Productive Care?
Health and Wellbeing Effects of Long-Term Care Subsidies and Supports

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Abstract

We examine the impact of long-term care subsidies on care receivers' physical and mental health outcomes, as well as their overall wellbeing. Specifically, we analyze the System of Autonomy and Attention to the Dependent People (SAAD) introduced in Spain in 2007. Utilizing regional differences in implementation and longitudinal data, we assess the intent-to-treat effects of SAAD subsidies and supports. Our findings indicate significant positive effects: an increase in life satisfaction by 0.24 points (on a 0-1 scale), a decrease in depressive symptoms by 1 percentage point with caregiving subsidies, and by 0.8 percentage points with home care supports. Moreover, there is an observed increase in survival probability by 3 percentage points with caregiving subsidies and 2.6 percentage points with home care supports. Comparing these outcomes with health care programs, we find that SAAD-related care programs align favorably with cost-per-quality-adjusted-life-year (QALY) measures. This underscores the social welfare benefits and effectiveness of long-term care subsidies, highlighting their crucial role in improving care receivers' health and quality of life.

Keywords: long-term care subsidies, long-term care supports, old age care, Spain, mortality, life expectancy, mental health, and life satisfaction

JEL I 18, J14, J16.

1. Introduction

The provision of adequate care for adults facing limitations in daily or instrumental activities not only reduces hospitalizations (Tomita et al., 2010; Costa-Font et al., 2018) and improves the well-being of caregivers and their families (Costa-Font and Vilaplana, 2022), but also enhances the health and quality of life of care recipients compared to those without support. Individuals receiving necessary care are less likely to experience illness, mental disorders, or premature death than those with unmet care needs. However, direct causal evidence of long-term care's (LTC) "productive" impact on recipients' health and well-being remains limited. Research has largely focused on how LTC investment reduces hospitalizations (Costa-Font et al., 2018) or the specific types of care such funding provides. Economists must reassess the value of LTC services and compare them with other health services or subsidies for older adults, which are often considered more productive. Given the relatively modest government funding for LTC compared to healthcare services, addressing this imbalance remains a critical issue.

To date, most efforts to measure the productivity of long-term care and other social services have failed to account for meaningful changes in outcomes, particularly in terms of quality. For instance, the UK Office for National Statistics (ONS) reports on productivity in adult social care services rely on a range of output measures between 1996 and 2005. However, while they incorporate quality to some extent, they remain limited in scope.

A notable exception is Yang et al. (2016), which employs care-related quality of life measures using data from the cross-sectional Adult Social Care Survey. However, their estimates are purely descriptive and do not stem from exogenous variation. Similarly, other studies primarily explore correlations between long-term care and certain health outcomes. For example, Tamiya et al. (2011), using national survey data from

before and after Japan's long-term care program (which provided only support services), found no significant impact on elderly care recipients' subjective health status or their ability to perform daily tasks.

In contrast, Kuzuya et al. (2006) found that more frequent use of day care services was associated with lower mortality among frail older adults living in the community. Additionally, other research highlights benefits linked to expanded support services, such as a reduction in institutionalization rates (Tomita et al., 2010).

This paper examines the impact of expanding subsidies for long-term care (LTC) services through the rollout of the System of Autonomy and Attention to Dependent People (SAAD) in Spain between 2007 and 2020. This reform broadened both the scope of support and funding for long-term care. We leverage regional differences in implementation and spending cuts in 2012 to analyze its effects.

Our study makes several key contributions. First, we provide causal evidence that access to subsidies and support affects care recipients' outcomes, including subjective well-being, mental health, health-related quality of life, and mortality. This, in turn, allows us to estimate quality-adjusted life years (QALY).

Second, we calculate the cost per QALY, which can be compared to standard benchmarks used in healthcare decision-making. This enables us to assess whether investments in long-term care provide value comparable to other healthcare expenditures.

Third, Spain presents a unique case as one of the few European countries to have universalized LTC services. Before the reform, subsidies and support were means-tested, and informal care was the default expectation. This created intergenerational inequalities—some individuals lacked caregivers and faced unmet needs without support.

By extending LTC subsidies, the reform provided access to care for low- and middle-income individuals who previously had limited options.

Finally, we examine the long-term effects of this significant expansion of subsidies and support between 2007 and 2020. Our study contributes to existing literature by further exploring the impact of SAAD on care recipients, with a particular focus on long-term outcomes.

The rest of the paper is a follow. The next section reports the background on the main evidence of the effects of long-term care supports of care receivers' health outcomes. Next, section describes the Spanish long-term care reform, section four reports the empirical strategy, section five reports the results, section six provides some robustness checks and an extension and a final section concludes.

2. Background

2.1 Long-term care effects on health and health care use.

The literature on the effects of home care supports on health and survival outcomes is mixed, with studies reporting both positive and no significant impacts, and in some cases, even negative effects. Several studies have found positive effects of home care on health and wellbeing. For instance, Stabile et al. (2006) using data from Canada, show that increased availability of publicly funded home care is associated with better self-reported health status, reduced use of informal care, and increased utilization of formal care services. Carlson et al. (2007) examine the Cash and Counseling Program (CCP) in the U.S. and find that beneficiaries of the program, which allows individuals to hire family members and friends for care, report higher life satisfaction and lower unmet care needs compared to those receiving care from agencies. The study suggests that

receiving paid care from close family members leads to better outcomes in terms of life satisfaction.

Similarly, Feng et al. (2010) investigate the introduction of public long-term care insurance (LTCI) in Shanghai, using a difference-in-differences (DID) strategy. They find that LTCI significantly reduces both hospital length of stay (by 41%) and inpatient expenditures (by 17.7%), with stronger effects observed in individuals aged 80 and older. Valluru et al. (2019) study primary care-based home interventions in the U.S. and observe that these programs increased survival among frail and medically complex Medicare beneficiaries without raising community care costs. Bannenberg et al. (2021) analyze the effects of a preventive home visit program in Norway and find that it led to a reduction in hospital admissions by 8% and a 4% reduction in mortality, along with a substitution of home care for nursing home care.

Other studies, such as those by Jens Wikström (2024), demonstrate that formal elder care reforms in Sweden, which made care more affordable, led to significant reductions in hospitalizations among seniors, as well as improvements in morbidity due to fewer preventable or treatable hospitalizations. Lei et al. (2025) examine long-term care policies in China and report that in-kind benefits, such as home and institutional care, are associated with a 2.4% reduction in one-year mortality rates and a 3.8% decrease in the likelihood of unmet needs. However, they find that cash benefits do not significantly affect these outcomes, possibly due to a lack of improvements in care provision.

Despite these positive findings, there are also studies that show no significant relationship between home care supports and health outcomes. Research by Van Rossum et al. (1993), Van den Elzen et al. (2006), McKnight (2006), and Hansen et al. (2008) finds no clear evidence that home care interventions impact health or survival.

Additionally, some studies report negative effects. For example, Theander and Edberg (2005) and Boumans et al. (2011) find that certain home care programs may lead to adverse outcomes. These contradictory results suggest that the effectiveness of home care supports may depend on various factors, such as program design, the type of care provided, and the characteristics of the recipients.

2.2 Long-term care and mental health and subjective wellbeing.

Long-term care services have the potential to significantly influence the mental health and well-being of individuals who would otherwise live with unmet needs. Hasche et al. (2010) studied the impact of a publicly funded long-term care agency providing home care (meals, personal care, and nursing care) to functionally impaired, low-income adults in the U.S. After one year, depressed clients showed improvements in quality of life and life satisfaction, although their outcomes remained significantly lower than those of non-depressed clients. Similarly, Markle-Reid et al. (2014) evaluated a six-month nurse-led mental health promotion intervention in Canada for older people receiving personal support services. The intervention effectively reduced depressive symptoms at six-month follow-up and anxiety at one-year follow-up, while also reducing hospitalizations, ambulance services, and emergency room visits.

However, consensus on the effect of home health care on health and well-being remains limited. Some studies suggest that older adults with their home care needs met report higher life satisfaction, lower loneliness, and less perceived life stress than those with unmet needs (Kadowaki et al., 2015). Addressing these gaps significantly elevates quality of life by enhancing social and environmental resilience for aging in place. Hsieh and Kenagy (2020) found that satisfaction with health, family life, and friendships mediated the relationship between the quality of home care services and well-being in the U.S.

Their findings suggest that quality home care can improve well-being in areas beyond health, particularly in family life and friendships. Additionally, research on China's public long-term care insurance pilot programs indicates improvements in self-reported health and a reduced one-year mortality risk (Lei et al., 2022).

On the other hand, some studies find negative associations between informal care and life satisfaction. Ouyang et al. (2019) and Zwar et al. (2019) investigated the effects of informal care in China and Germany, respectively, and found that recipients of informal care report lower life satisfaction. This is often explained by a perceived inability to manage their lives independently or feelings of guilt and being a burden on family members (Borg et al., 2006; Barken, 2017). Furthermore, Kim and Mitra (2022) studied the impact of the Korean public long-term care program and found that older adults in beneficiary households were 19.7% more likely to rate their health as good or very good compared to those in non-beneficiary households. The positive health effect was particularly strong among those who continuously utilized long-term care services.

Nevertheless, several studies document no significant effects. McKnight (2006), using U.S. data, found that reducing home care provision, without increases in institutional care or other medical services, did not improve health outcomes. In the Netherlands, an expansion of preventive home visits showed no benefit for the general population of elderly individuals living at home, though the intervention appeared effective for those in poor health (Van Rossum et al., 1993). While loneliness decreased during the study, the effect was short-lived (Van den Elzen et al., 2006). Similarly, Bulamu et al. (2021) found that older individuals receiving home care in Australia showed improved quality-of-life scores, but only for those receiving care for less than a year. Recent recipients of home care reported a greater ability to perform tasks that made them feel valued. Hansen et al.

(2008) also found no improvement in women's ability to perform daily living activities with home care, though a positive effect was noted for men with more severe disabilities.

Some studies even conclude negative effects of home care on health and well-being. Theander and Edberg (2005) examined a Swedish model of preventive home visits for people over 70 years of age and found that participants felt more confident and informed. However, well-being deteriorated between the first and second years, a trend not observed between the second and third years. Because no control group was used, the interpretation of these findings regarding health outcomes must be cautious. Boumans et al. (2011) compared outcomes for older people in Amsterdam receiving formal home care, informal care, or no care. They found that those receiving formal care reported significantly higher levels of loneliness and lower life satisfaction compared to those receiving informal care or no care at all.

2.3 Evidence home care expansion from LTC reforms on.

A potential source of evidence comes from the introduction of long-term care reforms that exogenously expand the subsidies and support of long-term care. This includes primarily reforms in Japan (in 2000) and South Korea (in 2008).

Several papers have analyzed the long-term care model in Japan. The Japanese long-term care reforms expanded only supports rather than providing cash subsides. Tamiya *et al.* (2011) analyzed those from a national survey before and after the start of the program. The results show no favorable effects on either the subjective health status of elderly care recipients or their ability to perform daily tasks. Kuzuya *et al.* (2006) documents that the intensity in day care use is associated with lower mortality in frail adults living in the community, although results of Ishibashi and Ikegami (2010) were less positive about the efficacy of day care. Tomita *et al.* (2010) reported that the use of

respite and day care services could prevent the elderly from being institutionalized or admitted to the hospital, even though Kato *et al.* (2009) observed a positive association between the use of respite stay and an increase in the level of care needed. Nonetheless day care and home care appear to have positive effects on the health of beneficiaries, the overall effects of respite care remain uncertain.

Sohn *et al.* (2020) studied the effect on mortality of long-term care insurance implemented in South Korea, which provides a comprehensive package of home- and institution-based care, mainly targeting older people who need assistance in daily living activities. Mortality rates were higher in the lower-middle-income group than in the high-income group. Disparities in mortality according to income gap in home-care users was higher than that of facility-based care users. Consistently, Kim and Lim (2015) conclude that increased utilization of long-term care at thresholds does not have a noteworthy effect on short-term mortality. A statistically significant impact on independent living was also not observed.

2.4 Evidence from the effect of Informal care on health outcomes.

Some studies have examined the effects on survival. Fujino and Matsuda (2008) analyzed the effect of informal care on survival. No significant results were observed for women. In contrast, compared to men who lived with others able to provide care throughout the day, mortality was higher for those who lived with others unable to provide sufficient care or those who lived alone without support from family or friends. Hernández-Pizarro (2018) examined data for Spain for the period from 2008 to 2015. She concluded that the reduction in the probability of dying in the first three years is not significant for beneficiaries with high level of dependency needs. However, the lack of significant mortality reduction does not imply that LTC cannot affect quality of life in other ways that are not captured by a reduction in mortality

Another set of studies provide evidence of effects on health care use. Rapp *et al.* (2015) explore whether financial assistance in the provision of non-medical care decreases the likelihood of emergency care rates among French patients diagnosed with Alzheimer's disease. Using instrumental variables to address the presence of a possible endogeneity bias, they find that beneficiaries of long-term care subsidies have a significantly lower rate of emergency care than non-beneficiaries. Costa-Font *et al.* (2018) examines the expansion of public subsidization of long-term care in Spain (2004-2015) and find strong evidence of a reduction in both hospital admissions and utilization among those receiving a care benefit and, albeit less strongly, among beneficiaries of publicly funded home care. Similarly, Serrano-Alarcón *et al.* (2022), using administrative data from long-term care benefit recipients for the period 2009-2014, find that the probability of avoidable hospital admissions and unscheduled primary care visits are lower among beneficiaries.

Next, some literature explores the effects on long-term care on mental health. Barnay *et al.* (2016) estimate the effects of both informal and formal home care on the mental health of older people in France who need help with daily activities. Their results show that receiving informal care reduces the risk of depression by 42% and that a one-unit increase in formal care hours improves mental health by 1.8 points on the 0-100 scale. The differential impact of formal and informal care on mental health could be explained by the fact that formal care has a short-term effect and meets immediate needs, whereas informal care has a longer-term impact. War *et al.* (2019) estimated the effect of receiving informal care on satisfaction level. They find that the transition from not receiving informal care to receiving informal care predicted a decrease in life satisfaction.

Prior evidence suggests effects on health outcomes mainly results from the use of instrumental variable analysis and/or focuses on short term effects of the introduction of

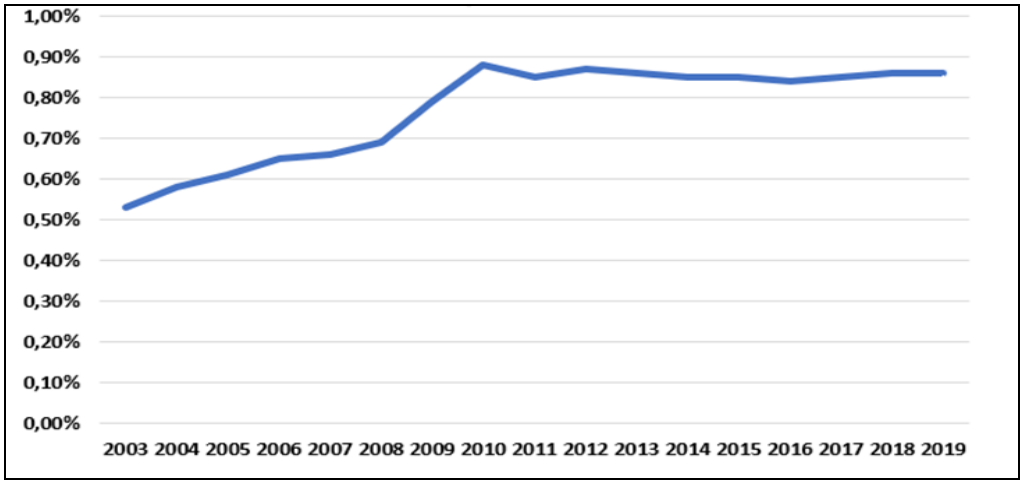
services. This paper will add to this literature by examining a battery of health outcomes, including mortality and mental health indicators, and computing a measure of effects on health outcomes that allow for a comparison with other health programs.

3. Institutional background

3.1 Long-term care in Spain.

Traditionally, the provision of care in Spain has relied heavily on informal care, often provided by family members. However, with increasing labor market participation of traditional caregivers, driven by changes in social norms, the sustainability of this model is being questioned. As noted by Costa-Font and Vilaplana (2023), the rising labor force participation challenges the continued viability of relying solely on informal care for dependent individuals, a model that prevailed in previous decades. This shift suggests that there may be a reduction in the availability of informal care, which could lead to unmet needs unless these are addressed by alternative supports, such as formal care options that families might be able to purchase. Figure 1 illustrates the increase in long-term care spending over time, particularly following the implementation of the System of Autonomy and Attention to the Dependent People (SAAD) reform, which is the focus of this paper.

Figure 1. Long-term care spending in Spain



Note: the figure below reports the share of GDP devoted to long-term care, including personal home care. Day care and institutional care. Source: OECD, 2023.

3.2 The System of Autonomy and Attention to the Dependent People (SAAD).

The long-term care reform in Spain was introduced following the unexpected election of the Spanish Socialist Workers' Party (PSOE) after the 2004 Madrid bombings, which occurred just three days before the election. Polls had predicted a conservative majority, making the election result and subsequent reform even more surprising (Garcia Montalvo, 2011). The reform, which marked a shift from previous government proposals, relied heavily on the support of smaller regional parties. As a result, the final wording of the regulation remained uncertain until its passage by the Spanish Parliament. The Act 39/2006, enacted on December 14, 2006, established the System of Autonomy and Attention to Dependent People (SAAD), which replaced the previous means-tested disability allowances that were only available to individuals with a care need greater than 65% and strict income thresholds.

SAAD came into force in January 2007, providing universal access to care for those who could prove stable residency for at least five years (with two of those years immediately preceding the application) and who exhibited moderate, severe, or high dependency needs, as determined by a needs assessment. The system categorized care needs based on frequency and intensity of support: intermittent support at least once a day for moderate

dependency, extensive support two or three times a day for severe dependency, and continuous support several times a day for high dependency.

Care needs are assessed using a scale agreed upon by the Territorial Council of Social Services, based on a questionnaire and direct observation of the individual in their usual environment by a professional team. The results of this assessment determine the degree of dependency and inform the creation of an Individualized Care Plan, which outlines the necessary services and benefits, considering the individual's financial capacity and family situation.

SAAD is financed through general taxes, with co-payments made by beneficiaries depending on the type and cost of the service and their financial situation. The National Government guarantees a minimum level of funding for the entire country, ensuring a common set of rights for all citizens regardless of their region of residence. The financing is shared between the National Government and the Autonomous Communities, with each contributing at least an equal share. Although management of the system is decentralized, the National Government and the Autonomous Communities work together to coordinate the system, define service intensities, and establish economic benefits. The Autonomous Communities are responsible for assessing dependency, managing benefits, and arranging the provision of services with private, commercial, and non-profit sectors.

Figure A1 shows the evolution of the SAAD, which began during a period of economic growth. It initially experienced a strong uptake, driven by the existing social services network's resources. The first phase (2007-2008) saw the SAAD take off, followed by a phase of consolidation and expansion from 2009 to 2010. During this phase, the share of SAAD beneficiaries in the total population increased from 1% to 1.4%, as depicted in Figures A2 and A3. Public expenditure on long-term care (LTC) also grew significantly,

from 3.809 billion euros (0.36% of GDP) to 8.004 billion euros (0.36% of GDP) (Gómez et al., 2012), as shown in Figure A4.

3.3 Caregiving subsidies and supports.

The System of Autonomy and Attention to Dependent People (SAAD) in Spain offers a range of benefits, subsidies, and supports, with a priority placed on services that promote autonomy, including telecare, home care supports, day and night centers, and residential care. Care recipients are expected to choose among these services after receiving recommendations from a care case manager. Care subsidies within SAAD are categorized into three types: the personal assistance allowance, the service-linked cash benefit, and caregiving subsidies for informal caregivers.

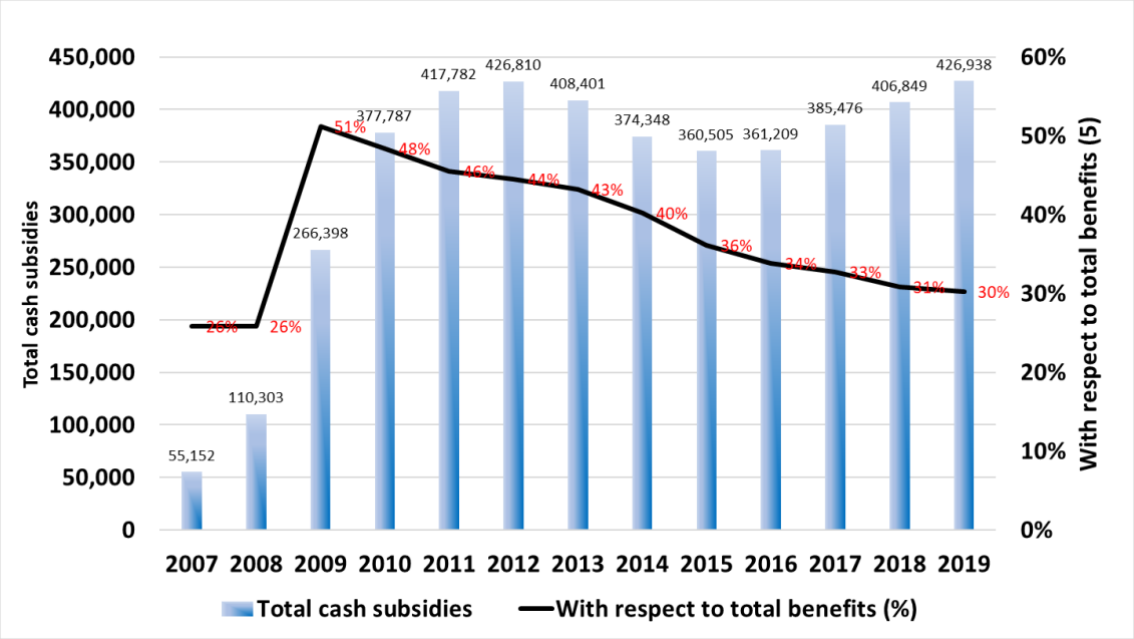
The personal assistance allowance, which is designed to employ a personal assistant for a specified period, has seen limited use. The service-linked cash benefit is provided when a service outlined in the Individualized Care Plan cannot be offered by the public sector, and it must be used to hire professional providers accredited by the administration. Caregiving subsidies, intended for exceptional circumstances, are granted when no accredited public or private resources are available to deliver the required care services. In such cases, care must be provided by a family member, though the beneficiary must have been receiving care from this informal caregiver for at least one year prior to applying. However, these subsidies only cover a small portion of the cost of care, and the beneficiary may be required to contribute through a co-payment, depending on their income.

Figure 2 illustrates the trends in total caregiving subsidies and their share of the overall spending on subsidies and supports within the SAAD framework. This data

highlights how caregiving subsidies have evolved over time in relation to the broader expenditure on long-term care services.

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Figure 2. caregiving subsidies as Total caregiving subsidies and % of total benefits



Source: own work using data from Estadísticas mensual - Instituto de Mayores y Servicios Sociales (imserso.es)

3.4 Home care supports and care subsidies.

The rollout of SAAD began with most severe cases (Major dependency) in 2007 and afterwards, expanded to severe and moderate dependency over time. Table 1 reports the number of hours of care and the monetary value of home care supports over time. The shift by the Socialist government in May 2010 from Keynesian economic stimulus policies to policies of fiscal austerity marked the beginning of social spending containment. These cutbacks were materialised in a reduction of spending on dependency in the 2011 State Budget, giving way to a period of slowing down. The slowdown was followed by a period of setback and deep adjustment of the SAAD (2012 to mid-2015). The change of political cycle in November 2011 led to an intensification of these

adjustment policies. In particular, Royal Decree-Law 20/2011, of 30 December, introduced a moratorium on the application of the LAPAD which delayed the incorporation of moderate dependents by one year. Finally, Royal Decree-Law 20/2012 of 13 July 2012 included measures reforming the SAAD, not so much to ensure its sustainability as to meet the "*requirement of compliance with public deficit targets*"[1]. These measures included the following: a) The reduction of the National Government's contribution to financing the minimum level of protection by 13%; b) The abolition of social security contributions for non-professional carers, which had hitherto been borne by the National Government. Carers could voluntarily remain in the contribution scheme, as long as they pay the full contribution themselves. c) A 15% reduction with immediate effect in the amount of the caregiving subsidies for informal caregivers and a reduction in the hours of care in the home help service (see Table 1); d) The establishment of a maximum suspension period of two years for receiving the caregiving subsidy from the date on which the right of access was generated; e) The extension of the moratorium on the incorporation of moderate dependents until July 2015; f) An increase in the user contribution (co-payment). Since then, it implies a co-payment for dependent persons with incomes above 532 euros per month (€2012). This co-payment would be progressive and would reach a maximum of 90% of the price of the care service received. Until this reform, this 90% was only applicable to residential services. From then on, it would apply to all types of services and financial benefits.

Table 1. Home care supports and care subsidies

	Home care supports (Hours per month)	**Caregiving subsidies (€/month)**

[1] Austerity cuts were an immediate reaction to the 2012 Spanish public deficit (8.9 per cent) which led to an implicit bailout of the Spanish economy and the implementation of severe budgetary cuts for the SAAD in July 2012 (Royal Decree 20/2012, 13 July 2012, on measures to guarantee budget stability and foster competitiveness).

2007		
Major dependency. Level 2	70-90	889.70-1,143.90
Major dependency. Level 1	55-70	699.05-889.70
2011		
Major dependency. Level 2	70-90	956.20-1,229.40
Major dependency. Level 1	55-70	751.30-956.20
Severe dependency. Level 2	40-55	546.40-751.30
Severe dependency. Level 1	30-40	409.80-546.40
Moderate dependency. Level 2	21-30	286.86-409.80
2013		
Major dependency	46-70	653.20-994
Severe dependency	21-45	298.20-639
Moderate dependency	Max. 20	284
2015		
Major dependency	46-70	628.36-956.20
Severe dependency	21-45	286.86-614.70
Moderate dependency	Max. 20	273.20
2017		
Major dependency	46-70	689.54-1,049,30
Severe dependency	21-45	314.79-674.55
Moderate dependency	Max. 20	Max. 299.80
2020		
Major dependency	46-70	697.36-1,061.2
Severe dependency	21-45	318.36-682.20
Moderate dependency	Max. 20	305.20

Source: Own work using Normativa sobre Dependencia - Instituto de Mayores y Servicios Sociales (imserso.es)

Between 2012 and 2014, the long-term care reform measures led to estimated savings of 2,278 million euros, which partly explains the stagnation of spending between 2011 and 2015, at around 0.7% of GDP, well below the EU average of 1.6% (European Commission, 2015). The SAAD began to show signs of recovery in mid-2015, with an increase in applications, the number of individuals assessed, and the proportion of the population benefiting from the program. This growth contributed to a reduction in waiting lists. A key factor in this growth was the inclusion of moderate dependents in the SAAD starting in mid-2015, a move that had been delayed since 2011.

However, the system faced additional financial challenges due to the failure of parliament to approve the general state budget in 2019 and 2020, forcing the government to operate under a prorogued 2018 budget. A decade after the reform's implementation, the reality of SAAD’s expansion has fallen short of earlier projections, with the number of beneficiaries and the scope of benefits being much lower than anticipated in the Libro Blanco (2004). In response to these challenges, the general state

budgets for 2021 and 2022 allocated a significant increase to the long-term care budget, with a 23.3% rise in 2022 compared to 2021, and a budget that was double the amount recorded in 2018 (Jiménez-Martín and Viola, 2022).

4. Data and Empirical Strategy

4.1 The Data

We use data from SHARE (Survey of Health, Ageing and Retirement in Europe) for Wave 1 (2004), Wave 2 (2006/2007), Wave 4 (2011), Wave 5 (2013), Wave 6 (2015), Wave 7 (2017), Wave 9 (2021/2022).[2] We do not include Wave 8 (2020) to avoid the effect of the Covid-19 pandemic. SHARE is the European equivalent of the Health and Retirement Survey, a panel dataset of interviewees born in 1960 or earlier and their partners. The use of individual survey data is especially important given that common administrative data lacks important controls for detailed socio-economic and demographic characteristics available in survey data. SHARE interviews all persons aged 50 years and over at the time of sampling[3] who have their regular residence in the respective SHARE country. Individuals are excluded from baseline or refreshment samples if they are incarcerated, hospitalized or out of the country during the entire survey period, unable to speak the country's language(s) or have moved to an unknown address. All SHARE respondents who were interviewed in any previous wave are part of the longitudinal sample. If they have a new partner living in the household, the new partner is eligible for an interview as well, regardless of age. Age eligible respondents who participated are traced and re-interviewed if they move within the country and end-of-life interviews are conducted if they decease. Younger partners, new partners and partners

[2] Unfortunately, wave 3 could not be included as it is not comparable with the other waves.
[3] In wave 1 all household members born 1954 or earlier are eligible for an interview. Starting in wave 2, for new countries or refreshment samples, there is only one selected respondent per household who has to be born 1956 or earlier in wave 2, 1960 or earlier in wave 4, 1962 or earlier in wave 5, 1964 or earlier in wave 6,1966 or earlier in wave 7 and 1969 or earlier in wave 8.

who never participated in SHARE will not be traced if they move and are not eligible for an end-of-life interview.

The initial sample consists of 29,002 observations (2,711 for the pre-SAAD period (2004-2006) and 26,291 observations for the post-SAAD period (2007-2022)). The population is divided into three groups: (i) receiving disability benefit or caregiving subsidy (4%-5%); (ii) receiving home care supports (7% in the pre-SAAD period and 10% in the post-SAAD period); (iii) not receiving any type of benefit (89%-86%, in each period) (see Table 1).

4.1.1 Description of the Outcomes

We consider the following outcomes:

Life satisfaction. This variable defined using the following question: '*On a scale from 0 to 10 where 0 means completely dissatisfied and 10 means completely satisfied, how satisfied are you with your life*?'. We define an ordinal variable which records the answer to this question.

Loneliness: Loneliness is an important risk factor for the onset of depression (Ge et al., 2017) and has been linked to other health conditions, such as dementia (Kuiper et al., 2015), suicidality (Stickley & Koyanagi, 2016), coronary heart disease (Valtorta et al., 2016) and increased risk of early mortality (Holt-Lunstad et al., 2015), leading to higher healthcare expenditure (Mihalopoulos et al.,2019).

We use the short three-item version of the Revised UCLA Loneliness scale (henceforth, R-UCLA) (Russell *et al.*, 1978). The wording of the items are: '*How often do you feel isolated from others?, How often do you feel you lack companionship?, How often do you feel left out?'*. In each case, the available responses are: 1. Often, 2, Some of the time, 3. Hardly ever or never. SHARE has created a scale ranging from 3 (not lonely)

to 9 (very lonely). It has been shown that this tool has favourable psychometric characteristics (Hughes *et al.*, 2004).

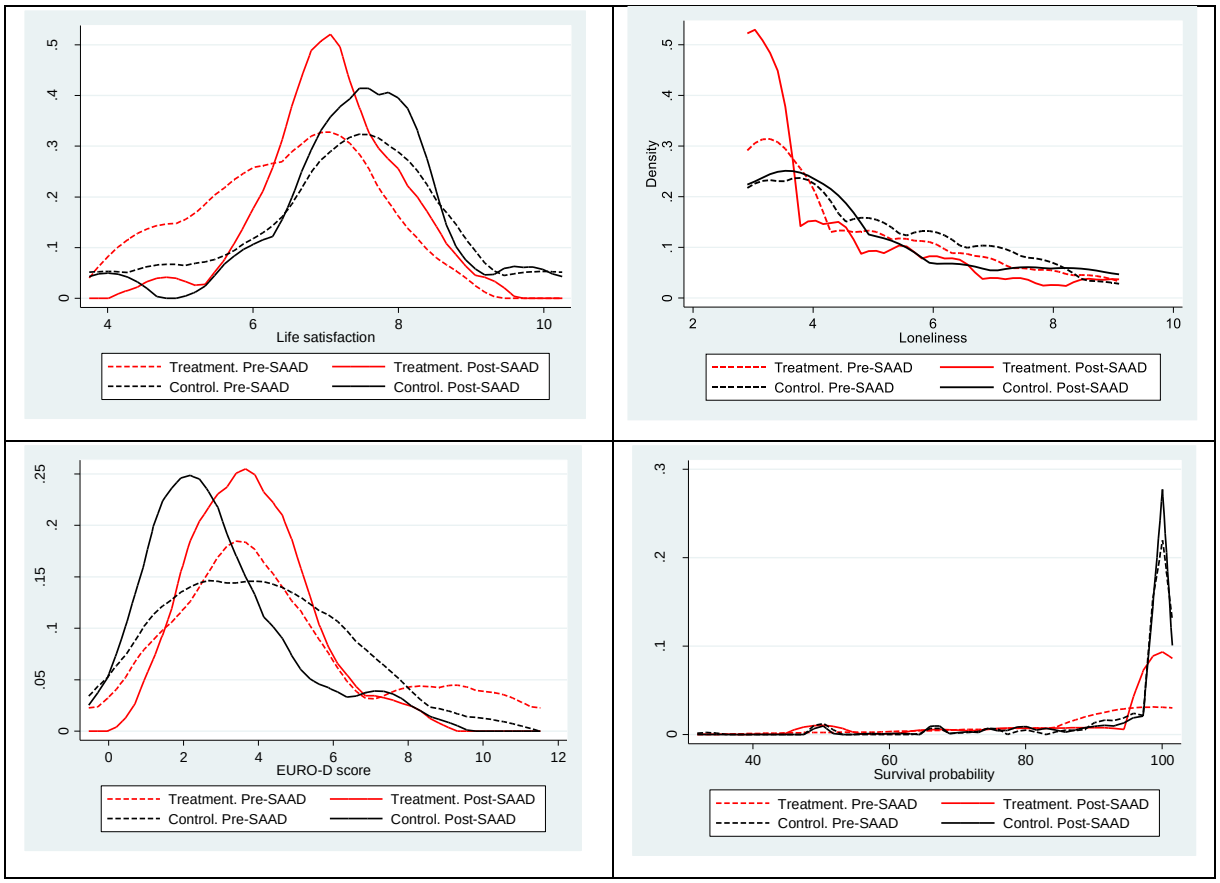
Depression. We use the EURO-D scale which has been applied to identify depressive symptoms in European countries (Prince *et al.,* 1999). The EURO-D scale is a 12-item scale in which the respondent is asked whether in the past month he/she has experienced any of the following symptoms: 'depressed mood', 'pessimism', 'suicidality', 'guilty feelings', 'sleep problems', 'loss of interest', 'irritability', 'less appetite', 'fatigue', 'lower levels of concentration', 'less enjoyment in life' and 'tearfulness'. A score greater than 3 out of 12 signals a depressive disorder, for which therapeutic intervention would be recommended (Dewey and Prince, 2005).

Survival. Merging the "Main Questionnaire" of one wave with the "End-of-life Questionnaire" of the next wave, we determine if the individual has died. In case a respondent deceased, interviewers conduct an end-of-life interview with a proxy respondent. The interview is a special form of proxy interview conducted either in person or by phone. Proxy-respondents can be a family or household member, a neighbour or any other person of the closer social network of the deceased respondent. The end-of-life interview mainly contains information on respondent's last year of life and the circumstance of death like time and cause of death. *We define a binary variable that takes the value 1 if the individual has survived between two consecutive waves and 0 if the individual has died.*

Given the reduction in the number of observations (respondents in one wave, who do not continue in the next wave), we have examined the possible existence of attrition bias. To investigate this issue, we estimate a series of attrition probits (Fitzgerald *et al.*, 1998) and performed pooling tests for the equality of coefficients from the initial sample with and without attritors, using the Becketti-Gould-Lillard-Welch test (Becketti *et al.*,

1988). To compute this test, first we regressed the outcome variables from the first wave on household characteristics, an attrition dummy, and the attrition dummy interacted with the other explanatory variables. Next, we tested for the joint significance of the interaction variables and the attrition dummy to determine whether the coefficients from the explanatory variables differ between households who attrit or remain in the sample. Results indicate that conditional attrition is random and therefore, it is unlikely to bias our estimates[4].

Figure 3. Kernel density function



Black dashed (straight) line represents the kernel density function for the control group before (after) the implementation of the SAAD.
Red dashed (straight) line represents the kernel density function for the treatment group (after) the implementation of the SAAD.
Lowest score for satisfaction (loneliness) denotes lower degree of life satisfaction (loneliness). Higher score for EURO-D denotes higher depressive symptoms. Treatment and control groups after CEM. Source: Own work using SHARE.

[4] Additionally, the small pseudo-R-squared from the attrition probits, which can be interpreted as the proportion of the attrition that is not random, from the Becketti-Gould-Lillard-Welch test (Outes-Leon and Dercon, 2008), reinforces our previous diagnostic.

Figure 3 displays the kernel density function of the 4 outcomes differentiating between treatment and control group (with the samples obtained after coarsened exact matching, CEM[5]) and in the period before/after SAAD. For the treatment group in the post-SAAD period we observe a favourable evolution: (i) shift to the right of the density function for life satisfaction (higher life satisfaction); (ii) decrease of the right tail of the EURO-D score (lower percentage of people with scores above 3 which means lower percentage with depressive symptoms); (iii) increase of the left tail of the loneliness distribution (which means lower percentage of unwanted loneliness) and (iv) increase of the right tail of the survival distribution.

4.2 ***Empirical Strategy.***

We examine whether differences in several outcomes (survival, depression, loneliness, and life satisfaction) are explained by the long-term care reform using a strategy that combines an innovative sample selection method, the coarsened exact matching (CEM), with either a DiD[6] or an event studies estimation strategy (survival model in the case of the individual survival probabilities plus other options for robustness). In what follows we describe in detail the CEM strategy as well as the estimation setups and the empirical specification.

4.2.1. The coarsened exact matching.

We use matching to preprocess the data prior to the estimation of our DD models in order to produce more accurate and less model-dependent estimates. This approach was proposed by Ho et al. (2007) and its main objective is to ensure that individuals in the treatment and control groups are as similar as possible in terms of covariate

[5] See the next section for a detailed description of the CEM sampling strategy.

[6] The introduction of the SAAD allows us to apply a difference-in-differences model comparing the outcomes of recipients of long-term care benefits versus the outcomes of non-recipients of long-term care benefits, before and after the introduction of the SAAD.

distribution. An advantage of the combination of DID with matching is is that it is “doubly robust” in the sense that, under weak conditions, if the matching or parametric models are correct, the causal estimates should be consistent (Ho et al., et al., 2007).

The most widely used current methods, propensity score and Mahalanobis matching, belong to the class of matching methods known as "same-percentage bias reducers," which do not guarantee any level of imbalance reduction in any given data set. Their properties hold only on average across all samples and even then, only by assuming a number of usually unverifiable assumptions about the data generation process. In contrast, CEM works by sampling and requires no assumptions about the data generation process and guarantees that the imbalance between treated and matched control groups will be no greater than the user's ex ante choice. Iacus et al. (2011) show that CEM dominates existing commonly used matching methods in its ability to reduce imbalance, model dependence, estimation error, bias, variance, mean square error, and others.

To make the estimation strategies more credible we apply an innovative matching method, the coarsened exact matching to achieve covariate balance between the treatment and the control group, as well as between before and after introduction of the SAAD. CEM matching methodology developed by Iacus *et al.* (2012) that can be used with repeated cross-sectional data (Heckman *et al.*, 1998). Previous work in the literature addressing similar research questions has attempted to address these identification problems by relying on propensity score matching (King and Nielsen, 2019).

The strategy consists of simultaneously matching using a set of possible confounders which are "coarsened", reducing the number of possible matching values for a given covariate with the aim of increasing the number of matches achieved[7]. Our choice

[7] CEM works as follows. First, it makes a copy of the set of covariates chosen for matching. Second, the variables are broken down into different meaningful strata (i.e., into equal intervals of the same size or into intervals of different

to use CEM is motivated by the fact that this method has been designed by the authors to provide an improvement over existing matching approaches in estimating causal inference by reducing any imbalance in covariates between treated and control units. CEM incorporates properties of the exact matching procedure, and in addition, it possesses a peculiar feature that distinguishes it from other matching methods, allowing the balance between treated and control groups to be chosen ex-ante, rather than having to be discovered ex-post. After applying the CEM method, a weighting variable is retrieved to equalise the number of observations within the comparison groups, which takes values between 0 and 1[8].

To our knowledge, this is the first work using the CEM to estimate the causal effect of the implementation of long-term care reform on physical and mental health outcomes. CEM has been used to define, for each year (before and after the introduction of SAAD), two groups of respondents of SHARE, based on age, gender, marital status, years of education, income and comorbidities[9]. These characteristics are considered to affect the use of formal care (Lee and Penning, 2019; de Klerk *et al.*, 2021) and health outcomes (Mackenbach *et al.*, 2008). An additional advantage of the CEM estimator over the standard matching procedure is that it allows us to control for unobserved time invariant factors. This implies that we assume that the outcome variables of interest of

dimension from each other), through user choice automatically or through the CEM algorithm. Third, a unique stratum is created for each observation and each observation is placed in a stratum. The strata created are reassigned to the original data set, and any strata that does not contain at least one treated and one control unit is removed. Thus, the treatment effect is based on the matching provided by the algorithm, since the difference between treated and control units is obtained from the difference in the outcome variable between units belonging to the same strata. Finally, the higher the coarsening (higher number of strata), the lower the imbalance, as well as the lower the number of matches provided by the CEM.

[8] To check the balance of two comparison groups, the multivariate imbalance measure L1 is used, whose size depends on the dataset and the selected covariates, and which takes values between 0 (perfect overall balance) and 1 (maximum imbalance), i.e. a larger value represents a larger imbalance between two groups. When good matching occurs, a substantial reduction in L1 is obtained (Green *et al.*, 2015). Table B3 also compares the L1-statistic the initial sample and the sample obtained after applying CEM. In the CEM process, the sample size is reduced from 29,002 to 26,738 observations (which means that we retain almost 93% of the sample).

[9] Muenning *et al.* (2017) and Tetteh *et al.* (2019) have found that CEM is preferable to other matching procedures (e.g. propensity score matching) in terms of more efficient processing and reduced model dependence, variance and bias. Ripollone *et al.* (2015) also showed that optimal performance is warranted only when the vector of important confounders is relatively small (fewer than 10), which is fulfilled in our case.

the treated and control units, in the absence of any treatment show the same growth trajectory, i.e., the parallel trend assumption of the DiD method. Table B2 documents comparable descriptive statistics for socio-demographic variables for the initial sample and the sample after CEM.

4.2.2. Estimation Strategies

Event-study estimates. We estimate the following event-study specification:

$$Y_{ict} = \sum_{j \neq -1} \beta_j 1\{\rho_{ict} = j\} + X'_{ict}\alpha_1 + E_{ct} + R_r + T_t + \varepsilon_{ict} \quad (1)$$

where Y_{irt} is the outcome variable (depression, life satisfaction, loneliness and survival) of individual *i* living in region *r* and interviewed in year *t*. $1\{\rho_{ict} = j\}$ denotes the leads and lags of SAAD implementation, which allow us to analyze non-parametrically differences between beneficiaries and non-beneficiaries of SAAD in years prior to and after the onset of SAAD.

X_{ict} refers to a vector of control variables including the respondent's sociodemographic characteristics (age, sex, marital status, level of education, body mass index, degree of dependency rated by the Katz's index[10], self-reported health status, chronic illness, smoking and drinking habits, days stayed at hospital during last year for surgery or medical tests, days stayed at hospital during last year due to mental health problems, number of days stayed in other institutions other than a hospital or a nursing home during last year (i.e., institutions for rehabilitation, convalescence), visits to general practitioner during last year, sedentary lifestyle, living alone, living in a rural area), E_{ct} is a vector of regional economic characteristics according to the respondent's place of

[10] The Katz Index (Katz, 1983) determines functional status as a measurement of the ability to perform six ADLs independently. We have computed this index using the information on ADLs provided by SHARE. Respondents have been classified into four categories: Katz_0 indicates that the individual performs all activities independently; Katz_1 indicates that the individual performs four or five activities independently; Katz_2 indicates that the individual only performs two or three activities; Katz_3 indicates that the individual needs help for all these activities (or all but one).

residence (real per capita GDP, unemployment rate), which helps to control for the effect of potentially relevant macroeconomic conditions. All regressions are estimated using calibrated sampling weights.[11] Finally, R_r and T_t denote regional fixed effects and year fixed effects, respectively, and ε_{ict} is an individual-specific error term.

Obtaining evidence that beneficiaries and non-beneficiaries exhibit similar time-varying changes in outcomes prior to SAAD is consistent with the notion of parallel trends. Furthermore, we directly test whether beneficiaries and non-beneficiaries present different pre-reform trends by means of a joint F-test that all pre-SAAD dummies are equal to zero (H_o: $\rho_{ict} = 0$ for $j < 0$).

Difference-in-difference estimates. Several studies have used a similar difference-in-difference strategy to analyse the effect of the introduction of a new policy (Winkelmann, 2004; Chou *et al.*, 2010), which basically involves comparing the change in an outcome variable for care recipient *i* in region *r* and time *t*, before the implementation of SAAD (when they received a disability allowance (DA_{ict}) or home care supports (HCB_{ict}), and after the implementation of SAAD (when they received caregiving subsidies (C_{ict}) or homecare (HCA_{ict}) with the counterfactual change as if they were not affected by the policy amendments. This counterfactual change is an actual variation for the control group if a common trend assumption is satisfied. According to the terminology of Callaway and Sant'Anna (2021), we use a *difference-in-difference model with staggered adoption* because once units have been treated, they remain so in

[11] SHARE provides two types of weights. The sampling design weights are defined as the inverse of the probability of being included in the sample of any specific wave. Although these weights compensate for the unequal selection probabilities of the sample units, unbiased estimators of the population parameters can only be obtained under the ideal situation of complete response. Unfortunately, given that SHARE data are affected by problems of unit non-response and sample attrition, estimators constructed using sample design weights alone may be biased (Lessler and Kalsbeek, 1992). The strategy used by SHARE to cope with these problems relies on the ex-post calibration procedure of Deville and Särndal (1992).

the following periods (units do not "forget" the treatment). Our specification is defined as follows:

$$Y_{irt} = X'_{ict}\alpha_0 + \alpha_1 E_{ct} + \alpha_2 DA_{ict} + \alpha_3 C_{ict} + \alpha_4 HCB_{ict} + \alpha_5 HCA_{ict} + R_r + T_t + \varepsilon_{ict} \quad (2)$$

Y_{irt} is the outcome (loneliness, life satisfaction, depression symptoms, survival probability[12]) of respondent i living in region r in year t. The key covariates of our specification are as follows: (i) DA_{ict} is a binary variable equal to 1 if the care recipient received a disability allowance before the SAAD, and 0 otherwise; (ii) C_{ict} is a binary variable equal to 1 if the care recipient received an allowance from the SAAD, and 0 otherwise; (iii) homecare support HCB_{ict}, is a binary variable equal to 1 if the care recipient received publicly funded homecare before the SAAD, and 0 otherwise; and (iv) HCA_{ict} is a binary variable equal to 1 if the care recipient received publicly funded homecare support after the SAAD, and 0 otherwise.

X_{ict} refers to a vector of control variables including the respondent's sociodemographic characteristics (same as in equation (1))[13], E_{ct} is a vector of regional economic characteristics according to the respondent's place of residence (real per capita GDP, unemployment rate), which helps to control for the effect of potentially relevant macroeconomic conditions; R_r and T_t denote regional fixed effects and year fixed effects, respectively, and ε_{ict} is an individual-specific error term.

[12] The linear probability model turns out to be a much more friendly environment, as compared to a probit model, for detecting and interpreting the coefficients of interaction terms (Angrist & Pischke, 2009). Ai and Norton (2003) show that the interaction effect in a nonlinear probit model is not necessarily equal to the marginal effect in the linear probability model. In non-linear models the ordinarily reported standard errors and marginal effects of interacted variables require corrections (Ai and Norton, 2003). For the benchmark specification we compare the standard errors of the linear probability model, with the non-corrected and corrected standard errors of the probit model.

[13] We categorize the explanatory variables in several groups (see Table B1 for the precise definition of these variables and Table B2 for descriptive statistics): (i) demographic characteristics (age, sex, marital status, and level of education); (ii) health and lifestyle variables (body mass index, degree of dependency rated by the Katz's index, chronic illness, smoking and drinking habits, self-reported health status and sedentary lifestyle; (iii) use of healthcare services (days stayed at hospital during last year for surgery or medical tests, days stayed at hospital during last year due to mental health problems, number of days stayed in other institutions other than a hospital or a nursing home during last year (i.e., institutions for rehabilitation, convalescence), visits to general practitioner during last year); (iv) household and environmental related variables (living alone, living in a rural area, adjusted income and wealth).

As discussed in Bertrand *et al.* (2004), one of the concerns is that the difference-in-difference specifications may underestimate the standard errors coefficient. We overcome this problem by applying their solution and applying block bootstrap (Efron and Tibshirani, 1994), because it maintains the autocorrelation structure, grouping all the observations that belong to the same region.

Given the progressive implementation of SAAD, treated individuals are those classified as highly dependent in 2007, while in 2011 it included the latter and those classified as severe, and considers some moderate dependents (Level 2), and finally from 2013[14] SAAD covered all dependents. Our main coefficients of interest are α_3 and α_5 which measure the effect of caregiving subsidies and home supports after the SAAD on the four outcomes of interest.

A plausible identification problem may be that the awarding of long-term care benefits may be correlated with other contemporary shocks. For example, the incidence of the economic crisis in 2008 may have difficulted the rollout of the SAAD. We address this issue on two ways. First, we include the unemployment rate in the vector of controls. Second, we run a falsification test based on the change in unemployment rate between 2008 and 2013. We bin regions in 4 quartiles and re-estimate equation (1) with quartile-by-year fixed effects. This specification allows us to test that common time shocks across regions varying according to recession severity have no effect on our results.

4.2.3. Specification exercises.

We also check if the relationship between the outcomes and the SAAD benefits arises from unobserved common shocks. For example, increasing life expectancy could lead to a spurious correlation between the outcomes and the SAAD resulting from the

[14] However, health-related variables recorded in SHARE do not allow distinguishing between the three degrees of dependency because the ranking scale used by SAAD involves a higher number of ADLs.

overarching trends, but not by the long-term care policy itself. For this purpose, we consider additional specifications that include common shocks using region-specific linear trends and a fixed effects model with interactions.

First, we introduce a region-specific linear trend:

$$Y_{ict} = X'_{ict}\alpha_1 + \alpha_2 DA_{ict} + \alpha_3 C_{ict} + \alpha_4 HCB_{ict} + \alpha_5 HCA_{ict} + R_r + \lambda(t)_c + \varepsilon_{ict} \quad (3)$$

Second, we consider a more flexible specification of (3) introducing interactive fixed effects, which allow for potentially non-linear region-specific time trends by nesting additive fixed effects inside the error term (Gobillon and Magnac, 2016). In this setup, the regression error term is decomposed into a muli-factor structure of time-varying common factors with heterogeneous effects by cross-sections plus an error term.

$$Y_{ict} = X'_{ict}\alpha_1 + \alpha_2 DA_{ict} + \alpha_3 SU_{ict} + \alpha_4 HCB_{ict} + \alpha_5 HCA_{ict} + R_r + F'_t\lambda_c + \varepsilon_{ict} \quad (4)$$

where F_t represents an unobserved factor common to all regions and λ_c is a region-specific factor loading, determined by iterative principal component analysis of the error term. These factors can be interpreted as regional trends in health status care to which regions respond differently based on observable characteristics. The main advantage of (4) is that it does not impose any specific constraint for the unobserved heterogeneity.

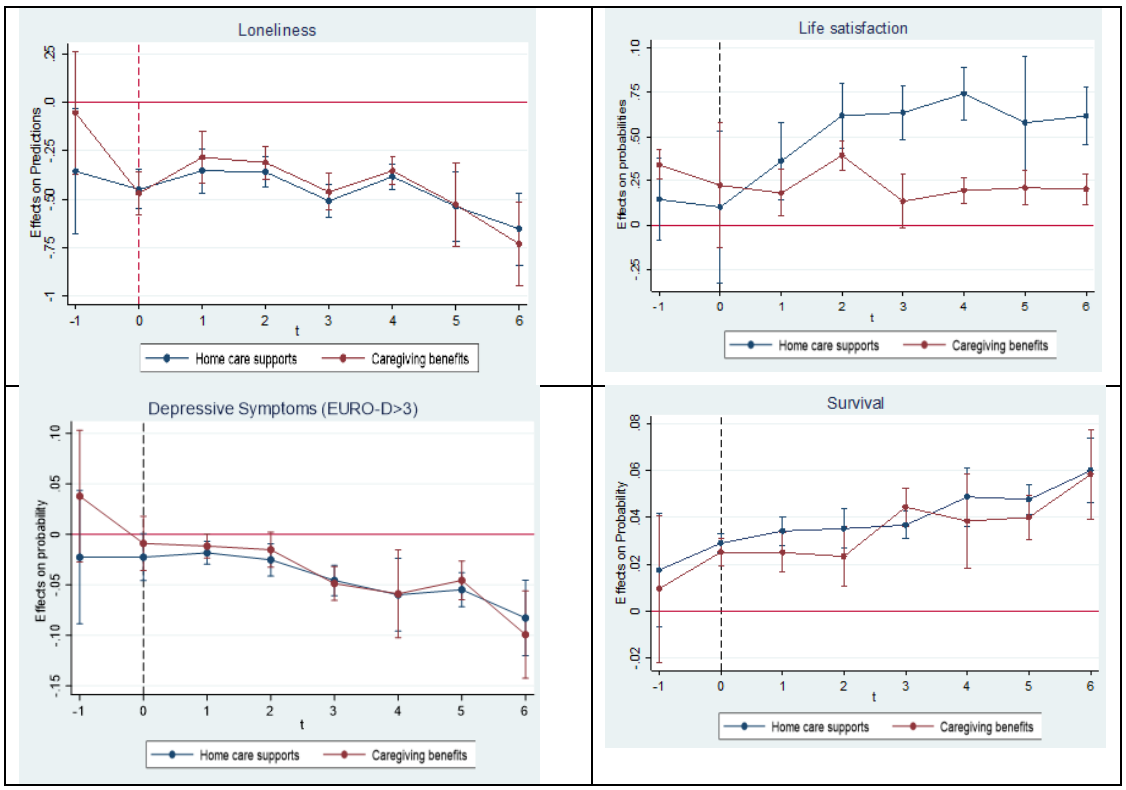
5 Results

5.1 Main Results

5.1.1. Event study estimates. The Figure 4 below displays the results of the event-study results that reveal that there is a significant change in all four outcomes after the entry of SAAD over time, namely increased life satisfaction and probability of survival and reduced loneliness and depression. These results are significant for both caregiving subsidies and home care supports. The differences between the two benefits are small for

loneliness, depression and survival. However, for life satisfaction a larger increase is observed for home care supports recipients.

Figure 4. Event-study.



Note: This table displays the event study coefficients of the four outcomes of interest for individuals receiving care subsidies and home care supports. Period 0: implementation of SAAD. Period -1 corresponds to pre-SAAD situation. Periods 1 to 6 corresponds to the situation after SAAD.
Source: Own work using SHARE.

To ensure the robustness of our findings, we conduct a pre-trend test to check for violations of the parallel trends assumption. This test examines the observed deviations from common trends in the pre-SAAD period to bound the treatment effect, accounting for potential post-SAAD deviations of different magnitudes. Rambachan and Roth (2023) formalized the methodology for pre-trends testing by imposing restrictions on the possible differences in post-treatment trends based on identified pre-trends. These restrictions suggest that pre-trends can provide insight into expected post-treatment counterfactual differences in trends.

Following this framework, we compare the differences between the treatment and control groups in the pre-SAAD period and evaluate these differences in relation to the observed effects in the post-SAAD period. If the effects observed in the post-SAAD period are "considerably large" relative to those seen in the pre-SAAD period, it supports the argument for a true treatment effect. Rambachan and Roth (2023) proposed generating adjusted confidence intervals by taking the largest difference in the pre-SAAD period between the treatment and control groups, and deriving confidence intervals for multiples of those differences. These intervals reflect the potential violations of the parallel trend assumption.

To implement this, we compare the original 95% confidence interval, which assumes no violations of the common trend, with adjusted confidence intervals that allow for violations of the common trend of 0.1, 0.25, 0.5, 1, and 2 times the magnitude observed during the post-SAAD period. Figure A5 illustrates that our estimates remain robust to violations of the parallel trend assumption, even when the magnitude of these violations is twice that observed in the post-SAAD period.

5.1.2 DiD estimates.

Table 2 displays the estimates for the four main outcomes considered using the CEM corrected sample. We estimated a pooled OLS-DiD model for all the outcomes[15]. We consider four nested specifications for each outcome (see footnote of Table 2 for a detailed description).

In the case of loneliness, we find that receiving caregiving subsidies (home care supports) implies a reduction in loneliness of 0.61 points (-0.52 points), respectively. In

[15] We found that estimation of ordered probit models for the first two outcomes and of a probit model for the third one reported comparable marginal effects.

the pre-reform period, receiving a disability allowance also had a significant effect (-0.52 points), but receiving home care supports had no significant effect. Therefore, with SAAD the 'protective' effect against loneliness has increased by 18% for caregiving subsidies and home care supports now do decrease loneliness (although by 15% less than caregiving subsidies).

Consistently, receiving caregiving subsidies (home care supports) increases life satisfaction by 0.24 points (0.50 points). In this case, none of the pre-reform benefits had a significant effect on life satisfaction. With the SAAD, both caregiving subsidies and home care supports have a significant and positive effect, with the latter being twice as large as the former.

Furthermore, the SAAD benefits lead to a reduction of 1pp. (caregiving subsidy) and 0.8pp. (home care supports) in the probability of presenting depressive symptoms. This anti-depressant effect was not detected in the pre-reform period, but with SAAD there is a reduction in the occurrence of depressive symptoms (13% more intense when receiving caregiving subsidies).

Whereas the pre-reform period only registered a reduction in loneliness with life in for disability benefits, but did not result in a reduction in mortality, the post-reform period reveals an increase in the probability of survival (3pp in the case of care benefits and 2.6pp in the case of home care supports). Our finding of an increase in survival and life satisfaction is in line with Hulur et al. (2017) which document evidence that life satisfaction is a good predictor of mortality.

In conclusion, SAAD benefits exert positive effects on the four outcomes analyzed (stronger in the case of care allowances in the reduction of loneliness and depressive symptoms and in the increase in survival; stronger in the case of home care supports in the increase in satisfaction).

5.2.3. Specification exercises

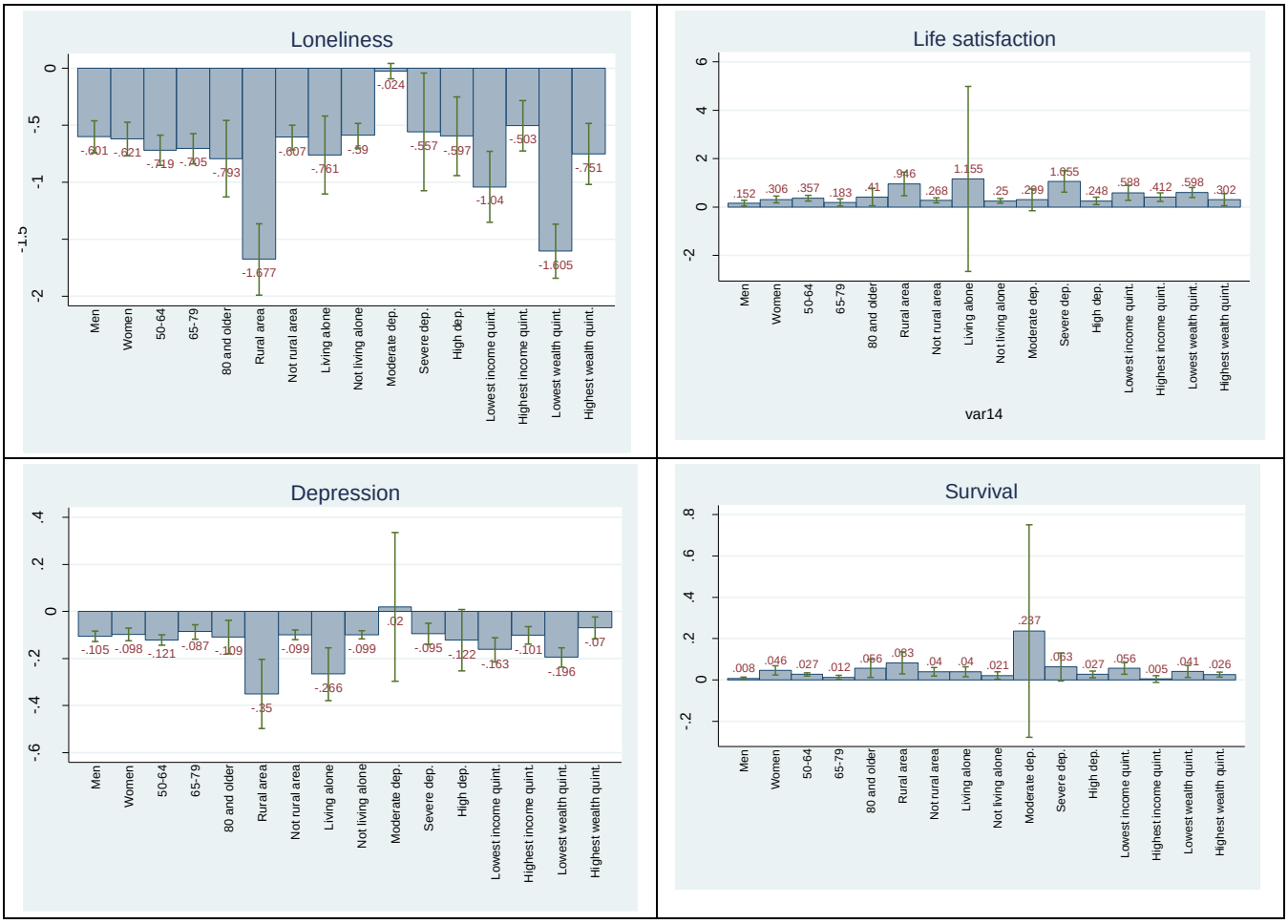
Tables D1 and D2 present the estimates corresponding to specifications (3) and (4), including region-specific linear trend or time-varying common factors with heterogeneous effects by cross-sections, respectively. Figure D1 provides a graphical comparison of the estimated coefficients for cash benefits-SAAD and home care supports-SAAD for these models.

Compared with the results of model (2) in Table 2, we observe that the sign and significance of the coefficients are maintained, but those of the alternative specifications show larger effects (in absolute value). Therefore, the specification of model (2) can be considered as a lower (conservative) threshold of the long-term effects of the SAAD on the outcomes analyzed.

5.2. Heterogeneity.

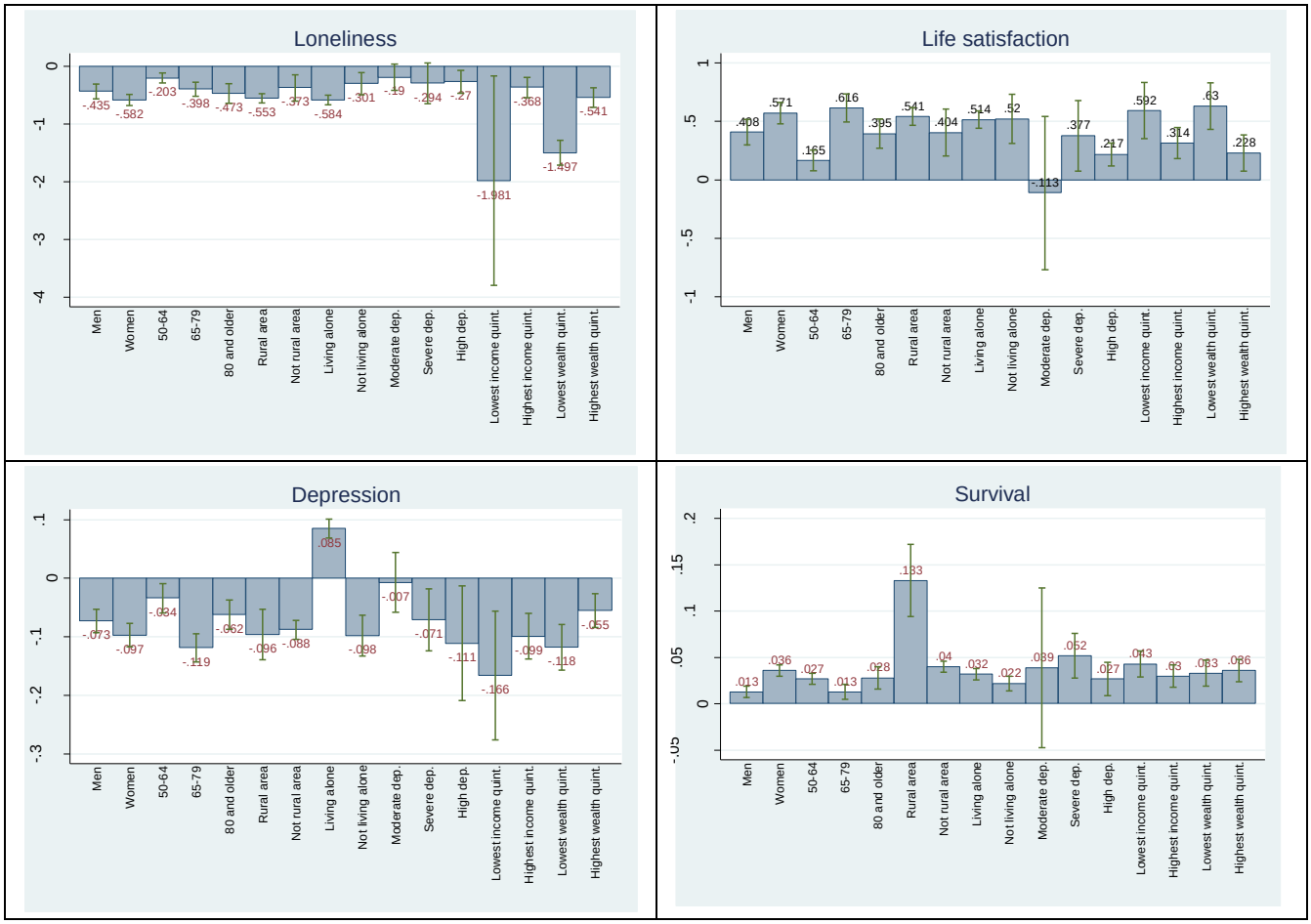
In this section we explore the heterogeneity of the impact of caregiving subsidies and home care supports on the outcomes analyzed. We consider the following dimensions: age, sex, place of residence, household size, level of dependency, income and wealth. Table A3.a to Table A3.d reports the OLS-DiD estimates of heterogeneous models using the CEM corrected sample.

Figure 5. Estimated effect of cash subsidies on outcomes



Blue bars denote the estimated coefficient for the variable “Cash subsidy SAAD”
Vertical bars represent 95% confidence intervals.
Completed tables are reported in Appendix A.

Figure 6. Estimated effect of home care supports on outcomes



Blue bars denote the estimated coefficient for the variable "Home care supports SAAD"
Vertical bars represent 95% confidence intervals.
Completed tables are reported in Appendix A.

Gender Receiving caregiving subsidies reduces the loneliness indicator in a similar way for men and women (0.60 points and 0.62 points, respectively). The impact of home care supports on loneliness is also negative, but it is 133% higher for women (-0.58 points versus -0.44 points). The life satisfaction indicator increases with both types of benefits, but the effect is 200% (133%) for caregiving subsidies (home care supports) for women compared to men. Similarly, the probability of suffering from depressive symptoms decreases by about 10pp. for caregiving subsidies (for both sexes) and somewhat more sharply in home care supports for women (-9.7pp vs. -7.3pp). Finally, the impact on the probability of survival is very small for men (only 1.3pp for home care supports), but much more significant for women (4.6pp for caregiving subsidies and 3.6pp for home care supports).

Age. The effect on loneliness derived from receiving caregiving subsidies shows a comparable magnitude regardless of age group (between 0.7 and 0.8 points). However, the reduction in loneliness derived from receiving home care supports is increasing with age (from -0.20 points for 50-64 years to -0.47 points for 80 years and older). Higher life satisfaction is observed in home care supports for 65-79 years cohort (+0.62 points) and in caregiving subsidies for 80+ (0.41 points). Both benefits imply a reduction in the probability of presenting depressive symptoms, although the greatest decrease is not observed univocally in the same benefit (caregiving subsidies for 50-64 years and 80 years and over; home care supports for 65-79 years). We highlight that the greatest increase in the probability of survival corresponds to the cohort aged 80+ receiving caregiving subsidies (+5.6 pp.), twice as much as when receiving home care supports (2.8 pp.) in the same age cohort, and four times more than for the 65-79 cohort (1.2pp-1.3pp.).

Place of residence. For all outcomes, receiving caregiving subsidies or home care supports results in a decrease in loneliness and depression or an increase in life

satisfaction and survival that is more intense for people living in a rural area. Receiving caregiving subsidies or home care supports in a rural area implies a reduction in loneliness (-276% and -148%) and an increase in survival (208% and 333%) more intense as compared to urban areas. It should also be highlighted that receiving caregiving subsidies increases life satisfaction (0.95 points in rural areas and 0.27 points in urban areas), which is a beneficial effect in both cases, but 353% more intense in rural areas.

Household size. Receiving some type of long-term care benefit has a stronger positive or negative impact for people living alone. And in the case of living alone, the effect is stronger for caregiving subsidies. Although this benefit is designed to be awarded to co-residents' caregivers, in exceptional situations (for example, living in an isolated environment) it can also be provided by non-co-resident family members or neighbours. It is noteworthy that, in this case, the indicator of loneliness decreases by 0.76 points, while that of satisfaction with life increases by 1.16 points. On the other hand, depressive symptoms decrease by 0.27pp (the impact being three times lower when receiving home care supports). Receiving caregiving subsidies doubles the probability of survival when living alone (+4pp. vs. +2pp. when not living alone).

Care needs. Approximating the level of dependency using the Katz index (moderate: 1, 2; severe; 3,4; highly dependent; 5, 6), we have estimated the impact of long-term care benefits on the four outcomes. We observe that there are no significant results for moderate dependents (this may be influenced by the interruption they suffered between 2012 and 2015). On the other hand, although significant and satisfactory results are found for severe and major dependents, these are more concentrated in the former group. Receiving caregiving subsidies (home care supports) has decreased loneliness and depression in both groups of dependents, but the effect has been greater for severe dependents (it has decreased 107% (92%) for loneliness and 128% (156%) for

depression). The increase in the probability of survival for highly dependent (2.7pp. for both benefits) is very encouraging, although this effect is 43% (52%) higher for the severely dependent (depending on whether caregiving subsidies were received, +6.3pp or home care supports, +5.2pp).

Income. For each wave we obtained the distribution by income quintiles of the interviewees according to household income (adjusted for household size). It is very appealing to note that the benefit of SAAD benefits has been concentrated in households with lower income levels. For example, receiving caregiving subsidies (home care supports) reduced loneliness by 207% (538%) and depression by 161% (168%) in lower-income households compared to higher-income households. But the most significant impact is concentrated in the survival indicator. Receiving caregiving subsidies implies an increase in the probability of survival 1120% higher in lower income households (+5.6pp vs. +0.5pp).

Wealth. for each wave, we obtain the distribution of households by wealth quintiles and analyze the impact of receiving long-term care benefits on the extreme quintiles. For wealthier and less wealthy households we observe positive effects on life satisfaction and survival and negative effects on loneliness and depression. These effects are stronger for lower wealth households. For example, receiving caregiving subsidies (home care supports) increases life satisfaction by 214% (277%) and decreases loneliness by 280% (215%). The impact on survival is also very significant, since receiving caregiving subsidies increases this probability 158% in households with lower levels of wealth compared to those with higher levels of wealth (+4.1pp. vs. +2.6pp).

6 Mechanisms

In this section we propose a number of mechanisms to support the results obtained, namely effect on (i) nutrition[16], (ii) maximal grip strength[17], (iii) locus of control[18] and (iv) hip or other bones fractures. As suggested by the literature, it is likely that the introduction of the SAAD has had a positive impact on nutrition, grip strength, internal locus of control and fractures.

6.1 Literature

Effectively, having regular care from an informal or formal caregiver may result in improved diet and reduced risk of malnutrition[19]. Second, hand grip strength has a significant inverse association with depression (Brooks *et al.*, 2018), and is a long-term predictor of all-cause mortality, cardiovascular disease, and cancer in men (Gale *et al.*, 2007). Higher prehensile strength is associated with better quality of life overall, as well as in the domains of autonomy, satisfaction with past, present, and future activities and achievements, and satisfaction with social participation (Xie and MA, 2021)

Locus of control reflects "whether or not the person perceives a causal relationship between his or her own behavior and reward" (Rotter, 1966), and may be differentiated between "*internal locus of control*" when people who believe that they control life outcomes and their own destiny versus "*external locus of control*" when they believe that

[16] For each of the following food categories "dairy products", "legumes, beans or eggs" "fruits or vegetables" and "meat, fish or poultry" we defined a binary variable that takes the value 1 if they are consumed at the indicated frequency: "every day", "3-6 times a week", "twice a week", "once a week" or "less than once a week", and 0 otherwise. This food groups respond literally to the SHARE questions, and it is not possible to know the frequency of consumption of "legumes" and "eggs" separately, or of "meat" and "fish" separately.

[17] We define a continuous variable that collects the respondent's maximum handgrip strength with the aid of a dynamometer.

[18] We measured locus of control through the question "How often do you feel that what happens to you is out of your control?". We defined four binary variables corresponding to the possible answers, which take the value 1 if the individual stated "often", "sometimes", "rarely" or "never", and 0 otherwise.

[19] Ramic *et al.* (2011) found that people living alone have a higher risk of malnutrition, reduced the number of meals per day and provoked a significantly lower daily intake of protein, fruits and vegetables in the diet relative to people living in a family environment. Moreover, depressed individuals consumed significantly lower amounts of legumes, fruits and vegetables, but higher amounts of sweets and refined sugars (Grases *et al.*, 2019). Furthermore, Saghafiane *et al.* (2018) reported an association between fruit or vegetable intake and risk of depression, such that every 100 g more fruit intake was associated with a 3 % lower risk of depression.

what happens in life is mainly due to external factors, such as fate, luck, or other people. Wong and Anitescu (2017) demonstrate that patients with an internal locus of control are less depressed than patients with a fatalistic view of their health/pain and Vuger-Kovacić *et al.* (2007) confirms the connection of external locus of control with anxiety and depression.

Fractures have been documented to be a powerful independent predictor of long-term excess mortality (Piirtola *et al.*, 2008). Fractures can also occur due to nutritional deficiencies. Karpouzos *et al.* (2017) show that insufficient intake of certain vitamins, especially A and D, and other nutrients, such as calcium, can affect bone health or even the time and degree of bone healing in the event of a fracture. Lonely older adults are more likely to suffer falls in the future (Zeytinoglu *et al.*, 2021). Depression may be also the cause to fracture, possibly influenced by medication use and dysregulated biological and lifestyle factors in depression (Wu *et al.*, 2010). Conversely, depression is a common response to chronic medical conditions which, in turn, can affect adherence to treatment and increase the risk of complications (Williams *et al.*, 2014).

6.2 Discussion of the mechanism

Nutrition. Table 3 reports the OLS-DiD estimates of nutrition models using the CEM corrected sample. Receiving benefits (disability allowance or home care supports) in the pre-SAAD period was not associated with any significant effect on diet. However, SAAD beneficiaries have benefited from substantial improvements in their diet: (i) 3.6pp (1.2pp) increase in the probability of consuming some type of dairy products every day when receiving caregiving subsidies (home care supports); (ii) 2.8pp (2.5pp) increase in the probability of consuming fruit and vegetables every day when receiving caregiving subsidy (home care supports), or 2.5 pp (1. (iii) 4pp (7.9pp) increase in the probability of consuming meat or fish or poultry daily when receiving caregiving subsidy (home care

supports) or 3.3pp (3.7pp) increase in the probability of consuming them 3-6 times per week (iv) 6pp (4.2pp) increase in the probability of consuming legumes or beans or eggs 3-6 times per week when receiving caregiving subsidy or home care supports. [We do not have sufficient information to assess other dietary characteristics such as consumption of sweets or prepared foods, but by considering the diagnosed diseases (e.g. diabetes), we are able to consider that the effect of receiving these benefits on the diet is filtered out possible contraindications to certain food groups depending on each patient's profile].

[Insert Table 4 about here]

Maximum grip strength. Table 4 reports the OLS-DiD estimates of maximum grip strength using the CEM corrected sample. People receiving long-term care allowance (before/after SAAD) show lower maximum grip strength (see Table 5). However, this negative differential is reduced in the post-SAAD period (from -4.92 kg (-2.93 kg) for men (women) receiving disability allowance to -1.98 kg (-2.41 kg) for men (women) with caregiving subsidy; from -6.42 kg (-3.73 kg) for men (women) receiving home care supports (pre-SAAD) to -4.36 kg (-1.95 kg) for men (women) with home care supports (post-SAAD). This increase in maximal grip strength is particularly significant in the 80+ cohort (grip strength increases 4.23 kg (1.63 kg) for men (women) with caregiving subsidy and 3.19 kg (1.89 kg) for men (women) with home care supports).

[Insert Table 5 about here]

Locus of control. Table 5 reports the OLS-DiD estimates of locus of control models using the CEM corrected sample. The likelihood of believing that things are out of control (see Table 6) increased 0.23pp (0.37pp) for men (women) receiving disability allowance and 47.8pp (40.9pp) for men (women) with home care supports (pre-SAAD). However, in the post-SAAD period, we observe a completely opposite behaviour: the

probability of considering that things are never out of control increases: 11.8pp (14.1pp) for men (women) receiving caregiving subsidy and 16.1pp (13.5pp) for men (women) with home care supports.

[Insert Table 6 about here]

Fractures. Table 6 reports the OLS-DiD estimates of locus of control models using the CEM corrected sample. In the pre-SAAD period, there is no significant effect on the probability of fractures. However, in the post-SAAD period we observe that: (i) receiving caregiving subsidy reduces the probability of hip fracture (other fracture) 2.4pp (1.6pp) for men and 7.1pp (3.6pp) for women; (ii) receiving home care supports reduces the probability of hip fracture (other fracture) 2.1pp (4.6pp) for men and 6.9pp (3.6pp) for women; (iii) these effects are concentrated in the 65-59 cohort for men and in the 50-64, 65-79 cohort for women; (iv) for women we highlight the 15.7pp (12pp) reduction in the probability of hip fractures in the 50-64 and 65-79 cohorts when receiving home care supports.

[Insert Table 7 about here]

7 QALYs estimates

7.1. Methods

Finally, the paper provides a back of the envelop calculation of the cost per quality adjusted life years (QALY) estimates from life expectancy and quality of life evidence in the data. This is important as health care decision making in several European countries is informed by such estimates[20]. However, in our setting the estimation of this effect is

[20] Authorities in Sweden and the Netherlands have recommended thresholds of approximately €57,000 (Bobinac *et al.*, 2010) and €80,000 (Ryen and Svensson, 2015), respectively. On the other hand, England and Wales explicitly state, through the National Institute for Health and Care Excellence (NICE) guidance, a range for defining the cost-effectiveness threshold, between £20,000 and £30,000 per QALY gained (NIHCE, 2013). The World Health Organisation (WHO) has suggested that health gains should be valued in terms of per capita GDP with technologies with an incremental cost per Disability Adjusted Life Year (DALY) of between one to three times the GDP per capita

complex, both because of problems of availability of information and because of the nature of the relationship between the variables. So far, we have calculated the impact of the SAAD on the probability of survival, depression, loneliness and life satisfaction. However, this evidence is not in itself enough to make recommendations as to whether or not we should increase the budget for long-term care. This incremental cost needs to be compared with a threshold value that dictates whether the long-term care benefits are considered cost-effective. This threshold value should therefore reflect the maximum amount that is considered appropriate to invest per unit of health effectiveness in a public long-term care system.

To measure quality of life in the population aged 15 years and older, the EQ-5D-5L instrument is generally used. This instrument consists of two parts: (i) a questionnaire measuring self-perceived health problems or limitations and (ii) a visual analogue scale (VAS). The questionnaire describes the health status of individuals on 5 dimensions: mobility, self-care, activities of daily living, pain or discomfort, and anxiety or depression. Each of these dimensions has 5 response levels: no problems, mild problems, moderate problems, severe problems and total impossibility. Secondly, the respondent is also asked to assess his/her health using a thermometer, the visual analogue scale, which provides a value for the state of health. It allows this value to be summed up between 100,

being considered cost-effective (Bertram and Edejer, 2021). In Spain, the literature reviewed by Sacristán *et al.* (2002) a threshold of 30,000 €/QALY. Subsequent reviews (De Cock *et al.*, 2017; Vallejo *et al.*, 2016) have proposed up to €45,000/QALY, in the first case, and a range of between €10,000 and €30,000/QALY, in the second. The paper by Vallejo *et al.* (2018) provides an estimate of a QALY in the Spanish National Health System, i.e., the value approximates the average opportunity cost of incorporating health technologies in the NHS when disinvestment is required to finance new interventions. They obtain an estimate of between 22,000 and 25,000 euros/QALY. It should be pointed out that the value of €22,000 corresponds to 2013 GDP per capita and €25,000 to 2017 GDP per capita.

the best imaginable state of health, and 0, the worst imaginable state of health (The EuroQoL Group, 1990).

The only source of Spanish nationally representative EQ-5D data are the Spanish Health Survey (SHS) conducted in 2011/12. The general objective of the ENSE 2011/12 was to provide the necessary information on the health of the population in order to be able to plan and evaluate health-related actions. The period for collecting the information was one year, from July 2011 to June 2012. The research was aimed at all persons residing in main family dwellings. When the same dwelling consisted of two or more households, the study was extended to all of them, but separately for each household. The information collected by the survey was divided into three questionnaires. The household questionnaire collected all household members and some basic socio-demographic variables for all household members. In addition, it included information on socio-demographic characteristics of the household reference person (the person who contributes most to the household budget). The adult questionnaire collected information on the selected person aged 15 years old or over in the household and finally, if there were minors in the household, the minor's questionnaire collected information on the selected minor. This information corresponded to additional socio-demographic variables of the selected persons, and all the target health variables of the survey. The information collection method was the computer-assisted personal interview (CAPI) that could be complemented, when necessary and in exceptional cases, by means of a telephone interview.

For the EQ-5D-5L, Ramos-Goñi *et al.* (2018) provide estimated rates based on the preferences of the Spanish population. The possible values of the EQ-5D-5L Spanish tariff range from -0.416 to 1, where a value of 1 corresponds to a situation of good health, and zero to a situation similar to death, with negative values corresponding to health states

considered socially worse than death. To assign the EQ-5D-5L scores from the National Health Survey (2022/2012) to SHARE respondents, we used coarsened exact matching using age, sex, marital status, educational level and comorbidities as linking variables. Table B4 reports the L1-statistic (with considerable reduction in the matched sample). In the CEM process, the sample size is reduced from 29,002 to 26,738 observations (which means that we retain almost 93% of the sample). Table B2 documents comparable descriptive statistics for socio-demographic variables for the initial sample and the sample after CEM.

Although temporal distance between both surveys could have introduced some bias, we consider that the matching carried out has considerably softened this possible bias. In addition, complementary analyses were carried out. First, the year of the SHARE wave 4 interview coincides with that of the National Health Survey (2011/2012). We compared the number of doctor visits, hospitalisations and medication consumption (variables that appear in both surveys) for the treatment and control groups and found no significant differences. Second, for all SHARE individuals (considering all waves) who have not been matched with respondents from the National Health Survey (2011/2012), we ran a regression where the dependent variable of 'non-matching' is explained as a function of sociodemographic and time variables. The results show that time effects are not significant.

Badia *et al.* (2001) have derived quantitative weights for each of the health states that can be described with the EQ-5D. These weights attempt to capture society's preferences for different health states and range from 0 (death) to 1 (perfect health), with possible negative values assigned to states considered worse than death. These predefined values are referred to as tariffs. Next, we estimate a model with a log-normal function on health-related decrements in quality of life, i.e. we transform the dependent variable into

1 minus the corresponding EQ-5D rate. The model estimated by generalized least squares follows the general lines of that proposed by Vallejo *et al.* (2018):

$$(1 - EQ - 5D_{it}) = \lambda + \kappa H_{it} + \theta SE_{it} + \nu_i + \tau_t + \varepsilon_{it} \quad (5)$$

The following health variables (H_{it}) were used: age; self-reported general health, chronic diseases, limitation (moderate or severe) for activities of daily living in the last 6 months due to health problems. Since individuals with the same level of health may report different values of health-related quality of life due to differences in the way they respond to these questions for reasons not related to their level of health, but to other variables, such as socio-economic variables (SE_{it}), we also include in the model the following variables: age, general health, chronic diseases, limitation (moderate or severe) for activities of daily living in the last 6 months due to health problems. Additionally, we include a number of socio-economic indicators: education, marital status, nationality and economic activity.

The aim is to create a health-related quality of life variable ($HRQoL_{it}$) that depends on the effect of the health variables itself, but controlling for the bias that the socio-economic variables may generate in this relationship (van Doorslaer and Jones, 2003). Therefore, when computing the predicted values of these models we use the estimated effects of the health variables on EQ- 5D, i.e. the coefficients $\hat{\kappa}$, while we set the value of the socio-economic variables equal to their sample mean when predicting, $\overline{SE_{it}}$, using the following formula:

$$\widehat{(1 - EQ - 5D_{it})} = \hat{\lambda} + \hat{\kappa} H_{it} + \hat{\theta}\overline{SE_{it}} + \nu_i + \tau_t + \varepsilon_{it} \quad (6)$$

The main challenge in estimating the relationship between long-term care cost and $HRQoL_{it}$ is the problem of endogeneity. In this case, our concern comes from the fact that long-term care is directly determined by a number of factors correlated with

the health of the population (e.g. regions with a higher percentage of elderly population will require more funding for long-term care), so that if these were not adequately controlled for, a significant bias in the observed estimate would then result (i.e. we might observe, erroneously, that the regions that spend more on long-term care are those that have a higher percentage of population in poorer health). We therefore propose the following model:

$$HRQoL_{irt} = \alpha LTC_{rt-1} + \beta X_{irt-1} + \nu_i + \rho_r + \tau_t + \zeta_{irt} \quad (7)$$

where $HRQoL_{irt}$ is the health outcome variable for individual *i*, living in region *r* in year *t*; LTC_{rt-1} is the long-term care expenditure in region *r* in the previous year; X_{irt-1} is a vector of explanatory variables; ρ_r and τ_t are region and year fixed effects, and ζ_{irt} is a random error term. The health outcome $HRQoL_{irt}$ and long-term care expenditure LTC_{rt-1} variables are expressed in logarithms so that the coefficient α can be interpreted as an elasticity, i.e. as the percentage change in the health of the dependent population due to a 1% increase in long-term care expenditure. Regional fixed effects (ρ_r) control for all determinants of health outcomes that vary across regions but are stable over time, while the year fixed effects (τ_t) control for changes over time that are constant across regions.

As regards the computation of the cost of long-term care benefits, we have used the information contained in SHARE. For caregiving subsidies, we directly used the monetary amount received by the dependent person and reported in SHARE. For home care supports, we multiplied the number of hours of care received by the public price of one hour of formal care. Both amounts have been expressed in annual terms and in 2022 euros (Table 7 and 8 report the average cost by sex and age cohort for each type of benefit).

7.2 Results

Tables 7 and 8 show the estimated coefficients of model, the years and days of life gained and the cost per QALY. Column 1 reports the coefficient for the long-term care variable (caregiving subsidy received or cost of home care supports). In both cases, these cost variables are expressed in euros/year and in logarithms, so the estimated coefficient can be interpreted as an elasticity. We observe that a 1% increase in caregiving subsidy (cost of home care supports) increases the average QALY by 0.000874% (0.000531%).

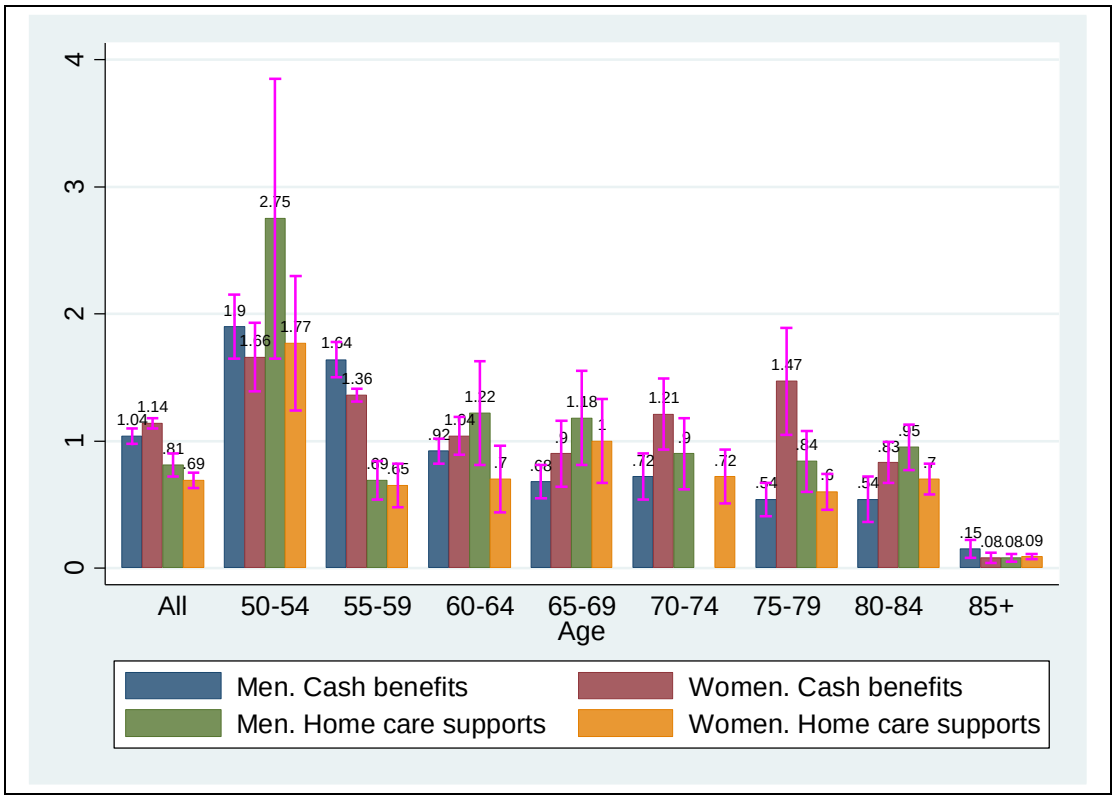
We then evaluate this result on the average cost (of caregiving subsidies and home care supports) by sex and age cohort (see column 3). The result indicates that an increase of €1 in caregiving subsidies (home care supports) expenditure per beneficiary per year leads to an increase of 0.0029 (0.0020) QALYs (column 4). For a better interpretation of these results, column 5 shows the increase in QALYs expressed in days (1.09 days for caregiving subsidies and 0.73 for home care supports). To estimate the cost per QALY, we use the average life expectancy by sex and age cohort (source: EUROSTAT), so if the average life expectancy for this population group is 18.40 years, then the cost per QALY for caregiving subsidy (home care supports) is 18. 40/0.0029 (18.40/0.0020), which is equivalent to €6,187.45 for caregiving subsidies (€5,815.96 for men and €6,398.95 for women) and €9,227.61 (€7,498.42 and €10,553.20 for women) in the case of home care supports.

Figure 5 shows the QALYs (expressed in days) by sex and age cohort. It is worth noting that (i) the number of QALYs is higher than 2 for men aged 50-54 receiving home care supports and for all other groups in this cohort the increase in QALYs is higher than 1.5 days; (ii) for cohorts 60-64 to 80-84, the number of QALYs

is higher for men when receiving home care supports and for women when receiving caregiving subsidies; (iii) the increase for women aged 75-79 receiving caregiving subsidies (1.47 days) is much higher than for the preceding cohorts.

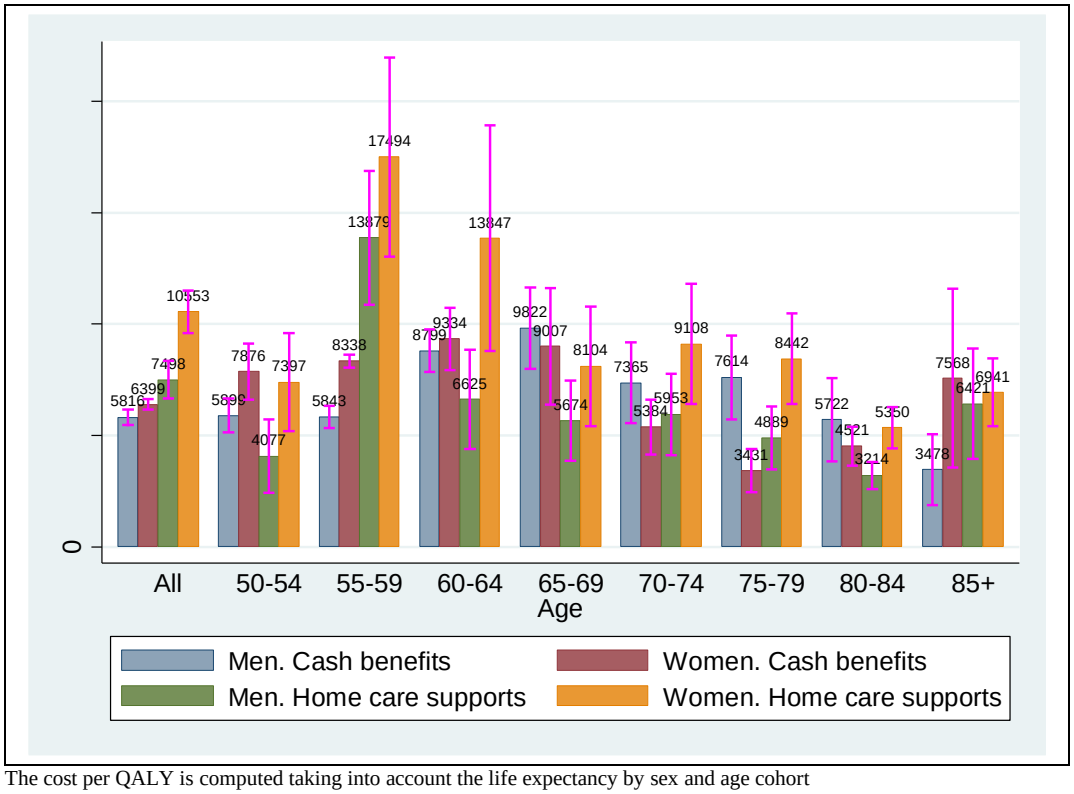
Similarly, Figure 6 displays the cost per QALY by sex and age cohort. The cost is significantly higher for women aged 55-59, 60-64 and 70-74 receiving home care supports; (ii) in the oldest cohort, the cost per QALY for men receiving caregiving subsidies is less than half that of men with home care supports and women; (iii) for home care supports recipients, the cost per QALY for men is about half that of women for the 60-64 and 75-79 age cohorts.

Figure 7. QALYs expressed in days per year gained



Each bar represents the number of health days years accrued by increasing caregiving subsidies (home care supports) in 1€ per year.
Data come from Tables 8 and 9.
Source: Own work using SHARE:

Figure 8. Cost per QALY (euros/year)



The cost per QALY is computed taking into account the life expectancy by sex and age cohort
Data come from Tables 8 and 9.
Source: Own work using SHARE.

To further clarify the interpretation of the magnitude of QALYs, Figure E1 provides the annual salary of home care workers in EU-27 and UK in PPP (€2017). It shows that Spain ranks third from the bottom, only ahead of Bulgaria and Cyprus. Therefore, the reduced amount of QALYs is in line with the cost of the home care service [a different question than the one addressed in this paper is why the small remuneration for these workers].

9. Conclusion

This paper has examined the long-term health and wellbeing effects of the introduction of caregiving subsidies and supports after the introduction of the System of Autonomy and Attention to the Dependent People (SAAD) to examine the short- and long-term effects on care receivers' mortality, life expectancy, mental health and life satisfaction. By leveraging the regional differences in its implementation and rich

longitudinal evidence we document that the expansion of both care subsidies and supports increase the health and wellbeing of the Spanish population in the period 2007-2020.

Our estimates suggest that the average effect of SAAD subsidies and home supports is that of 0.24 points (0.50 points) in life satisfaction from receiving caregiving subsidies (home care supports). Furthermore, *we find that* SAAD benefits lead to a reduction of 1pp. (caregiving subsidy) and 0.8pp. (home care supports) in the probability of presenting depressive symptoms. Finally, we find that home care supports) supports increases this probability of survival by 3pp (2.6pp), respectively. When we estimate the effects on quality adjusted life years (QALY), a 1% increase in caregiving subsidy (cost of home care supports) increases the average QALY by 0.000874% (0.000531%). When we estimate the cost per QALY we find that an increase of €1 in caregiving subsidies (home care supports) expenditure per beneficiary per year leads to an increase of 0.0029 (0.0020) QALYs. These estimates suggest that SAAD related care programs are overall in line with the cost-per QALY measures of health care programs.

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Tables and Figures

Table 1. Description of the sample

	Pre-SAAD period				
Wave	Year	Total	Disability allowance (means tested)	Home care supports (means tested)	Neither caregiving subsidies nor home care supports
Wave 1	2004	2,316	77	156	2,083
Wave 2	2006	395	22	33	340
Total Pre-SAAD		**2,711**	**99**	**189**	**2,423**
		100%	*4%*	*7%*	*89%*
	Post-SAAD period				
	Year	Total	Caregiving subsidies	Home care supports	Neither caregiving subsidies nor home care supports
Wave 2	2007	2,146	119	144	1,883
Wave 4	2011	3,863	220	337	3,306
Wave 5	2013	6,972	373	686	5,913
Wave 6	2015	6,064	259	644	5,161
Wave 7	2017	5,159	189	520	4,450
Wave 9	2021	962	33	148	781
Wave 9	2022	1,125	49	134	942
Total Post-SAAD		**26,291**	**1,242**	**2,613**	**22,436**
		100%	*5%*	*10%*	*85%*
Total		**29,002**	**1,341**	**2,802**	**24,859**
		100%	*5%*	*10%*	*86%*

Source: Own work using SHARE.
SAAD: System of Autonomy and Attention to Dependent People.

Table 2. The effect of SAAD on individual outcomes. OLS-DiD estimates. CEM corrected sample.

	M1	M2	M3	M4
Loneliness				
Disability allowance	-0.511**	-0.513**	-0.516**	-0.519**
	(0.274)	(0.273)	(0.272)	(0.271)
Caregiving subsidy SAAD	-0.601***	-0.605***	-0.609***	-0.612***
	(0.074)	(0.074)	(0.074)	(0.074)
Home care supports before SAAD	0.221	0.221	0.220	0.220
	(0.678)	(0.674)	(0.669)	(0.665)
Home care supports SAAD	-0.511***	-0.513***	-0.516***	-0.519***
	(0.056)	(0.056)	(0.056)	(0.056)
N	26,738	26,738	26,738	26,738
F	32.393	33.054	33.729	34.417
p	0.000	0.000	0.000	0.000
R2	0.324	0.331	0.338	0.345
Life satisfaction				
Disability allowance	0.030	0.030	0.030	0.030
	(0.082)	(0.082)	(0.082)	(0.082)
Caregiving subsidy SAAD	0.242***	0.241***	0.240***	0.240***
	(0.068)	(0.068)	(0.068)	(0.068)
Home care supports before SAAD	0.057	0.057	0.057	0.057
	(0.150)	(0.150)	(0.149)	(0.149)
Home care supports SAAD	0.509***	0.506***	0.503***	0.501***
	(0.051)	(0.051)	(0.051)	(0.051)
N	26,738	26,738	26,738	26,738
F	55.413	56.544	57.698	58.875
p	0.000	0.000	0.000	0.000
R2	0.308	0.314	0.321	0.327
Euro-D>3				
Disability allowance	-0.026	-0.026	-0.027	-0.027
	(0.025)	(0.025)	(0.025)	(0.025)
Caregiving subsidy SAAD	-0.105***	-0.101***	-0.101***	-0.101***
	(0.013)	(0.013)	(0.013)	(0.013)
Home care supports before SAAD	0.029	0.029	0.029	0.029
	(0.078)	(0.078)	(0.078)	(0.078)
Home care supports SAAD	-0.081***	-0.084***	-0.087***	-0.087***
	(0.010)	(0.010)	(0.010)	(0.010)
N	26,738	26,738	26,738	26,738
F	17.367	17.721	18.083	18.452
p	0.000	0.000	0.000	0.000
R2	0.310	0.316	0.322	0.329
Survival				
Disability allowance	-0.010	-0.012	-0.012	-0.012
	(0.015)	(0.015)	(0.015)	(0.015)
Caregiving subsidy SAAD	0.032***	0.030***	0.030***	0.030***
	(0.008)	(0.008)	(0.008)	(0.008)
Home care supports before SAAD	-0.002	-0.002	-0.002	-0.002
	(0.008)	(0.008)	(0.008)	(0.008)
Home care supports SAAD	0.026***	0.026***	0.026***	0.026***
	(0.003)	(0.003)	(0.003)	(0.003)
N	26,738	26,738	26,738	26,738
F	31.365	32.005	32.658	33.325
p	0.000	0.000	0.000	0.000
R2	0.363	0.370	0.378	0.386

Model M1 only includes age, sex, marital status and education level. M2: M1 + body mass index, degree of dependency rated by the Katz's index, chronic illness, smoking and drinking habits, self-reported health status and sedentary lifestyle. M3: M2 + days stayed at hospital during last year for surgery or medical tests, days stayed at hospital during last year due to mental health problems, number of days stayed in other institutions other than a hospital or a nursing home during last year (i.e., institutions for rehabilitation, convalescence), visits to general practitioner during last year. M4: M3+ living alone, living in a rural area, adjusted income and wealth, unemployment rate, regional GDP per capita, region and time fixed effects.

Marginal effects after ordered and duration models estimation are very similar to the reported values.

Standard errors between parentheses. Clustered estimates at regional level and block bootstrap with 1,000 replications. *statistically significant at 10%; ** statistically significant at 5%; *** statistically significant at 1%.

Table 3. Mechanism: nutrition. OLS-DiD estimation. CEM corrected sample

	Every day	3-6 times a week	Twice a week	Once a week	Less than once a week
Dairy products					
Disability allowance	0.035	-0.042	0.010	-0.010	0.006
	(0.042)	(0.031)	(0.020)	(0.011)	(0.021)
Caregiving subsidy (SAAD)	0.036**	0.012**	0.012*	-0.000	-0.017
	(0.016)	(0.005)	(0.006)	(0.008)	(0.016)
Home care supports (before SAAD)	0.045	-0.009	-0.014	-0.008	-0.015
	(0.028)	(0.021)	(0.013)	(0.008)	(0.014)
Home care supports (SAAD)	0.012***	0.030**	-0.005	0.000	0.007
	(0.004)	(0.015)	(0.010)	(0.005)	(0.010)
F	32.154	32.501	31.392	30.795	31.726
p	0.009	0.002	0.154	0.667	0.049
R2	0.408	0.409	0.405	0.403	0.407
Fruits and vegetables					
Disability allowance	-0.003	-0.023	-0.013	0.004	0.006*
	(0.023)	(0.021)	(0.013)	(0.004)	(0.004)
Caregiving subsidy (SAAD)	0.028***	0.025***	0.013*	0.003	0.000
	(0.003)	(0.003)	(0.007)	(0.004)	(0.003)
Home care supports (before SAAD)	0.004	-0.024	0.008	0.014	0.004
	(0.017)	(0.016)	(0.006)	(0.020)	(0.003)
Home care supports (SAAD)	0.025***	0.016**	0.019	0.006	0.001
	(0.006)	(0.008)	(0.014)	(0.015)	(0.002)
F	14.275	10.831	19.275	12.638	11.778
p	0.000	0.000	0.000	0.000	0.001
R2	0.315	0.311	0.304	0.303	0.302
Meat, fish and poultry					
Disability allowance	-0.028	-0.033	0.031	0.010	0.005
	(0.024)	(0.027)	(0.031)	(0.007)	(0.004)
Caregiving subsidy (SAAD)	0.040**	0.037***	0.015**	0.009*	0.004
	(0.020)	(0.012)	(0.007)	(0.005)	(0.004)
Home care supports (before SAAD)	-0.024	0.001	0.002	0.012	0.002
	(0.019)	(0.017)	(0.015)	(0.010)	(0.004)
Home care supports (SAAD)	0.079***	0.037**	0.008***	0.004	-0.019
	(0.027)	(0.018)	(0.003)	(0.004)	(0.023)
F	21.724	24.159	24.847	25.444	22.733
p	0.000	0.000	0.000	0.000	0.000
R2	0.320	0.313	0.335	0.305	0.303
Legumes, beans and eggs					
Disability allowance	0.022	0.017	0.021	0.013	0.025
	(0.016)	(0.023)	(0.024)	(0.016)	(0.015)
Caregiving subsidy (SAAD)	0.023***	0.060***	0.006	-0.002	-0.033
	(0.007)	(0.021)	(0.022)	(0.015)	(0.025)
Home care supports (before SAAD)	-0.013	-0.023	0.008	0.007	0.029
	(0.013)	(0.025)	(0.010)	(0.015)	(0.020)
Home care supports (SAAD)	0.025**	0.042**	0.016	0.006	0.030
	(0.012)	(0.017)	(0.015)	(0.010)	(0.021)
F	29.626	23.159	22.440	23.105	24.956
p	0.000	0.000	0.001	0.000	0.000
R2	0.409	0.412	0.402	0.412	0.405

Covariates: see M4 in table 2.

Clustered estimates at regional level and block bootstrap with 1,000 replications. * Statistically significant at 10%; ** statistically significant at 5%; *** statistically significant at 1%.

Marginal effects after ordered probit for fruits, dairy products, beans/legumes/eggs, meat/fish/poultry report similar effects.

Table 4. Mechanism: maximum grip strength. OLS-DiD estimates. CEM corrected sample

	All sample	50-64	65-79	80 and older
Men				
Disability allowance	-4.922**	-6.647***	-5.255**	-7.435***
	(1.999)	(2.416)	(2.481)	(2.123)
Caregiving subsidy (SAAD)	-1.977***	-3.300***	-1.592**	-3.139***
	(0.460)	(0.533)	(0.665)	(1.113)
Home care supports (before SAAD)	-6.424***	-4.641***	-4.261***	-4.868***
	(1.669)	(1.544)	(1.020)	(1.787)
Home care supports (SAAD)	-4.359***	-3.291***	-2.844***	-1.680**
	(0.467)	(0.997)	(0.704)	(0.763)
F	32.132	13.772	7.115	1.425
p	0.000	0.000	0.000	0.113
R2	0.355	0.362	0.328	0.337
Women				
Disability allowance	-3.933***	-5.298***	-2.120***	-3.296***
	(0.958)	(1.337)	(0.844)	(0.967)
Caregiving subsidy (SAAD)	-2.408***	-3.849***	-1.627***	-1.663***
	(0.342)	(0.438)	(0.534)	(0.351)
Home care supports (before SAAD)	-3.729***	-3.620**	-2.336**	-3.675***
	(0.734)	(0.432)	(1.091)	(1.186)
Home care supports (SAAD)	-1.945***	-1.818***	-1.075***	-1.789***
	(0.232)	(0.609)	(0.356)	(0.391)
F	99.438	16.325	34.077	6.459
p	0.000	0.000	0.000	0.000
R2	0.322	0.355	0.304	0.309

Covariates: Those of M4 in Table 2.

Standard errors between parentheses. Clustered estimates at regional level and block bootstrap with 1,000 replications. * statistically significant at 10%; ** statistically significant at 5%; *** statistically significant at 1%.

Table 5. Mechanism: locus of control. OLS-DiD estimates. CEM corrected sample

	How often do you feel that what happens to you is out of your control?			
	Often	Sometimes	Rarely	Never
Men				
Disability allowance	0.232**	-0.040	-0.223	-0.031
	(0.101)	(0.160)	(0.173)	(0.183)
Caregiving subsidy (SAAD)	-0.108***	0.035*	0.025	0.118***
	(0.012)	(0.019)	(0.021)	(0.022)
Home care supports (before SAAD)	0.478***	-0.194	0.515**	-0.142
	(0.143)	(0.226)	(0.245)	(0.259)
Home care supports (SAAD)	-0.146***	-0.084***	-0.070***	0.161***
	(0.012)	(0.019)	(0.020)	(0.021)
F	17.334	33.467	32.436	38.696
p	0.000	0.000	0.001	0.000
R2	0.230	0.206	0.204	0.215
Women				
Disability allowance	0.375***	0.060	-0.191	-0.245
	(0.104)	(0.150)	(0.149)	(0.155)
Caregiving subsidy (SAAD)	-0.148***	-0.116***	0.123***	0.141***
	(0.014)	(0.020)	(0.020)	(0.021)
Home care supports (before SAAD)	0.409***	0.017	-0.132	-0.260**
	(0.087)	(0.125)	(0.124)	(0.129)
Home care supports (SAAD)	-0.140***	-0.055***	0.059***	0.136***
	(0.009)	(0.013)	(0.013)	(0.014)
F	34.529	38.144	36.512	20.735
p	0.000	0.000	0.000	0.000
R2	0.244	0.211	0.209	0.227

Covariates: Those of M4 in Table 2.

Standard errors between parentheses. Clustered estimates at regional level and block bootstrap with 1,000 replications. * statistically significant at 10%; ** statistically significant at 5%; *** statistically significant at 1%.

Marginal effects after ordered probit for locus of control report similar effects.

Table 6. Mechanism: fractures. OLS-DiD estimates. CEM corrected sample.

	All sample	50-64	65-79	80 and older
Men. Hip fracture				
Disability allowance	0.012	-0.022	0.046	0.041
	(0.023)	(0.025)	(0.035)	(0.037)
Caregiving subsidy (SAAD)	-0.024***	-0.037***	-0.024***	-0.038
	(0.005)	(0.006)	(0.009)	(0.051)
Home care supports (before SAAD)	-0.002	-0.010	0.007	0.018
	(0.007)	(0.021)	(0.013)	(0.068)
Home care supports (SAAD)	-0.021***	-0.004	-0.029***	-0.014
	(0.005)	(0.012)	(0.009)	(0.013)
F	13.956	13.687	12.893	11.901
p	0.000	0.000	0.000	0.013
R2	0.306	0.316	0.310	0.332
Men. Other fracture				
Disability allowance	0.006	-0.008	0.005	0.089
	(0.019)	(0.015)	(0.027)	(0.099)
Caregiving subsidy (SAAD)	-0.016***	-0.009*	-0.034***	-0.038***
	(0.006)	(0.005)	(0.009)	(0.014)
Home care supports (before SAAD)	0.019	-0.007	-0.012	0.000
	(0.025)	(0.017)	(0.014)	(0.043)
Home care supports (SAAD)	-0.046***	-0.014**	-0.022***	-0.037***
	(0.004)	(0.007)	(0.006)	(0.010)
F	19.136	11.156	13.498	14.673
p	0.000	0.000	0.000	0.000
R2	0.321	0.304	0.310	0.336
Women. Hip fracture				
Disability allowance	0.027	-0.003	0.068	0.060
	(0.033)	(0.046)	(0.049)	(0.040)
Caregiving subsidy (SAAD)	-0.071***	-0.090***	-0.047***	0.047
	(0.008)	(0.011)	(0.013)	(0.057)
Home care supports (before SAAD)	-0.004	0.006	-0.008	0.003
	(0.027)	(0.080)	(0.038)	(0.077)
Home care supports (SAAD)	-0.069***	-0.157***	-0.120***	-0.057***
	(0.019)	(0.044)	(0.027)	(0.022)
F	7.867	5.472	10.467	10.876
p	0.000	0.000	0.000	0.000
R2	0.312	0.324	0.309	0.315
Women. Other fracture				
Disability allowance	0.024	0.062	-0.003	0.002
	(0.025)	(0.054)	(0.040)	(0.094)
Caregiving subsidy (SAAD)	-0.036***	-0.044***	-0.046***	0.002
	(0.008)	(0.011)	(0.014)	(0.024)
Home care supports (before SAAD)	-0.000	-0.007	-0.006	0.018
	(0.018)	(0.039)	(0.032)	(0.041)
Home care supports (SAAD)	-0.036***	-0.066***	-0.051***	-0.019*
	(0.005)	(0.015)	(0.009)	(0.010)
F	14.849	5.512	5.895	3.825
p	0.000	0.000	0.000	0.000
R2	0.316	0.318	0.316	0.329

Covariates: Those of M4 in Table 2.

Standard errors between parentheses. Clustered estimates at regional level and block bootstrap with 1,000 replications. * statistically significant at 10%; ** statistically significant at 5%; *** statistically significant at 1%.

Marginal effects after probit for hip fracture and other fracture report similar effects.

Table 7. QALY analysis for caregiving subsidies

		Coefficient for LTC cost (elasticity) (1)	Average LTC cost (2)	Health years (3)=(1)*(2)	**Healthy days per year (4)**	Life expectancy (5)	**Cost per QALY (euros/year) (6)=(5)/(3)**
Total							
	All	0.000874***	2.528,92	0.0030	1.09	18.40	6,187.45
		(0.000029)			(0.04)		(208.71)
	50-54	0.001406***	2.939,55	0.0049	1.78	33.30	6,828.80
		(0.000146)			(0.19)		(745.92)
	55-59	0.001193***	2.260,21	0.0040	1.46	28.80	7,197.30
		(0.000037)			(0.05)		(226.68)
	60-64	0.000804***	2.399,18	0.0027	0.99	24.48	9,008.05
		(0.000069)			(0.09)		(806.25)
	65-69	0.000621***	2.822,28	0.0021	0.78	20.40	9,520.15
		(0.000091)			(0.12)		(1,497.28)
	70-74	0.000750***	2.421,94	0.0025	0.93	16.42	6,469.35
		(0.000124)			(0.17)		(1,158.02)
	75-79	0.000659***	2.468,83	0.0022	0.82	12.72	5,691.34
		(0.000177)			(0.25)		(1,733.92)
	80-84	0.000521***	2.370,67	0.0018	0.64	9.52	5,416.56
		(0.000108)			(0.15)		(1,239.20)
	85+	0.000076***	2.625,33	0.0003	0.10	1.58	6,064.29
		(0.000260)			(0.02)		(1,044.41)
Men							
	All	0.000846***	2.417,87	0.0029	1.04	16.65	5,815.96
		(0.000050)			(0.03)		(171.89)
	50-54	0.001503***	2.900,13	0.0052	1.90	30.70	5,899.29
		(0.000199)			(0.13)		(390.64)
	55-59	0.001342***	2.272,43	0.0045	1.64	26.32	5,843.16
		(0.000116)			(0.07)		(252.58)
	60-64	0.000752***	2.265,55	0.0025	0.92	22.20	8,798.73
		(0.000083)			(0.05)		(485.68)
	65-69	0.000545***	2.599,77	0.0019	0.68	18.28	9,821.94
		(0.000103)			(0.06)		(928.48)
	70-74	0.000588***	2.350,50	0.0020	0.72	14.60	7,365.40
		(0.000148)			(0.09)		(927.40)
	75-79	0.000428***	2.893,71	0.0015	0.54	11.28	7,613.89
		(0.000108)			(0.07)		(961.12)
	80-84	0.000430***	2.593,71	0.0015	0.54	8.40	5,722.12
		(0.000143)			(0.09)		(952.10)
	85+	0.000118***	2.561,44	0.0004	0.15	1.40	3,477.90
		(0.000546)			(0.04)		(812.08)
Women							
	All	0.000913***	2.570,86	0.0031	1.14	19.92	6,398.95
		(0.000035)			(0.02)		(122.66)
	50-54	0.001308***	2.972,41	0.0045	1.66	35.78	7,876.16
		(0.000213)			(0.14)		(641.50)
	55-59	0.001113***	2.257,02	0.0037	1.36	31.12	8,337.61
		(0.000039)			(0.02)		(146.09)
	60-64	0.000840***	2.470,45	0.0028	1.04	26.60	9,333.56
		(0.000127)			(0.08)		(705.79)
	65-69	0.000712***	2.896,45	0.0025	0.90	22.20	9,006.64
		(0.000211)			(0.13)		(1,335.34)
	70-74	0.000961***	2.881,13	0.0033	1.21	17.90	5,384.04
		(0.000225)			(0.14)		(630.58)
	75-79	0.001199***	2.312,30	0.0040	1.47	13.84	3,431.27
		(0.000346)			(0.21)		(495.37)
	80-84	0.000673***	2.370,67	0.0023	0.83	10.26	4,520.62
		(0.000131)			(0.08)		(440.14)
	85+	0.000065***	2.633,85	0.0002	0.08	1.68	7,567.69
		(0.000195)			(0.02)		(2,044.50)

(1) Estimated coefficient for average caregiving subsidy (by sex and age cohort). Caregiving subsidy (euros/year) in logs.
(2) Average caregiving subsidy received (discounted copayment). euros/year
(3) Product (1)*(2). interpreted as healthy years will be accrued by increasing caregiving subsidies in 1€ per year
(4) Product 365*(4). interpreted as healthy days will be accrued by increasing caregiving subsidies in 1€ per year
(5) Average life expectancy by sex and age cohort. Source: Eurostat.
https://ec.europa.eu/eurostat/databrowser/product/view/demo_mlexpec?lang=en
(6) Ratio (5)/(3). cost per QALY

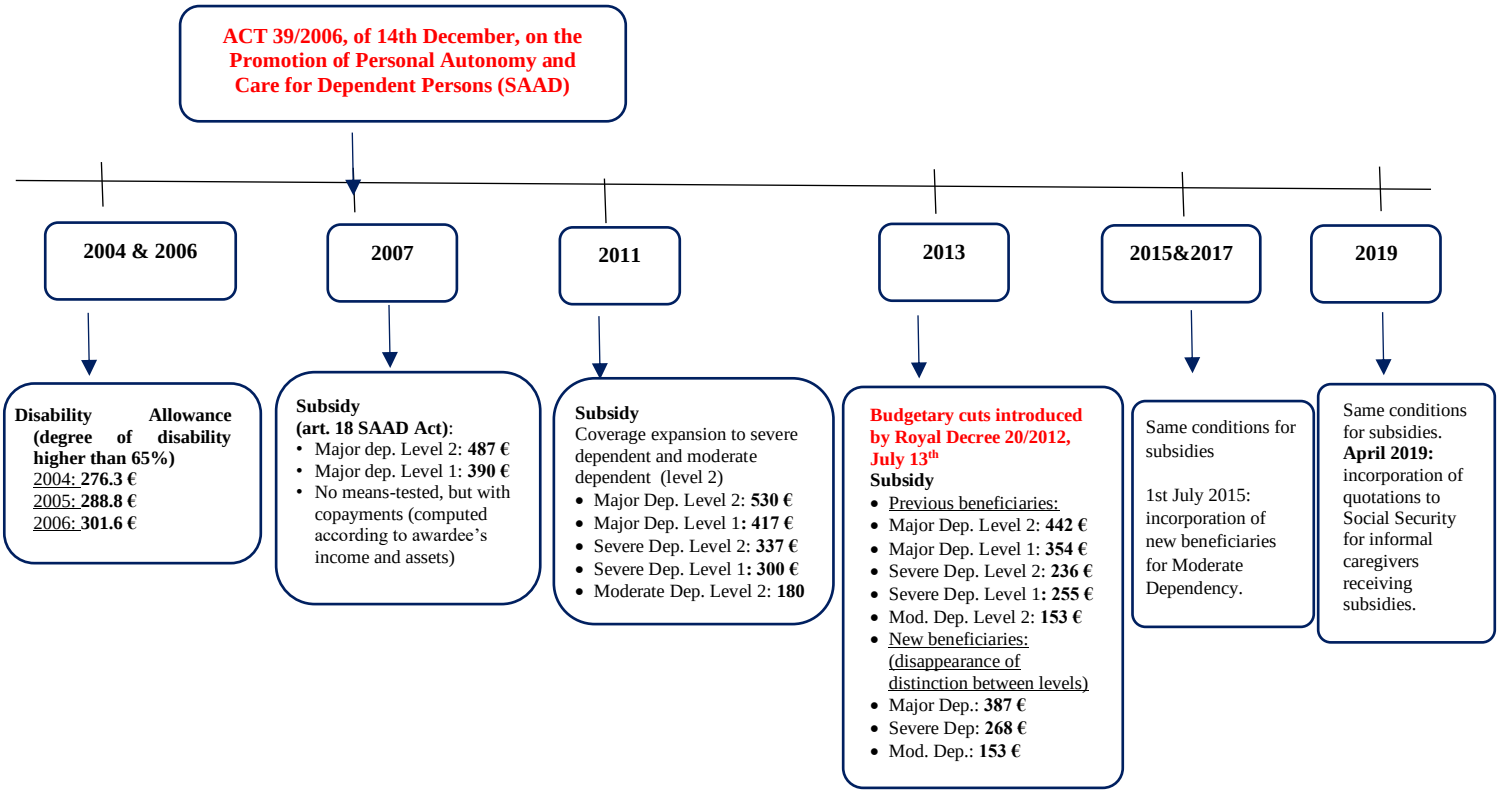
Table 8. QALY analysis for home care supports

		Coefficient for LTC cost (elasticity) (1)	Average LTC cost (2)	Health years (3)=(1)*(2)	**Healthy days per year (4)**	Life expectancy (5)	**Cost per QALY (euros/year) (6)=(5)/(3)**
Total							
	All	0.000531	5.697,98	0.0020	0.73	18.40	9,227.61
		(0.000038)			(0.03)		(330.23)
	50-54	0.001639	5.059,20	0.0061	2.22	33.30	5,485.10
		(0.000387)			(0.26)		(647.88)
	55-59	0.000461	4.985,25	0.0017	0.62	28.80	16,895.13
		(0.000150)			(0.10)		(2,750.45)
	60-64	0.000777	4.787,42	0.0029	1.04	24.48	8,561.12
		(0.000202)			(0.14)		(1,113.41)
	65-69	0.000700	5.083,17	0.0026	0.95	20.40	7,863.41
		(0.000178)			(0.12)		(1,000.28)
	70-74	0.000582	5.272,62	0.0022	0.79	16.42	7,580.03
		(0.000123)			(0.08)		(801.32)
	75-79	0.000530	5.593,86	0.0020	0.72	12.72	6,403.91
		(0.000093)			(0.06)		(562.05)
	80-84	0.000549	5.722,22	0.0021	0.75	9.52	4,614.86
		(0.000074)			(0.05)		(311.10)
	85+	0.000063	6.169,84	0.0002	0.09	1.58	6,659.05
		(0.000067)			(0.01)		(637.50)
Men							
	All	0.000593	5.545,01	0.0022	0.81	16.65	7,498.42
		(0.000068)			(0.05)		(430.02)
	50-54	0.002038	4.954,29	0.0075	2.75	30.70	4,076.82
		(0.000833)			(0.56)		(833.85)
	55-59	0.000513	4.972,50	0.0019	0.69	26.32	13,879.35
		(0.000113)			(0.08)		(1,529.30)
	60-64	0.000907	4.947,00	0.0034	1.22	22.20	6,625.35
		(0.000310)			(0.21)		(1,133.00)
	65-69	0.000868	5.146,36	0.0032	1.18	18.28	5,674.23
		(0.000281)			(0.19)		(919.06)
	70-74	0.000659	5.267,85	0.0025	0.90	14.60	5,952.97
		(0.000206)			(0.14)		(931.02)
	75-79	0.000617	5.490,00	0.0023	0.84	11.28	4,888.80
		(0.000181)			(0.12)		(717.50)
	80-84	0.000697	5.625,46	0.0026	0.95	8.40	3,213.64
		(0.000135)			(0.09)		(311.34)
	85+	0.000058	6.008,91	0.0002	0.08	1.40	6,420.94
		(0.000127)			(0.02)		(1,265.92)
Women							
	All	0.000502	5.762,23	0.0019	0.69	19.92	10,553.20
		(0.000046)			(0.03)		(483.60)
	50-54	0.001304	5.121,70	0.0048	1.77	35.78	7,397.03
		(0.000397)			(0.27)		(1,126.69)
	55-59	0.000481	4.993,75	0.0018	0.65	31.12	17,493.53
		(0.000125)			(0.08)		(2,274.25)
	60-64	0.000523	4.711,43	0.0019	0.70	26.60	13,846.53
		(0.000195)			(0.13)		(2,583.26)
	65-69	0.000740	5.034,39	0.0027	1.00	22.20	8,103.84
		(0.000251)			(0.17)		(1,375.30)
	70-74	0.000528	5.275,15	0.0020	0.72	17.90	9,107.84
		(0.000159)			(0.11)		(1,372.18)
	75-79	0.000437	5.643,36	0.0016	0.60	13.84	8,442.00
		(0.000107)			(0.07)		(1,034.02)
	80-84	0.000510	5.761,28	0.0019	0.70	10.26	5,349.70
		(0.000090)			(0.06)		(472.20)
	85+	0.000064	6.219,29	0.0002	0.09	1.68	6,940.98
		(0.000080)			(0.01)		(781.06)

(1) Estimated coefficient for average caregiving subsidy (by sex and age cohort). Home care supports (euros/year) in logs.
(2) Average cost of home care supports received (discounted copayment). euros/year
(3) Product (1)*(2). interpreted as healthy years will be accrued by increasing home care supports in 1€ per year
(4) Product 365*(4). interpreted as healthy days will be accrued by increasing home care supports in 1€ per year
(5) Average life expectancy by sex and age cohort. Source: Eurostat.
https://ec.europa.eu/eurostat/databrowser/product/view/demo_mlexpec?lang=en
(6) Ratio (5)/(3). cost per QALY

Appendix A

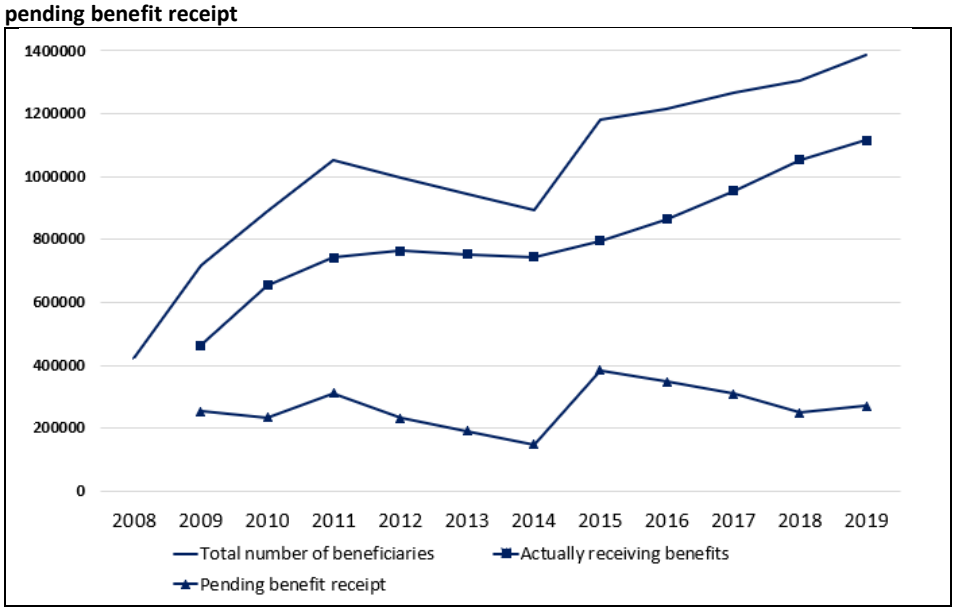
Figure A1. Disability allowance and caregiving subsidies in Spain per wave of the Survey of Health, Ageing and Retirement in Europe



Wave field time overview: Wave 1: April-December 2004; Wave 2: October-December 2006 and January-October 2007; Wave 4: January-November 2011; Wave 5: February-October 2013.

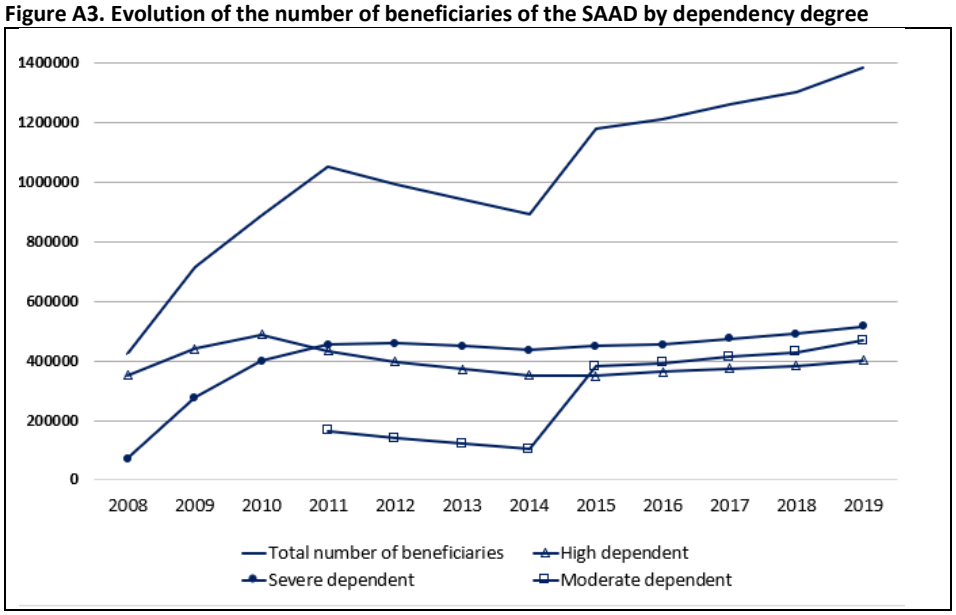
For a better understanding of the amount of caregiver allowance and disability allowance, they can be compared with minimum wage: 475.65 €/month (2004), 540.90 €/month (2006), 570.60 €/month (2007), 641.40 €/month (2011), 645.30 €/month (2013), 648.60 €/month (2015), 707.70 €/month (2017), 900 €/month (2019) (nominal euros).

Figure A2. Evolution of the number of beneficiaries of the SAAD, those actually receiving a benefit and those pending benefit receipt



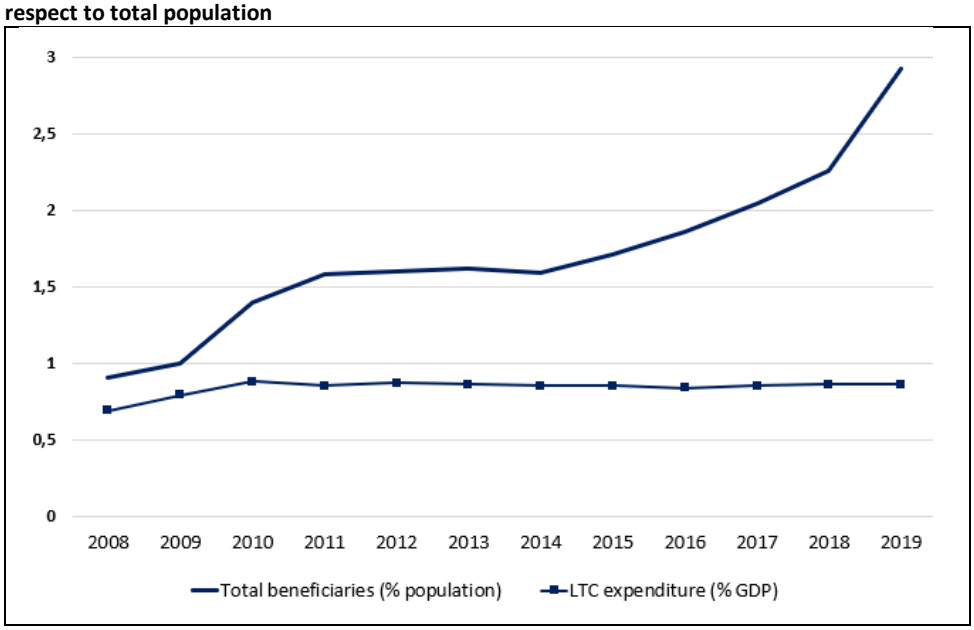
Source: own work using data from Imserso. Instituto de Mayores y Servicios Sociales :: Estadística mensual

Figure A3. Evolution of the number of beneficiaries of the SAAD by dependency degree



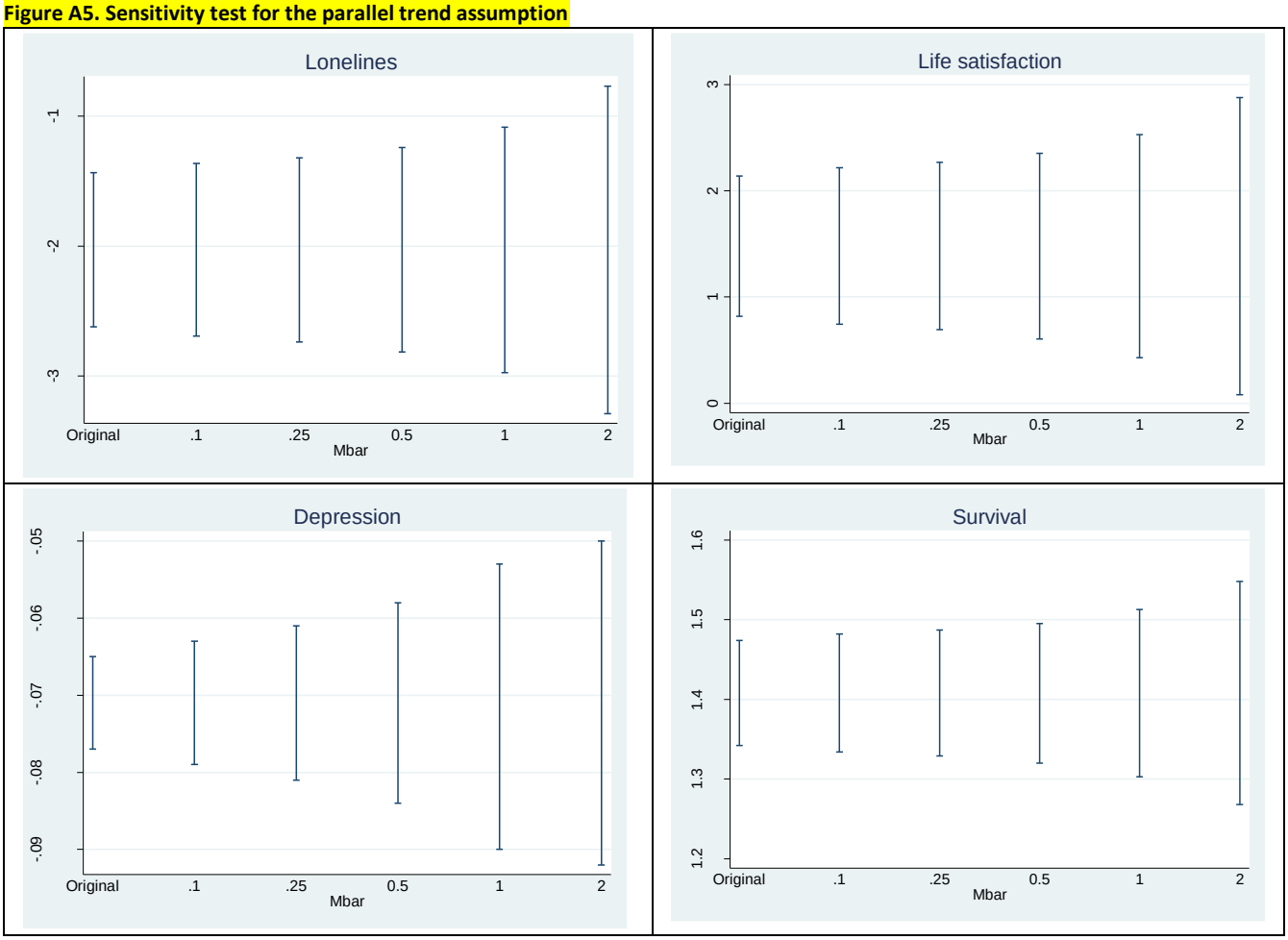
Source: own work using data from Imserso. Instituto de Mayores y Servicios Sociales :: Estadística mensual

Figure A4. Evolution of long-term care expenditure with respect to GDP and percentage of SAAD beneficiaries with respect to total population



Source: own work using data from Imserso. Instituto de Mayores y Servicios Sociales :: Estadística mensual

Figure A5. Sensitivity test for the parallel trend assumption



Sensitivity analysis of the parallel trend assumption based on Rambachan and Roth (2023). The figure shows the original estimate and estimates sensitive to violations of the common post-SAAD trend equal to 01. 0.25, 0.5, 1, 1.5 and 2 times the maximum deviation observed in the pre-SAAD period.

Table A3a. Heterogeneity. Gender and age. OLS-DiD. CEM corrected sample

	Loneliness	Life satisfaction	Depression (Euro-D>3)	Survival
Men				
Disability allowance	-1.082*	0.025	-0.002	0.002
	(0.590)	(0.084)	(0.006)	(0.014)
Caregiving subsidy (SAAD)	-0.601***	0.152**	-0.105***	0.008**
	(0.072)	(0.061)	(0.011)	(0.003)
Home care supports (before SAAD)	1.212	0.034	0.042	-0.002
	(0.882)	(0.070)	(0.035)	(0.011)
Home care supports (SAAD)	-0.435***	0.408***	-0.073***	0.013***
	(0.066)	(0.056)	(0.010)	(0.003)
F	21.990	36.643	13.448	39.342
p	0.000	0.000	0.000	0.000
R2	0.335	0.350	0.326	0.389
Women				
Disability allowance	-0.094***	0.034	-0.045***	-0.023
	(0.031)	(0.080)	(0.040)	(0.016)
Caregiving subsidy (SAAD)	-0.621***	0.306***	-0.098***	0.046***
	(0.075)	(0.073)	(0.014)	(0.011)
Home care supports (before SAAD)	-0.529	0.074	0.019	-0.002
	(0.501)	(0.209)	(0.110)	(0.005)
Home care supports (SAAD)	-0.582***	0.571***	-0.097***	0.036***
	(0.049)	(0.047)	(0.010)	(0.003)
F	43.792	75.647	22.227	28.785
p	0.000	0.000	0.000	0.000
R2	0.352	0.310	0.331	0.383
Age 50-64				
Disability allowance	-0.526	0.054	0.029	0.049
	(0.541)	(0.077)	(0.018)	(0.058)
Caregiving subsidy (SAAD)	-0.719***	0.357***	-0.121***	0.027***
	(0.068)	(0.061)	(0.011)	(0.004)
Home care supports (before SAAD)	-0.491	0.506	0.050	-0.022
	-1.616	(0.441)	(0.047)	(0.017)
Home care supports (SAAD)	-0.203***	0.165***	-0.034***	0.027***
	(0.044)	(0.045)	(0.013)	(0.003)
F	18.898	28.325	13.004	18.477
p	0.000	0.000	0.000	0.000
R2	0.239	0.278	0.229	0.268
Age 65-79				
Disability allowance	-0.102***	0.074	0.178***	0.005
	(0.046)	(0.057)	(0.043)	(0.017)
Caregiving subsidy (SAAD)	-0.705***	0.183**	-0.087***	0.012**
	(0.068)	(0.078)	(0.016)	(0.005)
Home care supports (before SAAD)	0.678	0.054	-0.004	-0.019
	(0.671)	(0.047)	(0.002)	(0.014)
Home care supports (SAAD)	-0.398***	0.616***	-0.119***	0.013***
	(0.062)	(0.061)	(0.012)	(0.004)
F	29.472	54.372	20.847	15.375
p	0.000	0.000	0.000	0.000
R2	0.250	0.213	0.241	0.256
Age 80 and older				
Disability allowance	0.007	0.025	0.049	-0.015
	(0.017)	(0.037)	(0.129)	(0.026)
Caregiving subsidy (SAAD)	-0.793***	0.410**	-0.109***	0.056***
	(0.171)	(0.183)	(0.036)	(0.022)
Home care supports (before SAAD)	-0.294	-0.001	0.055	-0.007
	(0.665)	(0.006)	(0.067)	(0.009)
Home care supports (SAAD)	-0.473***	0.395***	-0.062***	0.028***
	(0.087)	(0.064)	(0.013)	(0.006)
F	16.619	35.359	27.065	37.285
p	0.000	0.000	0.000	0.000
R2	0.252	0.252	0.233	0.356

Covariates: Those of M4 in Table 2 excluding those related to the heterogeneity dimension explored.

Standard errors between parentheses. Clustered estimates at regional level and block bootstrap with 1,000 replications. * statistically significant at 10%; ** statistically significant at 5%; *** statistically significant at 1%.

Table A3b. Heterogeneity. Residence. OLS-DiD estimates. CEM corrected sample

Lives in rural area				
Disability allowance	0.077	0.053	-0.134***	0.062
	(0.138)	(0.201)	(0.028)	(0.076)
Caregiving subsidy (SAAD)	-1.677***	0.946***	-0.350***	0.083***
	(0.159)	(0.249)	(0.075)	(0.027)
Home care supports (before SAAD)	0.496	0.123	-0.024	0.004
	(0.984)	(0.211)	(0.094)	(0.093)
Home care supports (SAAD)	-0.553***	0.541***	-0.096***	0.133***
	(0.041)	(0.039)	(0.022)	(0.020)
F	13.902	27.949	17.625	26.022
p	0.000	0.000	0.000	0.000
R2	0.364	0.139	0.348	0.415
Does not live in rural area				
Disability allowance	-0.237	0.151	-0.132***	0.009
	(0.535)	(0.221)	(0.032)	(0.014)
Caregiving subsidy (SAAD)	-0.607***	0.268***	-0.099***	0.040***
	(0.055)	(0.052)	(0.010)	(0.010)
Home care supports (before SAAD)	-0.330	0.153	-0.151***	0.027
	(0.474)	(0.281)	(0.023)	(0.024)
Home care supports (SAAD)	-0.373***	0.404***	-0.088***	0.040***
	(0.116)	(0.102)	(0.008)	(0.003)
F	58.503	139.803	41.185	84.780
p	0.000	0.000	0.000	0.000
R2	0.345	0.132	0.337	0.310
Lives alone				
Disability allowance	-0.255***	-0.001	0.170***	0.005
	(0.421)	(0.004)	(0.030)	(0.013)
Caregiving subsidy (SAAD)	-0.761***	1.155**	-0.266***	0.040***
	(0.174)	(1.951)	(0.057)	(0.012)
Home care supports (before SAAD)	0.328	0.255	0.100***	0.034***
	(0.501)	(0.178)	(0.025)	(0.010)
Home care supports (SAAD)	-0.584***	0.514***	0.085***	0.032***
	(0.043)	(0.038)	(0.008)	(0.003)
F	56.602	81.890	34.805	33.497
p	0.000	0.000	0.000	0.000
R2	0.243	0.282	0.232	0.340
Does not live alone				
Disability allowance	0.205	0.050	0.114	0.018
	(0.187)	(0.087)	(0.111)	(0.043)
Caregiving subsidy (SAAD)	-0.590***	0.250***	-0.099***	0.021**
	(0.055)	(0.049)	(0.009)	(0.009)
Home care supports (before SAAD)	-1.059	0.042	0.007	0.024
	(0.881)	(0.080)	(0.006)	(0.022)
Home care supports (SAAD)	-0.301***	0.520***	-0.098***	0.022***
	(0.097)	(0.107)	(0.018)	(0.004)
F	4.813	4.601	6.823	225.391
p	0.000	0.000	0.000	0.000
R2	0.030	0.033	0.044	0.573

Covariates: Those of M4 in Table 2 excluding those related to the heterogeneity dimension explored.

Standard errors between parentheses. Clustered estimates at regional level and block bootstrap with 1,000 replications. * statistically significant at 10%; ** statistically significant at 5%; *** statistically significant at 1%.

Table A3c. Heterogeneity. Dependency.
OLS estimates. CEM corrected sample

Moderate dependent				
Disability allowance	0.083	0.117	0.021	0.023
	(0.307)	(0.080)	(0.046)	(0.101)
Caregiving subsidy (SAAD)	-0.024	0.299	0.020	0.237
	(0.034)	(0.229)	(0.161)	(0.262)
Home care supports (before SAAD)	-0.991	0.167	0.035	-0.021
	(1.236)	(0.120)	(0.074)	(0.073)
Home care supports (SAAD)	-0.190	-0.113	-0.007	0.039
	(0.117)	(0.334)	(0.026)	(0.044)
F	3.694	10.395	13.392	16.431
p	0.000	0.000	0.000	0.000
R2	0.238	0.240	0.241	0.242
Severe dependent				
Disability allowance	-0.154	0.180	-0.017	0.393*
	(1.635)	(0.107)	(0.216)	(0.180)
Caregiving subsidy (SAAD)	-0.557**	1.055****	-0.095****	0.063**
	(0.263)	(0.229)	(0.023)	(0.034)
Home care supports (before SAAD)	1.847	0.033	0.087	-0.097
	(1.627)	(0.067)	(0.124)	(0.109)
Home care supports (SAAD)	-0.294*	0.377**	-0.071**	0.052***
	(0.179)	(0.154)	(0.027)	(0.012)
F	35.293	53.063	15.781	12.990
p	0.000	0.000	0.000	0.000
R2	0.381	0.324	0.363	0.353
High dependent				
Disability allowance	-0.805	0.120	-0.089	-0.062
	(1.977)	(0.091)	(0.218)	(0.175)
Caregiving subsidy (SAAD)	-0.597***	0.248***	-0.122*	0.027***
	(0.176)	(0.078)	(0.067)	(0.008)
Home care supports (before SAAD)	2.380	0.027	-0.034	0.159
	(1.975)	(0.068)	(0.154)	(0.123)
Home care supports (SAAD)	-0.270***	0.217***	-0.111***	0.027***
	(0.102)	(0.050)	(0.050)	(0.009)
F	22.408	21.205	20.654	16.749
p	0.000	0.000	0.000	0.000
R2	0.248	0.265	0.228	0.259

Covariates: Those of M4 in Table 2 excluding those related to the heterogeneity dimension explored.
Standard errors between parentheses. Clustered estimates at regional level and block bootstrap with 1,000 replications. * statistically significant at 10%; ** statistically significant at 5%; *** statistically significant at 1%.

Table A3d. Heterogeneity. Income and Wealth.
OLS-DiD estimates. CEM corrected sample

Lowest income quintile				
Disability allowance	-0.003	0.022	-0.159**	-0.012
	(0.010)	(0.020)	(0.064)	(0.028)
Caregiving subsidy (SAAD)	-1.040***	0.588***	-0.163***	0.056***
	(0.159)	(0.157)	(0.026)	(0.015)
Home care supports (before SAAD)	0.888	0.055***	-0.093**	0.017
	(0.925)	(0.019)	(0.047)	(0.021)
Home care supports (SAAD)	-1.981**	0.592***	-0.166***	0.043***
	(0.926)	(0.123)	(0.056)	(0.007)
F	29.334	15.326	29.713	56.928
p	0.000	0.000	0.000	0.000
R2	0.343	0.388	0.344	0.339
Highest income quintile				
Disability allowance	-1.023	0.089	-0.014	-0.004
	(0.715)	(0.051)	(0.035)	(0.026)
Caregiving subsidy (SAAD)	-0.503***	0.412***	-0.101***	0.005
	(0.113)	(0.091)	(0.019)	(0.008)
Home care supports (before SAAD)	1.082	0.079	0.069	0.032
	(1.011)	(0.067)	(0.048)	(0.020)
Home care supports (SAAD)	-0.368***	0.314***	-0.099***	0.030***
	(0.090)	(0.068)	(0.020)	(0.006)
F	22.393	25.286	29.006	53.775
p	0.000	0.000	0.000	0.000
R2	0.255	0.221	0.238	0.396
Lowest wealth quintile				
Disability allowance	-1.256	-0.124	0.094	0.014
	(1.939)	(0.223)	(0.066)	(0.027)
Caregiving subsidy (SAAD)	-1.605***	0.598***	-0.196***	0.041***
	(0.121)	(0.107)	(0.021)	(0.015)
Home care supports (before SAAD)	-0.384	0.184	-0.004	0.022
	(1.123)	(0.093)	(0.008)	(0.022)
Home care supports (SAAD)	-1.497***	0.630***	-0.118***	0.033***
	(0.109)	(0.101)	(0.020)	(0.007)
F	38.896	18.103	38.961	71.727
p	0.000	0.000	0.000	0.000
R2	0.341	0.394	0.342	0.356
Highest wealth quintile				
Disability allowance	-0.776	0.017	-0.256***	0.132
	(0.591)	(0.030)	(0.060)	(0.155)
Caregiving subsidy (SAAD)	-0.751***	0.302***	-0.070***	0.026***
	(0.137)	(0.129)	(0.024)	(0.006)
Home care supports (before SAAD)	-1.635	0.041	-0.154***	0.010
	(1.901)	(0.055)	(0.046)	(0.010)
Home care supports (SAAD)	-0.541***	0.228***	-0.055***	0.036***
	(0.087)	(0.079)	(0.015)	(0.006)
F	17.961	33.274	29.191	65.985
p	0.000	0.000	0.000	0.000
R2	0.275	0.267	0.240	0.327

Covariates: Those of M4 in Table 2 excluding those related to the heterogeneity dimension explored.
Standard errors between parentheses. Clustered estimates at regional level and block bootstrap with 1,000 replications. * statistically significant at 10%; ** statistically significant at 5%; *** statistically significant at 1%.

Appendix B

Table B1. Explanatory variables in the stock-sampling duration model

Categories	Definition
Socio-demographic variables	○ Age and age squared. ○ Gender ○ Level of education. Education is categorized in four levels using the 1997 International Standard Classification of Education (ISCED): primary, lower secondary, upper secondary, post-secondary non tertiary and tertiary education. ○ Living alone ○ Living in a rural area
Economic-related variables	○ Household income refers to annual income (in euros) net of taxes collected by all household members. Income was adjusted for the purchasing power of different currencies using the PPP exchange rate of the year in which the "Main Questionnaire" was performed. Income was divided by the square root of the number of household members to adjust for household size. ○ Household net worth is defined as the value of total assets (the total amount of financial assets plus the total amount of non-financial assets; note that this indicator only takes into account the value of dwellings from non-financial assets) minus the total value of outstanding liabilities as is expressed in the same terms as household income ○ Being employed at the time of the survey.
Health status	○ Self-reported health status[21]. We define five binary variables corresponding to the following categories: excellent, very good, good, fair and poor. ○ Chronic conditions. We define seven binary variables corresponding to the following pathologies: Alzheimer, diabetes, cancer, high blood pressure, lung disease, stroke and heart attack. ○ Number of days stayed at hospital during last year for surgery or medical tests.
Smoking	[SHARE questions]: "Have you ever smoked cigarettes, cigars or a pipe daily for a period of at least one year? "and "Do you smoke at the present time?" We define two binary variables: ○ Current smoker: takes the value 1 if the respondent is smoking at the time of the survey, 0 otherwise. ○ Past smoker: takes the value 1 if the respondent has smoked at least one year, but is not currently smoking, 0 otherwise.
Drinking alcohol	[SHARE questions]: "I am now going to ask you a few questions about what you drink. During the last 3 months, how often have you drunk any alcoholic beverages, like beer, cider, wine, spirits or cocktails?" We define two binary variables corresponding to the following categories ○ Not having drunk during the last 3 months or less than one per month (teetotal) ○ Drinking every day or 5-6 times per week
Sedentary lifestyle	[SHARE questions]: "We would like to know about the type and amount of physical activity you do in your daily life. How often do you engage in vigorous physical activity (such as sports, heavy housework, or a job that involves physical labour) or in activities that require a moderate level of energy (such as gardening, cleaning the car, or doing a walk)?" We define a binary variable "sedentary lifestyle" that takes the value 1 if the respondent is engaged in a vigorous or moderate activity "one or three times a month" or "hardly ever, or never"·.
Weight	Using body mass index (BMI) provided by SHARE we define the following categories, and include the variable "normal weight" in the regression. ○ Underweight: if BMI is lower than 20. ○ Normal weight: if BMI lies between 20 and 24.9 ○ Overweight: if BMI lies between 25 and 29.9 ○ Obese: if BMI is greater than 30.

[21] Self-reported health is a good indicator of morbidity and a powerful predictor of future health and mortality (Burström and Fredlund, 2001; Van Doorslaer and Gerdtham (2003).

Table B2. Descriptive statistcs

	Initial sample		Sample after CEM (SHARE)		Sample after CEM with National Health Survey	
	No LTC benefit	With LTC benefit	No LTC benefit	With LTC benefit	No LTC benefit	With LTC benefit
N	26,992	4,361	24,782	4,307	23,383	4,145
Life satisfaction						
Completely disatisfied	0.53	1.77	0.53	1.79	0.53	1.80
1	0.38	1.45	0.38	1.46	0.38	1.47
2	0.71	1.69	0.71	1.70	0.72	1.72
3	1.24	2.42	1.25	2.45	1.26	2.48
4	1.85	2.74	1.85	2.75	1.86	2.76
5	8.73	15.63	9.11	16.85	9.53	18.27
6	8.8	11.85	8.90	12.03	9.00	12.21
7	18.02	18.61	18.43	19.04	18.85	19.50
8	31.29	23.21	32.51	23.88	33.84	24.60
9	16.1	10.88	16.42	11.03	16.76	11.18
Completely satisfied	12.35	9.75	9.90	7.02	7.29	4.02
EURO-D						
No depressed	23.41	12.35	23.18	11.93	22.95	11.50
1	20.3	12.94	20.01	12.52	19.71	12.10
2	14.42	10.39	14.52	10.44	14.63	10.50
3	10.54	11.27	10.60	11.33	10.65	11.40
4	8.04	8.33	8.10	8.40	8.17	8.47
5	7.02	10.29	7.07	10.40	7.12	10.50
6	5.16	9.22	5.19	9.31	5.21	9.39
7	4.01	8.24	4.03	8.31	4.04	8.38
8	3.04	5.78	3.05	5.81	3.06	5.85
9	2.16	5.2	2.16	5.23	2.17	5.25
10	1.31	3.82	1.31	3.84	1.31	3.86
11	0.49	1.67	0.49	1.67	0.49	1.68
Very depressed	0.1	0.5	0.29	0.81	0.48	1.13
Feel things are out of control						
Often	9.89	25.3	10.87	31.70	12.05	41.75
Sometimes	25.97	32.29	32.71	42.72	43.42	60.96
Rarely	28.93	20.78	37.30	25.10	51.21	31.40
Never	35.21	21.63	47.61	26.31	70.27	33.23
Loneliness scale						
Not lonely	69.23	51.69	70.63	53.03	72.12	54.43
4	11.78	12.03	11.85	12.10	11.92	12.18
5	7.54	13.39	7.57	13.48	7.60	13.57
6	6.3	12.03	6.32	12.10	6.34	12.18
7	2.54	5.42	2.54	5.43	2.55	5.45
8	0.94	1.36	0.94	1.36	0.94	1.36
Very lonely	1.67	4.08	0.15	2.49	-1.46	0.84
Men	42.96	37.1	43.88	37.79	44.85	38.50
Women	57.04	62.9	56.12	62.21	55.15	61.50
Age	69.97	70.34	71.42	72.81	72.97	75.46
	17.06	11.96	16.21	12.03	15.34	12.10
Household size	(2.42	2.39	2.48	2.45	2.54	2.51
	1.09	1.25	1.10	1.27	1.11	1.28
Lives alone	10.87	19.36	12.05	23.11	13.50	28.45
Real income (adjusted household size)	13,849	13,125	13,897	13168	13,945	13,211
	(19,064)	(21,374)	(19,155)	(21,488)	(19,247)	(21,604)
Real wealth (adjusted household size)	177,108	151,400	184950	157,130	193,501	163,303
	(315,474)	(413,497)	(340355)	(456,242)	(369,315)	(508,281)
Lives in rural area	49.03	46.33	52.46	49.40	56.40	52.88
Marital status						
Married. living with spouse	73.95	57.98	75.77	59.10	77.69	60.26
Registered partnership	0.87	0.35	0.87	0.35	0.87	0.35
Married. living separated	1.16	1.06	1.16	1.06	1.16	1.06
Never married	5.74	7.17	6.07	7.68	6.44	8.27
Divorced	2.84	1.49	2.84	1.49	2.85	1.49
Widowed	15.44	31.95	13.28	30.31	11.00	28.56
Level of education						
None	22.01	37.12	22.17	37.58	22.34	38.05
ISCED 1	37.91	42.16	38.39	42.75	38.88	43.36
ISCED 2	20.37	11.78	20.51	11.83	20.65	11.87
ISCED 3	8.67	4.05	8.70	4.06	8.72	4.06

ISCED 4	1.17	0.35	1.17	0.35	1.17	0.35
ISCED 5 or 6	9.87	4.54	9.07	3.44	8.24	2.30
Body mass index						
Underweight	0.95	2.98	0.95	2.98	0.95	2.99
Normal weight	31.78	35.7	32.12	36.12	32.46	36.56
Overweight	45.75	42.72	46.45	43.33	47.17	43.95
Obese	21.52	18.6	20.49	17.56	19.42	16.50
Self-reported health status						
Excellent	3.69	1.07	3.69	1.07	3.70	1.07
Very good	14.77	3.78	14.84	3.78	14.92	3.79
Good	37.64	18.2	38.11	18.31	38.60	18.42
Fair	29.28	33.98	29.57	34.36	29.86	34.76
Poor	14.62	42.97	13.78	42.47	12.93	41.96
Current smoker	3.03	3.51	3.12	3.63	3.22	3.77
Past smoker	4.17	3.31	4.34	3.42	4.53	3.54
Regular alcohol consumption	12.22	10.4	13.71	11.48	15.59	12.80
Sedentary	16.12	35.41	18.72	47.95	22.22	70.94
Heart attack	11.43	18.52	12.74	21.95	14.36	26.77
Lung disease	6.02	11.63	6.38	12.98	6.79	14.67
Stroke	2.66	7.02	2.73	7.51	2.81	8.08
Cancer	4.16	7.67	4.33	8.26	4.52	8.94
Parkinson/Alzheimer	1.28	3.05	1.30	3.14	1.31	3.24
Hip fracture	2.2	5.07	2.25	5.33	2.30	5.61
Diabetes	16.64	24.24	19.41	30.12	23.18	39.19
Hypertension	39.55	44.38	55.19	64.08	85.65	105.13
Arthritis	9.27	18.52	10.13	21.95	11.16	26.77

No LTC benefit: the respondent does not receive any type of long-term care benefit (disability allowance, caregiving subsidy or home care supports).
LTC benefit: the interviewee receives any type of any type of long-term care benefit (disability allowance, caregiving subsidy or home care supports).

Table B3. L1 statistic before and after CEM (coarsened exact matching method). SHARE

	Initial sample	Sample after CEM
Man	0.112	1.836E-14
	(-0.145)	(2.244E-14)
Age	0.022	2.448E-14
	(0.022)	(2.448E-14)
Years of education	0.228	2.448E-14
	(0.253)	(-6.936E-14)
Married	0.050	4.488E-16
	(0.050)	(2.244E-16)
Single	0.099	1.224E-14
	(0.100)	(2.040E-14)
Household size	0.228	9.384E-16
	(-0.253)	(1.428E-14)
Number of comorbidities	0.082	4.284E-16
	(0.012)	(4.488E-14)
Income quartile: 1st	0.050	1.734E-14
	(0.057)	(-2.958E-14)
Income quartile: 2nd	0.022	9.588E-14
	(-0.022)	(1.010E-13)
Income quartile: 3rd	0.109	6.834E-16
	(0.114)	(8.160E-14)
Income quartile: 4th	0.189	7.548E-16
	(0.194)	(7.956E-14)
Multivariate L_1	0.797	6.532E-16
N	29,002	26,738
Matched	-	24,808 (92.78%)
Unmatched	-	1,930 (7.22%)

This matching procedure allows us to obtain a treatment and a control group for each wave of SHARE.
Difference in means between parenthesis.

Table B4. L1 statistic before and after CEM (coarsened exact matching method). SHARE and National Health Survey (2011/2012)

	Initial sample	Sample after CEM
Man	0,050	5,435E-14
	(0,050)	(5,435E-14)
Age	0,507	5,435E-14
	(0,562)	(-1,540E-13)
Years of education	0,111	9,963E-16
	(0,111)	(4,982E-16)
Married	0,220	2,717E-14
	(0,222)	(4,529E-14)
Single	0,507	2,083E-15
	(-0,562)	(3,170E-14)
Household size	0,181	9,510E-16
	(0,027)	(9,963E-14)
Number of comorbidities	0,111	3,849E-14
	(0,127)	(-6,567E-14)
Income quartile: 1st	0,050	2,129E-13
	(-0,050)	(2,242E-13)
Income quartile: 2nd	0,242	1,517E-15
	(0,254)	(1,812E-13)
Income quartile: 3rd	0,419	1,676E-15
	(0,430)	(1,766E-13)
Income quartile: 4th	1,768	1,450E-15
	(0.344)	(8.145E-14)
Multivariate L_1	0.797	6.532E-16
N	26,738	25,177
Matched	-	23,825 (94.63%)
Unmatched	-	1,352(5.37%)

This matching procedure allows us to assign the variables from the EQ-5D-5L of the Spanish National Health Survey (2022/2012) to SHARE respondents (all waves). Difference in means between parenthesis.

Appendix C. Estimation of the survival model

The departure point of our analysis is the duration model of Jenkins (1995). He estimated a discrete-time hazard model to explain the effect of different covariates over the transition to retirement. The key point of his model is to use as unit of analysis the time of risk of an event, so that time periods prior to selection into the sample can be ignored. In this way, the estimation of the discrete-time hazard model is simplified to the estimation of a binary outcome (retired vs. not retired in the case of Jenkins (1995), or live vs. died, in our case). We create our sample of interest selecting alive individuals at each wave of SHARE following them through the next waves, until they are observed to decease or they are censorfed. Transition to death is estimated using a discrete-time hazard model which allows us to analyze the impact of socioeconomic characteristic and health indicators over the probability of not surviving.

To understand how the stock-sampling works, consider first individuals who are alive at wave 1. In the following waves, they may be still alive or have died. Using Jenkins' (1995) notation $t = \tau$ is the first observation of the stock sample, that is, the first period at which the individual is at risk of decease. By the time of the second interview (for the subsample of follow-up respondents), each individual may be still living (censored duration data $\delta_i = 0$) or have died (complete duration data $\delta_i = 1$). $t = \tau + s_i$ is the year of the decease if $\delta_i = 0$, and is the final year of our observation period if $\delta_i = 0$. Therefore, each respondent i contributes to s_i of life spell data. Given that the probability of dying at each time period t provides information on the duration distribution, the discrete-time hazard (h_{it}) is defined as:

$$h_{it} = P[T_i = t \,|T_i \geq t, \Omega_{it}]$$

where Ω_{it} is a vector of explanatory variables[22] that varies with time and T_i is a random variable representing the time at which the decease is observed. Then, upon the restriction of being alive at the beginning of the spell, the conditional probability of observing an uncompleted spell (i.e., being alive at the next interview) is the following:

$$Pr[T_i > t|T_i > \tau - 1] = \prod_{t=\tau}^{\tau+s_i}(1 - h_{it})$$

The probability of dying between the initial observation (τ) and next interview is:

$$Pr[T_i > t|T_i = \tau - 1] = h_{i\tau+s_i} \prod_{t=\tau}^{\tau+s_i-1}(1 - h_{it}) = \frac{h_{i\tau+s_i}}{1 - h_{i\tau+s_i}} \prod_{t=\tau}^{\tau+s_i}(1 - h_{it})$$

And the log-likelihood function for the complete sample is:

$$\log L = \sum_{i=1}^{N} \delta_i log\left(\frac{h_{i\tau+s_i}}{1 - h_{i\tau+s_i}}\right) + \sum_{i=1}^{N}\sum_{t=\tau}^{\tau+s_i} log\,(1 - h_{it})$$

We can simplify the log-likelihood by defining a binary indicator. For those who are alive at the end of the observation period: $y_{it} = 0$, for all periods. For those who die: $y_{it} = 0$ for all periods, except the last one in which case $y_{it} = 1$. It can also be expressed as: $y_{it} = 1$ if $t = \tau + s_i$ and

[22] Disability allowance, home care before SAAD, caregiving subsidy (after SAAD), home care (after SAAD), age, sex, level of education, body mass index, degree of dependency rated by the Katz's index , chronic illness, smoking and drinking habits, self-reported health status, days stayed at hospital during last year for surgery or medical tests, days stayed at hospital during last year due to mental health problems, number of days stayed in other institutions other than a hospital or a nursing home during last year (i.e., institutions for rehabilitation, convalescence), visits to general practitioner during last year, sedentary lifestyle, living alone, living in a rural area, adjusted income and wealth, region and time fixed effects. Definitions are shown on Table B1.

$\delta_i = 1$ (for decease-observation) and $y_{it} = 0$ otherwise (for alive-observation). After introducing this binary indicator in the log-likelihood function we get:

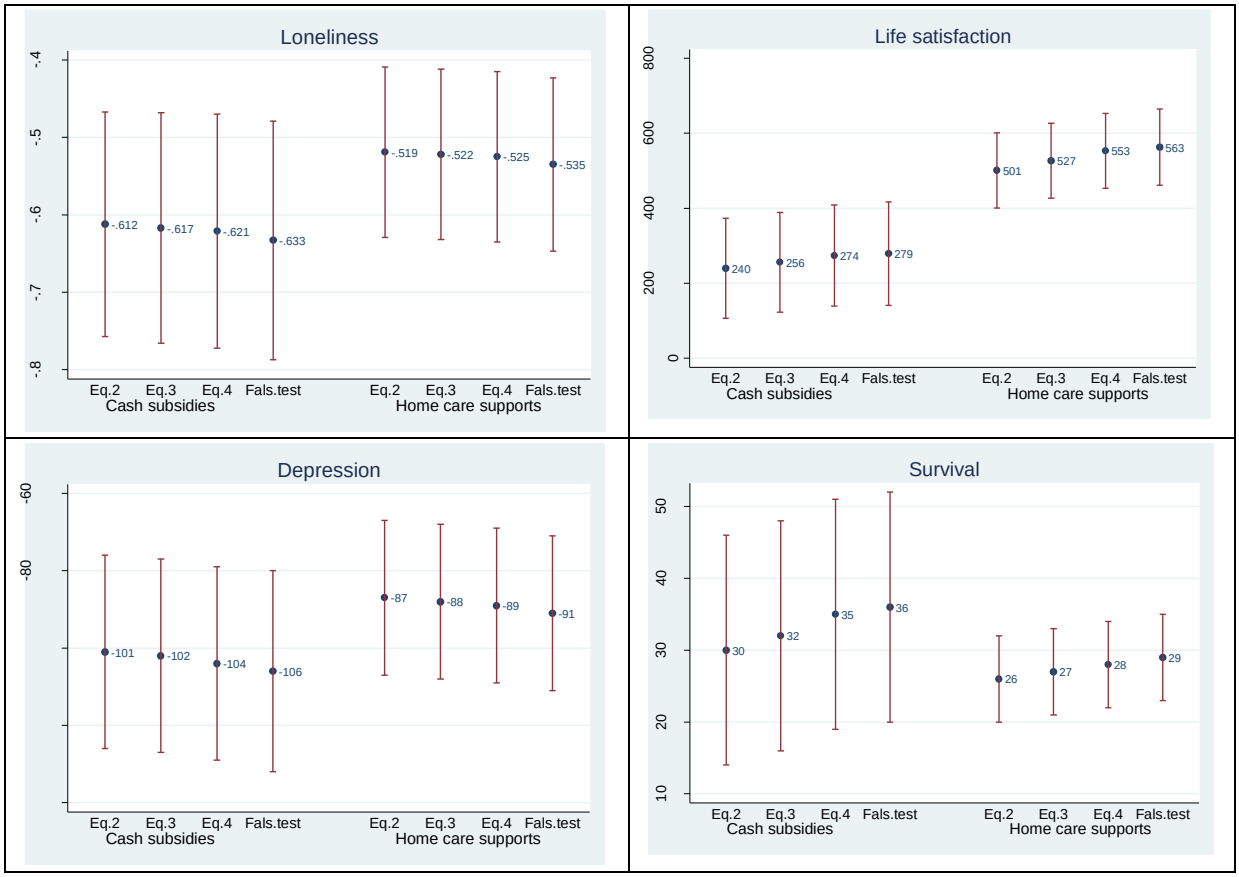
$$\log L = \sum_{i=1}^{N} \sum_{t=\tau}^{\tau+s_i} y_i log\left(\frac{h_{i\tau+s_i}}{1-h_{i\tau+s_i}}\right) + \sum_{i=1}^{N} \sum_{t=\tau}^{\tau+s_i} log\,(1-h_{it})$$

This last equation seems like the log-likelihood function of a binary variable, where the unit of analysis is the spell period.

In the estimation of the discrete time hazard model, we have adjusted five different functional forms: exponential, Gompertz, Weibull, log-normal and log-logistic. To determine which one fits better to the data we have obtained the cox-snell residuals and two information criteria (AIC y BIC). As the model fits better to the data, the cox-snell residuals seem like an exponential distribution with scale parameter equal to 1. For this purpose, we have estimated the Kaplan-Meier cumulative hazard function using the cox-snell residuals as the time variable and plotted them against the cox-snell residuals. We appreciate that the cox-snell residuals are nearer to the bisector of the first quadrant for the Weibull function. Additionally, the AIC and BIC attain the lowest values for this specification.

Appendix D

Figure D1. Robustness check. Comparison of different models



Each dot represents the estimated effect for the corresponding outcome according to equation 3 (proposed model), equation 4 (alternative specification with region-specific linear trends and a fixed effects model with interactions), equation 5 (alternative specification with muli-factor structure of time-varying common factors with heterogeneous effects by cross-sections) and falsification test (dividing the regions into 4 quartiles according to the 2008-2013 unemployment rate and re-estimating with quartile-by-year fixed effects).

Table D1. Alternative specification with region-specific linear trends and a fixed effects model with interactions. OLS-DiD estimates. CEM corrected sample.

	M1	M2	M3	M4
Loneliness				
Disability allowance	-0.525**	-0.527**	-0.530**	-0.533**
	(0.290)	(0.290)	(0.289)	(0.288)
Caregiving subsidy SAAD	-0.605***	-0.609***	-0.614***	-0.617***
	(0.076)	(0.076)	(0.076)	(0.076)
Home care supports before SAAD	0.236	0.236	0.235	0.235
	(0.695)	(0.691)	(0.686)	(0.682)
Home care supports SAAD	-0.514***	-0.516***	-0.519***	-0.522***
	(0.056)	(0.056)	(0.056)	(0.056)
N	26,738	26,738	26,738	26,738
F	31.344	31.961	32.591	33.232
p	0.000	0.000	0.000	0.000
R2	0.314	0.320	0.327	0.333
Life satisfaction				
Disability allowance	0.032	0.032	0.032	0.032
	(0.084)	(0.084)	(0.084)	(0.084)
Caregiving subsidy SAAD	0.258***	0.257***	0.256***	0.256***
	(0.068)	(0.068)	(0.068)	(0.068)
Home care supports before SAAD	0.066	0.066	0.065	0.065
	(0.154)	(0.154)	(0.153)	(0.153)
Home care supports SAAD	0.535***	0.532***	0.529***	0.527***
	(0.051)	(0.051)	(0.051)	(0.051)
N	26,738	26,738	26,738	26,738
F	52.342	53.347	54.369	55.409
p	0.000	0.000	0.000	0.000
R2	0.299	0.304	0.311	0.316
Euro-D>3				
Disability allowance	-0.027	-0.027	-0.028	-0.028
	(0.025)	(0.025)	(0.025)	(0.025)
Caregiving subsidy SAAD	-0.106***	-0.102***	-0.102***	-0.102***
	(0.013)	(0.013)	(0.013)	(0.013)
Home care supports before SAAD	0.031	0.031	0.031	0.031
	(0.078)	(0.078)	(0.078)	(0.078)
Home care supports SAAD	-0.082***	-0.085***	-0.088***	-0.088***
	(0.010)	(0.010)	(0.010)	(0.010)
N	26,738	26,738	26,738	26,738
F	17.065	17.407	17.756	18.112
p	0.000	0.000	0.000	0.000
R2	0.300	0.306	0.312	0.318
Survival				
Disability allowance	-0.012	-0.014	-0.014	-0.014
	(0.020)	(0.020)	(0.020)	(0.020)
Caregiving subsidy SAAD	0.035***	0.032***	0.032***	0.032***
	(0.008)	(0.008)	(0.008)	(0.008)
Home care supports before SAAD	-0.002	-0.002	-0.002	-0.002
	(0.010)	(0.010)	(0.010)	(0.010)
Home care supports SAAD	0.027***	0.027***	0.027***	0.027***
	(0.003)	(0.003)	(0.003)	(0.003)
N	26,738	26,738	26,738	26,738
F	30.381	30.981	31.591	32.214
p	0.000	0.000	0.000	0.000
R2	0.350	0.356	0.364	0.371

Model M1 only includes age, sex, marital status and education level. M2: M1 + body mass index, degree of dependency rated by the Katz's index, chronic illness, smoking and drinking habits, self-reported health status and sedentary lifestyle. M3: M2 + days stayed at hospital during last year for surgery or medical tests, days stayed at hospital during last year due to mental health problems, number of days stayed in other institutions other than a hospital or a nursing home during last year (i.e., institutions for rehabilitation, convalescence), visits to general practitioner during last year. M4: M3+ living alone, living in a rural area, adjusted income and wealth, unemployment rate, regional GDP per capita, region-specific linear trends and a fixed effects model with interactions.

Marginal effects after ordered and duration models estimation are very similar to the reported values.

Standard errors between parentheses. Clustered estimates at regional level and block bootstrap with 1,000 replications. * statistically significant at 10%; ** statistically significant at 5%; *** statistically significant at 1%.

Table D2. Alternative specification with muli-factor structure of time-varying common factors with heterogeneous effects by cross-sections. OLS-DiD estimates. CEM corrected sample.

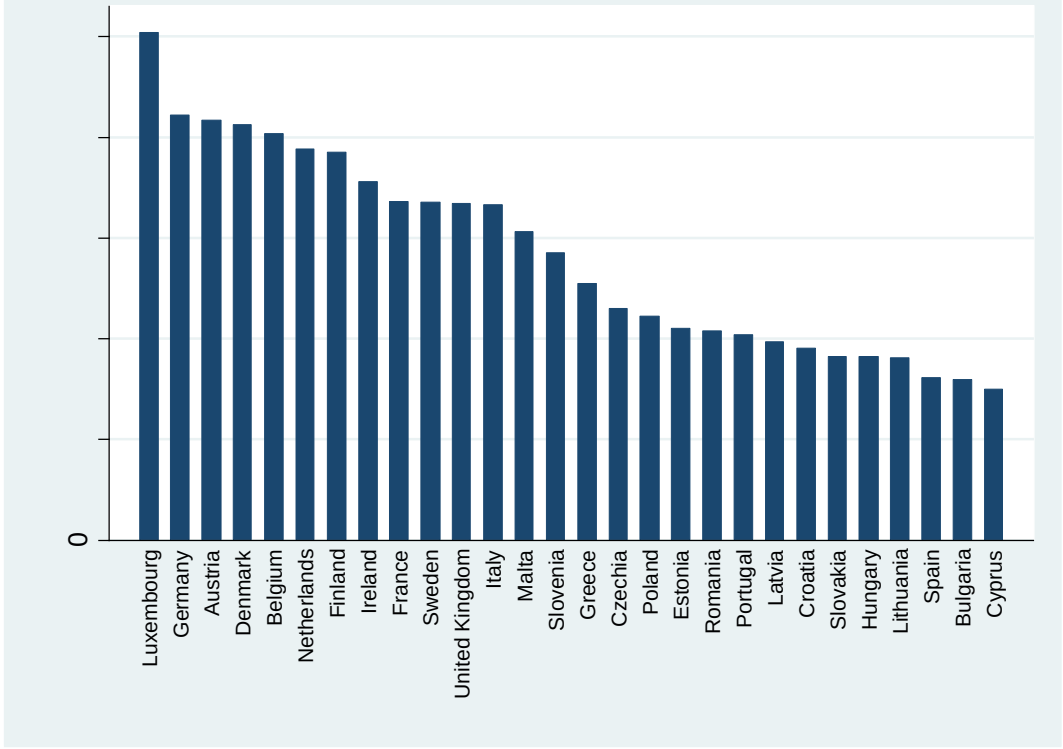
	M1	M2	M3	M4
Loneliness				
Disability allowance	-0.540**	-0.542**	-0.545**	-0.548**
	(0.308)	(0.307)	(0.306)	(0.305)
Caregiving subsidy SAAD	-0.610***	-0.614***	-0.618***	-0.621***
	(0.077)	(0.077)	(0.077)	(0.077)
Home care supports before SAAD	0.252	0.252	0.251	0.251
	(0.713)	(0.709)	(0.704)	(0.700)
Home care supports SAAD	-0.517***	-0.519***	-0.522***	-0.525***
	(0.056)	(0.056)	(0.056)	(0.056)
N	26,738	26,738	26,738	26,738
F	30.361	30.940	31.529	32.128
p	0.000	0.000	0.000	0.000
R2	0.304	0.310	0.316	0.322
Life satisfaction				
Disability allowance	0.035	0.035	0.035	0.035
	(0.086)	(0.086)	(0.086)	(0.086)
Caregiving subsidy SAAD	0.276***	0.275***	0.274***	0.274***
	(0.069)	(0.069)	(0.069)	(0.069)
Home care supports before SAAD	0.076	0.076	0.075	0.075
	(0.158)	(0.158)	(0.157)	(0.157)
Home care supports SAAD	0.562***	0.559***	0.556***	0.553***
	(0.051)	(0.051)	(0.051)	(0.051)
N	26,738	26,738	26,738	26,738
F	49.603	50.501	51.413	52.339
p	0.000	0.000	0.000	0.000
R2	0.290	0.295	0.301	0.306
Euro-D>3				
Disability allowance	-0.027	-0.027	-0.028	-0.028
	(0.026)	(0.026)	(0.026)	(0.026)
Caregiving subsidy SAAD	-0.108***	-0.104***	-0.104***	-0.104***
	(0.013)	(0.013)	(0.013)	(0.013)
Home care supports before SAAD	0.034	0.034	0.034	0.034
	(0.079)	(0.079)	(0.079)	(0.079)
Home care supports SAAD	-0.083***	-0.086***	-0.089***	-0.089***
	(0.010)	(0.010)	(0.010)	(0.010)
N	26,738	26,738	26,738	26,738
F	16.774	17.104	17.441	17.783
p	0.000	0.000	0.000	0.000
R2	0.291	0.297	0.302	0.308
Survival				
Disability allowance	-0.014	-0.016	-0.016	-0.016
	(0.027)	(0.026)	(0.026)	(0.026)
Caregiving subsidy SAAD	0.037***	0.035***	0.035***	0.035***
	(0.008)	(0.008)	(0.008)	0.008)
Home care supports before SAAD	-0.002	-0.002	-0.002	-0.002
	(0.013)	(0.013)	(0.013)	(0.013)
Home care supports SAAD	0.028***	0.028***	0.028***	0.028***
	(0.003)	(0.003)	(0.003)	(0.003)
N	26,738	26,738	26,738	26,738
F	29.458	30.021	30.593	31.177
p	0.000	0.000	0.000	0.000
R2	0.338	0.344	0.350	0.357

Model M1 only includes age, sex, marital status and education level. M2: M1 + body mass index, degree of dependency rated by the Katz's index, chronic illness, smoking and drinking habits, self-reported health status and sedentary lifestyle. M3: M2 + days stayed at hospital during last year for surgery or medical tests, days stayed at hospital during last year due to mental health problems, number of days stayed in other institutions other than a hospital or a nursing home during last year (i.e., institutions for rehabilitation, convalescence), visits to general practitioner during last year. M4: M3+ living alone, living in a rural area, adjusted income and wealth, unemployment rate, regional GDP per capita, muli-factor structure of time-varying common factors with heterogeneous effects by cross-sections

See other notes below table D1.

Appendix E

Figure E1. Comparison of annual wage for home care worker (PPP; €2017)



Source: own work using Eurofound and Eurostat.