The Effect of Long-Term Care Benefits on Mortality*

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This Version: November 2016. The most updated version here.

(*Job Market Paper*)

Abstract

In OECD countries, 50% of adults aged 65 and over are, to some extent, limited in performing daily activities. In fact, 20% of the over sixty-fives are severely limited. Long-Term Care (LTC) policies aim to improve the life of those individuals, who have lost their autonomy, and soften the burden they bear. This translates to an average expenditure on LTC of 1.7% of GDP in OECD countries. Yet, little evidence has shed light on the effects of LTC policies on the beneficiaries. This paper 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 following official guidelines. To estimate the causal effect of LTC benefits on mortality, we exploit the quasi-random assignment of examiners to LTC applicants in Spain. Given the variation in examiners' leniency (tendency to grant greater benefits), applicants assigned to more lenient examiners are more prone to get access to a higher degree of benefits. Estimates based on Spanish LTC beneficiaries (2008-2014) indicate that the access to greater benefits can be effective in extending beneficiaries' life. When the level of LTC needs is moderate, LTC is particularly effective in postponing death, as care prevents or delays the impairments' worsening. While policy-makers tend to prioritise the provision of LTC to individuals with high needs, these findings emphasise the provision of LTC to those at initial stages of LTC needs.

Keywords: Long-Term Care Benefits, Effectiveness, Mortality

JEL classification: I38, H53, J14.

*I am indebted to Guillem López Casasnovas and Catia Nicodemo for their insightful guidance. This paper benefited from helpful conversations and suggestions from Pieter Bakx, Cristina Bellés, kizkitza Biguri, Ruben Enikolopov, Pilar Garcia-Gomez, Anne Gielen, Sergi Jiménez, Maarten Lindeboom, Maria Lombardi, Darjush Trafreschi, Ana Tur-Prats, Judit Vall-Castelló, Eddy Van Doorslaer, and all seminar and conference participants at the Erasmus School of Economics (Erasmus University Rotterdam), AES 2015, EvaluAES, 2016 and iHEA 2015. I would also like to thank Cecilia Fabregas, Inma Palet, Nuria Claros and the rest of the team of *Dependency* at Catalan Government Department of Work, Social Affairs and Family for the help with data, and all the managers of different SEVAD institutions who kindly provide the complementary data. Errors remain my own. I acknowledge financial support from the *Institut d'Estudis Autonòmics*, Catalan Government.

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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] In fact, 20% of the over sixty-fives are severely limited. These needs create a demand for Long-Term Care (LTC), which translates to 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 designed LTC systems with a twofold objective. First, interventions aim to ensure that people with LTC needs live with higher quality. Second, policies are meant for guaranteeing the financial protection of these population and their family, against the catastrophic expenditure of LTC costs. This paper analyses the effects of public LTC benefits on beneficiaries.

Despite the large expenditure on LTC, which keeps growing annually at 4% in OECD countries, the value of each euro allocated to LTC is still unknown. Furthermore, LTC demand is expected to soar as the following three trends suggest. First, *ageing* has increased the population at highest risk of LTC needs, the elderly. Second, *socieconomic 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. In this vein, families has 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, and enlarged the period in which they will suffer from LTC needs. 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' outcomes is difficult due to data limitations which affect the research design in two ways. First, selection threatens identification. That is, the elderly who receive larger public LTC resources 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 paper sheds lights on the effects of public LTC benefits on mortality, by using data of

[1] Basic ADL include: functional mobility, bathing, dressing, self-feeding, 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 1.6% (1%) of GDP.

124.895 LTC beneficiaries in Spain. To deal with the selection problem, we exploit the variation in the level of LTC benefits granted by the quasi-randomly assigned examiners of LTC needs. The assessment of LTC needs to determine the amount of LTC benefits is conducted by examiners organized in regional teams. Examiners follow an official scale, which serves to evaluate how individuals' limitations affect their autonomy in performing ADL. In spite of the objectivity of this scale, the examiners can exercise some discretionary power (i.e., examiners can slightly over-report the level of needs). Accordingly, an applicant is more prone to be entitled to greater benefits if she has been assigned to a systematically more lenient examiner. We construct examiner leniency using a leave-out mean, a residualised measure based on all other assessments in which the examiner grants greater benefits. This leave-out leniency measure is highly predictive of the amount of benefits, but uncorrelated with claimants' observable characteristics. Given the quasi-random assignment of examiners to LTC benefit claimants, the use of examiner leniency as an instrumental variable allows us to isolate an exogenous variation in claimants' benefits, and thus estimate the causal effect of greater LTC benefits. The instrumental variables estimates focus on the variation in the benefits granted among marginal claimants, which are the claimants most likely to be affected by policy changes.

One of the strength of our framework is the Spanish LTC register, an administrative dataset that contains detailed information of health status, including mortality, and linked to examiners ID. In this paper, we look at the effects of public LTC benefits on mortality. Steptoe et al (2015) have documented that longer survival is positively associated to wellbeing. In fact, life expectancy and mortality are suggested as valid measures for quality of life.[3] Maynou et al. (2015) argue that mortality can be a summary measure of the availability of health-care and social services, among other factors. Therefore, looking at this extreme outcome, this paper studies the effect of a LTC public policy. Based on the life expectancy of individuals with LTC needs, we focus on the probability of dying within the first three years since the claimant applied for benefits. We also explore alternative measures such as the probability of being alive at the age of 85, 90, 95 and reaching the age of life-expectancy. While improvements in the quality of life can postpone death, the absence of reductions in mortality does not necessarily imply that LTC benefits do not enhance the quality of life. Hence, any decreases in mortality must result from substantially large effects of LTC on beneficiaries' wellbeing.

Our local average treatment effects (LATE) indicate that being entitled to greater benefits

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

can be effective in extending beneficiaries' life. The Spanish LTC system establishes three degrees of benefits. Being granted a higher degree of benefits gives the claimant access to greater benefits, as each degree represents a discrete jump in the allowance's amount. Given the three degrees of benefits, the analysis is threefold. This setting enables us to obtain the LATE at three different points of the LTC needs distribution. Estimates for cutoff 1 –at low level of LTC needs– compares claimants non-eligible for LTC benefits with claimants entitled to the lowest level of LTC benefits. Similarly, the cutoff 2 –at moderate level of LTC needs– compares claimants entitled to the lowest and medium levels of LTC needs. Finally, in cutoff 3 –at high level of LTC needs– the comparison is between claimants entitled to medium and high levels of LTC benefits. Thus, in cutoff 1 (2 and 3) we estimate the effect of being entitled to benefits of Degree I (II and III, respectively).

Results are larger for individuals with a moderate level of LTC needs: being entitled to *Degree II* benefits, compared to *Degree I*, reduces the probability of dying in three years after the application date by 12%. When LTC needs are moderare, LTC is more effective in postponing mortality as it prevents or delays further impairments. The effect is stronger for recipients with low levels of income (less than 8000 euros of annual income), widows (and widowers) and those who suffer from a mental illness or mobility-related diseases. For low levels of LTC needs, our results show a 3% reduction in mortality of claimants entitled to *Degree I* benefits compared to non-eligible claimants. This is contrary to what we would expect: compared to individuals with moderate LTC needs we would expect equal or larger effect, since the scope of LTC for preventing mortality is larger the lower the level of needs is. We attribute this smaller magnitude to the fact that, as a result of public spending cuts in 2012, only 13% of the elegibles in Degree I actually received benefits.[4] Thus a 3% reduction actually implies a sizeable effect of LTC benefits on mortality.

Finally, the reduction in the probability of dying within the first three years is not significant for beneficiaries with high level of LTC needs. The severity of their functional limitations might prevent LTC benefits from extending their life. That is, LTC cannot avoid their health deterioration. However, the lack of significant reduction in mortality does not imply that LTC could not affect the quality of life in other ways which are not captured by a reduction in mortality. All these results are robust to different specifications and alternative outcome measures.

This research contributes to the strand of the literature on the effects of LTC policies. This research has mainly studied the effects of LTC benefits at the family level (one of the goals of the

[4]The public spending cuts in 2012 does not affect those in Degree II and III, in fact more than 80% of the eligible has already received a benefit. The reminding 20% are waiting for a benefit, or died before the benefit was allocated.

policy). Bauer and Sousa-Poza (2015) summarise the state of this literature well: the absence of professional LTC is associated with a family-cargiver with lower level of employment, lower quality of psychological health and worse physical health. Yet, the evidence on the effects of LTC benefits on beneficiaries is limited in size and quality. There is a set of papers that looks at the effects of care on recipients' quality of life, in the UK.[5] However, they focus on a particular intervention (instead of a global LTC system) and, most importantly, they do not overcome the issue of selection. This research could conclude a positive association between care and recipients' quality of life. Carslon et al. (2007) and Rapp et al. (2016) based their research on two randomized experiments. They overcome the selection problem, but the external validity is limited as they look at particular interventions.[6] Finally, two papers have taken a broader perspective by analising the effects of a system of LTC. Barnay and Juin (2016), using an instrumental variable approach, explore the effects of care on mental health in France, using self-reported survey outcomes. Finally, Kim and Lim (2015), the most related paper, analyses the effects of South-Korean LTC system by exploiting the discontinuity in its eligibility criterion. They show that eligibility affects the take-up of formal care, and reduces the intensity of informal care (which is not subsidized at all), which in turn reduces medical expenses. Yet, their focus is not on direct beneficiaries outcomes, as information on medical utilization is at an aggregate level.

On methodological grounds, the instrument used in this paper belongs to the growing literature that relies on judge or examiner leniency. The majority of these papers have focused on the effects of judicial system on criminal and labour outcomes. Among them, the most related papers are French and Song (2014) and Dalh et al. (2014), as they examine a judges decision in terms of granting disability benefits. The authors assess the effects of receiving disability insurance on wages and intergenerational cultural transmission, respectively. Outside the judicial context, Sampat and Williams (2015) estimates the effects of patents on follow-on scientific research and product development by exploiting the differential leniency of patent examiners. An advantage of the LTC setup is the possibility of reproducing a Local Average Treatment Effects (LATE) estimates at different points of the needs distribution. This triple analysis enables a comprehensive study of the impact

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

[6] In 2007, Carlson et al. exploit a Randomized Control Experiment in the provision of *at home care* benefits, they conclude that cash-provision relative to inkind provision increases life satisfaction and other quality of life related measures. Using PLASA study, Rapp et al. 2015 find a that recipients of LTC subsidies have significantly lower rate of emergency care. Despite the accuracy of the outcome data, the external validity of PLASA intervention has not been proved.

of LTC benefits along the distribution of needs.

These findings are also relevant for policy makers. Western Countries would need to reform current policies given demographic projections and other expected factors. The European Commission's projections estimate that the population aged 65 or more will be 28% by 2060, upfront to the current 18%. The proportion of the old older (+ 80) –the cohort with highest risk of LTC needs– will more than double (from 5% to 12%), becoming as numerous as the young population (0-14). On top of that, *ageing* will also 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 to allocate public resources more efficiently.

Our findings highlight the importance of providing care at initial stages of LTC needs, as opposed to reducing or removing the LTC benefits of claimants with lower levels of needs, something that usually occurs in times of 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.[7] In addition, the findings could be also extrapolated, with caution, to developing countries. Countries in Latin America, like Uruguay and Argentina, or in Asia, like China, have already started to face population's ageing and are urged to design their own LTC policies.

The remainder of this paper is organized as follows. Section 2 describes the Spanish LTC system. Section 3 discusses the identification strategy and presents the data. Section 4 provides main findings and robustness checks. Finally, Section 5 concludes.

2 LTC in Spain: the ACT *39/2006*

In December 2006, the Spanish Government passed the Act on the *Promotion of Personal Autonomy and Care of Dependent People (Act 39/2006)*, henceforth LEPA or LTC Act. The Act enabled the establishment of a universal LTC system, as it covers all forms of autonomy's loss regardless of the cause (age, illness or disability). Before this act, public provision to meet LTC needs were restricted to the poor without any family support and depended on municipal resources. Thus, meeting LTC needs remained under family responsibility, being informal caregiving the main form of LTC.

[7] Secondary prevention of LTC needs implies the identification of LTC at early phases. Early detection, the goal is to slow down the causes of LTC needs. Through this, LTC interventions aims to improve quality of life and life expectancy, which are main goals of Active Ageing according to WHO.

The policy is established at national level and implemented at Autonomous Community (i.e. county) level. Despite the universality, the eligibility for LTC benefits depends on a needs assessment, conducted by examiners with medical or social services background. These examiners, organized in regional teams, follow official guidelines –known as *BVD (Barem de Valoració de la Dependència)*– to evaluate how individuals' limitations affect their autonomy in performing ADL.[8] The outcome of the needs assessment is a score, which ranges from 0 to 100 –being 100 the maximum level of LTC needs–. The score is reported to the county government, who use it to assign the claimant a LTC needs Degree, as follows:

- from 0 to 24, the claimant is non-eligible to public LTC benefits
- from 25 to 49, the claimant has LTC needs of Degree I
- from 50 to 74, the claimant has LTC needs of Degree II
- from 75 to 100, the claimant has LTC needs of Degree III

Each *Degree* gives access to a menu of LTC benefits, including Tele-assistance (T), Home Care (HC), Day-Care Centres (DCC), Nursing Homes (NH) and subsidies for a Informal Caregiver (IC).[9] The main difference between *degrees* is the intensity of the benefit, which is increased with needs. Thus, there is a discontinuous jump in the amount of benefits by degrees, as it can be observed in Table 1. Table 1 reports the monthly benefit, by type of care and degree, but on average the monthly allowance in *Degree I* is 180 euros, in *Degree II* is 412 euros and in *Degree III* is 695 euros. The system is funded by public administrations and the user.[10]

Figure 2 summarize the multistep process. It starts by the submission of a personal information form and a medical diagnosis form signed by the GP. This latter document is used to validate the impairments during the needs assessment. The need assessment is conducted within the Degree Procedure, which finishes when county government issues a form to notify the claimant in which Degree has been assigned. If the claimant becomes eligible to LTC benefits, she can choose within the options available in the *Degree* she has been classified, and her contribution will depend on her financial capabilities. This takes place during the *PIA, the programme for individual assistance, Procedure* at municipal level. Figure 4 provides the general timeline of this process. If claimant

[8]The official guidelines are regulated in the Royal Decree 504/2007. This scale considers 47 tasks grouped in ten activities, more detailed in Pena-Longobardo et al. (2016).

[9]Benefits can be directly provided by the government (service provision) or a voucher to choose a service within public providers, with the exception of informal caregiver that is compensated with cash transfer.

[10]National and Autonomous Community governments finance, at same rate, with general revenues LTC expenditure, and the users' funding is made through copayments. Furthermore, for some type of allowance as Tele-Assistance or at home professional assistance, local authorities also contribute to their funding.

chooses a service, like nursing homes, with long-waiting time, she is offered a nursing home or other service voucher in the meantime. Yet, the claimant generally suffers from a delay to receive any benefit, which on average is five months. However, the recipient is entitled to receive the voucher amount during the delay ex-post. If claimants' health status deteriorates, she can ask for a re-assessment to opt for higher benefits, the reassessment requires to repeat the 2 steps of the procedure.[11] In addition, the claimant can change the type of benefit, within the ones available in the *Degree*, which implies the second process –the *PIA*– as many times as benefits changes or modification. But 78% of the beneficiaries stick to the first benefit chosen.

In December 2015, more than one million and a half individuals have applied for LTC benefits in Spain, among them 55% are 80 years old or more, and represent 31% of the old-older cohort (80+). [12] From all assessed claimants (93%), 78% are eligible for LTC benefits: 23% in *Degree III*, 30% in *Degree II* and 25% in *Degree I*. And 65% of the eligible has already received a benefit.

2.1 Assignment of LTC benefit claimants to Examiners

In Spain, there are 17 Autonomous Communities (counties) where Social Service Departments run LTC under the supervision of SAAD (the System for Autonomy and Assistance to LTC, i.e. the Spanish LTC system). We focus in the North-East county, Catalonia –which has 16% of Spanish population and 17% of LTC benefit claimants–.

Catalonia has 21 regional teams in charge of LTC needs assessment, all coordinated by Social Service Department. The team is formed by nurses, physiotherapists, psychologists and social workers. All them, working under civil servant conditions with fixed monthly salary. The majority of them are women on their forties, according to Social Service Department. With the exception of LTC needs assessment of kids, the chief of the regional team distributes the assessments on a mechanical, rotational basis based on the date a case is received.[13] Thus, the assignment system provides a quasi-random variation conditional on the team region. Benefits' claimants are not randomly assigned to assessment teams. The postal code in which the claimants lives determines the team in which she is assigned.

On average, an examiner makes 400 assessments per year, which could slightly vary given the

[11] 27% of claimants has applied for a re-assessment. We ignore the re-assessment outcomes, and focus on the first assessment the claimant had.

[12] LTC Claimants represent 3.45% of Spanish Population. 75% are elder (65+), which implies that 14% of the elderly in Spain has claimed the benefits.

[13] Children assessments can only be conducted by one member of the team with special training but are not included in this analysis focused on the elderly.

population density: assessing in rural areas takes the additional time of commuting to applicant's residence, which reduces the number of assessments per day. The number of examiners by team ranges from 4 to 15, and on average each team is formed by 8 examiners. There is no specialization of examiners by type of impairment (functional or cognitive), age, municipality or other characteristic. Each assessment follows official guidelines that require to complete a questionnaire, which weights the different limitations reported and summarizes them in an score. The use of the questionnaire ensures all examiners value the same limitations considering a given criteria. In addition, when the examiner marks in the questionnaire a limitation, she has to justify it stating a medical diagnosis of the claimant that could cause such limitation (i.e. if the examiner selects mobility limitations, the claimant has to have a mobility-related disease diagnosed and therefore recorded in NHS medical records). Although all these features restrict examiners' subjective evaluations, they can still exercise some discretionary power, adjusting by one or two points the score. Therefore, a key element of this framework is that not only examiners are quasi-randomly assigned, but they also differ in their propensity to grant higher benefits (or propensity to adjust LTC needs' scores). This setting allows us to exploit within team variation in examiner level of leniency.

Different from judges' decisions which imply multiple treatments (type and duration of the sentence and other conditions) (Dobbie et al. , 2016), examiners' decisions have minimum probabilities to yield to multiple treatments: they do not advice the type of benefit, give medical advice or provide other sort of information. They only meet the claimant during the hour of the assessment and do not communicate the assessment outcome. Thus, there is limited scope for influencing outcome variable (mortality) other than through the channel of granting higher benefits.

3 Empirical Strategy and Data

3.1 Identification Strategy

In order to test the effect of public LTC benefits on mortality, we exploit the discontinuity in the amount of the allowances between the three degrees of benefits. Particularly, we perform a triple analysis at low, moderate and high level of LTC needs. We compare non-eligible claimants with claimants in *Degree I* to estimate the effects of benefits at low level of LTC (cutoff 1). At moderate (and high) level of LTC needs –or cutoff 2 (3)–, we compare claimants in Degree I (II) with claimants in *Degree II (III)* to estimate the effects of higher benefits. Thus, for benefit claimant i in cutoff c (i.e. level of LTC needs), consider a model that relates the probability of dying within the first three

years to an indicator whether the individual was granted with greater benefits, i.e. the individual is *Above* $A_{i,c}$ the cutoff score or has granted a higher degree of benefits:

$$y_{i,c} = \beta A_{i,c} + \alpha_j X_{i,c} + u_{i,c}$$

where $y_{i,c}$ is the outcome variable which takes value 1 if individual has died within the first three years after the application date, $A_{i,c}$ takes value 1 if individual i is *Above* the cutoff c or in the higher degree, and $X_{i,c}$ is a vector of (individual) control variables, including: age, marital status, labour disability acknowledgment, annual income, health care diagnosis before the assessment, region and year fixed effects and trends. $u_{i,c}$ is an error term.

The OLS estimates would be biased as the elderly who have granted higher allowances are more likely to experience more severe impairments than those who do not, and therefore higher probability of death. Although the policy has the ingredients for a regression discontinuity design (a continuous running variable, score, which leads a discontinuous treatment, benefits), the selection problem cannot be solved using this approach. Hernandez-Pizarro et al. (2015) finds that scores distribution is not smooth, but presents notches around the cutoff points, Figure 6. This invalidates a Regression Discontinuity Design because of the manipulation of the running variables (LTC Scores). To address selection, we precisely exploit the manipulation. As we document below, some examiners are systematically more lenient than others, i.e. have a higher propensity to grant higher benefits (by adjusting needs score such as the claimant is classified in a higher Degree (i.e. *Above*, henceforth). Combined with the conditional quasy-random assignment of claimants to examiners, these features rise to exogenous variation in the probability of having granted higher benefits or being "Above". At cutoff 1 or low level of LTC needs, the exogenous variation allows us to estimate the effect of being eligible for LTC benefits. At cutoff 2 and 3, respectively, the exogenous variation allows us to estimate the effect of having granted higher benefits, which given the high take-up rate of benefits seems equivalent to estimate the effect of receiving higher benefits.[14] The precise meaning of having granted more benefits or being above is a higher intensity of the care, because *higher degree* of benefits does not offer different type of care.[15] The choice of care is an endogenous decision of claimants, and therefore this approach does not isolate the effect of a particular type of care.

[14] In *Degre II and III*, more than 80% of the granted claimants receives the benefit. The remainding 20% is formed by individuals waiting for the benefits (i.e. the latest claimants) or claimants who died before the average waiting time period, which we called "premature death". When we exclude these observations from the analysis, in the Robustness Check section, estimates remain stable: same significance and similar magnitude.

[15] For the case of Nursing Homes, being *Above* does not provide more intensity of care but the voucher is larger, therefore the contribution of the beneficiary is lower compared to beneficiaries *below*.

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

$$y_{i,c} = \beta A_{i,c} + \alpha X_{i,c} + u_{i,c}$$

The instrumental variables estimates, described in the above two-equation system, focus on the variation in the benefits granted among claimants at the margin of having granted higher benefits (i.e. around the cutoff points). But these are the claimants most likely to be affected by policy changes that alter the cutoffs of the benefits' degrees. Yet, the policy design, with 3 set of discontinuous benefits, allows us to estimate the Local Average Treatment Effect (LATE) at three different points of LTC needs distribution, which enables a more comprehensive analysis along needs distribution.

3.2 IV Calculation

We construct the instrument using a residualised, leave-out examiner leniency measure following Dahl et al. (2014), using information about 114 examiners. A simple leave-out mean of examiner leniency would be biased as the randomization takes place at regional level and the LTC Act has a gradual implementation of benefits, which supposes changes across time. We account for this selection by defining our instrument as the residuals from an OLS equation in which examiner leniency leave-out mean is regressed on year, team and year-by-time fixed effects. Thus, the within-cell variation set in the residuals can be interpreted as the propensity of granting higher degree benefits or above rate. This approach controls for any differences over time or across times in the characteristics of the claimants and the leniency of the examiners.

The leave-out mean is based on the *Above* Rate or *granting higher benefits* Propensity 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 side, producing biased estimates.

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

Where AR, the *Above Rate* represents the leave-out mean for individual i, examined by j at cutoff point c. $n_{j,c}$ are all the assessments done by examiner J at cutoff C; k indexes the assessment by examiner J and A equals 1 if individuals is classified *Above* or in the *higher degree*, i.e. in cut off 2 A takes value one if claimant is in *Degree II*. The Above Rate is, then, regressed on fully interacted year and team dummies, and the residuals are used as the Examiner Leniency Measure ($Z_{i,j,c}$).

Figures 7, 8 and 9 show the distribution of examiner leniency for cutoff 1, 2 and 3 respectively. For instance, in cut-off 2, the average leniency is around 0, with an standard deviation of 0.06 and ranges from -0.26 to 0.24. The solid lines in the figures presents graphically the first stage: it is the local linear regression of *Above* as being entitled of Degree II benefits (the higher degree) on examiner leniency; dashed-line lines represents the 95% confidence interval. This plot from a local regression is the flexible analog of the first stage regression. The likelihood of being granted with higher benefits is monotonically increasing in examiner leniency, and close to linear. As a robustness check, I construct an alternative measures: (i) one based on French and Song (2014), which demeans all variables and (ii) another, in which the the assessment outcome is based on predicted score by examiner, instead of the Above dummy. It also First stage performs almost identical for these other ways of constructing the instrument in terms of significance and magnitude, hence the rest of the paper is focused in the former measure for simplicity. I do also perform much more simple measures as examiner fixed effect or examiner deviation rate, and results are consistent.

3.3 Data

We focus on the North-East Spanish Autonomous Community: Catalonia. Our analysis is based on individual administrative data provided by the Catalan Government. Concretely, this unique micro-dataset is directly drawn from the Secretary of Social Inclusion and the Promotion for Personal Autononomy (SIPAP). The data, for the first time, allows us to understand better the effects of LTC system. It consists of all records of individuals who have applied for LTC allowances between 2008 and 2015.[16] It contains $501,823$ individuals. I focus on the elderly ($452,635$ individuals, who represent 90% of the original sample), and on the first benefits they received.[17]

The dataset embraces sociodemographic variables (age, gender, place of residence, civil status, date of birth and death), health status characteristic (the existence of labour disability and its type, suffering from mental health or intellectual disabilities, and the 5 main medical diagnosis causing the lack of autonomy) and the process of LTC (which includes the level of LTC needs, information regarding the needs test and the benefit –type of LTC service, amount of the cash transfer or copayment and the period of usage–). LTC registers do not incorporate information to identify the examiner. I overcome this limitation by merging the LTC register with the Assessment Records of each assessment team. The match is perfect as we rely on the register code. As each assessment

[16] The LEPA entered into force in June 2007.

[17] 64% of individuals eligible to benefits take one benefit, the remainder 36% make any type of re-application, the majority of them cause by health status worsening.

team has its own organization, not all teams had available such information. I manage to get the information for 15 out of 23 teams. Table 2 presents the summary statistics for all claimants in Catalonia, and the restricted subsample to which we could identify the examiner. The sample restriction does not imply any selection issue as it represents well all the claimant population in terms of these observables. Table 2 includes all the sociodemographic and health variables. The outcome variable of death takes value 1 if individuals has died within the first 3 years after the application (and 0 otherwise). Figure 10 shows the mortality rate and the monthly average LTC benefit by LTC scores. One of the strength of our framework is that the Spanish LTC register includes mortality. Steptoe et al (2015) have documented that longer survival is positively associated to wellbeing. In fact, life expectancy and mortality are suggested as valid measures for quality of life.[18] Maynou et al. (2015) argue that mortality can be a summary measure of the availability of health-care and social services, among other factors. Therefore, looking at this extreme outcome, this paper studies the effect of a LTC public policy. Based on the life expectancy of individuals with LTC needs, we focus on the probability of dying within the first three years since the claimant applied for benefits. This value takes value 1 if individuals dies within the first three years after the application date. Similarly, I have construct measure with different window time, such us two years or all the period in which the claimant is in the system. We also explore alternative measures such as the probability of being alive at the age of 85, 90, 95 and reaching the age of life-expectancy. While improvements in the quality of life can postpone death, the absence of reductions in mortality does not necessarily imply that LTC benefits do not enhance the quality of life. Hence, any decreases in mortality must results from substantially large effects of LTC on beneficiaries' wellbeing.

4 Results

4.1 The Validity of the Instrument

Table 4 presents formal first stage regressions by threshold. Being assigned to a 10% more lenient examiner, increases the probability of having granted benefits of Degree I (II and III) by 9.5% (8.5% and 7%, respectively). In cut-off 2, for instance, this implies that moving from the least to the most lenient examiner would imply an increase in the likelihodd of being in Degree II of 45%. These estimates are highly consistent with the other research that use a similar instrument based on judge leniency.

[18] For instance, Becker et al. (2005) or Maslow (1943).

The internal validity of this approach depends on the identification assumptions on conditional independence (random assignment), exclusion and monotonicity. While observable characteristic can predict the probability of having granted higher benefits, *random assignment* implies that examiner cannot be predicted using observable characteristic. Table 3 present such tests for cutoff 2. Column 1 presents the estimates from a regression of higher benefits indicator (or an indicator of being Degree II, in this case) on different observable characteristics. Column 2 presents estimates from a regression of examiner leniency on covariates. Four out of fifteen turn out to be significant despite the small magnitudes and opposite signed, compared to Column 1 regressions. As far as we control for this characteristics, this correlations would not threat our findings. However, our strategy would be not valid if any unobservable is correlated with examiner leniency. Looking at the significant variables, it is a difficult to find a possible unobservable characteristic correlated with them. In addition, we performed the regression for each year and there is no stability in significant coefficient, which supports that by chance some examiners face a certain type of individuals. Thus, all these suppose little evidence against the hypothesis of random assignment. However to better convince about independence, we explore data with more detail and we identify that the random assignment could be questioned for 2 of the 15 teams. These two teams are from quite different regions. When we remove this teams, Column 3, only physical disability keeps significant. Age and income does not predict examiner anymore. Thus, as a robustness check we replicate all the analysis excluding this two groups and main estimates keep consistent.

Second, conditional on random assignment is sufficient to interpret a causal effects of the reduced form on the effect of being assessed by a more lenient examiner. Interpreting the causal effect of the IV estimates of measuring the causal effect of being granted with higher benefits requires exclusion restriction. I.e., examiners must not affect mortality by other channel than the probability of getting higher benefits. Examiners only meet the claimant during the assessment, which last one hour. In addition, examiners do no report the outcome of the assessment, as they outcome is sent to central government, who maps the score into one of three LTC degrees and issues a document to inform the claimant about the Degree she got. Thus all the features of the LTC process, the exclusion restriction is likely to be valid. In fact, finding similar results in the reduced form and two-stage least square is consistent with exclusion restriction.

Finally, if examiners differ only in leniency and rank applicants the same with respect to severity, then Imbens and Angrist's (1994) monotonicity assumption is satisfied. The monotonicity assumption implies that a case allowed by low lenient examiner will always be allowed by the a more

a lenient examiner. One testable implication is that the first stage must be positive for different subsamples. We peform first stage by income, age, civil status and suffering mental illness. All coefficients are positive and significants. A second testable implications is that if an examiner is lenient with one group, for instance with low income, she would also be lenient with medium or high income individuals. We test that redefining the instrument of one group using the granting higher benefits propensity of all the other cases outside the selected subsample. For example, for married subsample, we use granting higher benefits rate from all assessment of widow and single individuals. First stage keep positive and significant, suggesting that lenient examiners behave consistently across subsamples as monotonicity requires.

4.2 The effects of LTC benefits

Tables 5, 6, 7 show main results for the cutoffs 1, 2 and 3, which respectively are associated to low, moderate and high level of LTC needs. In all tables, Columns 1 and 2 shows OLS results: for all sample and restricted instrument sample. Column 4 presents the Reduced Form and Column 3 is our preferred specifications, based on 2SLS. Additionally, Columns 5 and 6 present 2SLS for the alternative outcomes of reaching 95 and life expectancy age. These two regressions have a reduces sample size, as only individuals who could potentially reach that age threshold are included (i.e. very young claimants are excluded). Consistent with existing descriptive work (see Figure 10), OLS indicates a positive relationship between the level of LTC benefits and the probability of dying (even when controlling with a rich set of sociodemographic and health-related variables). In contrast, the 2SLS reveals the existance of bias and reverse causality in previous estimates: higher benefits delays death. The OLS-reduced form is consistent and yields to similar magnitude estimates.

The results are larger for individuals with a moderate level of LTC needs: being entitled to *Degree II* benefits reduces the probability of dying in three years after the application date by 12% compared to being entitled to *Degree I*. When LTC needs are moderare, LTC is more effective in postponing mortality as it prevents or delays further impairments. The effect is stronger for recipients with low levels of income (less than 8000 euros of annual income) and non-married individuals, Columns 1 to 3 in Table 8. As expected, low income individuals have less resources to devote to care services, and therefore LTC is restricted to the one publicly provided. Their constraints to the private market explains the larger effects. Similarly, those non-married (single, widows and divorced) have lower probability of informal care provided by the spouse, making them more dependent to formal LTC services. and those who suffer from a mental illness or mobility-related diseases. We also explore

heterogenous effects by chronic conditions, reported in Table 8: Columns 4 to 9. Looking at medical literature, there exists at least to channels through which LTC could prevent health deterioration and avoid premature death in the elderly. These two channels are associated to some particular disease and looking at heterogeneous effects by this pathologies could support the prevention as the mechanism that explains life expectancy effects. First, individuals suffering from mental illness tend to receive anxiolytic or tranquilizer medical treatment. This has been associated with lower mobility and the consequent increase of the risk of sudden stroke. Similarly, the elderly with mobility-related diseases needs to be moved to avoid stroke (given their higher thromboembolic risk). For beneficiaries with these types of chronic condition, higher benefits suppose a larger reduction in the probability of dying in three years after the application. Second, LTC can be preventive if it increases the adherence to medical treatment. The adherence to medical treatment is essential for the survival of individuals with some pathologies including cardiac or circulatory problems, hypertension and diabetes. We test whether individuals with circulatory diagnosis have larger benefits of LTC to show some evidence that support the adherence to medical treatment hypothesis.

For low levels of LTC needs, our results only show a 3% reduction in mortality. This is contrary to what we would expect: compared to individuals with moderate LTC needs we would expect equal or larger effect, since the scope of LTC for preventing mortality is larger the lower the level of needs is. We attribute this smaller magnitude to the fact that, as a result of public spending cuts in 2012, only 13% of the elegibles in Degree I actually received benefits. *The public spending cuts in 2012 does not affect those in Degree II and III, in fact more than* 80% *of the eligible has already received a benefit. The reminding* 20% *are waiting for a benefit, or died before the benefit was allocated.* Thus, our estimates could be interpreted as an Intent-to-Treat Effect (ITT). The 3% reduction actually implies a sizeable effect of LTC benefits on mortality.

Finally, the reduction in the probability of dying within the first three years is not significant for beneficiaries with high level of LTC needs. Here, the high take-up rate of benefits (above 80%) –as in moderate level– makes the estimates of being entitle equivalent to the estimates of receiving benefits. In fact, the 20% who do not receive the benefit is because they died before the typical waiting time, or they are waiting for benefits as did their application during 2015. Robustness checks includes the estimates removing these individuals, and the effects do not change. The severity of their functional limitations might prevent LTC benefits from extending their life within 3 years time expand. However, we estimate the effect on the months receiving the benefits (Columns 5 and 6). We find that Receiving benefits from *Degree III* compared to *Degree II* increases by 4 months

the time in the system. Given that the average period in the system is 36 months, this estimate represents a sizeable effect of 11%. That is, LTC has less scope to avoid their health deterioration. Additionally, LTC benefits could affect the quality of life in other ways which are not captured by a reduction in mortality. Yet, we explore the existence of any mechanism that offset the effects of LTC for claimants with high level of LTC needs, presented in Table 9. First, I test for the existence of moral hazard. Imagine to individuals with LTC aiming at nursing home. As nursing home make the individual incur waiting time, in the meantime the preferred care could be informal caregiver. According to Table 1, the applicant below the threshold receives 300 euros compared to the 416 euros of the applicant *Above*. In the latter case, the cash transfer represents 63% of minimum salary and can make change the preference regarding the nursing home. If this would be true, the individual below would move to nursing home once it becomes available, whereas the individual *Above* would rather prefer to keep under informal caregiver. In order to test that, Columns 4 and 5 in Table 6 present the estimation on reassessments and whether the individual end up in nursing home .

All these results are robust to different specifications and alternative outcome measures. We have replicate the estimates for the subsamples before and after the public spending cut of 2012. Results are larger in the pre-cuts periods, suggesting that income effects matter.

5 Conclusion

This paper exploits the variation in leniency across the quasi-randomly assignment of LTC needs examiners to estimate the effect of being granted higher LTC benefits on mortality. We find that LTC is effective in extending beneficiaries' life. In particular, when the level of LTC needs is moderate LTC reduces the probability in three years by 12%, which represents more than one third of the mortality rate.

Thus, my overall conclusion is that LTC prevents or delays the worsening of the limitations, which in turn postpones death. Our findings highlight the importance of providing care at initial stages of LTC needs, as opposed to only focus on the provision of LTC for those with needs, something common in LTC policies. In fact, reducing or removing the LTC benefits of claimants with lower levels of needs is something that usually occurs in times of 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.[19] In addition, the findings

[19]Secondary prevention of LTC needs implies the identification of LTC at early phases. Early detection, the goal is to slow down the causes of LTC needs. Through this, LTC interventions aims to improve quality of life and life

could be also extrapolated, with caution, to developing countries. Countries in Latin America, like Uruguay and Argentina, or in Asia, like China, have already started to face population's ageing and are urged to design their own LTC policies.

However, this policy implications is partial as other dimension of quality of life, not captured by mortality, should also be studied. Our future work hope to complete this analysis, by focusing in less extreme outcomes. In particular, we will proxy these other dimension by merging LTC register with medical records. some health shocks are direct consequence of neglected basic assistance (i.e. preventable episodes of ill-health).

expectancy, which are main goals of Active Ageing according to WHO.

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Tables & Figures

Figure 1: **Spanish LTC system: Funnel procedure**

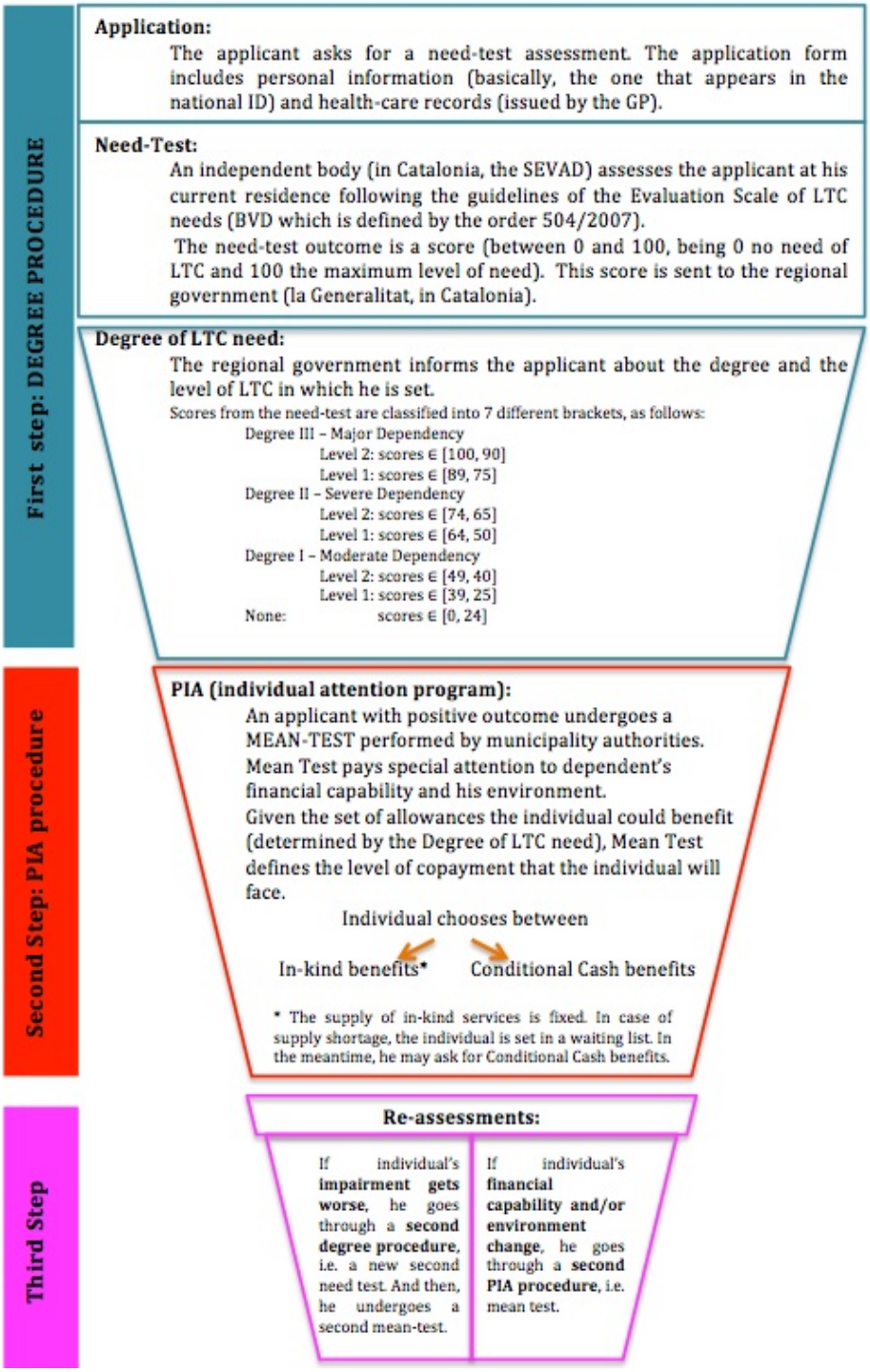


Figure 2: **Spanish LTC system**

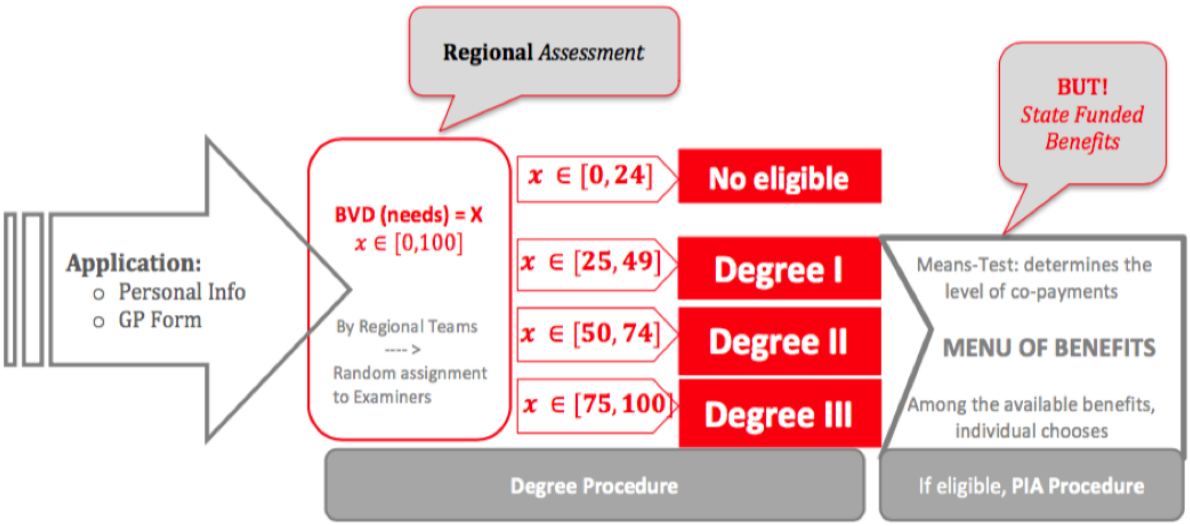
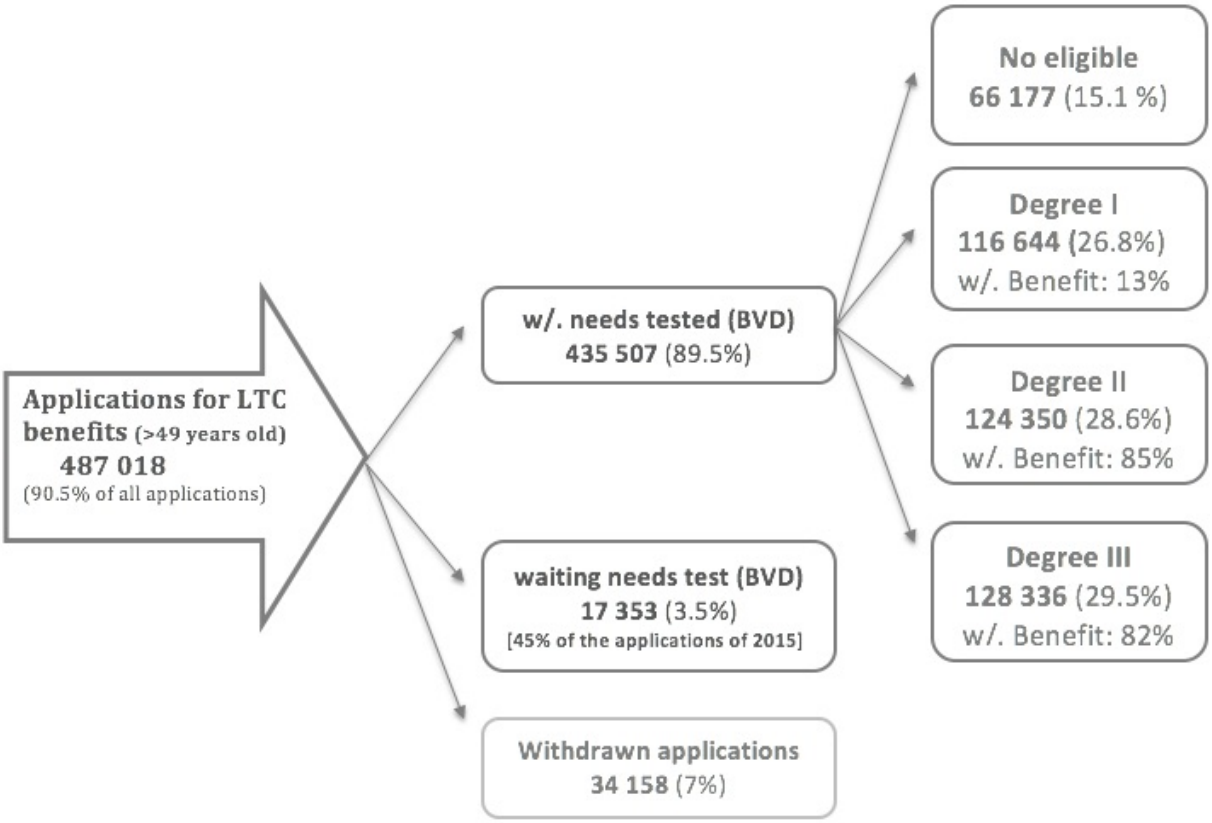


Table 1: **Monetary value of LTC benefits by Degrees**

	IC informal caregiver	NH nursing home		DCC day care centre		AHC at home care	TC telecare
	voucher	voucher	service	voucher	service	service	service
Degree III	500 , 416	830 , 625	1870-c	520 , 375	853-c	936-c , 725-c	20-c
Degree II	337 , 300	462 , 400	1595-c	277 , 240	730-c	527-c, 351-c	
Degree I	180			180	597-c	234-c	

Note: All amounts are euros/month. The lack of amount indicates lack of that benefit availability for that level of LTC need. FB refers to financial benefits, which includes cash transfer for formal LTC -vouchers- or cash transfer to compensate informal caregiver, and S to services. AHC has also the possibility of FB, however very few people take that option, for simplicity has not been included in this table, although it is considered in the whole analysis, the amount are identical to informal caregiver within the category. The amount of FB is the maximum average monthly transfer, so the one the poorest received (individuals with IRSC<2.5). As annual income increases the transfer is reduced, the minimum transfer is the 80% of the one of the poorest (individuals with IRSC>5.5). The level of copayment in S depends on financial capabilities, too. The amount of benefit is the reference cost of that service minus the copayment. To compute LTC benefit, a key variable, the amount of cash transferred is assigned in the case of financial benefit, and the reference cost minus the copayment is the benefit in the case of services.

Figure 3: **Spanish LTC process**



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

Figure 4: **Spanish LTC system**

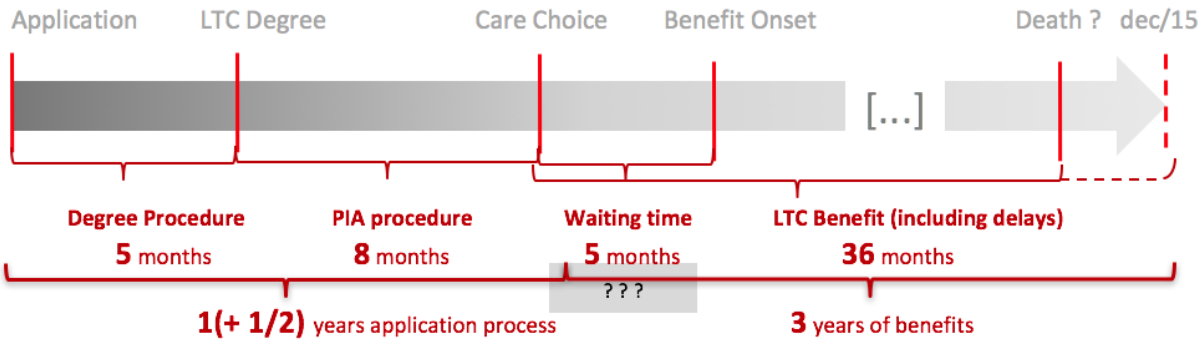


Figure 5: **Average monthly benefit by scores**

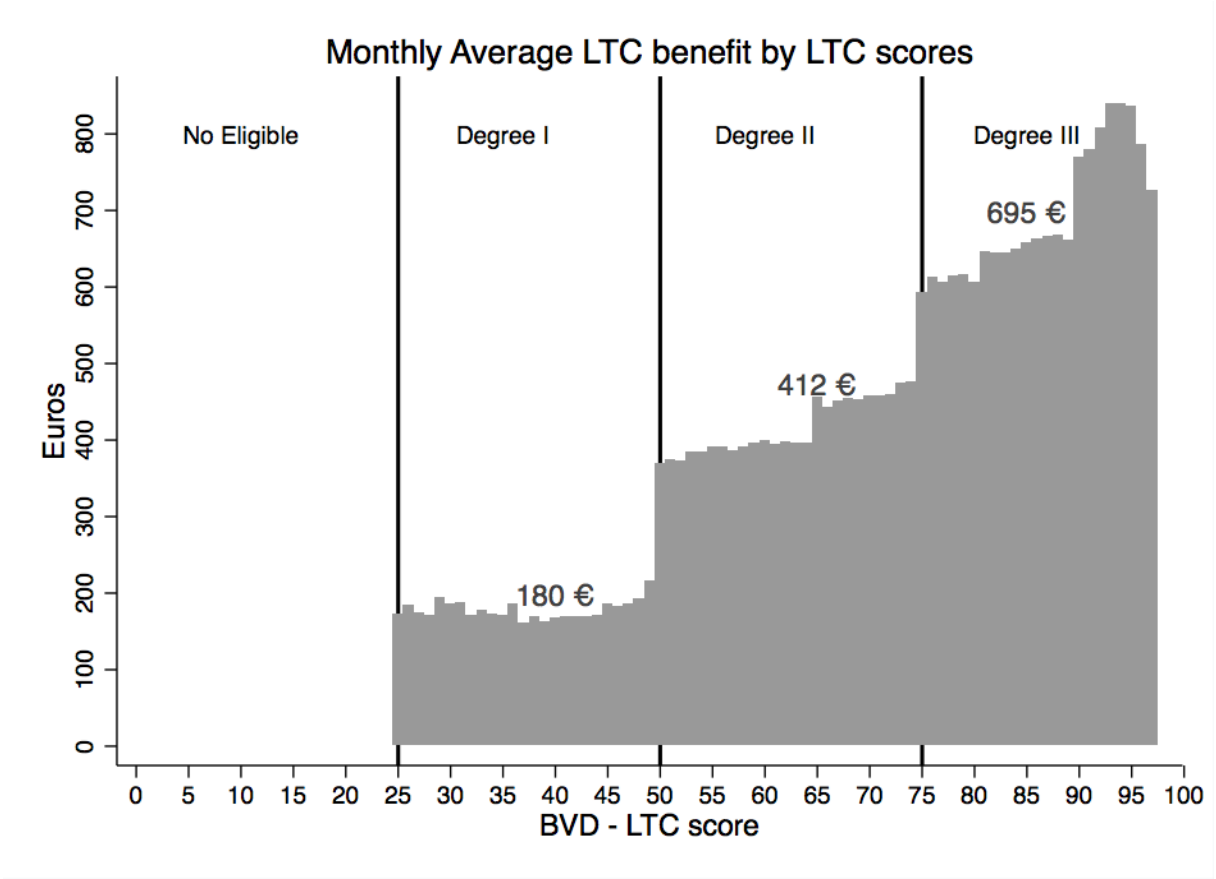


Table 2: Summary Statistic

	Cutoff 1		Cutoff 2		Cutoff 3	
	All-sample	**Z-sample**	**All-sample**	**Z-sample**	**All-sample**	**Z-sample**
Female	0.662	0.655	0.661	0.660	0.661	0.658
Age	77.82	77.80	79.04	79.13	80.93	81.00
Married	0.435	0.439	0.415	0.422	0.359	0.387
Widow	0.390	0.390	0.418	0.421	0.444	0.462
Physical Disability	0.215	0.210	0.175	0.174	0.109	0.117
Intellectual Disability	0.024	0.024	0.031	0.031	0.027	0.027
Circulatory Diagnosis	0.522	0.534	0.504	0.516	0.474	0.483
Digestive Diagnosis	0.034	0.042	0.029	0.036	0.025	0.033
Osteoarticular Diagnosis	0.523	0.545	0.473	0.498	0.402	0.426
Sensorial Diagnosis	0.034	0.041	0.023	0.029	0.014	0.019
Respiratory Diagnosis	0.222	0.226	0.206	0.211	0.180	0.187
Nephro-urology Diagnosis	0.279	0.274	0.292	0.288	0.302	0.306
Mental Diagnosis	0.262	0.266	0.269	0.274	0.250	0.257
Annual Income	11439.3	11459.1	11487.6	11427.5	11674.9	11641.2
Missing Inc	0.684	0.713	0.399	0.380	0.472	0.337
Observations	180,521	57,919	240,994	73,093	252,686	66,976

Figure 6: **Average monthly benefit by scores**

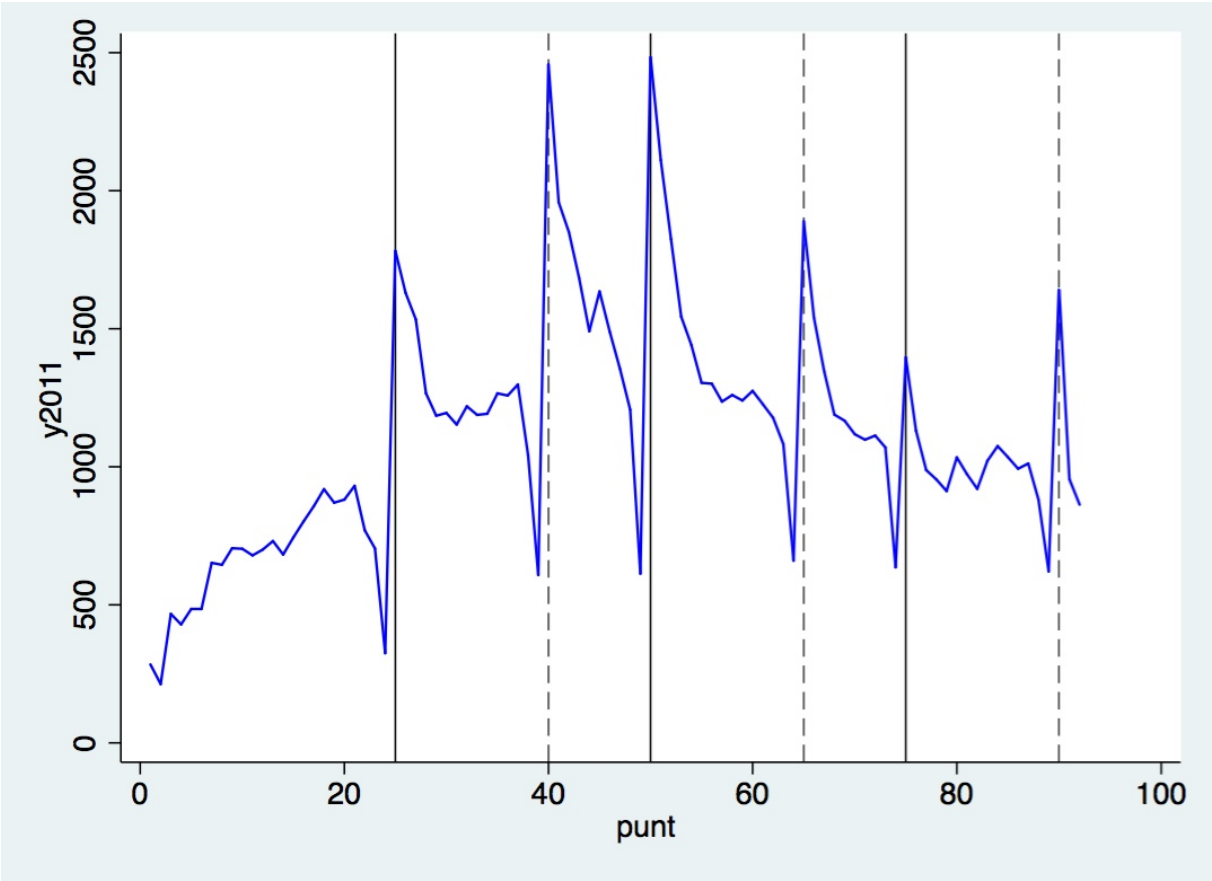


Figure 7: **Examiner Leniency, cutoff 1**

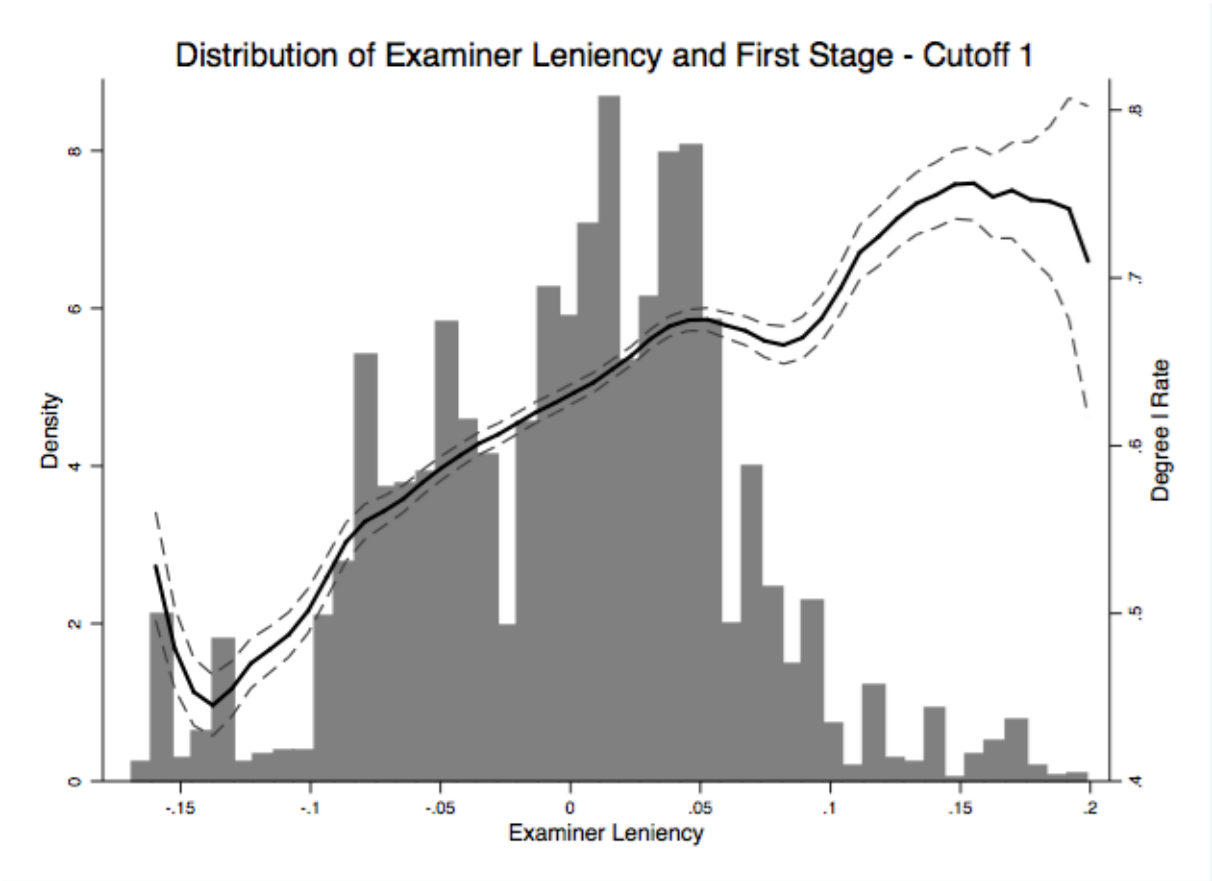


Table 3: Testing Random Assigment

		Examiner Leniency	
	P(D II)	**Full Sample**	**Restricted Sample**
Female	-0.0275***	0.0011	0.0001
	(-4.96)	(1.62)	(0.000)
Age	0.0044***	-0.0001**	0.0000
	(13.29)	(-2.45)	(0.000)
Married	-0.0115***	-0.0003	-0.0009
	(-3.48)	(-0.62)	(0.001)
Widow	0.0223***	-0.0008	-0.002
	(4.29)	(-1.58)	(0.001)
Physical Disability	-0.0803***	0.0029***	0.0027**
	(-11.33)	(3.14)	(0.001)
Intellectual Disability	0.0286*	-0.0011	0.0008
	(2.04)	(-0.72)	(0.002)
Circulatory Diagnosis	-0.0371***	-0.0009	-0.0026***
	(-9.64)	(-0.51)	(0.000)
Digestive Diagnosis	-0.0273***	0.0005	0.0036
	(-3.79)	(0.18)	(0.001)
Osteoarticular Diagnosis	-0.0598***	0.0026**	0.0005
	(-11.72)	(2.50)	(0.001)
Endo-metabolic Diagnosis	-0.0310***	0.0009	0.0006
	(-6.12)	(0.54)	(0.000)
Sensorial Diagnosis	-0.000495	0.0008	0.0036
	(-0.05)	(0.38)	(0.003)
Respiratory Diagnosis	-0.0359***	0.0004	-0.0004
	(-7.80)	(0.71)	(0.0007)
Nephro-urology Diagnosis	0.0218***	-0.0016	-0.0019
	(8.80)	(-1.37)	(0.000)
Mental Diagnosis	-0.00451	-0.0024	-0.0009
	(-1.53)	(-1.59)	(0.001)
Income	0.0397***	0.0004***	0.0001
	(8.38)	(3.20)	(0.000)

Notes: Standard error clustered by team. Column 1 reports the OLS estimates from OLS regression of Higher Degree, in this case Degree II, on each of the variables listed and time-by-team fixed effects. Column 2 reports estimates from OLS estimates of Examiner Leniency on each of the variable listed and time-by-team fixed effects. Analogously, Column 3 replicates Column 2 but excluding two teams from the sample. *** indicates 1% significance, ** 5% and * 10%

Figure 8: **Examiner Leniency, cutoff 2**

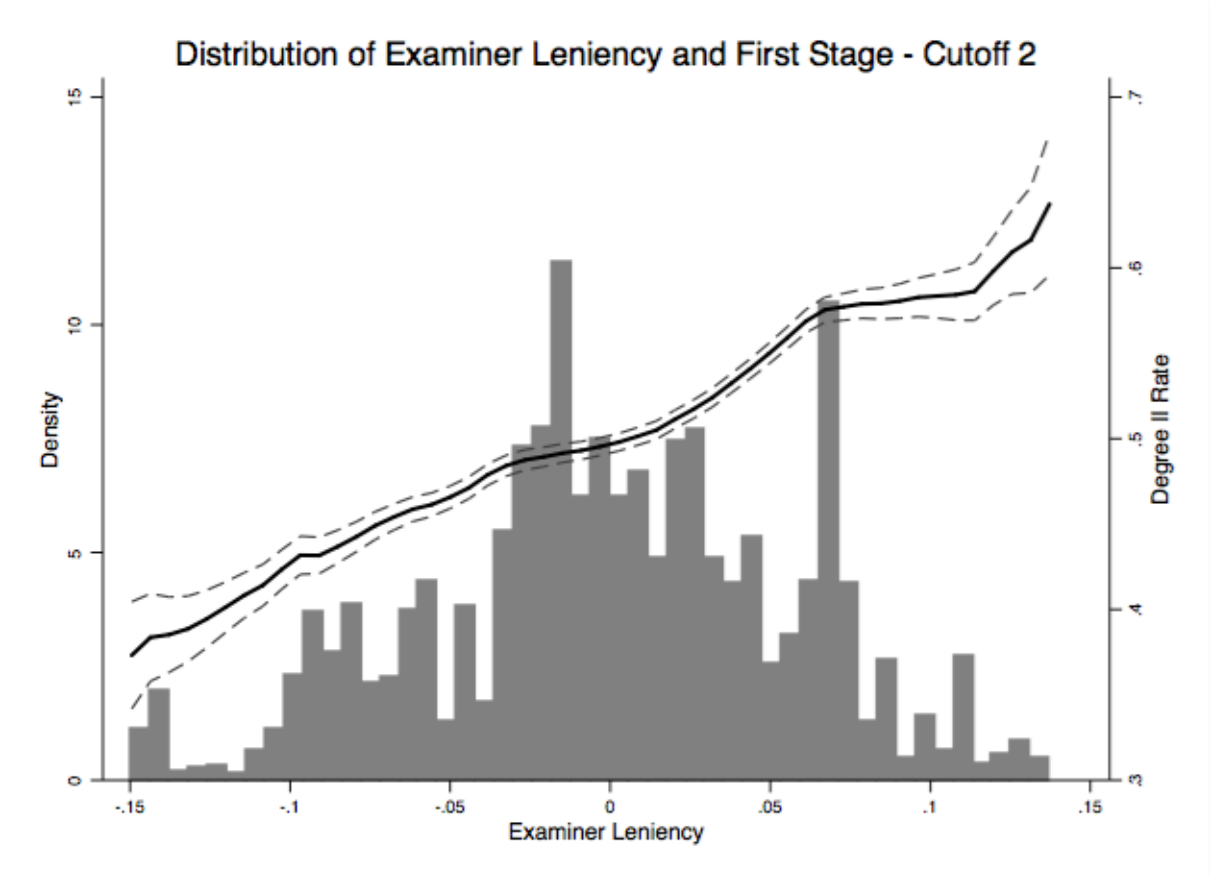


Figure 9: **Examiner Leniency, cutoff 3**

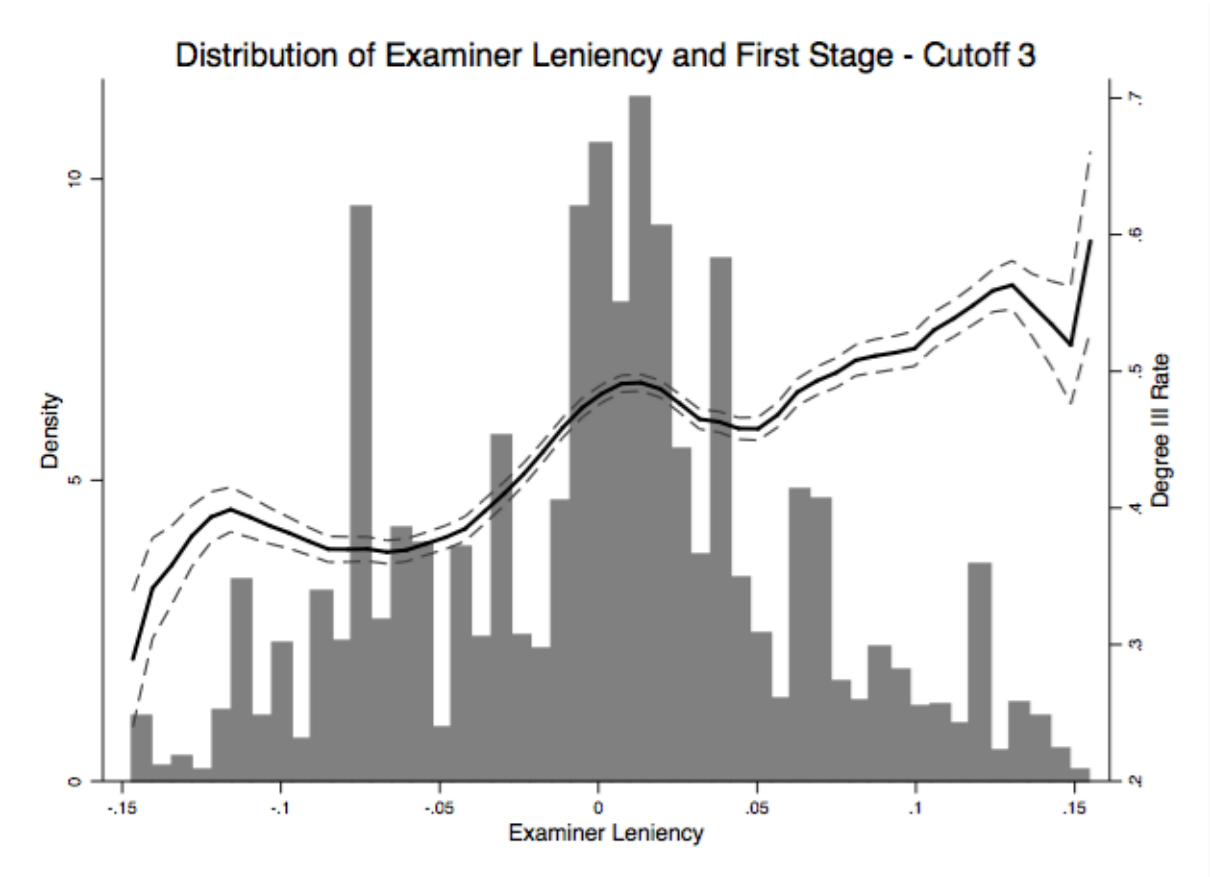


Figure 10: **Average monthly benefit by scores**

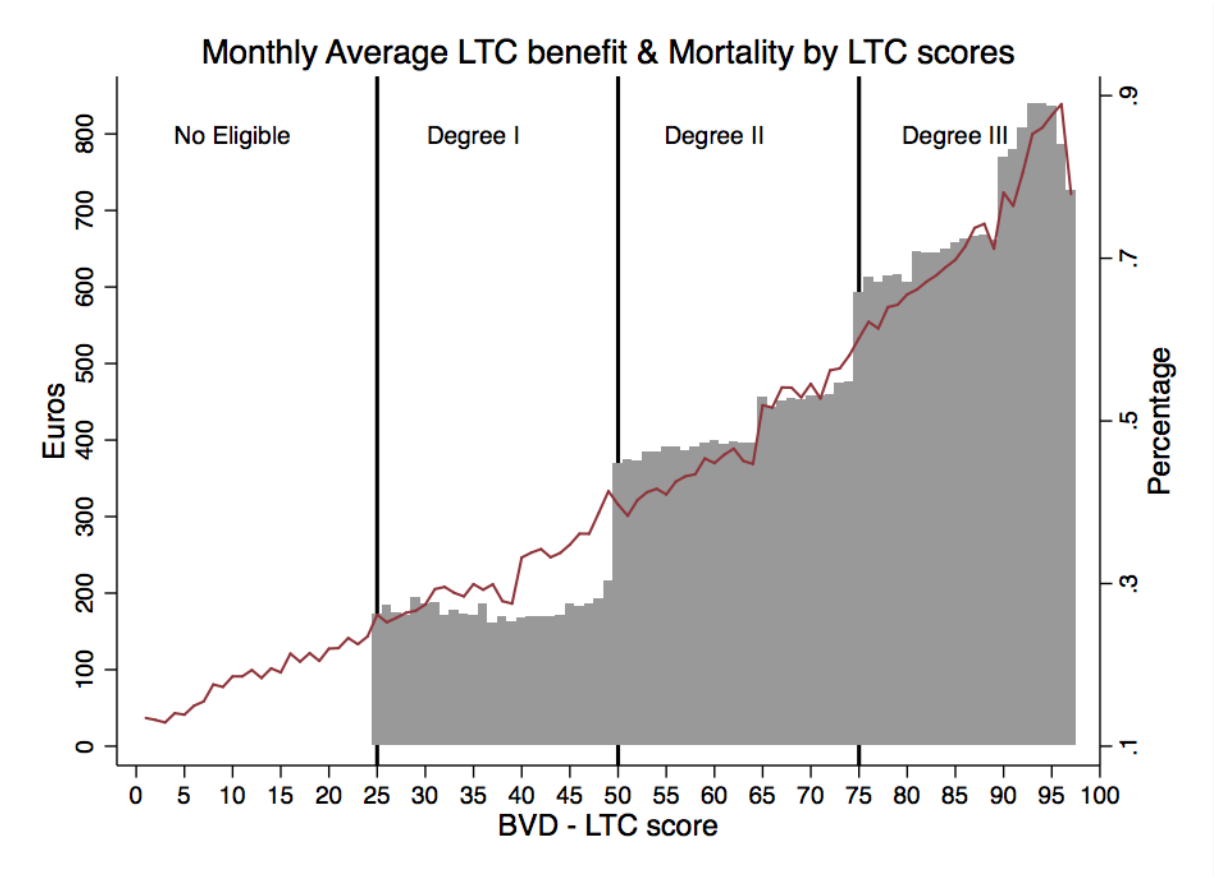


Table 4: **Results: First Stage, by cutoff**

Dependent Variable	Cutoff 1 P(Degree I)	Cutoff 2 P(Degree II)	Cutoff 3 P(Degree III)
Examier Leniency	0.949***	0.853***	0.693***
	(0.0251)	(0.0289)	(0.0636)
	37.82	29.54	10.89
Observations	57,041	71,844	65,502
R-squared	0.091	0.100	0.159
Covariates	Yes	Yes	Yes
Region FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Mean Examiner Leniency	0.62	0.5	0.45

Table 5: **Results: Cutoff 1**

Outcome Variable	Death				Age Death 95	Reach LE
	OLS	OLSZ	2SLS	ReducedF	2SLS	2SLS
Above Cutoff 1 (Degree I)	0.0781***	0.0756***	-0.0328**	-0.0320**	0.244**	0.0312*
	(0.00298)	(0.00314)	(0.0144)	(0.0143)	(0.124)	(0.0161)
	26.23	24.06	-2.27	-2.23	1.96	1.94
Observations	180,613	57,041	57,041	57,041	3,326	25,149
R-squared	0.243	0.213	0.193	0.201	0.165	0.123
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 6: **Results: Cutoff 2**

Outcome Variable	Death in 3 years				Age Death 95	Reach LE
	OLS	OLSZ	2SLS	ReducedF	2SLS	2SLS
Above Cutoff 2 (Degree II)	0.0812***	0.0776***	-0.128***	-0.112***	0.131**	0.0520**
	(0.00235)	(0.00332)	(0.0387)	(0.0346)	(0.0667)	(0.0203)
	34.55	23.36	-3.30	-3.24	1.97	2.56
Observations	227,659	71,844	71,844	71,844	7,625	37,667
R-squared	0.308	0.281	0.242	0.272	0.258	0.167
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 7: **Results: Cutoff 3**

Outcome Variable	Death in 3 years				Months with Benefits	
	OLS	OLSZ	2SLS	ReducedF	2SLS - all	2SLS - dead
Above Cutoff 3 (Degree III)	0.173***	0.171***	-0.0506	-0.0374	4.245*	2.667*
	(0.0024)	(0.00734)	(0.0432)	(0.0333)	(2.447)	(1.613)
	53.22	23.32	-1.17	-1.12	1.73	1.65
Observations	207,550	65,502	65,502	65,502	55,297	28,921
R-squared	0.385	0.360	0.331	0.343	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 8: **Heterogeneous Effects: Cutoff 2**

	Low income	Civil Status		Mental		Circulatory		Mobility	
		no married	married	Yes	No	Yes	No	Yes	No
Above Cutoff 2 (Degree II)	-0.0935***	-0.152***	-0.0372	-0.155***	-0.0205	-0.108***	-0.0942*	-0.111***	-0.0982
	(0.0320)	(0.0431)	(0.0587)	(0.0474)	(0.0336)	(0.0330)	(0.0544)	(0.0333)	(0.0644)
	-2.92	-3.52	-0.63	-3.28	-0.61	-3.27	-1.73	-3.32	-1.53
Observations	24,185	31,975	22,669	31,371	19,689	28,549	26,095	25,532	29,112
R-squared	0.104	0.062	0.152	0.072	0.139	0.091	0.115	0.076	0.115
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes