, we want to investigate whether this pattern reflects the true score distribution (i.e. Spanish LTC needs distribution) or the hypothesis of strategic adjustments for people just scored below the thresholds.

We find evidence suggesting the latter. First, we draw from Vilaplana (2010) the scores calculated using the answers from the Spanish Disability and Dependency Survey for 2008 (SDDS). The survey included many questions about the items evaluated in the needs assessment because it was used to test the validity of the needs scale. Although it is based on self-reported measures, the score distribution in Figure 3.4 does not depict any notch at any cutoff score.[11]

Second, we study some features of the system that could induce adjustments. By definition, for claimants just below the cutoffs, the scheme of benefits is unfair because one point of difference in the cutoff scores implies a big jump on benefits. Yet, one point of difference in any non-cutoff scores does not imply any jump in benefits, as Figure 3.5 shows. We claim that examiners, aware of this, could adjust the score of claimants below the threshold. Although this fact does not nec-

[10]The Figure represents the distribution of scores in 2011. The distributions of the rest of the years, from 2008-2010, present a similar pattern. These Figures are available upon request.

[11]The spike around 0 is explained as the survey is representative of the Spanish population, including people with full-functional capacity and autonomy.

essarily increase claimants' health status, it increases the amount of care, which is expected to translate into greater quality of life. Thus, the adjustments can be triggered by prosocial motivation, common among public workers (see Besely and Ghatak, 2005, or Dur and Zoutenbier, 2014). In particular, there is solid evidence that HC are concerned about their patients' utility and they are willing to adjust (when a threshold determines the treatment) if this increases the care received by the patients (Ellis and McGuire, 1986 and Almond et al., 2010). Given the assessment's regulation (described in the previous section), the adjustments cannot be large. That explains why prosocial HC do not exercise substantial discretionary power, shifting the distribution to the right. They only adjust those at the margin; applicants whose real score is close to a cutoff, for whom an adjustment could improve their benefits. We provide some testable implications supporting this claim. In 2012, a reform of the LTC Act reduced the number of categories from six to three.[12] Suppressing the discontinuity in benefits at some cutoff scores eliminates the kinks in these scores (see Figure 3.6).[13] In 2014, the score distribution became smooth around the suppressed thresholds, and at the same time, the notches at remaining cutoffs increased substantially. Other features, such as the possibility of re-assessments, could lead to adjustments. However, we discard the possibility of an increased future workload because the number of reassessments is low. Only 27% of claimants apply for a reassessment, which does not threaten future workload for examiners. In general, individuals with LTC needs are close to death, and given the timing of the application process reassessments are unlikely.[14] Moreover, there are no reputation gains linked to their assessment tasks. Therefore, the lack of direct and implicit economic or social returns when adjusting scores suggests that prosocial preferences must, to some extent, motivate the adjustments.

[12] The reform was set by the Royal Decree 20/2012.

[13] To check the effects of the reform, we gather the score distribution in 2014. The response to the reform is not particular to the studied region, but it is also observed in the other regions. Figure 3.3 showing the Basque Country score distribution also depicts the same pattern after the reform.

[14] I.e. the complex bureaucracy discourages the claimants from reassessments. In general it takes a bit more than a year, between the claim and the choice of benefits, and the reception of the benefit could delay a bit further if there are capacity constraint. When this individuals deteriorate, their life spam could be less than the time they need to go through the process. The system also regulates the timing of a re-assessment (only allowed after a year of the previous assessment, unless a severe health shock affect the claimant, which requires to be medically justified).

Yet other values or emotional feelings, such as altruism and warm glow, could play a role. According to altruism, HC would target the adjustment towards the more disadvantaged group (low-income, single, with mental illness, rural areas...), but there is no significant difference in the score distribution between these groups. Based on observable characteristics, we do not identify significant positive discrimination (see Section 3.4). On the other hand, warm glow would suppose that HC give something (Andreoni, 1990); but precisely because HC do not internalise the cost of providing extra care to adjusted individuals, because it is borne by all the society, as this social intervention is financed with general taxation.

3.3.2 A Model of score adjustments

We present a simple theoretical framework to study the unintended consequences of a non-linear scheme of benefits when there are no financial incentives in place. To quantify the impact of the distortion, which is presented in Section 3.4, we should identify which scores in the distribution are affected by the adjustments.

Consider a standard model, where the individual's utility depends on Health and Income $U(Y, H)$. For an individual with LTC needs, d, her health status and income are determined by the severity of her needs (θ) and the associated social benefits (b). Thus, the utility function could be expressed as $U_d(Y(b), H(\theta))$, where $H'(\theta) < 0$ and $Y'(b) > 0$, and rewritten as:

$$U_d(b_d, \theta_d) = \gamma b_d - (1 - \gamma)\theta_d \tag{3.1}$$

where γ is the weight for each component ($0 < \gamma < 1$). We assume that the severity of LTC needs is uniformly distributed among the population, $\theta \sim U(0, 1)$, where $f(\theta)$ is the associated density function.

Policy makers allocate benefits on needs basis to LTC claimants'. However, claimants' needs are not directly observable and health-care Providers (HC) measure them. HC, as other public workers, have prosocial preferences, getting returns from others' welfare gains (Fehr and Schmidt, 1999, Besley and Gathak, 2005). The HC is assumed to be interested in both her profits and the claimants' benefits (Ellis and McGuire, 1986). As HC is paid on a fixed salary basis, the components of her utility function could be simplified to the claimant's utility and her work disutility and can be expressed as:

$$U_{hc}(U^d(b_d(\theta_d + x_{hc}), \theta_d), C(x_{hc})) = \alpha\left(\gamma b_d - (1-\gamma)\theta_d\right) - \left(\frac{x_{hc}^2}{2}\right) \tag{3.2}$$

where α ($\in [0,1]$) accounts for the HC's prosocial preferences. When $\alpha > 0$ the hc could marginally adjust the score, θ_d, increasing it by x_{hx} points: $\theta_d^{hc} = \theta_d + x_{hc}$. The adjustment is marginal and it cannot exceed a certain amount, ($0 \leq x_{hc} \leq \epsilon$, where $0 < \epsilon < 1$). Furthermore, adjusting bears a convex cost, generating work disutility: $C(x_{hc}) = \frac{x_{hc}^2}{2}$. This cost is explained by the extra time (effort) to compute the adjusted score (θ_d^{hc}).[15]

Policy-makers target LTC benefits according to the severity of claimants' needs. Thus, they define two degrees of LTC needs. Claimants' with needs below a certain level of needs, θ_j, receive y, while claimants' with needs above this level, receive $y + \Psi$, as specified below:

$$b_d = \begin{cases} y & \text{if} \quad \theta_d^{hc} \in [0, \theta_j) \\ y + \Psi & \text{if} \quad \theta_d^{hc} \in [\theta_j, 1] \end{cases}$$

The structure of LTC benefits is going to influence HC's decision as their utility depends on the benefits received by claimants. However, the impact will also depend on HC's prosocial preferences, which make also distinguish two main scenarios:

(a) The hc does not have prosocial preferences. If examiners do not have *prosocial preferences (*$\alpha = 0$*)*, the adjustment does not take place: $x_{hc} = 0\ \forall\theta_d$, and the associate cost is zero. From a Utilitarian Government perspective, the

[15]As it is well documented that people often tell the truth, even at some personal cost (Gneezy, 2005; Fischbacher and Heusi, 2008, Erat and Gneezy, 2009; Lundquist et al., 2009),we can also interpret this cost as hc's aversion to lie.

Applicants' Welfare (AW) of this benchmark case (denoted by 0) is :

$$AW_0 = \int_0^{\theta_j} U_d(b_d, f(\theta_d))d\theta_d + \int_{\theta_j}^1 U_d(b_d, f(\theta_d))d\theta_d =$$
$$\int_0^{\theta_j} [\gamma y - (1-\gamma)f(\theta_d)]\, d\theta_d + \int_{\theta_j}^1 [\gamma(y+\Psi) - (1-\gamma)f(\theta_d)]\, d\theta_d = \gamma(y + \Psi(1-\theta_j)) \tag{3.3}$$

With an associated budget of:

$$Budget_0 = y\left(\int_0^{\theta_j} f(\theta_d)d\theta_d\right) + (\Psi + y)\left(\int_{\theta_j}^1 f(\theta_d)d\theta\right) = y + \Psi(1-\theta_j) \tag{3.4}$$

(b) The hc have prosocial preferences. If examiners have *prosocial preferences* ($0 < \alpha \leq 1$), score adjustment could happen. However, adjusting the score is costly. The hc faces three possibilities depending on the (*true*) score of the applicant (θ_d):

- **(i)** $\theta_d \geq \theta_j$: The adjustment does not increase the d's benefits and the hc incurs only a positive cost, thus the adjustment does not happen. Formally: $U^a_{hc} \leq U^{na}_{hc} \iff \alpha\left(\gamma(y+\Psi) - (1-\gamma)\theta_d\right) - \frac{(x_{hc})^2}{2} \leq \alpha\left(\gamma(y+\Psi) - (1-\gamma)\theta_d\right)$
- **(ii)** $\theta_d < \theta_j$ and the patient's score (θ_d) is far from the threshold (θ_j): $\theta^{hc}_d = \theta_d + x_{hc} < \theta_j$. Thus, the cost of adjusting is larger than benefits, and the adjusment does not happen. Formally: $U^a_{hc} \leq U^{na}_{hc} \iff (\alpha\left(\gamma y - (1-\gamma)\theta_{dhc}\right) > \frac{(x_{hc})^2}{2}) \leq \alpha\left(\gamma y - (1-\gamma)\theta_d\right)$
- **(iii)** $\theta_d < \theta_j$ and the patient's score (θ_d) is close to the threshold (θ_j): $\theta^{hc}_d = \theta_d + x_{hc} \geq \theta_j$ (where $0 < x_{hc} \leq \epsilon$), the adjustment could take place. Formally: $U^a_{hc} > U^{na}_{hc} \iff \alpha\left(\gamma(y+\Psi) - (1-\gamma)\theta_{dhc}\right) - \frac{(\theta_{dhc}-\theta_d)^2}{2} > \alpha\left(\gamma y - (1-\gamma)\theta_d\right)$ which occurs if $\frac{(\theta_{dhc}-\theta_d)^2}{2} \leq \alpha\left(\gamma y - (1-\gamma)\theta_d\right)$

A graphical representation of these three cases is presented in the Appendix (see Figure 3.A.2). The number of adjusted claimants depends positively on the prosocial preferences of the HC ($\frac{\partial x_{hx}}{\partial \alpha} > 0$), the difference in the amount of benefits between groups ($\frac{\partial x_{hx}}{\partial \Psi} > 0$) and the weight assigned to the LTC benefits ($\frac{hx}{\partial \gamma} > 0$). Assuming all examiners have the same prosocial preference level, their decisions are equivalent to a shift of the threshold towards the left, denoted by $\theta_{j'} = \theta_j - \epsilon$.

Applicants' whose score is $\theta_d \leq \theta_j - \epsilon$ would be automatically upgrade as illustrated in Figure 3.A.3, in the Appendix. The larger the ϵ, the more applicants will be adjusted.
From a Utilitarian Government perspective, the Applicants' Welfare (AW_1) is:[16]

$$AW_1 = \int_0^{\theta_{j'}} U^d(b_d, f(\theta_d))d\theta_d + \int_{\theta_{j'}}^1 U^d(b_d, f(\theta_d))d\theta_d =$$
$$\int_0^{\theta_{j'}} [\gamma y - (1-\gamma)f(\theta_d)]\, d\theta_d + \int_{\theta_{j'}}^1 [\gamma(y+\Psi) - (1-\gamma)f(\theta_d)]\, d\theta_d = \gamma(y + \Psi(1-\theta_{j'})) \tag{3.5}$$

With an associated budget of:

$$Budget_1 = y\left(\int_0^{\theta_{j'}} f(\theta_d)d\theta_d\right) + (\Psi + y)\left(\int_{\theta_j'}^1 f(\theta_d)d\theta_d\right) = y + \Psi(1-\theta_{j'}) \tag{3.6}$$

Compared to the non-prosocial preferences case, the AW is larger as $\theta_j' < \theta_j$, in concrete $\triangle AW = (\theta_j - \theta_{j'})\Psi\gamma$. But, the budget required would also be greater $\triangle Budget = \Psi(\theta_j - \theta_{j'})$.

3.4 Empirical Setting: data and counterfactual estimation

3.4.1 Data

The administrative database used in this study is drawn from the Catalan Institute of Care and Social Services (ICASS). It consists of all records of individuals who have claimed LTC benefits in Catalonia, the North-East Spanish region, between 2008 and 2011. It contains $361,292$ individuals with information on their demographic characteristics (age, gender, marital status, zip code, health-related records, labour disability status, date of death, and income) and their application process (application dates, team performing needs assessment, LTC score, LTC degree and benefits, in case the claimant become eligible). Table 3.2 reports the

[16] For simplicity, the welfare analysis under the system of benefit does not considered the effect of the adjustment on the hc's welfare, they receive a fixed wage.

descriptive statistics of claimants' characteristics by LTC needs.

The sample is dominated by women (66%), widows (41%), from Barcelona (73%). On average, individuals are 79 years old. Around 25% of the sample has acknowledged a Labour Disability and almost the half (46%) have cognitive impairments. The average annual income is around 11000 euros. From all applicants, 30% has been classified in Degree III, 26% in Degree II, 21% in Degree I and the remainder 21% were not eligible claimants.[17]

3.4.2 Measuring the unintended consequences of the benefit system

In this Section we quantify the extra expenditure on LTC benefits caused by the adjustments. First, we verify that claimants above and below each threshold are not different in terms of observable characteristics. Results in Table 3.3 suggest that these variables do not to drive this probability. We document that there is no discrimination across gender, age or health status that could justify why these people are upgraded into the next threshold. If prosocial HC adjust just the claimants close to the threshold, independently from their demographics and health characteristics, we can reconstruct the distribution of the true score. The back of the envelope calculations approximate the costs associated with adjustments.

As the analysis is based on the observables support, we can developed the following non-parametric model to quantify the number of claimants affected by the adjustments. The distribution of the scores around the thresholds could be represented by a geometric progression, a sequence of numbers where each term (after the first) is found by multiplying the previous one by a fixed, non-zero number called the common ratio (see Hazewinkel, 2001). If we want to recover the fre-

[17] Although 79% are eligible, only 55% has received any allowance. The gap is explained due to the gradual implementation (by 2011, Degree I start delivering services), attrition (some claimants withdraw or die before the allocation, around 5%), and the waiting time (those who entered during second term of 2011, around 8%, are still waiting). The eligibles receive mainly a voucher or cash transfer (77%): 63% of all benefits are subsidies for informal caregiving and 37% of beneficiaries prefer a professional care service. Of them, 14% access the service with a voucher, the 23% get a inkind benefit.

quency of n_0 (for example 24) we need to eliminate some of the observations at the scores after n_0 (for example 25, 26, etc.) and add them to the n_0. Defining the true frequencies (i.e. the number of applicants in each score) as: n_0, n_1,n_2,n_3... n_k, and applying the geometric progression rule, we can write the following model:

$$n_1 = (1-\lambda)\theta_1$$
$$n_2 = (1-\lambda^2)\theta_2$$
$$n_k = (1-\lambda^k)\theta_k$$
$$n_0 = \theta_0(1+\lambda+....+\lambda^k)$$

Assuming that the parameter (θ) is the same for each score n we can rewriting our model such as:

$$n_{s+1} = (1-\lambda^{s+1})\theta$$
$$n_{s+2} = (1-\lambda^{s+2})\theta$$
$$n_{s+k} = (1-\lambda^k)\theta$$
$$n_s = \theta(1+\lambda^s+....\lambda^{s+k})$$
$$= \theta\frac{1-\lambda^{s+k+1}}{1-\lambda}$$

Based on a Poisson functional form, we can estimate θ and λ for each threshold to recover the *true* distribution of the LTC needs. The Poisson function is:[18]

$$f(\mu,k) = e^{-\mu} * \mu^{n_k}/k!$$

Where $\mu = \theta(1-\lambda^i)$

Assuming that k is five, two points above and two points below to the threshold, the associated likelihood is:

$$L(\theta,\lambda) = \frac{1}{n_0!}\exp\left\{-\theta\left(\frac{1-\lambda^5}{1-\lambda}\right)\right\}\left\{\theta\left(\frac{1-\lambda^5}{1-\lambda}\right)\right\}^{n_0}\prod_{i=1}^{4}\frac{1}{n_i!}\exp\left\{-\theta\left(1-\lambda^i\right)\right\}\left\{\theta\left(1-\lambda^i\right)\right\}^{n_i}$$

and the log-Likelihood is.[19]:

[18]The gradual implementation of the Spanish LTC system affects the distribution of score by year. We capture this by estimating the parameters also by year of implementation.

[19]As the maximum likelihood has not a close form, we solve the optimization by Newton Rapson procedure.

$$l(\theta,\lambda) = \log L(\theta,\lambda) = -\theta\left(\frac{1-\lambda^5}{1-\lambda}\right) + n_0\log(\theta) + n_0\log\left(\frac{1-\lambda^5}{1-\lambda}\right) + \sum_{i=1}^{4} -\theta\left(1-\lambda^i\right) + n_i\log(\theta) + n_i\log\left(1-\lambda^i\right)$$

$$\frac{\partial l(\theta,\lambda)}{\partial\theta} = -\left(\frac{1-\lambda^5}{1-\lambda}\right) + \frac{n_0}{\theta} + \sum_{i=1}^{4}\left(-\left(1-\lambda^i\right) + \frac{n_i}{\theta}\right)$$

$$\frac{\partial l(\theta,\lambda)}{\partial\lambda} = -\left(\frac{5\theta\lambda^4-\theta(1-\lambda^5)(1-\lambda^{-1})}{1-\lambda}\right) + \frac{n_0}{1-\lambda^5}\left(-5\lambda^4 + \frac{1-\lambda^5}{1-\lambda}\right) + \sum_{i=1}^{4}\left(\left(i\theta\lambda^{i-1}\right) - \frac{i\lambda^{i-1}n_i}{1-\lambda^i}\right)$$

Table 3.A.1, in the Appendix, reports the number of adjusted claimants and the estimated λ and θ, by year and threshold. We identify that almost 9000 claimants (3%) between 2008 and 2011 had their score adjusted. Graphically, Figure 3.7 shows the counterfactual score distribution without the adjustments in 2010.[20] To ensure the validity of our approach, we test whether this methodology recovers the scores far away from the thresholds of the original distribution (see Figure 3.8). Our non-parametric approach reproduce the original number of claimants in all scores not affected by adjustments.

The back of the envelope calculations (see Table 3.4) estimates that the cost of adjusting 9000 claimants is $838,136$ euro per month. To calculate the cost, we multiply the number of adjusted individuals in each threshold by the average expenditure per claimant above and below the threshold. The difference between these numbers gives the cost of adjustment per threshold.

3.5 An Alternative Scheme of Benefits: a linear function

Figure 3.6 suggests that the reduction of number of thresholds raises the percentage of adjusted claimants in the remaining thresholds. In contrast, increasing the number of thresholds to better target benefits should decline the adjusting behaviour because the marginal gain of adjusting decreases. In this section, we

[20]The rest of the years are available upon request.

consider the most extreme case: a scheme of benefits with as many thresholds as scores, which is equivalent to a continuous scheme of benefits. First, we develop the conceptual framework and second, we check how its implementation would have been in our setup.

3.5.1 Linear system of benefits with prosocial HC

Assume that each score has a fixed value or price, τ, such that the total benefit payed to each claimant (b_d) is:

$$b_d = \tau\theta_d^{hc} = \tau(\theta_d + x_{hc})$$

For simplicity, we choose a liner function to define the benefits, but any other continuous function could also be possible. Under the new continuous function of benefits, the prosocial HC or examiner maximizes the optimal level of adjustments as follows:

$$\max_{x_{hc}} \quad \alpha\left(\gamma\tau(\theta_d + x_{hc}) - (1-\gamma)\theta_d\right) - \frac{x_{hc}^2}{2}$$

where the FOC leads to: $x^* = \alpha\gamma\tau$. As under the bracket structure, adjustments increase with the hc's prosocial motivation (α: as $\frac{\partial x_{hc}}{\partial\alpha} > 0$), the additional benefits received from being on the right-side of the threshold (τ: as $\frac{\partial x_{hc}}{\partial\tau} > 0$), and the weight the dependant assigns to income (γ: as $\frac{\partial x_{hc}}{\partial\gamma} > 0$). From a Utilitarian Government perspective, the Applicants' Welfare under this alternative (denoted by the subscript 2) is:

$$\begin{gathered} AW_2 = \int_0^1 U^d(b_d, f(\theta_d))d\theta_d = \\ \int_0^1 \left[\gamma\tau(f(\theta_d) + x_{hc}^*) - (1-\gamma)f(\theta_d)\right]d\theta_d = \gamma\tau + (\gamma\tau)^2\alpha - (1-\gamma) \end{gathered} \tag{3.7}$$

With an associated budget of:

$$Budget_2 = \tau\left(\int_0^1 f(\theta_d)d\theta_d\right) + \tau\left(\int_0^1 (x_{hc}^*)d\theta_d\right) = \tau + \alpha\gamma\tau^2 \tag{3.8}$$

A linear system of LTC benefits does not avoid the adjusting behaviour among prosocial decision makers. Yet, the adjustments affect all claimants by the same amount, shifting to the right the distribution of scores. This, in turn, increases the public expenditure. To deal with it, policymakers could link the linear system of benefits to a fixed budget. The fix budget forces the HC to internalize the cost of adjusting.[21] In others words, if the optimal choice of adjustments is positive, the fixed budget reduces the discreteness of the HC. HC now maximises the adjustments as follows:

$$\max_{x_{hc}} \quad \alpha\left(\gamma\tau(\theta_d + x_{hc}) - (1-\gamma)\theta_d\right) - \frac{x_{hc}^2}{2}$$
$$\text{s.t. } \tau\int_0^1 \left[f(\theta_d) + x_{hc}\right] d\theta_d = y + \Psi(1-\theta_{j'}) = M$$

By isolating τ in the budget constraint and substituting in the objective function we have:

$$\max_{x_{hc}} \quad \alpha\left(\gamma\frac{M}{\int_0^1 [f(\theta_d) + x_{hc}]d\theta_d}(\theta_d + x_{hc}) - (1-\gamma)\theta_d\right) - \frac{x_{hc}^2}{2}$$

Solving this case, $\hat{\tau} = \left(-\frac{1}{2}\right)\sqrt{1 + 4(\alpha\gamma)(y + \Psi(1-\theta_{j'}))}$ represents the optimal τ for the given level of expenditure. The optimal adjustment is the same above, with the particularity that τ takes the value $\hat{\tau}$: $x^* = \alpha\gamma\hat{\tau}$. From a Utilitarian Government perspective, the Applicants' Welfare under this alternative (denoted by the subscript 3) is:

$$\begin{gathered} AW_3 = \int_0^1 U^d(b_d, f(\theta_d))d\theta_d = \\ \int_0^1 \left[\gamma\tau(f(\theta_d) + x_{hc}^*) - (1-\gamma)f(\theta_d)\right] d\theta_d = \gamma\hat{\tau} + (\gamma\hat{\tau})^2\alpha - (1-\gamma) \end{gathered} \tag{3.9}$$

With an associated budget of:

$$Budget_3 = \text{Budget}_1 = y + \Psi(1-\theta_{j'}) \tag{3.10}$$

[21]In the UK for example, the government has created the Commissioning Clinical Groups (CCGs) where they are responsible to getting the best possible health outcomes for the local population, by assessing local needs, deciding priorities and strategies, and then buying services on behalf of the population from providers such as hospitals, clinics, community health bodies, etc.

3.5.2 The value of a score point in Spanish LTC context

In this second part, we calculate the value or price a score point for our setting. We take the score distribution of claimants in November 2011, as well as, the other characteristics of the claimants. Thus, we assume that the number of individuals, their severity, their income level and choice would not have changed under a linear system of benefits. This assumption is required because the voucher amount also depends on financial capabilities (the wealthiest individuals received 80% of the amount the least wealthy) and the type of benefit (because the cost of care varies). This discrimination by income and care implies that we need to the find the value of the point of the score for all the possible combinations between care and income groups. In order to apply this positive discrimination (by income and care choice), we follow the criterion set in the Act 39/2006. The Act establish a maximum amount of benefit. Applying a given discount to this amount, the system defines all the voucher amounts (i.e. the maximum amount is gradually reduced when financial means increase or the cost of the care is lowered, being the amount of the reduction defined by the discounts). Tables 3.5 and 3.6 report the income discount and services discount. We also set the fixed budget, B equal to the amount of public expenditure in 2011.

We define the set of care options as:

$$I \equiv \{nh, hch, hcl, dc, ic\}$$

where nh refers to nursing home, hch and hcl are professional care at home at high or low level respectively, dc is the day-care center and ic is the informal caregiver cash transfer. We define the annual income levels as establish by the government

$$c \equiv 1, 2, ..., 6.$$

where 1 is the lowest income level (less than 7,000 euro) and 6 is the maximum(more than 46,000 euro). And, $n_{s,i,c}$ determines the number of benefit issued by score, s (where $s = 1, 2....100$), care choice, i and income group c. In order to determine τ, we have to solve:

$$B = \sum_{s=0}^{100} \sum_{i \in I} \sum_{c=1}^{6} \tau (1 - \delta_i)(1 - \gamma_c) n_{s,i,c} \tag{3.11}$$

In November 2011, with the given budget B and all care choice $n_{s,i,c}$, the value of τ is:

$$\tau = B / (\sum_{s=0}^{100} \sum_{i \in I} \sum_{c=1}^{6} (1 - \delta_i)(1 - \gamma_c) n_{s,i,c}) = 8.43€ \tag{3.12}$$

Applying to this 8 euro the discounts of care and income groups, we can determine the value of τ for all possible combinations. Table 3.7 presents the price or value of one point in the score in euro, by the type of service and income groups. For the wealthiest group with the cheapest care, the value is estimated to be around 4 euro, whereas the value for the least wealthy group of claimants with the most expensive care (nursing homes) is 13.5 euro. Of course, these values depend on claimants' choice, which we assume not to be changed if a linear scheme of benefits would be implemented. Figure 3.A.4, in the Appendix, shows the distribution of the average allowances by each base point of the score, for home residence (12.8% of the total care) and informal care-giver (86.7% of the total care) calculated for both schemes: bracket and smooth. The linear scheme of benefits avoids within and between categories inequality. With respect to the discontinuous system, claimants receiving informal caregiver cash subsidies with scores from 50 to 55 and from 90 to 92 lose, as the amount is reduced. However, the maximum lost is 17% of the subsidy received under the discontinuous system, and people with the rest of the scores are always better off. Similarly, the majority of claimants receiving a voucher for going to a residence or nursing home are also better with the continuous system (only claimants with scores between 90 and 96 have the voucher reduced by approximately 13%).

3.6 Conclusions

This paper provides one of the few empirical evidence on prosocial motivated health care professionals (HC). First, we document that HC behave according to their prosocial motivation. Second, we identify the unintended consequences when prosocial HC have to determine the level of LTC needs (with a continuous measure) that allow the needy to access a discontinuous scheme of public LTC benefits. HC adjust the score of claimants whose real score are just below the thresholds to access to greater benefits. We find that around one million euro of the total expenditure is due to the adjusting behaviour, which affects 3% of claimants. Yet, whether the adjustments improve or not the quality of life of these claimants is beyond the scope of this paper, but should be analysed in future research. Third, we present a theoretical framework where we suggest that defining LTC benefits with a linear function based on the needs score, instead of degrees. Increasing the number of thresholds, following the literature (see Hillman, 2003), minimise the adjusting behaviour.[22] By minimizing the length of the brackets, the unfairness within and between degrees tend to disappear, as well as, the notches without reducing the utility of beneficiaries. Yet, the use of a fixed budget or, other mechanisms, to force the HC to internalise the cost of adjusting is required to control the budget.

[22] See, for instance, the Earned Income Tax Credit designed by policy-makers to reduce the poverty trap.

Tables & Figures

Table 3.1: Monetary value of LTC monthly benefits

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Informal Caregiver (IC)	Nursing Homes (NH)		Day Care Centre (DCC)		Home Care (HC)	TeleAssistance (TA)
type of benefit	*cash transfer*	*voucher*	*service*	*voucher*	*service*	*service*	*voucher*
Degree III	431	831	1870-c	409	853-c	537	
Degree II	303	494	1595-c	247	730-c	307	20-c
Degree I	168			171	597-c	211	

Notes: All amounts are in euros. For the benefits in *voucher* or *cash transfers* the reported amount is the average, as the amount depends on beneficiary's financial capability. For benefits of *public services*, the monthly value is defined as the public cost/price of the service minus the copayment (C), which depends on beneficiary's financial capability.

Figure 3.1: Score's distribution in 2011

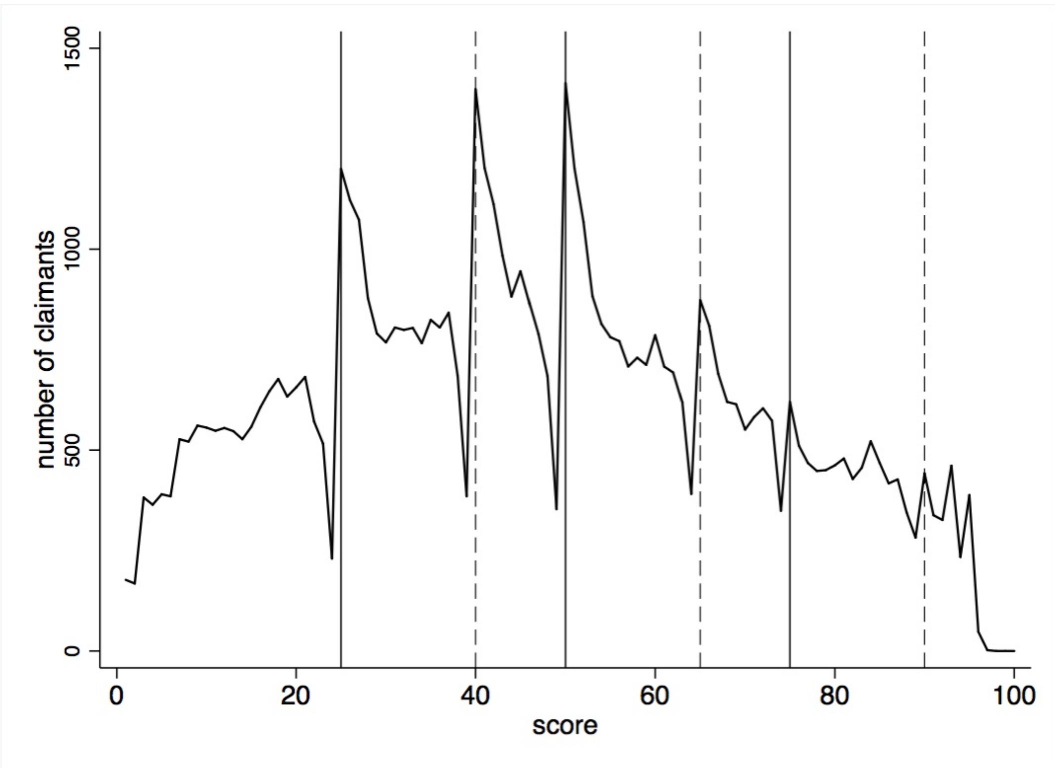


Figure 3.2: Score distribution by medical board (SEVAD) of LTC assessment

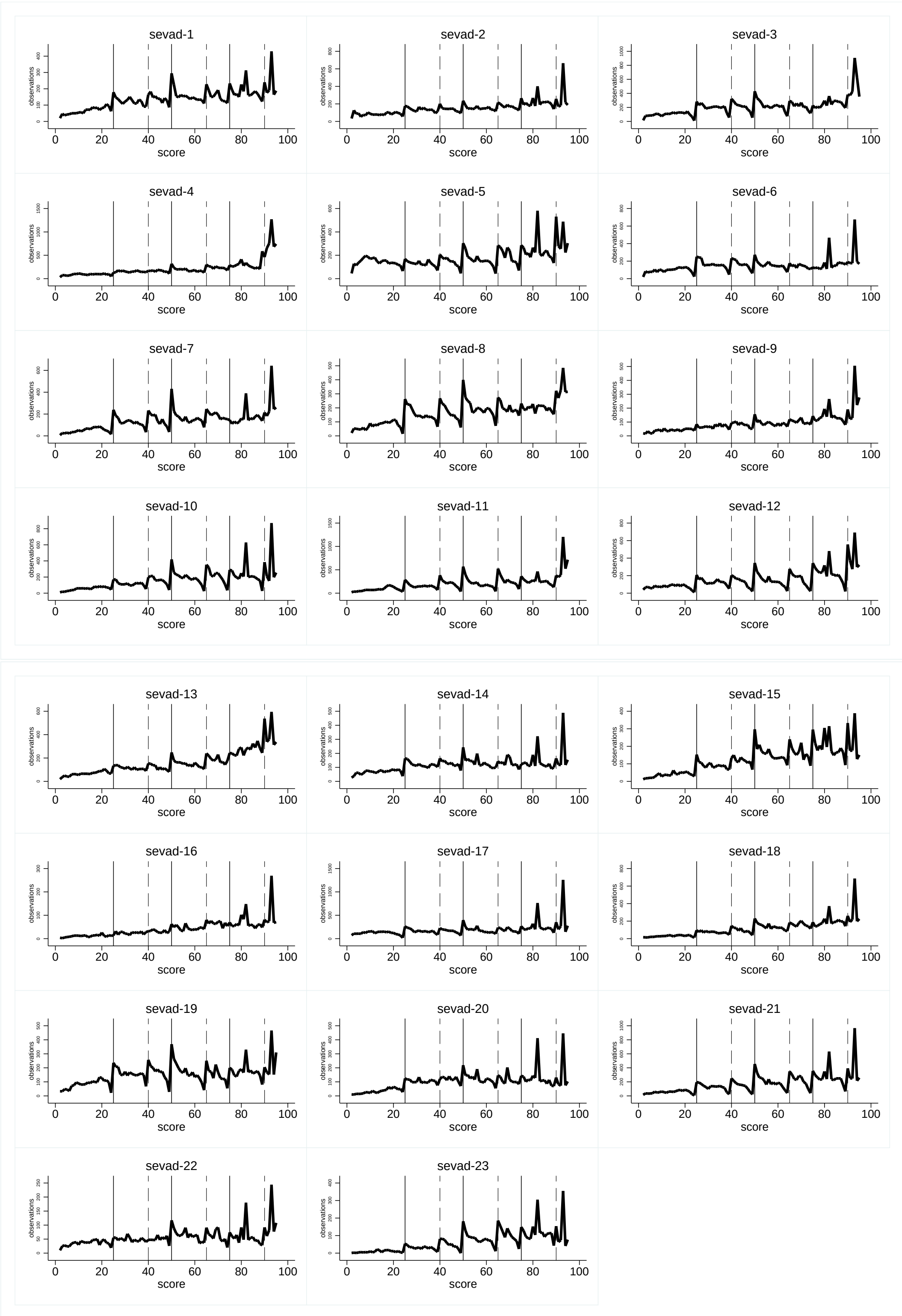
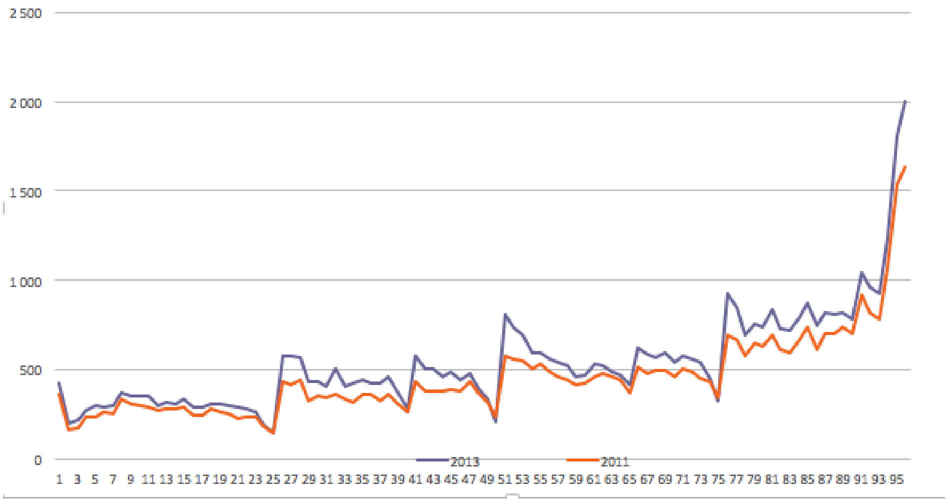
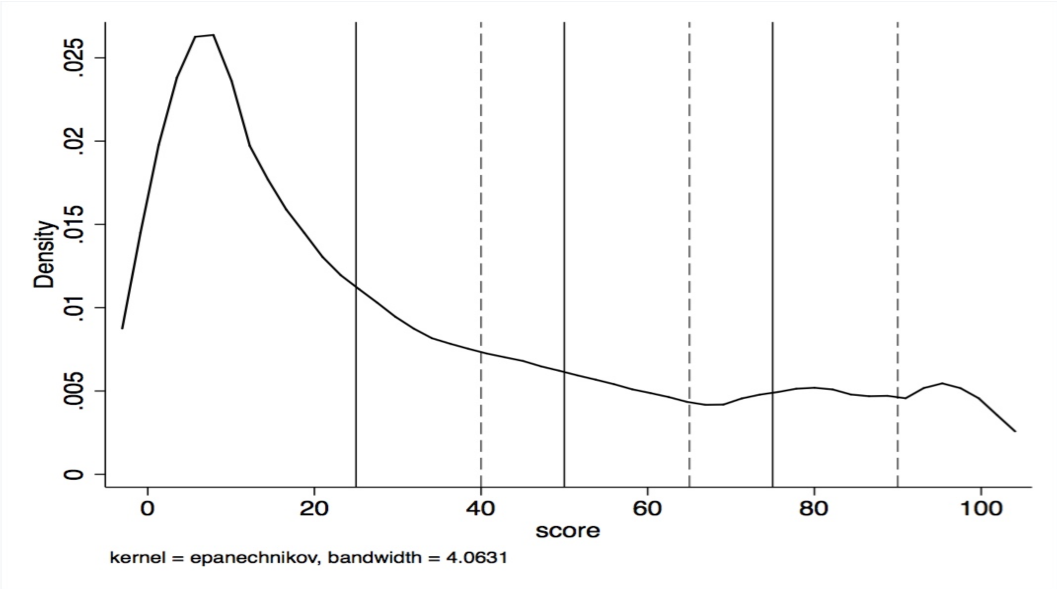


Figure 3.3: Score Distribution in Bask Country



Source: Bask Country Region administrative records.

Figure 3.4: Kernel density of the Estimated Score from SDDS survey responses



Source: Vilaplana, 2010.

Figure 3.5: Average monthly benefits by scores

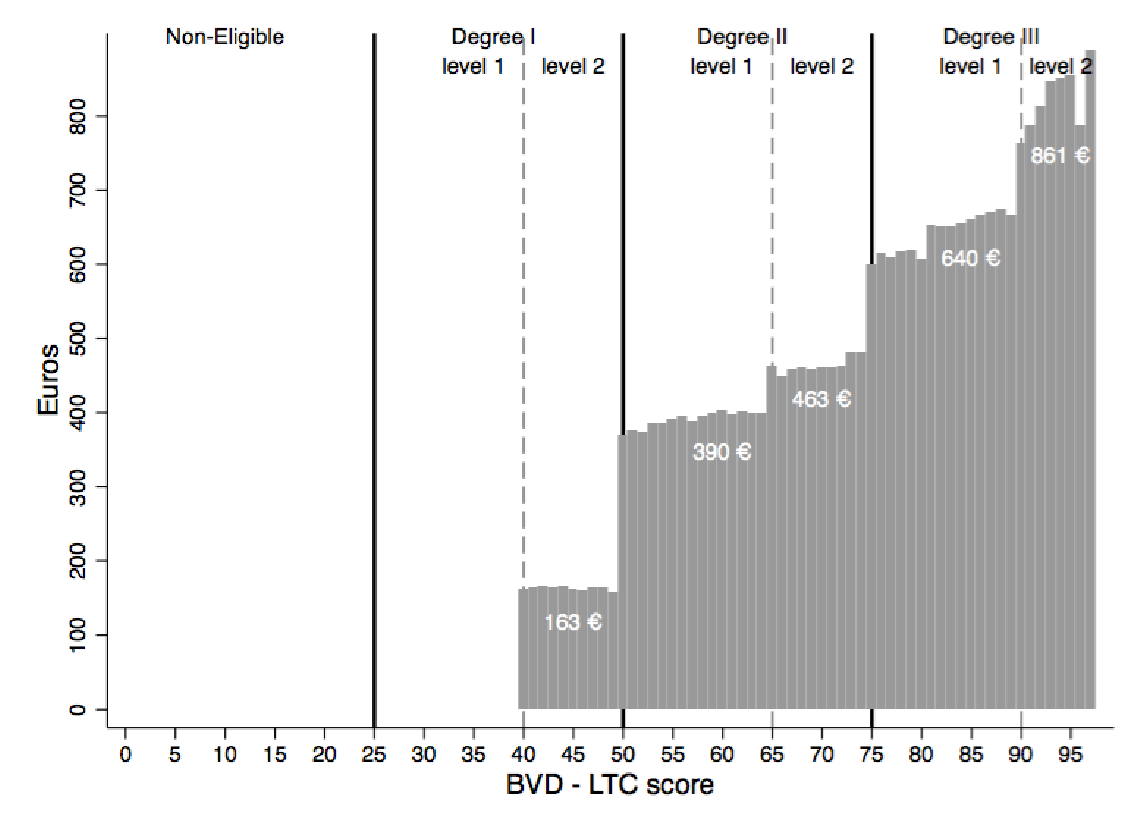


Figure 3.6: Score distributions before and after levels' removal

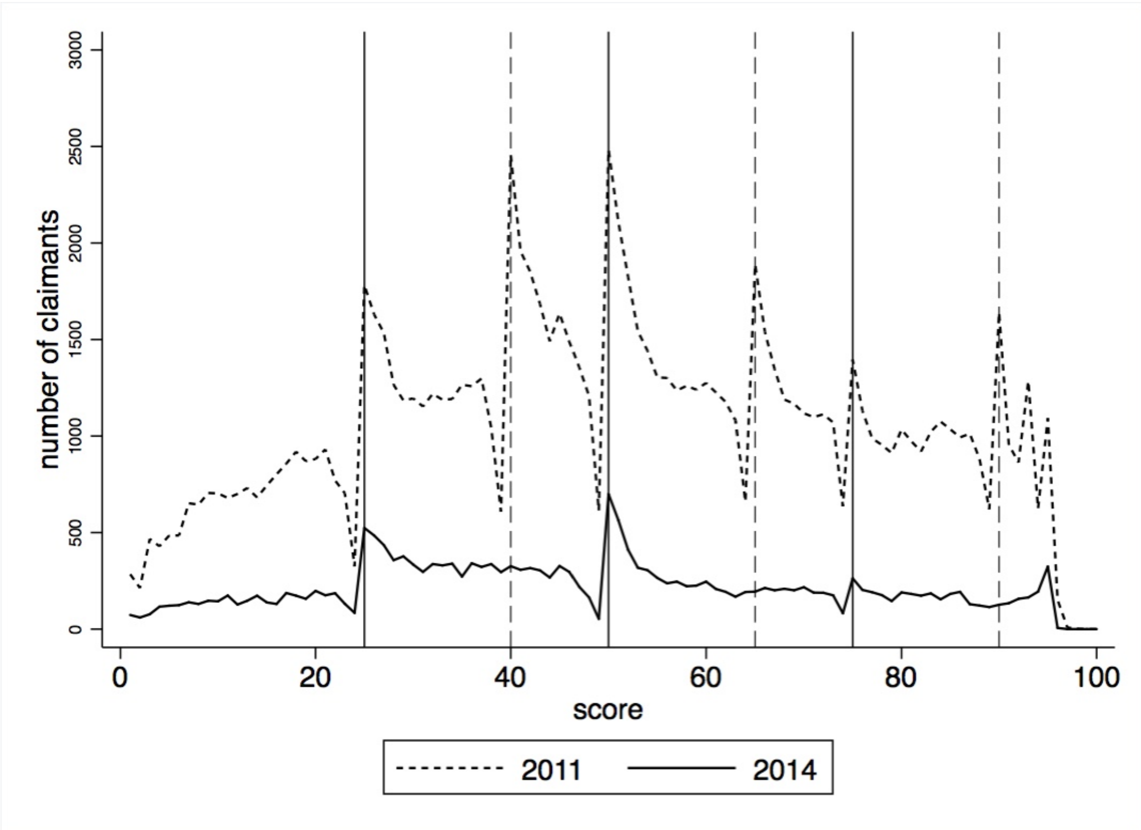


Table 3.2: Descriptive Statistics

	(1) All Sample	(2) No Degree	(3) Degree I	(4) Degree II	(5) Degre III
Female	0.66	0.61	0.69	0.66	0.68
Age	78.99	77.93	77.09	78.37	81.43
Age: 40-54	0.05	0.05	0.07	0.06	0.04
Age: 55-69	0.11	0.13	0.14	0.11	0.07
Age: 70-84	0.48	0.52	0.53	0.48	0.43
Age: +85	0.35	0.30	0.27	0.34	0.45
Civil Status					
Married	0.37	0.42	0.42	0.38	0.30
Widow	0.41	0.38	0.39	0.42	0.45
Single	0.10	0.10	0.11	0.12	0.09
Other CS	0.11	0.09	0.08	0.08	0.16
Region (province)					
Barcelona	0.73	0.75	0.73	0.71	0.73
Girona	0.09	0.07	0.08	0.10	0.10
Lleida	0.07	0.07	0.07	0.07	0.07
Tarragona	0.11	0.10	0.13	0.12	0.11
Year of Application					
*2007**	0.15	0.07	0.03	0.08	0.35
2008	0.27	0.20	0.20	0.28	0.33
2009	0.24	0.22	0.29	0.29	0.18
2010	0.20	0.22	0.30	0.23	0.10
*2011**	0.14	0.28	0.18	0.11	0.04
Labour Disability	0.26	0.23	0.29	0.28	0.26
Cognitive impairment	0.46	0.24	0.29	0.53	0.76
Annual Income (euros)	11028.62	11629.84	11036.01	10810.79	11295.37
Missing Income	0.61	0.92	0.37	0.41	0.73
Score	52.53	6.39	36.58	61.24	86.13
Acces to benefits	0.55	0.00	0.19	0.87	0.83
Voucher or Cash Transfer	0.77		0.69	0.83	0.74
Type of Benefit					
At home Care	0.07		0.13	0.07	0.06
Day Care Centre	0.03		0.03	0.03	0.02
Informal Caregiver	0.63		0.69	0.72	0.54
Medical Nursing Home	0.02		0.01	0.01	0.03
Nursing Home	0.24		0.07	0.15	0.34
TeleCare	0.02		0.07	0.02	0.01
Observations	361292	76233	74252	95723	115084
		0.21	0.21	0.26	0.32

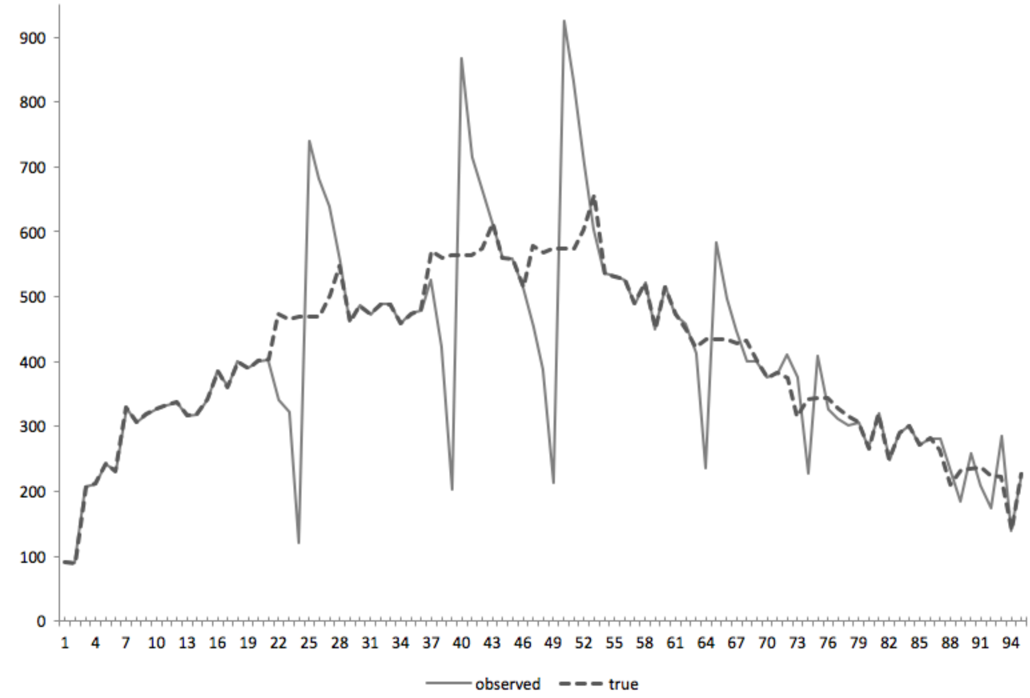
Notes: (*) The implementation in 2007 started in June, and observations of 2011 do not include December.

Table 3.3: Above the cutoff

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	DI l1 vs DI l2 37-42	DI-l2 vs DII-l1 47-52	D II l1 vs DII l2 62-67	DII-l2 vs DIII-l1 72-77	DI l1 vs DI l2 37-42	DI-l2 vs DII-l1 47-52	D II l1 vs DII l2 62-67	DII-l2 vs DIII-l1 72-77
Female	-0.014**	-0.002	0.003	0.010	-0.016**	-0.004	0.004	0.008
	(0.007)	(0.007)	(0.011)	(0.011)	(0.007)	(0.006)	(0.010)	(0.011)
Age: 55-69	0.016	-0.004	-0.022	0.013	0.016	0.005	-0.020	0.024
	(0.020)	(0.017)	(0.015)	(0.029)	(0.020)	(0.017)	(0.015)	(0.028)
Age: 70-84	0.021	0.022	-0.025*	-0.003	0.028	0.036***	-0.012	0.012
	(0.016)	(0.014)	(0.013)	(0.022)	(0.016)	(0.012)	(0.013)	(0.020)
Age: +85	0.026	0.026*	0.001	0.028	0.038*	0.045***	0.018	0.042**
	(0.019)	(0.013)	(0.016)	(0.021)	(0.020)	(0.012)	(0.014)	(0.018)
Married	0.016	0.001	0.022**	0.035**	0.006	-0.004	0.018*	0.035**
	(0.010)	(0.010)	(0.008)	(0.015)	(0.011)	(0.011)	(0.009)	(0.015)
Widow	0.030***	-0.001	-0.011	0.004	0.022*	-0.006	-0.015	0.008
	(0.010)	(0.009)	(0.009)	(0.016)	(0.012)	(0.009)	(0.010)	(0.015)
Disability	-0.009	-0.015	-0.015	-0.014	-0.004	-0.007	-0.003	-0.006
	(0.011)	(0.010)	(0.009)	(0.011)	(0.010)	(0.009)	(0.009)	(0.010)
Number of Diagnosis					0.008	-0.007	-0.007	-0.012**
SEVAD F.E.	NO	NO	NO	NO	YES	YES	YES	YES
Province F.E	NO	NO	NO	NO	YES	YES	YES	YES
Observations	17,108	23,334	22,317	21,366	17,105	23,324	22,304	21,347

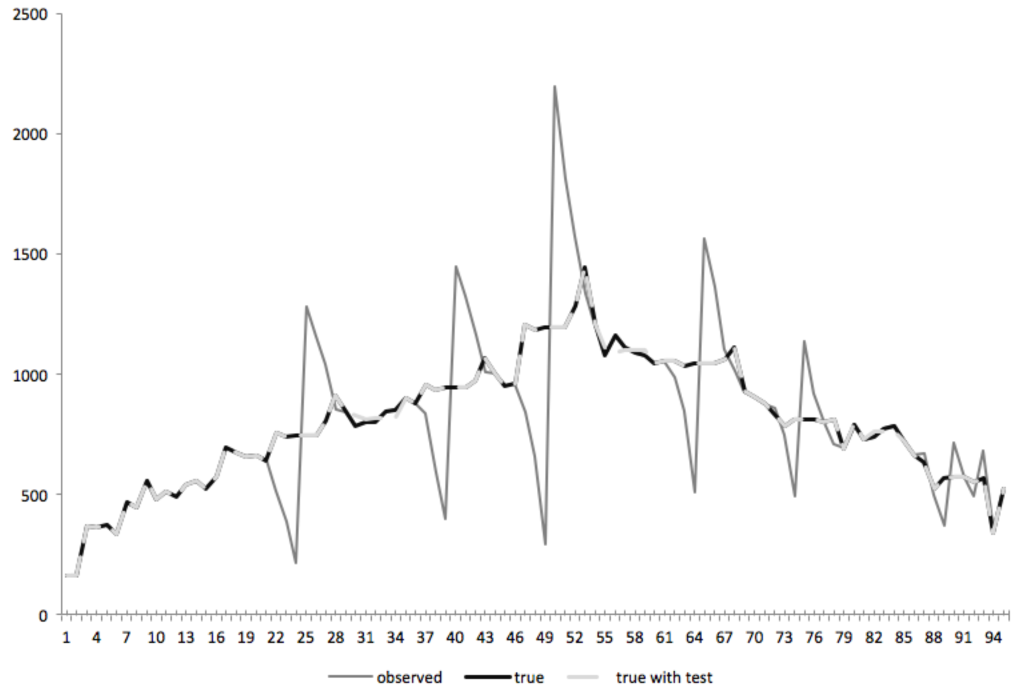
Dependent variables: a dummy which takes value one if the score is 3 points above the threshold, 0 if 3points below. All OLS regressions include time fixed effects. Robust Standard errors, clustered at SEVAD level. The reference variables are age cohort from 40 to 54 years old and divorced. Significance levels: One star (*) if $p < 0.05$, two stars(**) if $p < 0.01$, and three stars (***) if $p < 0.001$.

Figure 3.7: Score distributions: observed vs *true*



Notes: This graph presents the distribution of 2010. The *true* distribution is obtain with the counterfactual estimation.

Figure 3.8: Score distributions: observed vs *true* II



Notes: This graph presents the distribution of 2010. Compared to 3.7 it includes the *true with test distribution*, which is constructed estimating the counterfactual values in other parts of the distribution which are not affected by the adjustments.

Table 3.4: Back of the envelope Calculations

	(1)	(2)	(3)	(4)	(5)
	Degre I	**Degree II**		**Degree III**	
	Level II	**Level I**	**Level II**	**Level I**	**Level II**
Number of adjusted claimants	31	3424	2395	2063	981
Monthly Expenditure					
With Adjustments	5583	1040948	811797	566136	584345
Without Adjustments	0	605052	723589	471456	442576
Difference or "potential savings"					
Total	5583	435896	88208	94680	141769
Percentage	100.00	41.87	10.87	16.72	24.26

Table 3.5: Discounts by Care Options (LTC Act 39/2006)

		discounts
Residence	δ_r	0
Informal Caregiver	δ_{ic}	0.37
At home care (high)	δ_{hch}	0.2
At home care (low)	δ_{hcl}	0.4
Day Care Centre	δ_{dc}	0.4

Table 3.6: Discounts by Care Options (LTC Act 39/2006)

	Annual Income Group		**discounts** *j= ic, hch, hcl, dc*	*j=nh*
1	**$\leq$ 7967.73**	$\gamma_{j,1}$	0	-0.6
2	**(7967.73,11951.6]**	$\gamma_{j,2}$	0	-0.3
3	**(11951.6,19919.33]**	$\gamma_{j,3}$	0	0
4	**(19919.33,35854.79]**	$\gamma_{j,4}$	0.05	0.05
5	**(35854.79,43822.52]**	$\gamma_{j,5}$	0.1	0.1
6	**$\geq$ 43822.5**	$\gamma_{j,6}$	0.2	0.2

Note: the discount nursing home is negative for the three lowest income groups. As the maximum voucher for NH is insufficient to cover the cost for the lowest income groups, the system provides a financial complement.

Table 3.7: The value of τ, by care and income group

			(1)	(2)	(3)	(4)	(5)
			LTC Services linked to FB				
	Annual Income Group		**Nursing Home** δ_r	**Informal Caregiver** δ_{ic}	**At home care (high)** δ_{hch}	**At home care (low)** δ_{hcl}	**Day Care Centre** δ_{dc}
1	**$\leq$ 7967.73**	$\gamma_{j,1}$	13.49	5.31	6.75	5.06	5.06
2	**(7967.73,11951.6]**	$\gamma_{j,2}$	10.96	5.31	6.75	5.06	5.06
3	**(11951.6,19919.33]**	$\gamma_{j,3}$	8.43	5.31	6.75	5.06	5.06
4	**(19919.33,35854.79]**	$\gamma_{j,4}$	8.01	5.05	6.41	4.81	4.81
5	**(35854.79,43822.52]**	$\gamma_{j,5}$	7.59	4.78	6.07	4.55	4.55
6	**$\geq$ 43822.5**	$\gamma_{j,6}$	6.75	4.25	5.40	4.05	4.05

Appendix 3.A Supplementary Tables and Figures

Figure 3.A.1: Spanish LTC system: Funnel procedure

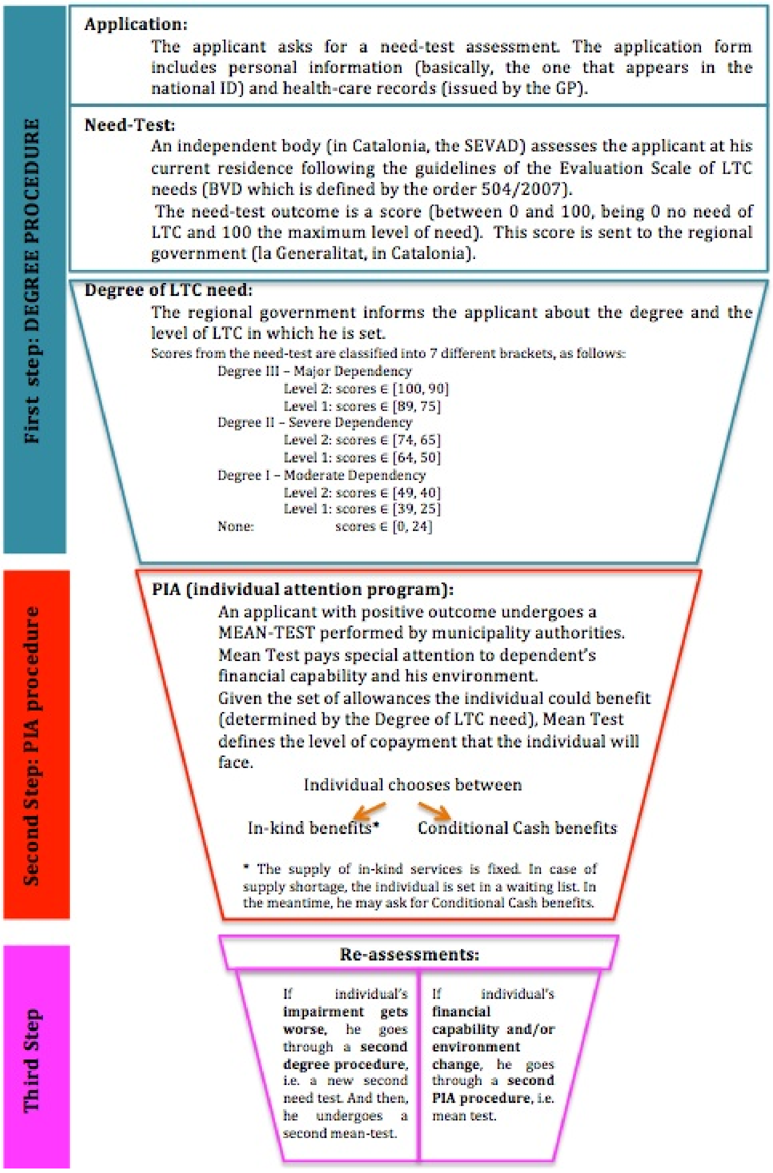


Figure 3.A.2: Prosocial HC

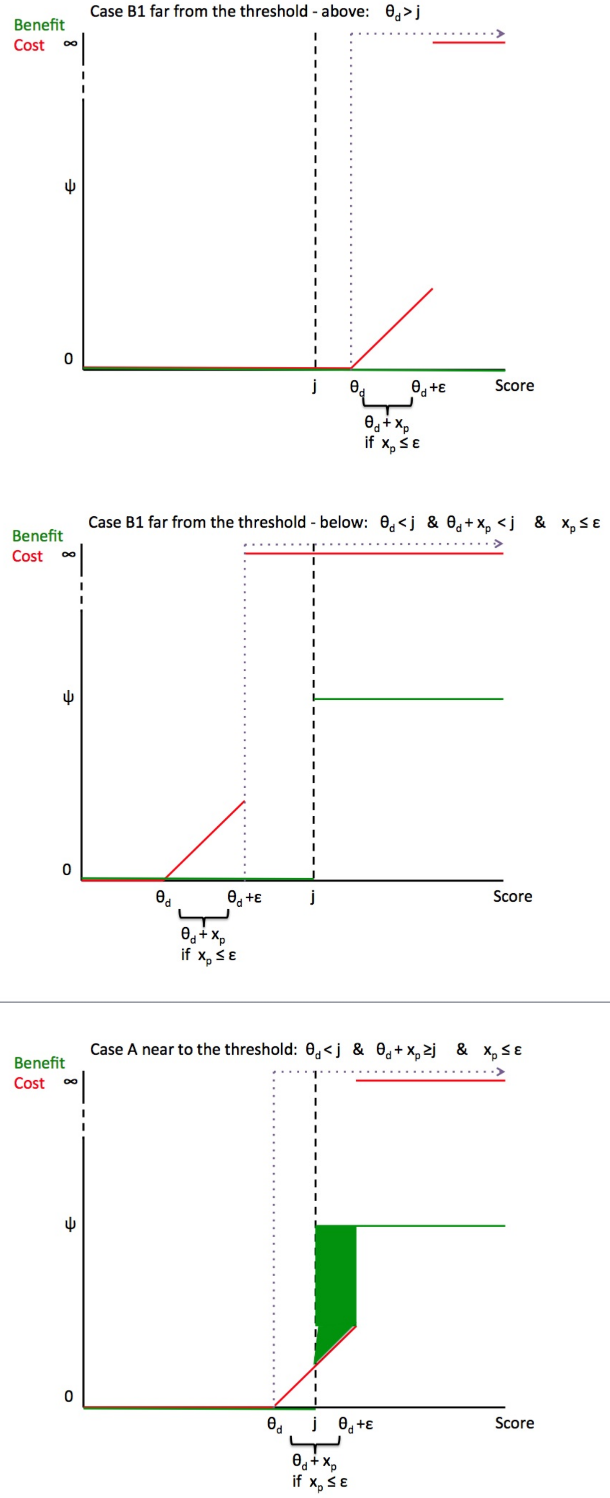


Figure 3.A.3: Threshold Shift: the unintended consequence of a non-linear scheme of benefits with prosocial HC

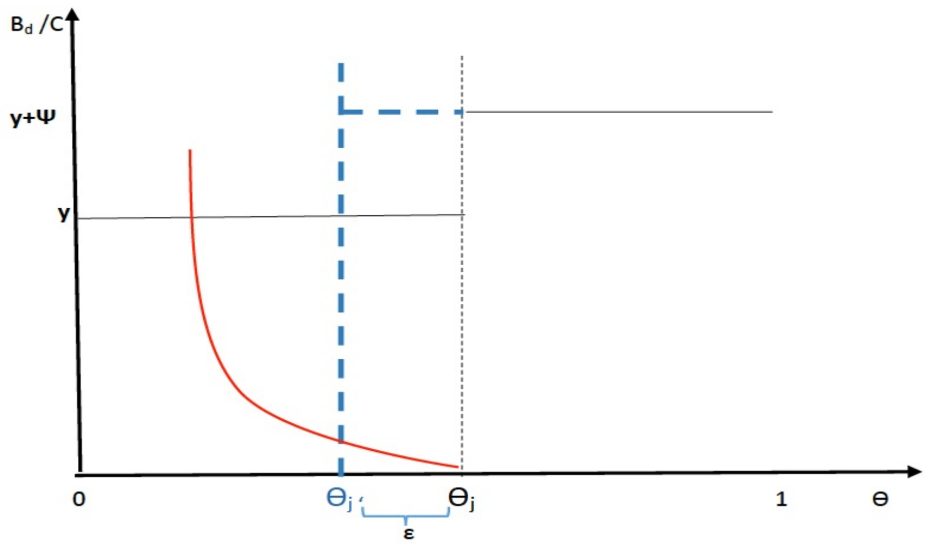
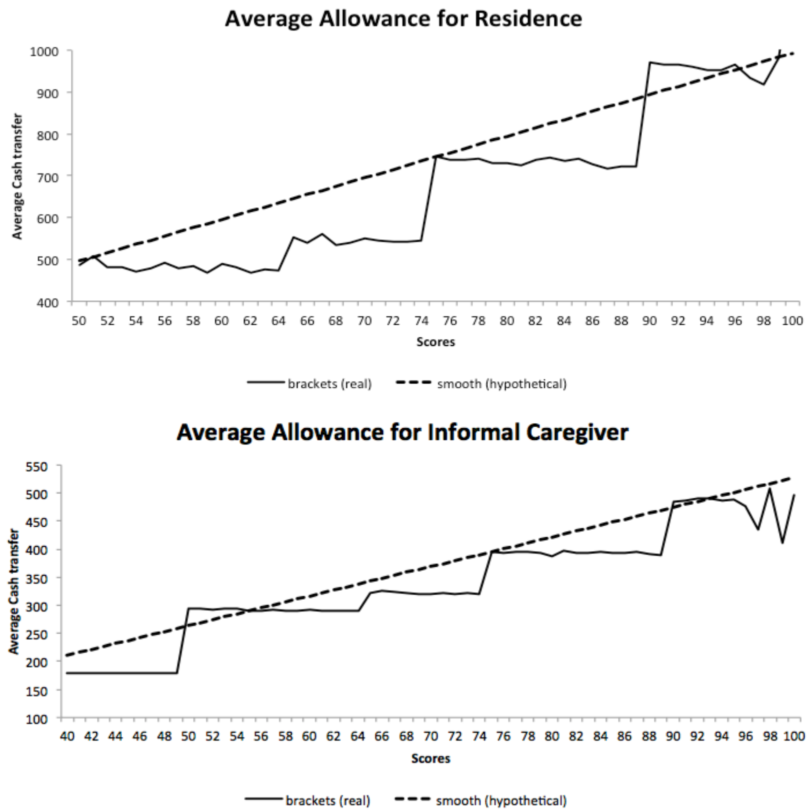


Table 3.A.1: Adjusted claimants and estimated parameters, by years and threshold

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
From none to degree I-I: 23-27							
	$\Delta 23$	$\Delta 24$	$\Delta 25$	$\Delta 26$	$\Delta 27$	λ	θ
2008	255	285	-222	-134	-184	0.067	479.40
2009	474	559	-485	-293	-255	0.088	816.00
2010	487	549	-466	-344	-226	0.065	819.00
2011	251	315	-246	-182	-138	0.128	500.80
From degree I-I to degree I-II: 38-42							
	$\Delta 38$	$\Delta 39$	$\Delta 40$	$\Delta 41$	$\Delta 42$	λ	θ
2008	192	215	-159	-128	-120	0.072	624.61
2009	361	410	-370	-225	-176	0.064	950.40
2010	379	646	-515	-336	-174	0.067	973.67
2011	224	294	-293	-139	-86	0.123	567.00
From degree I-II to degree II-I: 48-52							
	$\Delta 48$	$\Delta 49$	$\Delta 50$	$\Delta 51$	$\Delta 52$	λ	θ
2008	527	604	-1043	-119	31	0.039	1021.60
2009	707	846	-1075	-381	-97	0.067	1257.18
2010	433	916	-808	-367	-174	0.099	1086.00
2011	235	290	-278	-179	-68	0.100	556.20
From degree II-I to degree II-II: 63-67							
	$\Delta 63$	$\Delta 64$	$\Delta 65$	$\Delta 66$	$\Delta 67$	λ	θ
2008	620	701	-702	-411	-208	0.058	1223.60
2009	500	574	-645	-326	-103	0.058	1107.80
2010	151	535	-444	-237	-5	0.112	837.80
2011	86	119	-137	-64	-4	0.122	374.00
From degree II-II to degree III-I: 73-77							
	$\Delta 73$	$\Delta 74$	$\Delta 75$	$\Delta 76$	$\Delta 77$	λ	θ
2008	476	530	-540	-297	-169	0.050	1368.40
2009	245	321	-428	-132	-6	0.090	963.20
2010	35	322	-295	-93	31	0.115	631.20
2011	18	39	-72	-1	16	0.180	283.40
From degree III-I to degree III-II: 88-92							
	$\Delta 88$	$\Delta 89$	$\Delta 90$	$\Delta 91$	$\Delta 92$	λ	θ
2008	532	621	-823	-161	-169	0.055	1828.80
2009	182	220	-430	-33	61	0.039	869.00
2010	19	177	-201	-18	23	0.094	429.80
2011	6	12	-45	-4	31	0.058	183.00

Figure 3.A.4: Continuous vs Discontinuous schemes of benefits



The average score under the bracket system of payment is computed directly with our data. To build the comparable allowances for each score under the smooth system of payment, we use the weighted average monetary value of a point, and then when multiply this value per each score. The weights used are the proportion of individuals by care option.

Bibliography

Abásolo, I., Saez, M., and López-Casasnovas, G. (2017). Financial crisis and income-related inequalities in the universal provision of a public service: the case of healthcare in Spain. *International Journal for Equity in Health*.

Aizer, A. and Doyle, J. J. (2015). Juvenile Incarceration, Human Capital, and Future Crime: Evidence from Randomly Assigned Judges. *The Quarterly Journal of Economics*.

Alberini, A., Cropper, M., Krupnick, A., and Simon, N. B. (2004). Does the value of a statistical life vary with age and health status? Evidence from the US and Canada. *Journal of Environmental Economics and Management*, 48(1):769–792.

Aldy, J. E. and Viscusi, W. K. (2007). Age Differences in the Value of Statistical Life: Revealed Preference Evidence. *Review of Environmental Economics and Policy*, 1(2):241–260.

Aldy, J. E. and Viscusi, W. K. (2008). Adjusting the Value of a Statistical Life for Age and Cohort Effects. *The Review of Economics and Statistics*, 90:573–581.

Almond, D., Doyle, J. J., Kowalski, A. E., Williams, H., and Williams, H. (2010). Estimating Marginal Returns To Medical Care: Evidence From At-Risk Newborns. *The quarterly journal of economics*, 125(2):591–634.

Andreoni, J. (1990). Impure Altruism and Donations to Public Goods: A Theory of Warm-Glow Giving. *The Economic Journal*, 100(401):464.

Angrist, J. D., Imbens, G. W., and Rubin, D. B. (1996). Identification of Causal Effects Using Instrumental Variables. *Journal of the American Statistical Association*, 91(434):444–455.

Bar, H. and Lillard, D. (2010). A Heap of Trouble? Accounting for Mismatch Bias in Retrospectively Collected Data on Smoking.

Barnay, T. and Juin, S. (2016). Does home care for dependent elderly people improve their mental health? *Journal of Health Economics*, 45:149–160.

Bauer, J. and Sousa-Poza, A. (2015). Impacts of Informal Caregiving on Caregiver Employment, Health and Family. *Journal of Population Ageing*, 8:113–145.

Becker, G. S. (1974). A Theory of Social Interactions. *Journal of Political Economy*, 82:1063–1093.

Bergman, M. A., Johansson, P., Lundberg, S., and Spagnolo, G. (2016). Privatization and quality: Evidence from elderly care in Sweden. *Journal of Health Economics*, 49:109–119.

Besley, T. and Ghatak, M. (2005). Competition and Incentives with Motivated Agents. *American Economic Review*, 95(3):616–636.

Bhuller, M., Dahl, G. B., Løken, K. V., and Mogstad, M. (2016). Incarceration, Recidivism, and Employment. *NBER Working Paper: 22648*.

Blank, R. M. (2000). When Can Public Policy Makers Rely on Private Markets? The Effective Provision of Social Services. *The Economic Journal*, 110.

BOE (2006). Act 39/2006, of 14th December, on Promotion of Personal Autonomy and Assistance for Persons in a Situation of Dependency.

BOE (2007). Royal Decree 504/2007, of 20th April, which approves the scale to value the dependency situation established by Law 39/2006 of 14th December.

BOE (2011). Royal Decree 174/2011, of 11th February, which approves the scale to value the dependency situation established by Law 39/2006 of 14th December, which promotes the personal autonomy and care to those individuals in dependency situation.

BOE (2012a). Royal Decree 20/2012, 13th July, of measures to ensure budgetary stability and promoting competitiveness.

BOE (2012b). Royal Decree 2/2012, of 3rd of February,m on State Budget.

BOE (2013). Royal Decree 1046/2013, of 27th of Desember, to fix the minimum interprofessional wage for 2014.

Bonsang, E. (2009). Does informal care from children to their elderly parents substitute for formal care in Europe? *Journal of health economics*, 28(1):143–54.

Carlson, B. L., Foster, L., Dale, S. B., and Brown, R. (2007). Effects of Cash and Counseling on Personal Care and Well-Being. *Health Services Research*, 42:467–487.

Cave, M. (2001). Voucher Programmes and their Role in Distributing Public Services. *OECD Journal on Budgeting*, 1(1):59–88.

Cebul, R. D., Rebitzer, J. B., Taylor, L. J., and Votruba, M. E. (2011). Unhealthy Insurance Markets: Search Frictions and the Cost and Quality of Health Insurance. *American Economic Review*, 101(5):1842–1871.

Charness, G. and Haruvy, E. (2002). Altruism, Equity, and Reciprocity in a Gift Exchange Experiment: An Encompassing Approach.

Coveney, M., García-Gómez, P., Van Doorslaer, E., and Van Ourti, T. (2016). Health Disparities by Income in Spain Before and After the Economic Crisis. *Health Economics*, 25(S2):141–158.

Culyer, A. J. (1971). The nature of the commodity health care and its efficient allocation. *Oxford Economic Papers*, 23(2):189–211.

Dahl, G. B., Kostol, A. R., and Mogstad, M. (2014). Family Welfare Cultures. *The Quarterly Journal of Economics*, 129(4):1711–1752.

DatosMacro (2017). Salario Medio en España: http://www.datosmacro.com/mercado-laboral/salario-medio/espana.

Departament de Treball Afers Socials i Família (2016). Registre d'Entitats, Serveis i Equipaments Socials (RESES).

Dobbie, W., Goldin, J., and Yang, C. (2016). The Effects of Pre-Trial Detention on Conviction, Future Crime, and Employment: Evidence from Randomly Assigned Judges. *NBER Working Paper: 22511*.

DOGC (2007). Act 12/2007, of 11th October, Social Services.

Doyle, J. J. (2007). Child Protection and Child Outcomes: Measuring the Effects of Foster Care. *American Economic Review*, 97(5):1583–1610.

Duell, D., Koolman, X., and Portrait, F. (2017). Practice variation in the Dutch long-term care and the role of supply-sensitive care: Is access to the Dutch long-term care equitable? *Health Economics*.

Dur, R. and Zoutenbier, R. (2014). Intrinsic Motivations of Public Sector Employees: Evidence for Germany. *German Economic Review*, 16(3).

Ederer, F. and Manso, G. (2013). Is pay for performance detrimental to innovation? *Management Science*, 59(7):1496–1513.

Eduardo, J. and Pérez, M. (2007). El valor monetario de la vida estadística en España a través de las preferencias declaradas*. *Revista de Economía Pública*, (4):183–125.

Ellis, R. P. and McGuire, T. G. (1986). Provider behavior under prospective reimbursement: Cost sharing and supply. *Journal of Health Economics*, 5(2):129–151.

Ellis, R. P., McGuire, T. G., Ellis, R., and McGuire, T. G. (1990). Optimal payment systems for health services. *Journal of Health Economics*, 9(4):375–396.

Emanuel, E. J. and Fuchs, V. R. (2005). Health Care Vouchers — A Proposal for Universal Coverage. *New England Journal of Medicine*, 352(12):1255–1260.

Epple, D., Romano, R. E., and Urquiola, M. (2017). School Vouchers: A Survey of the Economics Literature. *Journal of Economic Literature*, 55(2):441–492.

Erat, S. and Gneezy, U. (2009). White Lies. *Rady School of Management*.

Erreygers, G. (2009). Correcting the Concentration Index. *Journal of Health Economics*, 28(2):504–515.

European Comission: Economic and Financial Affairs (2016). *Joint report on health care and long-term care systems and fiscal sustainability*. Publications Office of the European Union.

Evans, R. G. (1984). *Strained Mercy: The Economics of Canadian Health Care*. Butterworth-Heinemann.

Fehr, E. and Camerer, C. F. (2007). Social neuroeconomics: the neural circuitry of social preferences. *Trends in Cognitive Sciences*, 11(10):419–427.

Fehr, E. and Falk, A. (1969). European economic review. *European Economic Review*, 46(4-5):687–724.

Fehr, E. and Schmidt, K. M. (1999). A Theory of Fairness, Competition, and Cooperation. *The Quarterly Journal of Economics*, 114(3):817–868.

Feldstein, M. S. (1970). Corporate Taxation and Dividend Behaviour. *The Review of Economic Studies*, 37(1):57–72.

Fischbacher, U. and Heusi, F. (2013). Lies in Disguise: An experimental study on cheating. *Journal of the European Economic association*, 11.

Forder, J., Malley, J., Towers, A.-M., and Netten, A. (2014). Using cost-effectiveness estimates from survey data to guide commissioning: an application to home care. *Health economics*, 23(8):979–92.

Francois, P. and Vlassopoulos, M. (2008). Pro-Social Motivation and the Delivery of Social Services. *CESifo Economic Studies*.

French, E. and Song, J. (2014). The Effect of Disability Insurance Receipt on Labor Supply. *American Economic Journal: Economic Policy*, 6(2):291–337.

Frey, B. S. and Jegen, R. (2001). Motivation Crowding Theory. *Journal of Economic Surveys*, 15(5):589–611.

Frey, B. S. and Oberholzer-Gee, F. (1997). The Cost of Price Incentives: An Empirical Analysis of Motivation Crowding- Out. *The American Economic Review*, 87:746–755.

García-Gómez, Hernández-Quevedo, Jiménez-Rubio, and Oliva-Moreno (2015). Inequity in long-term care use and unmet need: Two sides of the same coin. *Journal of Health Economics*, Volume 39:Pages 147–158.

Gary S. Becker Tomas J. Philipson, R. R. S. (2005). The Quantity and Quality of Life and the Evolution of World Inequality. *The American Economic Review*, 95(1):277–291.

Gneezy, U. (2005). Deception: The Role of Consequences. *American Economic Review*, 95(1):384–394.

Gravelle, H., Sutton, M., and Ma, A. (2010). Doctor Behaviour under a Pay for Performance Contract: Treating, Cheating and Case Finding? *The Economic Journal*, 120(542):129–156.

Guo, J., Konetzka, R. T., and Manning, W. G. (2015). The causal effects of home care use on institutional long-term care utilization and expenditures. *Health economics*, 24 Suppl 1:4–17.

Hansmann, H. (1996). The changing roles of public, private, and nonprofit enterprise in education, health care, and other human services. In *Individual and social responsibility: Child care, education, medical care, and long-term care in America*, pages 245–276. University of Chicago Press.

Hazewinkel, M. (2001). The Algebra of Quasi-Symmetric Functions Is Free over the Integers. *Advances in Mathematics*, 164(2):283–300.

Hernandez-Pizarro, H., Lopez-Casasnovas, G., and Nicodemo, C. (2015). Against the Discontinuity Trap: The case of Long-Term care in Spain.

Hillman, A. L. (2003). *Public finance and public policy: responsibilities and limitations of government*. Cambridge University Press.

IDESCAT (2011). Població. Per sexe, edat quinquennal i estat civil.

Imbens, G. W. and Angrist, J. D. (1994). Identification and Estimation of Local Average Treatment Effects. *Econometrica*, 62:467–75.

IMSERSO (2015). Información estadística del Sistema para la Autonomía y Atención a la dependencia.

Instituto Nacional de Estadística (2008). Spanish Disability and Dependency Survey.

Iversen, T. and Lurås, H. (2000). The effect of capitation on GPs' referral decisions. *Health economics*, 9(3):199–210.

Jiménez-Martín, S., Costa-Font, J., and Vilaplana-Prieto, C. (2016). Thinking of Incentivizing Care? The Effect of Demand Subsidies on Informal Caregiving and Intergenerational Transfers. *FEDEA*.

Jiménez-Martín, S. and Vilaplana Prieto, C. (2015). Informal care motivations and intergenerational transfers in European countries. *Health economics*, 24 Suppl 1:89–103.

Jiménez-Martín, S., Vilaplana Prieto, C., Vegas-Sánchez, R., and Gutiérrez, L. (2010). The Long-Term Care System for the Elderly in Spain.

Jöel, M.-E., Dufour-Kippelen, S., Duchêne, C., and Marmier, M. (2010). The Long-Term Care System for the Elderly in France.

Jones, A. M., Rice, N., D' Uva, T. B., and Balia, S. (2007). Health and Retirement. In Routledge, editor, *Applied Health Economics*, chapter 7. New York, first edition.

Jürges, H. and Köberlein, J. (2015). What explains DRG upcoding in neonatology? The roles of financial incentives and infant health. *Journal of Health Economics*, 43:13–26.

Kakwani, N., Wagstaff, A., and van Doorslaer, E. (1997). Socioeconomic inequalities in health: Measurement, computation, and statistical inference. *Journal of Econometrics*, 77 (1).

Kim, H. B. and Lim, W. (2015). Long-term care insurance, informal care, and medical expenditures. *Journal of Public Economics*, 125:128–142.

Laudicella, M., Siciliani, L., and Cookson, R. (2012). Waiting Times and Socioeconomic Status: Evidence from England. *Social Science & Medicine*, 74 (9).

Le Grand, J. (2003). *Motivation, Agency, and Public Policy*. Oxford University Press.

Levitt, S. D. and List, J. A. (2007). What Do Laboratory Experiments Measuring Social Preferences Reveal about the Real World? *The Journal of Economic Perspectives*, 21:153–174.

López-Casasnovas, G., Hernández-Pizarro, H., and Meis, U. (2017). Informe Econòmic i Social ACRA 2016. Technical report, CRES-UPF.

Maslow, A. H. (1943). A theory of human motivation. *Psychological Review*, 50(4):370–396.

Maynou, L., Saez, M., Bacaria, J., and Lopez-Casasnovas, G. (2015). Health inequalities in the European Union: an empirical analysis of the dynamics of regional differences. *The European Journal of Health Economics*, 16(5):543–559.

McCrary, J. (2008). Manipulation of the running variable in the regression discontinuity design: A density test. *Journal of Econometrics*, 142(2):698–714.

McGuire, T. G. (2000). Physician agency. *Handbook of Health Economics*, 1:461–536.

Mot, E., Aouragh, A., de Groot, M., and Mannaerts, H. (2010). The Long-Term Care System for the Elderly in the Netherlands.

Netten, A., Trukeschitz, B., Beadle-Brown, J., Forder, J., Towers, A.-M., and Welch, E. (2012). Quality of life outcomes for residents and quality ratings of care homes: is there a relationship? *Age and ageing*, 41(4):512–7.

OECD (2015). *Health at a Glance 2015: OECD indicators*. Health at a Glance. OECD Publishing.

Organisation for Economic Co-operation and Development. (2012). *Mortality risk valuation in environment, health and transport policies.* OECD.

Peña-Longobardo, L. M., Oliva-Moreno, J., García-Armesto, S., and Hernández-Quevedo, C. (2016). The Spanish long-term care system in transition: Ten years since the 2006 Dependency Act. *Health Policy*, 120(10):1177–1182.

Perry, J. L., Hondeghem, A., and Wise, L. R. (2010). Revisiting the Motivational Bases of Public Service: Twenty Years of Research and an Agenda for the Future. *Public Administration Review*.

Publishing, O. (2013). *Health at a glance 2013: OECD indicators*. OECD publishing.

Quezada-Hofflinger, A. (2008). School Choice and Equity: The impact of voucher schools on educational inequality in the Chilean case.

Rapp, T., Chauvin, P., and Sirven, N. (2015). Are public subsidies effective to reduce emergency care use? Evidence from the PLASA study. *Social Science & Medicine*, 138:31–7.

Rivero, A. (2013). Análisis de las tasas de participación de la Ley de Dependencia en España.

Rizzo, J. A. and Zeckhauser, R. J. (2003). Reference Incomes, Loss Aversion, and Physician Behavior. *Review of Economics and Statistics*, 85(4):909–922.

Rizzo, J. A. and Zeckhauser, R. J. (2007). Pushing incomes to reference points: Why do male doctors earn more? *Journal of Economic Behavior & Organization*, 63(3):514–536.

Sallee, J. M. and Slemrod, J. (2012). Car notches: Strategic automaker responses to fuel economy policy. *Journal of Public Economics*, 96(11-12):981–999.

Sampat, B. and Williams, H. (2015). How Do Patents Affect Follow-On Innovation? Evidence from the Human Genome. Technical report, National Bureau of Economic Research, Cambridge, MA.

Samuelson, P. A. (1993). Altruism as a Problem Involving Group versus Individual Selection in Economics and Biology. *American Economic Review*, 83(2).

Shulz, E. (2010). The Long-Term Care System for the Elderly in Germany.

Siciliani, L. (2015). Waiting Times: Evidence of Social Inequalities in Access for Care. In *Data and Measures in Health Services Research*, pages 1–17. Springer US, Boston, MA.

Siciliani, L. and Verzulli, R. (2009). Waiting times and socioeconomic status among elderly Europeans: evidence from SHARE. *Health Economics*, 18(11):1295–1306.

Smith, A. (1759). *The Theory of Moral Sentiments*. London.

Steptoe, A., Deaton, A., and Stone, A. A. (2015). Subjective wellbeing, health, and ageing. *The Lancet*, 385(9968):640–648.

Van Houtven, C. H., Coe, N. B., and Konetzka, R. T. (2015). Family structure and long-term care insurance purchase. *Health economics*, 24 Suppl 1:58–73.

van Leeuwen, K., Malley, J., Bosmans, J., Jansen, A., Ostelo, R., van der Horst, H., and Netten, A. (2014). What can local authorities do to improve the social care-related quality of life of older adults living at home? Evidence from the Adult Social Care Survey. *Health & Place*, 29:104–113.

Wagstaff, A., Paci, P., and van Doorslaer, E. (1989). Equity in the finance and delivery of health care: some temptative cross-country comparisons. *Oxford Review of Economic Policy*, 5 (1):89–112.