The Aging Parent Penalty Across Countries*

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Abstract

In this study, we analyze the "aging parent penalty" and how it affects adult children of different genders. While previous studies have explored the "child penalty" faced by parents, little attention has been given to the costs to individuals who support their aging or ill parents. Using SHARE data and a quasi-experimental approach based on event studies around a health shock experienced by the parent, we examine the impact of parental health on adult children's employment in six European countries. We find that the gender gap in employment widens after a parental health shock, which aligns with the child penalty literature. However, when examining countries by caregiving system, we find that the effect on the employment gap varies across countries. In countries where parents rely on informal care from relatives, daughters often assume caregiving responsibilities when their parents fall ill, which decreases their employment rate. In contrast, in countries where parents rely on formal care provided through the market, sons often take on the financial support role for their ill parents, which increases their employment rate. This work is particularly relevant for the ongoing discussion about the gender implications of caregiving and financial responsibilities in the context of an aging population.

Keywords: gender roles, health care, economics of the elderly, caregiving

JEL Codes: J16, J14, I11

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1 Introduction

Recent studies have shown that childcare affects the careers of mothers and fathers in different ways (Bertrand et al., 2010; Angelov et al., 2016; Kleven et al., 2019; De La Vega, 2022). This brings up the question of whether these gender differences in caregiving apply only to childcare or if other types of informal care work are also unequally divided between genders. While the impact of childcare on caregivers has been widely discussed in recent years, there has been little attention given to the costs to individuals supporting their aging or ill parents. Rellstab et al. (2020) found no effect of parental health shock on children's employment in the Netherlands. Frimmel et al. (ming) found that parental health shock negatively affects their children's labor market activities in Austria. However, after a policy reform relaxing constraints and liberalizing formal care work, the adverse effects of parental health shock on children's employment were mitigated. These results show how the influence of parental health on adult children's labor market outcomes can differ across countries and times, depending on the division in the responsibility of caring for the elderly.

To analyze the impact of parental health on employment across different countries, this study uses data from the Survey of Health, Ageing and Retirement in Europe (SHARE), studying households in which parents experienced a health shock in different years. When analyzing the impact of parental health shocks on children's employment in all countries in our study, we find that the gender gap in employment widens after a parent falls ill. This finding aligns with the literature examining the impact of childcare on the gender employment gap.[1] However, when examining countries by caregiving system, we find that the effect on the employment gap varies across countries. In countries where parents rely on informal care from relatives, daughters often assume caregiving responsibilities when their parents fall ill, which leads to a decrease in their employment rate. In contrast, in countries where parents rely on formal care provided through the market, sons often take on the financial support role for their ill parents, which leads to an increase in their employment rate.

This study classified Western European countries into three caregiving systems based on the division of care responsibility for the elderly between the family, market, and government: (1) Countries where caregiving duties are mostly provided informally by the family (hereafter, *family-based care countries*). (2) Countries where market solutions play a substantial role in caregiving for the elderly (*market-based care countries*). (3) Countries where caregiving duties are mostly provided by the government (*government-based care countries*). These categories also correspond to the welfare regimes classification established by Esping-Andersen (1999).

Pooling all six countries, we observe that a parental health shock increases the gender employment gap. Yet, its impact varies across caregiving systems. In countries where families primarily provide informal caregiving, parents receive more support from their children after experiencing a health shock. In these countries, daughters' employment declines by 8.5% following parental health shock. This indicates daughters relocate their time between family duties and employment. In these countries, we find no significant effect of the parental health shock on sons' employment.

[1] Findings from various countries indicate that the persistent gender inequality in the labor market is largely driven by the unequal division of childcare responsibilities between fathers and mothers (Bertrand et al., 2010; Daniel et al., 2013; Goldin, 2014; Angelov et al., 2016; Kuziemko et al., 2018; Kleven et al., 2019).

In countries where caregiving duties are commonly provided by the market, after experiencing a shock to their health, parents receive more professional help and their healthcare expenditure increases. As the responsibility of caring for the elderly is fulfilled through the market, more work is required to pay for these services. In these countries, sons experience a 4.9% increase in employment. This may occur because sons are required to provide financial assistance for their parents or because parents stop supporting their children in times of illness. In these countries, we find no significant effect of parental health shocks on daughters' employment.

In countries where caregiving duties are mostly provided by the government, there is an increase in the use of professional help after a parental health shock, with no significant change in healthcare expenditure. Additionally, compared to other countries, parents in these countries are more likely to receive disability benefits before experiencing a health shock, and this likelihood increases even further afterwards. In these countries, there is no change in employment for either daughters or sons, suggesting elderly parents rely on the welfare system rather than assistance from their children.

This work adds to the body of research exploring the impact of health shocks on family members' employment. Most studies in this field focus on how such shocks affect spouses, with mixed results. Some report spouses reduce their labor supply in response to a partner's health shock (García-Gómez et al., 2013; Jeon and Pohl, 2017), while others find no significant effect (Dobkin et al., 2018; Macchioni Giaquinto et al., 2022). Fadlon and Nielsen (2021) show fatal health shocks significantly increase the labor supply of surviving spouses, driven by families facing substantial income losses.

In this paper, we examine the impact of a parental health shock on their adult children's employment. Like Fadlon and Nielsen (2021), we found an increase in sons' employment in countries with rising parents' health expenses. We also find daughters' employment declines following a parental health shock in countries where caregiving is provided by the family, which coincides with Frimmel et al. (ming). In countries where the government provides caregiving, there is no effect on children's employment, aligning with Rellstab et al. (2020). To the best of our knowledge, we are the first to compare the employment outcomes across different types of countries and to connect the results on employment to the increase in paid formal care and children's informal care responsibilities.

There is extensive literature on the relationship between informal caregiving and family members' labor market outcomes. Studies in this area consistently found informal caregiving reduces employment and working hours for caregivers (Heitmueller, 2007; Bolin et al., 2008; Leigh, 2010; Ciani, 2012; Schmitz and Westphal, 2017; Heger and Korfhage, 2020). While the estimated effect is often modest, it tends to be more pronounced for female caregivers (Van Houtven et al., 2013; Bauer and Sousa-Poza, 2015; Simard-Duplain, 2022). These studies show the effect of parents' aging on children's outcomes conditionally on them being the caregivers for their parents. When we examine the effect of an exogenous parental health shock on children's employment, we provide a causal effect of parents' health deterioration. Additionally, we provide a broader perspective on the aging parents' effect on their children beyond caregiving duties. The health deterioration of elderly parents can affect children's labor market outcomes through other mechanisms, such as increased financial burdens on families (García-Gómez et al., 2013; Trevisan and Zantomio, 2016).

In this sense, our paper connects to the literature estimating the effect of parenthood on parents' employment and income, commonly known as the "child penalty". Similarly to the parental health shock examined in this paper, the birth of a child is a shock affecting parents' employment through various channels, including caregiving responsibilities and financial demands. Research on this topic repeatedly demonstrates a differential effect of childbirth on mothers and fathers, where the first childbirth reduces mothers' employment (Bertrand et al., 2010; Angelov et al., 2016; Kleven et al., 2019). This mirrors our results showing daughters reduce their employment when a parental health shock increases caregiving needs. Additionally, it was found fathers increase their employment after the first childbirth when taking on the breadwinner role in the family (De La Vega, 2022). This coincides with our result, showing an increase in sons' employment when a parental health shock increases the financial burden. Our results also show having same-sex siblings mitigates the effect of a parental health shock on employment. This corresponds to Andresen and Nix (2022), who found the effect of first childbirth on employment is mitigated in same-sex couples.

This research makes three main contributions. We are the first to examine the causal effect of a parental health shock on the gender gap in employment. Specifically, we show sons and daughters assume different roles in response to supporting their aging parents, increasing the gender employment gap. This finding enriches the broader discussion on the gendered implications of caregiving and financial responsibilities in the context of the increasingly elderly population. Also, it addresses a critical gap in the literature by examining how the division of care responsibility for the elderly impacts adult children's time allocation. Frimmel et al. (ming) have demonstrated parental health has a negative impact on their children's employment. As far as we know, we are the first to establish a connection between the decline in employment and an increase in the assistance parents receive from their children as a response to a parental health shock. Lastly, it sheds light on how different types of caregiving systems related to caregivers' labor market results. Specifically, it shows how the division of care responsibility for the elderly between the family, market, and government is associated with the employment decisions of adult children.

2 Data and sampling

Our analysis is based on longitudinal data collected from individuals aged 50 or older participating in the Survey of Health, Ageing and Retirement in Europe (SHARE) (Börsch-Supan et al., 2013). In our main sample, we use data from SHARE waves 1-2 and 4-6, collected between 2004 and 2015, with an average two-year interval between each wave.[2] These waves provide comprehensive data on participants' social, economic, and health status.[3] Additionally, participants supplied information about their adult children, including employment details. Using the provided dataset, we construct panel data following the participants' children's employment and parental health through the years. In our sample, we focus on six European countries: Denmark, Germany, Italy, Spain, Sweden, and Switzerland.

[2]Waves 3 and 7 of SHARE were unique waves focusing on participants' childhood and history and did not include children's information.

[3]Appendix C provides a description of the variables used in this paper.

Our main analysis focuses exclusively on children whose parents experienced a *health shock*. A "health shock" is defined as an event in which the parent of an individual reports being diagnosed with a new health condition for the first time, having indicated in previous waves they had never been diagnosed with any of the health conditions. To identify the shock, we consider any of the following conditions: stroke, heart attack, cancer, Parkinson's disease, or chronic lung disease.[4,5] We consider the first diagnosis for the shock in the case of multiple diagnoses. To mitigate possible selection effects and to ensure the sample is as close as possible to a balanced panel, we restrict our sample to individuals who are observed: (1) at least twice, once before and once after the parental health shock; (2) in at least two consecutive waves. These restrictions follow the strategy used by Kleven et al. (2019). This leaves a sample of 8,522 individuals (i.e., SHARE participants' children) and 28,572 person-year observations.

3 Methodology

We use an event-study methodology to examine short- and medium-term changes associated with parent's health shock. Consider a panel of $i = 1...N$ individuals from $j = 1...J$ households, in which the variables are observed for a subset of $p = 1...P$ periods, measured in years, with increments of two years. In this setup, every unit receives treatment (i.e., parent's health shock) in some period E_i within the sample and stays treated forever.[6] Let $k_{ip} = p - E_i$ be the "relative time," the number of years relative to the parental health shock (the event), and let the letter t denote the event time.

Using an event studies approach, we examine the impact of a parent's health shock on the labor market outcomes of daughters and sons. Specifically, we estimate the following model separately for sons and daughters:

$$y^g_{ijpt} = c_i + \gamma^g_{ip} + \sum_{\substack{k=-6 \\ k\neq -2}}^{6} \beta^g_k I[k = t] + \epsilon_{ijpt} \tag{1}$$

where y^g_{ijpt} is the outcome of interest for individual i, of gender g, from household j, in year p and at event time t. The third term on the right-hand side includes event-time dummies. We omit the event-time dummy at $t = -2$, implying the event-time coefficients β^g_k measure the impact of the parent's health shock relative to the two years before the parental health shock; c_i and γ^g_{ip} are individual and calendar year×country fixed effects (FE), respectively. Standard errors are clustered at the parental household level because siblings are affected by the same parental health shock (Abadie et al., 2023).

Following the methodology of Kleven et al. (2019) to estimate the outcome variables for each

[4]The proportions of all SHARE participants diagnosed with a health shock in each country are as follows: 7.6% in Germany, 9.7% in Sweden, 11% in Spain, 9% in Italy, 10.2% in Denmark, and 9.2% in Switzerland.

[5]Unfortunately, information regarding Alzheimer's disease is not available in all waves of SHARE used in this study.

[6]Our analysis focuses only on households that experienced a health shock, as using "never treated" individuals could be problematic. This is because individuals whose parents experience a health shock differ systematically from those whose parents do not.

period relative to the years before the parental health shock, we define the following equation:

$$\widetilde{y}^{g}_{ijpt} = \hat{y}^{g}_{ijpt} - \sum_{k \neq -2} \hat{\beta}^{g}_{k} I\left[k = t\right] = \hat{c}_i + \hat{\gamma}^{g}_{ip} \tag{2}$$

where $\widetilde{y}^{g}_{ijpt}$ is the predicted outcome when the contribution of the event time dummies is omitted.

We then calculate the effect of the parental health shock in relative year t as a percentage of the counterfactual outcome, the absence of parental health shock, by Eq. (3):

$$p^{g}_{t} = \frac{\hat{\beta}^{g}_{t}}{E\left[\widetilde{y}^{g}_{ijpt} | t\right]} \tag{3}$$

Having estimated the impacts of parental health shock on daughters and sons separately, following Kleven et al. (2019) we define an "aging parent penalty" on daughters *(d)* relative to sons *(s)* at event time t as:

$$aging\ parent\ penalty_{\,t} = \frac{\hat{\beta}^{p}_{t} - \hat{\beta}^{d}_{t}}{E\left[\widetilde{y}^{d}_{ijpt} | t\right]} \tag{4}$$

In some of the analyses, to allow estimation when the sample size is relatively small, we also examine differences in the impacts of parental health shock on the outcome of interest within a general before/after framework instead of an event-study structure. Specifically, we take the event-study equation (Eq. (1)) and collapse the event-time year dummies into a simple variable before and after the parental health shock ($Shock_{ip}$). Formally, we estimate the following model:

$$y^{g}_{ijp} = c_i + \gamma^{g}_{ip} + \beta^{g} Shock_{ip} + \epsilon_{ijp} \tag{5}$$

Where $Shock_{ip} = 1$ if in year p individual i is observed after the parental health shock (k $\geq$ 0). All other variables are previously defined. Standard errors are clustered at the parental household level.

Our approach focuses only on households that experienced a similar unexpected health shock during our sample period. Hence, the average treatment effect is identified solely based on the event's timing. Our identification assumption is that given the year×country and individual fixed effects, the timing of the parental health shock is not associated with the employment of their adult children in any of the periods.[7] This strategy allows us to estimate the parental health effects on the employment of their adult children.

4 Employment

Figure 1 shows the impact of the parental health shock on children's employment by gender, based on the event-time coefficients estimated by Eq. (1) expressed as a percentage of the counterfactual outcome defined in Eq. (3). The figure shows that in the first period following the parental health shock, daughters' employment declines by 3.7%, while there is no statistically

[7] As parents in our sample experience a health shock in different periods, and the treatment effect may diminish over time, which can bias our results, we also employ an additional estimation strategy proposed by Callaway and Sant'Anna (2021) using 2 alternative comparison groups in Section 8.

significant change in sons' employment relative to two years before the shock This decline in daughters' employment persists over the following six years, ranging from 5.8% to 8.9%. The long-run aging parent penalty, which represents the percentage by which daughters' employment falls behind sons' employment following the parental health shock, is 8.5%. Overall, our results show a gendered response to parental health shocks: when their parents fall ill daughters reduce their employment, increasing the gender employment gap.

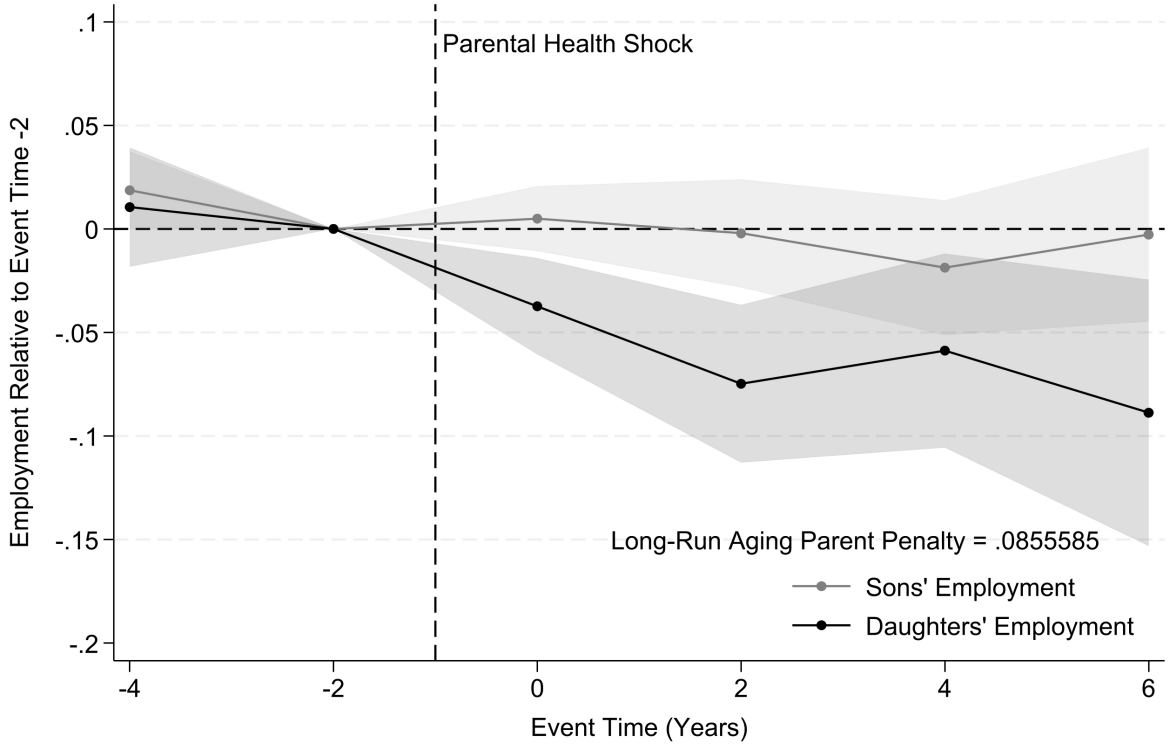


Figure 1: Parental health shock impacts on children's employment

Notes: This figure shows the impacts of parental health shock on children's employment by gender. The figure shows the event-time coefficients estimated by Eq. (1) expressed as a percentage of the counterfactual outcome defined in Eq. (3), including 90 percent confidence intervals. Standard errors are clustered at the individual level. The figure also reports the long-run "aging parent penalty", the percentage by which daughters' employment falls behind sons' employment following the parental health shock, defined by Eq. (4) and measured at event time 6.

These results parallel findings from the child penalty literature, which consistently show that employment responses to the birth of a first child differ by gender, with women typically reducing their employment (Bertrand et al., 2010; Angelov et al., 2016; Kleven et al., 2019; De La Vega, 2022). However, while it is straightforward that parents are responsible for caring for their children, the expectation that children will take on caregiving responsibilities for their aging parents is less explicit. Having children is a deliberate choice, whereas a parent's illness is an exogenous shock. Hence, while the child's caregiving responsibilities are fulfilled primarily by the parents, elderly care responsibilities can be assumed by three main entities: the government, the individual's immediate family and relatives, or the individuals themselves. When families or individuals take on caregiving, this responsibility can be managed through home production, where care is provided by family members, or by outsourcing the caregiving to market-based solutions, such as hiring professional caregivers or opting for hospitalization in nursing homes.

The division of elderly care responsibilities typically involves a combination of all three entities, though the balance varies significantly across countries. In some countries, individuals rely more heavily on government support, while in others, families or the market play a more dominant role. In the following sections, we classify European countries into three caregiving systems based on how elderly care is distributed. We then analyze the aging parent penalty within each system, examining how sons and daughters are differently affected depending on the caregiving system in their country.

5 Caregiving systems classification

In this paper, we classify European countries into three caregiving systems. This section outlines the basis for this classification and presents evidence that supports its validity. One can examine three key aspects for classifying countries into three caregiving systems based on the division of care responsibility for the elderly between the family, market, and government. First, the formal policies set by the government provide valuable insight into the institutional settings for elderly care. Second, the social norms regarding who is expected to care for the elderly reveal cultural expectations and values that influence caregiving responsibilities. Lastly, one can also ask the elderly who actually takes care of them and examine the empirical reality of elderly care. In our work, we adopt the welfare regimes classification proposed by Esping-Andersen (1999). We strengthen this classification by analyzing the differences between the types of countries along three dimensions: formal policies, social norms, and parents reporting. This approach allowed us to validate the differences in caregiving systems across the countries we investigated.

In this section, we only focus on countries that participated in all waves of the SHARE survey; Austria, Belgium, Denmark, France, Germany, Italy, Spain, Sweden, and Switzerland.[8] Esping-Andersen (1999) classified welfare states into three main types: Liberal, Conservative (Corporatist), and Social Democratic. This typology is based on the level of government intervention, the structure of social benefits, and the role of the market and family in welfare provision. Social Democratic welfare regimes, exemplified by countries like Denmark and Sweden, are characterized by universal benefits, strong government involvement, and high levels of social protection. Conservative (Corporatist) welfare regimes, such as those in Austria, Belgium, France, Germany, and Switzerland, emphasize earnings-related benefits and social insurance, focusing on maintaining the individual's standard of living based on their past employment and contributions. A variation of the Conservative model, often referred to as the Southern European or Mediterranean welfare regime, includes countries like Italy and Spain, where social protection is more fragmented, and families play a more significant role in caregiving.

While Esping-Andersen's (1999) classification primarily focuses on income redistribution and welfare policies, we adapt this framework to elderly caregiving by specifically examining how caregiving responsibilities are distributed among different entities. Countries with a Democratic welfare regime, are characterized by high universal public welfare spending, with the *government* primarily providing for the needs of the aging population. In countries that follow the

[8] Although the Netherlands participated in all waves of the SHARE survey, in wave 6 it was part of an experimental online and telephone survey rather than the regular one. As a result, key data, including responses to the child questionnaire essential for the study, are missing, making its data unusable.

Conservative (Corporatist) model, welfare expenditure is shared between the government and the *market*. While there is public welfare spending for elderly care, it is less universal compared to Social Democratic models and there is a higher level of private welfare expenditure. In Southern European welfare countries, the formal public and private welfare spending are lower, and a lion's share of the caregiving burden falls on *family* members rather than the government or market.

Thus, we classify countries into three caregiving systems based on the entity that plays a significant role in elderly care: government-, market-, and family-based. In the following subsections, we will detail and validate this classification by examining the different dimensions of elderly care systems, including formal policies, social norms, and the empirical reality of caregiving arrangements.

5.1 Formal policies

In this subsection we validate the caregiving systems classification proposed by Esping-Andersen (1999) by examining differences in welfare policies related to elderly care. Different countries implement varying policies for elderly care, and the comparison between them to determine the main provider of elderly care is not always straightforward. An alternative approach is to examine data on Long-Term Care (LTC) expenditures.[9]

LTC services can be fulfilled formally by the government or the market or informally by relatives. Using OECD[10] data, Appendix Figure B.1 illustrates the variations in formal LTC expenditure among all countries which participated in all waves of SHARE.[11] The figure shows government and out-of-pocket LTC expenditure by country as a percentage of GDP (left vertical axis) and the total annual LTC expenditure per capita in Purchasing Power Parities (PPP), Euro 2015 prices (right vertical axis).

Sweden and Denmark have the highest formal LTC expenditure as a percentage of GDP and in terms of total expenditure. In these countries, the government's share of formal LTC expenditure is also the highest, standing at 93%. Italy and Spain exhibit low government and out-of-pocket LTC expenditure as a percentage of GDP, and their low formal expenditure per capita is noteworthy.[12] In Switzerland, Belgium, France, Germany, and Austria, formal LTC expenditure, as a percentage of GDP and total expenditure per capita, is within the middle range. Notably, there is a significant variance in the percentage of expenditure covered by the government, with coverage ranging from 66% in Switzerland to 90% in Belgium.

Given the data presented in Figure B.1, the countries are categorized as follows: Sweden and Denmark, where the LTC total expenditure is substantially high and more than 90% is covered by the government, are classified as *government-based care countries*. Germany and Switzerland,

[9] LTC is a range of services for individuals with physical or cognitive limitations, who require ongoing assistance with daily activities, such as bathing, getting out of bed, and dressing. It also includes basic medical support, health monitoring, and tasks like housework and transportation (Fujisawa and Colombo, 2009).

[10] OECD (2004-2019), Health expenditure and financing, https://data-explorer.oecd.org (accessed on 23/05/2024).

[11] Informal caregiving is rarely collected, and therefore data reporting informal costs of caregiving is unavailable.

[12] The low formal expenditure in Italy and Spain cannot be explained by a lower need for LTC in these countries, as the percentage of the population over 80 years old is not correlated with the formal expenditure on LTC (OECD 2010, population age structure, https://data-explorer.oecd.org, accessed on 04/06/2024). In addition, the formal LTC expenditure does not correlate with the percentage of individuals diagnosed with a health shock in SHARE. For example, Spain has the highest diagnosis rate (11%) and the lowest formal LTC expenditure.

where the out-of-pocket expenditure exceeds 30% of the total formal expenditure on LTC are classified as *market-based care countries*. In Italy and Spain, the total out-of-pocket and government LTC expenditure constitutes less than 1% of GDP. In the absence of substantial formal LTC services provided either by the government or the market, we classified these countries as *family-based care countries*. In these countries, the need for LTC is fulfilled informally by relatives, as we show in Subsection 5.3. The remaining countries cannot be classified because of the absence of a clear pattern distinguishing them as one type of caregiving system or another. In the following subsections, we will focus exclusively on these six countries—two from each caregiving category—to further examine how this caregiving systems classification aligns with the different dimensions of elderly care.

5.2 Caregiving norms

In this subsection, we examine attitudes towards the responsibility of caring for ill parents, whether by the children or by the government, in order to further validate our countries' classification. We use the joint World Values Survey (WVS) and European Values Study (EVS) Wave 7, carried out from 2017 to 2022 across all countries in our sample. In these surveys, subjects were asked to rate how much they agree with the statements "Adult children have the duty to provide long-term care for their parents" and "The government should take more responsibility to ensure that everyone is provided for".

For each statement, we create a dummy variable that equals 1 if the individual agrees or strongly agrees with the statement and 0 if the response is neutral or disagrees. Appendix Figure B.2 illustrates the percentage of respondents who agree with each statement in each type of caregiving system. There are significant differences between the types of caregiving systems in both statements. In terms of agreeing with the statement about the duty of children to provide care for parents, the highest agreement is found in family-based care countries, where 67% of respondents agree with the statement. This is followed by market-based care countries, where 39% agree, and lastly, government-based care countries, with 22% agreement. An opposite pattern emerges regarding the government's responsibility that everyone is provided for. Here, the highest level of agreement is observed in government-based care countries, with 72% of respondents agreeing. This is followed by 63% and 46% in market- and family-based care countries, respectively. These results show the caregiving values in these countries align with the division of caregiving responsibilities between the family and the government.

5.3 Formal and informal care

In this subsection, we present the association between a parental health shock and informal care provided by children, formal professional care, healthcare expenditure, and disability benefits received from the government, using our main SHARE data.[13] By analyzing these associations using the model described by Eq. (5), we strengthen our countries' classification and link the

[13]Note that our identification assumption enables us to estimate the causal relationship between parental health shocks and the employment of their adult children. However, this assumption may not hold for the outcome variables discussed in this subsection. Consequently, we interpret the results as indicating a correlation between parental health shocks and formal and informal care, while refraining from making definitive causal claims.

employment results, present in section 7, to the formal and informal care parents receive.[14]

In panel A of Table 1, we examine the correlation between parents' health shock and their children's help across different countries. We base our analysis on parents' responses to a question regarding whether their children had provided them with help or personal care in the past 12 months. In family-based care countries, a shock to the parents' health is associated with a 7.1 percentage points (57%) increase in the share of parents who received help from their children, while no such increase was observed in market- and government-based care countries. Interestingly, before the health shock, the average number of parents who reported their children helped them was similar across all types of countries, at about 12%. However, after the health shock of the parents, this diverges between the types of countries. This finding supports the notion that in family-based care countries, caregiving duties are provided informally by the family.

In panel B of Table 1, we show the association between parental health shock and the formal care received by parents. We conducted our analysis based on parents' responses to questions about whether they had received professional or paid assistance with domestic tasks they were unable to perform themselves due to health problems over the last 12 months. After a health shock, the use of professional or paid help increases by 4.5 percentage points in market-based care countries and 2.9 percentage points in government-based care countries. This corresponds to a 180% increase and a 97% increase, respectively. It is worth mentioning that given how the question is worded, this help could be paid for out-of-pocket or be covered by the government (or health insurance if available). Conversely, no significant increase in professional or paid help is observed in family-based care countries. This further supports the notion that in family-based care countries, caregiving duties are provided informally.[15] It also suggests that parents rely on formal assistance after experiencing a shock to their health in government- and market-based care countries. To understand whether there is a difference in the type of formal care received in government- and market-based care countries, we examine changes in parents' healthcare expenditure and disability benefits following a health shock.

Upon analyzing the annual expenditure on healthcare services demonstrated in panel C of Table 1, we can observe an annual increase in healthcare expenditure across all countries, although it is insignificant in government-based countries. The countries with the highest increase in healthcare expenditure are market-based care countries, where caregiving duties are substantially provided by the market. For these countries, there is an average increase of EUR 308 per year in health expenses, representing a 97% increase.[16] Moderate increases were observed in family-based countries (EUR 148, 51%), and the smallest insignificant increase in government-based care countries. These results correspond to the differences in formal LTC expenditure discussed in Section 5.

Panel D of Table 1 presents the association between parental health shock and disability benefits received by the parents. This analysis is based on responses to a question regarding

[14]Since healthcare expenditure, children's informal care, professional help, and benefits received are based on answers provided at the parental level, the analysis in this subsection pools daughters and sons together.

[15]Note that the mean of professional or paid help before the parental health shock in family-based care countries is slightly higher. This may be attributed to the fact that individuals in our sample are slightly older in these countries, which corresponds with the high life expectancy in Italy and Spain.

[16]According to German prices, 2015.

the various benefits parents receive. We classify a parent as receiving a disability benefit if they report any disability or sickness benefit from a public source. The table shows an increase in the probability of receiving a disability benefit across all caregiving systems following a health shock. However, the increase is statistically insignificant for the family-based care countries. The largest increase is observed in government-based care countries, with a rise of 4.8 percentage points. In market-based care countries, the increase is more moderate, at 1.9 percentage points. Considering the percentage of parents receiving benefits prior to the shock, the increase in market-based countries represents a 79.2% rise. This high percentage change is due to the low pre-shock, benefit-receiving rate in these countries, which equals 2.4%. It is important to note the share of people receiving disability benefits in market-based care countries remains the lowest among all types of caregiving systems despite the significant increase in benefit-receiving rates in these countries. In contrast, the pre-shock rate is highest in the government-based care countries, at 11.3%. This implies parents in government-based care countries tend to rely more on public benefits both before and after the shock.

The analyses presented in Table 1 provide evidence supporting the classification of countries based on how they provide care for their elderly population.[17] Family-based care countries tend to rely on informal care carried out by family members, particularly the children of the elderly. In market-based care countries, the caregiving duties are fulfilled by professional care for a fee, while in government-based care countries, the government provides professional care and financial support. This analysis also allows us to link the employment results present in Section 7 to the formal and informal care parents receive.

[17] To avoid bias, which may result from different individuals answering different questions, we conducted the same analysis on a sample of individuals who answered all four questions in at least one year. This approach ensures that the number of individuals remains consistent across outcomes within each caregiving system. The results of this analysis are presented in Appendix Table A.1 and remain consistent with our findings.

Table 1: Average parental health shock impacts by type of caregiving system

	(1) Family-based	(2) Market-based	(3) Government-based
Panel A: Help from children			
	0.071***	0.003	0.016
	(0.023)	(0.031)	(0.025)
Mean	*0.124*	*0.112*	*0.124*
Effect as % of mean	57.5%	3.0%	12.8%
Observations	11,168	5,974	7,950
# individuals	3,594	2,131	2,628
Panel B: Professional or paid help			
	0.016	0.045*	0.029*
	(0.017)	(0.027)	(0.017)
Mean	*0.038*	*0.025*	*0.030*
Effect as % of mean	41.6%	180.2%	96.7%
Observations	9,588	4,709	7,407
# individuals	3,623	2,084	2,684
Panel C: Health expenditure			
	149*	307**	53
	(83)	(151)	(35)
Mean	*292*	*315*	*257*
Effect as % of mean	50.9%	97.4%	20.5%
Observations	9,628	5,273	7,485
# individuals	3,626	2,161	2,691
Panel D: Disability benefits			
	0.010	0.019*	0.048***
	(0.012)	(0.010)	(0.015)
Mean	*0.053*	*0.024*	*0.113*
Effect as % of mean	18.9%	79.2%	42.7%
Observations	12,421	6,813	9,211
# individuals	3,643	2,176	2,698

Notes: This table shows the impact of parental health shock on children's help, professional care, healthcare expenditure, and disability benefits based on Eq. (5), using parent FE instead of child FE. The dependent variable in panel A equals one if the parent indicates one of his children helps him or provides him with personal care. The dependent variable in panel B equals one if the parent indicated he had received professional or paid help with domestic tasks. The dependent variable in panel C is the annual amount paid on health in Euro in terms of Germany's prices in 2015. The dependent variable in panel D equals one if a parent indicated he had received a disability or sickness benefit from a public source. Standard errors are clustered at the parental household level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

6 Summary statistics

Appendix Table A.2 presents summary statistics for parents and children by the different types of caregiving systems. As shown in Table A.2, parents are 71.6 years old on average at the time of their health shock diagnosis. Parents from family-based countries tend to be older than those from other caregiving systems, which aligns with the higher life expectancy in Italy and Spain.[18] However, children are of similar age at the time of the health shock, ranging from 41 to 43, suggesting they are at comparable life stages in terms of family and career. Hence, age differences are not likely to drive our results.[19]

Another key observation from the table shows the percentage of parents with more than a high school education in family-based countries is relatively low, at 7%. Although this may initially appear low, it is important to note it reflects the proportion of individuals within the same cohort with more than a high school education in Italy and Spain.[20,21]

The table further demonstrates the pre-shock employment of daughters is lower than that of sons across all caregiving systems. In addition, the pre-shock employment of daughters in family-based countries is particularly low, at 62%. This corresponds to the low female employment rate of this age group in Spain and Italy, as recorded by the OECD.[22] Parents' employment is very low across all caregiving systems, as parents are 71.6 years old on average, an age at which most are already retired.[23]

The lower pre-shock daughters' employment in family-based care countries does not pose a threat to our empirical strategy. However, we may encounter a problem if there are differences in employment trends across types of caregiving systems before the parental health shock. In order to assess differences in pre-trend employment patterns between types of caregiving systems, Appendix Figure B.3 illustrates the employment rates of children 2-8 years before the parental health shock. Across all types of caregiving systems, the employment trends for sons and daughters in the eight to two years before a parental health shock are similar. Sons maintain an employment rate of about 84% throughout the entire period. Although daughters have different employment rates, with higher rates in government-based care countries and lower rates in family-based countries, the trends in employment follow a consistent pattern across all caregiving systems. These findings suggest our results are unlikely to be driven by differences in pre-shock employment trends across countries.

[18] OECD (2010), Life expectancy by age and sex, https://data-explorer.oecd.org (accessed on 20/09/2024)

[19] To ensure that our results are not driven by age differences, we conduct the analysis described by Eq. (5) for individuals of working age: 25-34. Moreover, this age group aligns with the group typically examined in the child penalty literature and allows for a better comparison with the results of studies in this area. The results, presented in Appendix Table A.3, are consistent with those from the full sample.

[20] Eurostat data: https://ec.europa.eu/eurostat/databrowser/explore/all/all_themes (accessed on: 20/09/2024).

[21] Although differences exist between caregiving systems, they do not affect our results. We analyze each country group separately, ensuring that comparisons are made only among individuals within the same caregiving system. As a result, our estimated coefficients reflect the impact of a parental health shock on children's outcomes, conditional on living in a specific group of countries, without bias from cross-country differences.

[22] OECD (2010), Employment and unemployment by five-year age group and sex, https://data-explorer.oecd.org (accessed on 20/09/2024).

[23] Given their low likelihood of being in the labor force, any potential effect of a health shock on parents' employment would be negligible. Thus, we do not conduct such analysis.

7 Employment by caregiving systems

In Section 4, we observed a clear gendered pattern when pooling the six European countries: when parents fall ill, the gender employment gap widens. Now, we delve deeper into our analysis to examine whether this gendered effect varies across caregiving systems. Subsection 5.3 previously highlighted differences between caregiving systems. We found that a shock to the parents' health is associated with an increase in the share of parents who receive informal care from their children in family-based care countries. In market-based care countries, a shock to the parents' health is associated with increased use of paid professional care. In government-based care countries, a shock to parents' health is associated with increased use of professional care and the likelihood of receiving disability benefits. These differences in caregiving arrangements suggest that the impact of a parental health shock on children's employment may also vary across systems.

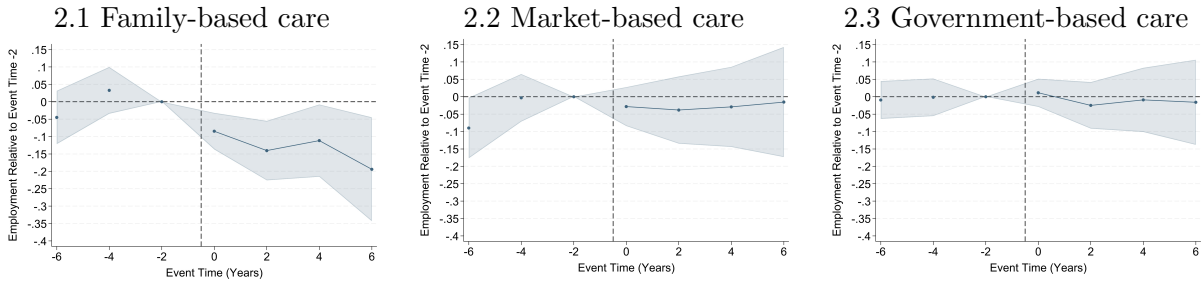
In Figure 2, we present the impacts of the parental health shock on children's employment based on event-time coefficients estimated by Eq. (1) expressed as a percentage of the counterfactual outcome defined in Eq. (3). The results for daughters are presented in panel A of Figure 2. We find that in family-based care countries, when a parent becomes ill, their daughters' employment decreases. In the year the parent reports being diagnosed with a health shock, there is a reduction of 6.7% in daughters' employment relative to the employment rate before the shock. In the two to six years following the health shock, the decrease in daughters' employment remained present, showing a sustained 8.8%-16% reduction. In contrast, we did not find the health shock to the parent affects the daughters' employment in market- and government-based care countries.

The results for sons are presented in panel B of Figure 2. We find in the year the parent reports being diagnosed with a health shock, sons in market-based care countries experienced a 4% increase in employment. Nevertheless, this impact has diminished over the years. We do not find the parental health shock affected sons' employment in family- and government-based care countries.

To complement these results, we present the average parental health shock impacts on children's employment in Table 2, where we present the employment β^{wg} coefficients estimated from Eq. (5), separately for each caregiving system and gender. As in our event-time analysis, daughters' employment decreases in family-based care countries by 8.5% on average over the 0-6 years after their parents become ill. For sons in market-based care countries, we find a 4.9% average increase in employment.

Our results indicate a divergence in the caregiving dynamics and labor market responses between genders within different caregiving systems. An explanation for the differential effects on children's employment could be attributed to the division of care responsibility for the elderly among the market, government, and family. In family-based care countries, caregiving duties are mainly provided informally by the family, negatively impacting daughters' employment. In market-based care countries, caregiving duties are mainly provided formally through the market and require additional financial resources, positively impacting sons' employment. In government-based care countries, caregiving duties are mainly provided formally by the government; therefore, no effect is observed on the employment of daughters and sons.

Panel A - Daughters' employment



Panel B - Sons' employment

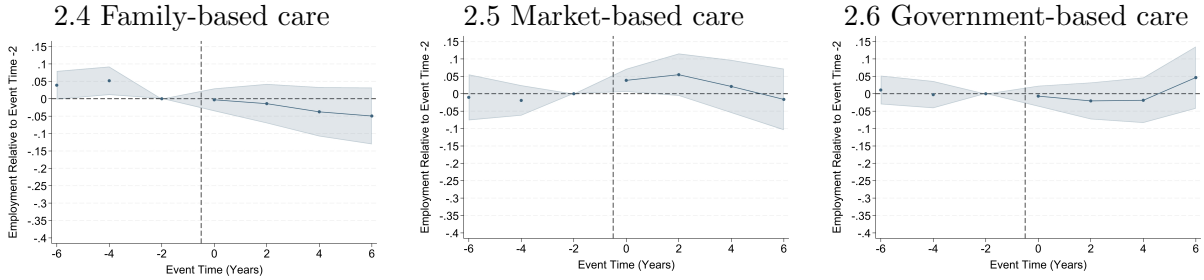


Figure 2: parental health shock impacts on children's employment.

Notes: This figure shows the impacts of parental health shock on children's employment by type of caregiving system. Panel A presents the impacts on daughters' employment, and panel B on sons' employment. Each subfigure shows the event-study coefficients estimated from Eq. (1) expressed as a percentage of the counterfactual outcome defined in Eq. (3), including 90 percent confidence intervals. Standard errors are clustered at the parental household level.

Table 2: Average parental health shock impacts by type of caregiving system

	Daughters			Sons		
	(1) Family	(2) Market	(3) Gov.	(4) Family	(5) Market	(6) Gov.
Employment	-0.054***	-0.020	0.012	-0.013	0.041**	-0.007
	(0.019)	(0.024)	(0.018)	(0.015)	(0.017)	(0.014)
Mean	*0.632*	*0.722*	*0.803*	*0.848*	*0.836*	*0.851*
Effect as % of mean	-8.5%	-2.7%	1.4%	-1.5%	4.9%	-0.8%
Observations	5,800	3,303	4,223	6,326	3,273	4,718
# individuals	1,714	1,065	1,258	1,876	1,061	1,392

Notes: This table shows the average impacts of parental health shock on children's employment by type of caregiving system based on Eq. (5). Columns (1)-(3) present the impact on daughters' employment in family-based care, market-based care, and government-based care countries, respectively. Columns (4)-(6) present the impact on sons' employment in family-based care, market-based care, and government-based care countries, respectively. Standard errors are clustered at the parental household level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

8 Alternative comparison groups

In Section 7, we show labor market responses to a parental health shock vary by gender and caregiving system. To do this, we use an event study analysis, where individuals act as their own comparison group over time. Recent literature on event studies highlights the potential bias in results when there is variation in treatment timing and heterogeneous treatment effects (De Chaisemartin and d'Haultfoeuille, 2020; Goodman-Bacon, 2021; Sun and Abraham, 2021). This concern is relevant to this study, as parents in our sample experience a health shock in different periods, and the treatment effect may diminish over time.

To overcome this concern, we employ an additional estimation strategy proposed by Callaway and Sant'Anna (2021), using a doubly robust DID estimator based on stabilized inverse probability weighting, as described in Sant'Anna and Zhao (2020). As in the event study, we use this method separately for daughters and sons and for each caregiving system.[24] This method also allows us to use two additional comparison groups to estimate the effect of the shock, reinforcing our results. In all the analyses in this section, we control for age, country, parental gender, and parental education level.

The first comparison group is the *not-yet-treated*: individuals whose parents will experience a health shock within the time frame of analysis (2004-2015) but have not yet experienced it. The not-yet-treated serves as a useful comparison group assuming, conditional on covariates, the outcomes of the group treated in year t and the group treated in year $T > t$ would have followed parallel trends had the treatment not occurred. Given we apply this model to samples of individuals of the same gender and caregiving system whose parents experience the same health shock and assuming the timing of the shock is random, the parallel trends assumption is plausible.

The not-yet-treated group does not allow us to estimate the event study coefficient for the earliest event time (-6) and the latest event time (6). This limitation arises because, during these periods, all of the sample's individuals are either not-yet-treated or already treated. One potential solution is to use a group of *never-treated* individuals. However, using the *never-treated* could be problematic, as individuals whose parents experience a health shock may differ systematically from those whose parents do not.

Instead, we construct a comparison group using individuals whose parents experienced a health shock after the time frame of analysis, specifically in waves 8 and 9 of the SHARE study conducted in 2019 and 2021.[25] Although these individuals are eventually treated, they effectively serve as a *never-treated* comparison group for our main sample since they were not treated within the analysis time frame. This comparison relies on the assumption that, in the absence of a health shock, the outcomes of individuals treated in year t would have followed a parallel trend to those treated only after the analysis period. Assuming the timing of the shock is not associated with the outcome variable, and given we compare individuals of the same gender and caregiving system, it is likely the conditional parallel trends assumption holds.

Appendix Figure B.4 presents the results for the Callaway and Sant'Anna (2021) event time coefficient and a weighted average of the ATTs (average effects of treatment on the treated) in

[24] In this section, we present the results for daughters in family-based care countries and sons in market-based care countries. All other analyses are available upon request.

[25] This wave was not used in the main analysis because of the disruption caused by COVID-19.

the upper right corner of each subfigure. The results for daughters in family-based care countries are presented in panel A. We find similar event-time coefficients to those found in Subsection 4. When a parent becomes ill, daughters in family-based care countries experience a decrease in employment. This is true for both comparison groups, although the effect is no longer significant two years after the shock when using the never-treated as a comparison group. Nonetheless, the magnitude of the effect in the first period after the shock is similar to the one found using the event study design.

The Callaway and Sant'Anna (2021) analysis results for sons in market-based care countries are presented in Panel B of Appendix Figure B.4. The results for this group are similar to those of the event study design. We find a short-run increase in sons' employment following the parental health shock. The effect found using the Callaway and Sant'Anna method is comparable in magnitude to the effect found in Section 7.

Combining the results for sons and daughters, our analyses consistently align with our previous findings. For daughters in family-based care countries, both the event study and the Callaway and Sant'Anna estimator reveal a significant decrease in employment following a parental health shock. Similarly, for sons in market-based care countries, both methods show a short-term increase in employment after a parental health shock. The consistency of results across different strategies and comparison groups reinforces our findings, demonstrating they are robust to biases that might arise from variations in treatment timing and heterogeneous treatment effects.

9 Siblings' gender composition

Our previous analysis indicates divergence in the caregiving dynamics and labor market responses between genders within different caregiving systems. In family-based care countries, caregiving duties mainly fall on the family, reducing daughters' employment. In market-based care countries, caregiving duties are handled through the market, increasing sons' employment. In this section, we examine whether the gender-based effect varies depending on the gender composition of the individual's siblings.[26]

Andresen and Nix (2022) found child penalties are much smaller and decrease over time in female same-sex couples. Hence, it would be interesting to show what happens to the aging parent penalty for children who have same-sex siblings. While drawing conclusions from same-sex couples to the general population might raise some questions, in our study, the comparison between individuals with a brother versus those with a sister reduces some of the concerns around generalizations.

Similar to Andresen and Nix (2022), we expect that when the child has only same-sex siblings, the care and financial burden will be divided between the siblings. Therefore, the adverse effect on daughters' employment in family-based care countries is likely to be reduced when they have a sister. Similarly, the increase in sons' employment in market-based care countries is likely to be less pronounced in the presence of brothers.

The effect of a parental health shock on daughters' employment in family-based care countries

[26]Linking siblings is only possible using information from wave 3, which limits the sample size for the analysis of siblings' gender composition.

by siblings' gender composition is presented in Appendix Table A.4. The first column shows the effect for daughters who have siblings. As the vast majority of the sample has at least one sibling, the result for this group is similar to the one found for the entire sample.[27] Columns 2 and 3 present the impact of a parental health shock on two groups: daughters from families with same-sex siblings (i.e., only sisters) and daughters from mixed-sex siblings (i.e., at least one brother). The effect for the first group is positive but not statistically significant. In contrast, daughters from a family with mixed-sex siblings experience a decrease in employment after a parental health shock. The effect is greater than that found for the entire sample, with an average 8.6 percentage points decrease, corresponding to 13.7%. This indicates that the decrease in daughters' employment in family-based care countries is driven by women from mixed-sex families, suggesting that sisters share caregiving duties.

Appendix Table A.5 presents the results for sons in market-based care countries by siblings' gender composition. The results for sons with siblings are similar to those for the entire sample, as most of the children in the sample have siblings. As for daughters, the gender composition of siblings in the family plays a role in the effect of parental health shock on employment. The employment effect of the parental shock for sons from a family with same-sex siblings (i.e., only brothers) is positive, albeit relatively small and statistically insignificant. Conversely, the effect for sons with a sister is positive, larger in magnitude, and statistically significant. This suggests sons with brothers can share the financial burden, thereby mitigating the effect, whereas sons with sisters may need to take a larger share of the increased expenses.

10 Gendered roles and the division of responsibilities

Our findings highlight a significant divergence in the caregiving and labor market responses to a parental health shock across genders and caregiving systems. This divergence reflects a broader debate regarding the economic efficiency of caregiving roles versus the influence of social norms. When it comes to child caregiving, decisions within households about who should reduce labor market participation typically factor in the household's overall income. This aligns with Becker's (1985) model, where the family seeks to minimize economic costs, often resulting in women—who traditionally earn less—assuming a larger share of caregiving responsibilities. However, when caregiving involves elderly parents, the decision-making process is not made within a single economic unit, as siblings usually belong to different households.

The Beckerian economic efficiency, thus, does not play a central role in the context of elderly caregiving. For example, even if a brother earns more than his sister, the economic benefit he gains by staying employed does not translate into a direct financial advantage for the sister if she reduces her employment to provide care for their parents. This situation raises the question of why women are more likely to assume caregiving roles, while men are more likely to take on breadwinner roles. Akerlof and Kranton (2000)'s theory on deviations from social norms offers a relevant explanation; according to their model, deviating from expected social behavior leads to a decrease in an individual's utility, thereby making women more likely to conform to caregiving expectations and men to breadwinner expectations.

[27] For both sons and daughters, the complementary group of only children is too small for this analysis.

In this section, we examine perceptions regarding gender roles and provide suggestive evidence for the relationship between norms and the division of caregiving duties by gender. To understand whether there are differences in values regarding the gender division of caregiving and financial support across different caregiving systems, we used the Eurobarometer survey carried out in 2017 across all EU countries.[28] In this survey, subjects were asked to rate how much they agree with the statements "The most important role of a man is to earn money" and "The most important role of a woman is to take care of her home and family".

For each statement, we create a dummy variable that equals 1 if the individual agrees or strongly agrees with the statement and 0 if the response is neutral or disagrees. Appendix Figure B.5 illustrates the percentage of respondents who agree with each statement in each type of caregiving system. In all countries, the rate of agreement with the statement "the most important role of a man is to earn money" is higher than the rate of agreement with the statement "the most important role of a woman is to take care of her home and family." This is especially evident in market-based care countries, where the gap between the two statements is particularly large. Differences also exist between the types of countries. The percentage of respondents who agree a man's role is to earn money stands at 44% in family-based care countries, 40% in market-based care countries, and 16% in government-based care countries. In the case of the statement that a woman's role is to take care of her home and family, 42% agree in family-based care countries, 30% in market-based care countries, and 14% in government-based care countries.

These results show the gender norms in family- and market-based care countries align with the division of caregiving and breadwinner responsibilities between daughters and sons. When there is a gap in supporting the elderly, daughters typically take on the caregiving responsibility, while sons assume the financial support role. This pattern is consistent with Akerlof and Kranton (2000)'s model: women, who are traditionally expected to be caregivers, avoid deviating from this social expectation and are more likely to step in when there is a need for care. Similarly, men, who are expected to be financial providers, fulfill the social norm and assume the breadwinner role.

11 Heterogeneity: daughters' employment

In this section, we assess the impact of parental health shocks on daughters' employment in family-based care countries, taking into account the personal characteristics of both parents and daughters. We are particularly interested in identifying differences based on parental gender, marital status, income, and voluntary insurance coverage. Additionally, we want to examine whether a parental health shock has different effects on daughters' employment depending on whether they have children of their own and whether they live near their parents.

We expect the effects to be more pronounced for children of unmarried parents. This is because married parents have a partner to rely on for caregiving, thus relying less on their daughters for help. On the other hand, differences between parents of different genders can indicate children tend to take care more of the parent of their own gender. We also expect the

[28] Eurobarometer does not include information on Switzerland because it is not part of the EU. Therefore, market-based care findings from this survey represent Germany only.

effect to be stronger for children of parents with low incomes and no voluntary medical insurance, as these parents may depend more heavily on family support in the absence of other resources. Therefore, we also examine whether the results differ based on the parents' education (which is highly correlated with income) and whether the parents have voluntary insurance coverage.

The impact is expected to be more pronounced for daughters who live close to their parents. There is no clear prediction regarding how having children of her own will affect the daughter's response to a parental health shock. Daughters who are also mothers might work less because they take care of their own children, giving them more time to care for their parents without altering their employment status. On the other hand, their caregiving responsibilities for their children may limit the resources they can devote to their parents, potentially leading them to reduce employment to allocate more time for caregiving duties.

Appendix Table A.6 presents the impacts of a parental health shock on daughters' employment in family-based care countries, stratifying the sample by parents' gender and marital status two years before the health shock. The results indicate the impact of parental health shocks on daughters' employment is the same, regardless of the gender of the parent. In contrast, as expected, daughters of unmarried parents experience a greater impact of parental health shocks on their employment compared to those whose parents are married.

Appendix Table A.7 shows the effects of a parental health shock on daughters' employment divided into two samples based on parents' education level (high school or less, or more than high school) and whether the parents had voluntary insurance coverage two years before the health shock. The results are in line with our prediction, indicating the observed effect is linked to children of parents with lower levels of education. This may be because these parents cannot afford alternative professional treatments, unlike parents with higher levels of education.[29] Furthermore, for those with private insurance, no negative effect on daughters' employment is observed, as the insurance may cover the cost of alternative professional treatments.

As shown in Appendix Table A.8, the effect of a parental health shock on daughters' employment is positive and significant regardless of whether the daughter has children of her own two years before the parental health shock. However, the living distance between the daughter and her parents two years before the parental health shock is important. The effect is positive and significant if the daughter lived within 100 kilometers of her parents. In contrast, if the daughter lived more than 100 kilometers away the impact is smaller in magnitude and not statistically significant. This makes sense, as daughters living closer to their parents are more likely to provide support and assistance during health crises, thereby impacting their employment.

Our analysis demonstrates parental health shocks have a notable impact on daughters' employment; the extent of this impact is influenced by various factors. Unmarried parents are more likely to rely on their daughters for care, resulting in a more pronounced effect on the daughters' employment. Additionally, parents with lower levels of education and without voluntary insurance coverage are associated with greater employment disruptions for their daughters, possibly because they are less likely to afford alternative professional care. The geographical proximity of a daughter to her parents plays a crucial role; daughters living within 100 kilometers of their parents experience a significant impact on their employment, and those living farther away do

[29] As mentioned in Section 6, the low percentage of parents with more than a high school education in these countries corresponds to European data.

not. All these results align with the explanation that daughters' employment in family-based care countries decreases because they take on caregiving responsibilities for their parents after a parental health shock.

12 Robustness

12.1 Immigration and the 2008 Financial Crisis

One factor that can bias our results is the possibility of parents relocating based on anticipated health status. For example, parents can move from family- or market-based care countries to government-based care countries for better social support. This, in turn, might alter the impact of the parental health shock. To address this, we estimate the coefficients from Eq. (5) using a sample excluding the children of immigrant parents. The results, shown in Appendix Table A.9, remained unchanged, indicating that sorting does not bias the results.

Another concern is that part of the observed effect stems from the 2008 financial crisis, as different parents experienced the shock in different years, with some also facing a health shock during the financial crisis. Given that countries like Italy and Spain were hit particularly hard by the crisis, the observed decrease in daughters' employment in these countries might be attributed to the crisis rather than to the health shock. Since 2008 is not included in our sample, we address this concern by estimating the coefficients from Eq. (5) using a sample that excludes individuals who experienced a health shock in 2007, the year prior to the crisis. The results, shown in Appendix Table A.10, remained unchanged, indicating that the crisis does not bias the results. Notably, the positive coefficient for sons in market-based countries decreases slightly and is not statistically significant but maintains its direction.

12.2 Significant health shock

To validate the selected conditions constitute a significant health shock, we examine the impact of the health shock on two indicators of parents' health status, using the model described by Eq. (1). The first indicator is a binary variable equaling 1 if a parent reported their health as at least good (i.e., good, very good, or excellent) and 0 otherwise. The second indicator is a binary variable equaling 1 if a parent reported taking medication at least once a week and 0 otherwise. Appendix Figure B.6 presents the results, showing parents across all caregiving systems are less likely to report good health and more likely to take medication regularly following a health shock. These findings confirm the conditions considered in this study do indeed result in a significant and unanticipated deterioration in health.

12.3 Various health conditions

One potential concern is that a particular health condition is driving the results. A straightforward way to test for this would be to estimate the coefficients from Eq. (5) separately for each sample of individuals whose parents were diagnosed with the same condition. However, analyzing each condition separately is not feasible due to the limited sample size. Instead, we group conditions based on their similarities in disease progression, caregiving needs, and potential labor market disruptions. Specifically, we categorize them into three groups: (1) stroke and

Parkinson's, (2) heart attack and lung disease, and (3) cancer. Appendix Table A.11 presents the impact of parents' health shock on children's employment by health condition, focusing on daughters' employment in family-based care countries and sons' employment in market-based care countries. This table indicates that no single health condition is driving the results.

13 Conclusion

This study focuses on the "aging parent penalty" children might experience in response to a deterioration in their parent's health. We show that a parental health shock widens the gender employment gap, with a long-run aging parent penalty of 8.5%. We further show that this widened gender employment gap arises from two dynamics. In countries where parents rely on informal care from relatives, daughters typically assume the caregiving role and reduce their employment. In countries where care is provided primarily through the market, sons assume the financial support role and increase their employment.

These findings align with the literature on the child penalty. In family-based care countries, where families primarily provide informal caregiving, parents are more likely to receive help from their children after a health shock. Although healthcare expenditure increases after such shocks, parents do not receive additional professional care, as family members step in to meet the growing needs. In particular, daughters significantly reduce their employment by 8.5% to balance family duties and work after their parents experience a health shock. In comparison, this reduction is equivalent to a quarter of the mother's "child penalty", estimated at a 35% decrease in employment in Italy and Spain (Kleven et al., 2023). Sons' employment, however, remains unchanged after the parental health shock in these countries.

In market-based care countries, there is an increase in parents' healthcare expenses and in the use of formal professional care after a health shock. In these countries, sons' employment increases by 4.9% in the year their parent is diagnosed with a health shock. This increase corresponds to half of the "breadwinner effect" observed in men when becoming breadwinner-fathers, previously estimated at a 10% increase in employment in Germany (De La Vega, 2022). This implies individuals must finance the professional care themselves in market-based care countries, and sons increase their employment to adjust to the increasing expenses following the shock. In contrast, parental health shock does not affect daughters' employment in these countries.

In government-based care countries, where the government finances a large share of healthcare services, parents increase their use of professional care without a significant corresponding rise in healthcare expenditure. In addition, there is an increase in the probability of receiving disability benefits and no increase in the likelihood of parents receiving help from their children. Indeed, in these countries, we find no effect of a parental health shock on children's employment. This implies children do not need to adjust their employment when their parents fall ill when the government provides most of the caregiving needs.

These findings highlight the role of welfare policies and gender norms in shaping the employment gender gap. Previous studies showed that the gendered division of childcare responsibilities is the main driver of this gap. We contribute to the literature by demonstrating that caregiving responsibilities for the elderly further widen it. As caregiving and breadwinning responsibilities

are typically divided along gender lines, the caregiving system in place plays a significant role in the development of the employment gender gap. Policies relying on family-based care often create economic disparities that primarily affect women, as they tend to take the caregiver role. In contrast, in countries depending on the market for caregiving, the obligation to pay for these services falls mainly on men, who are more likely to fulfill the breadwinner role.

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Appendix

A Tables

Table A.1: Parental health shock impacts for individuals who answered all three questions

	(1) Family-based	(2) Market-based	(3) Government-based
Panel A: Help from children			
	0.072***	0.002	0.015
	(0.023)	(0.032)	(0.025)
Mean	*0.124*	*0.109*	*0.123*
Effect as % of mean	57.5%	2.2%	12.3%
Observations	11,112	5,774	7,918
Panel B: Professional or paid help			
	0.017	0.044	0.031*
	(0.017)	(0.027)	(0.017)
Mean	*0.038*	*0.025*	*0.031*
Effect as % of mean	45.2%	176.0%	99.5%
Observations	9,455	4,612	7,251
Panel C: Health expenditure			
	147*	309*	51
	(84)	(172)	(36)
Mean	*294*	*319*	*258*
Effect as % of mean	49.9%	96.8%	19.8%
Observations	9,488	5,038	7,315
Panel D: Disability benefits			
	0.011	0.018*	0.049***
	(0.012)	(0.010)	(0.016)
Mean	*0.053*	*0.025*	*0.115*
Effect as % of mean	19.7%	72.3%	42.5%
Observations	12,198	6,470	8,989
# individuals	3,555	2,029	2,610

Notes: This table shows the impact of parental health shock on children's help, professional care, healthcare expenditure, and disability benefits based on Eq. (5) for individuals who answered all three questions in at least one year, using parent FE instead of child FE. The dependent variable in panel A equals one if the parent indicates one of his children helps him or provides him with personal care. The dependent variable in panel B equals one if the parent indicated he had received professional or paid help with domestic tasks. The dependent variable in panel C is the annual amount paid on health in Euro in terms of Germany's prices in 2015. The dependent variable in panel D equals one if a parent indicated he had received a disability or sickness benefit from a public source. Standard errors are clustered at the parental household level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.2: Summary statistics

		By caregiving systems		
	Full sample	Family-based	Market-based	Government-based
Panel A: Parents				
Female	0.50	0.50	0.51	0.50
	(0.50)	(0.50)	(0.50)	(0.50)
Age at the time of shock	71.61	73.20	69.95	70.94
	(9.57)	(9.53)	(9.47)	(9.40)
More than high school	0.21	0.07	0.28	0.32
	(0.41)	(0.25)	(0.45)	(0.47)
Number of children	2.56	2.66	2.42	2.53
	(1.35)	(1.47)	(1.31)	(1.18)
Pre-shock employment (female)	0.14	0.06	0.21	0.19
	(0.35)	(0.24)	(0.41)	(0.39)
Pre-shock employment (male)	0.15	0.10	0.17	0.20
	(0.36)	(0.30)	(0.38)	(0.40)
Individuals	3,377	1,397	909	1,071
Panel B: Children				
Female	0.48	0.48	0.50	0.47
	(0.50)	(0.50)	(0.50)	(0.50)
Age at the time of shock	43.08	43.86	41.84	43.02
	(10.12)	(9.93)	(10.29)	(10.12)
More than high school	0.40	0.28	0.44	0.52
	(0.49)	(0.45)	(0.50)	(0.50)
Number of children	1.16	1.09	1.05	1.35
	(1.21)	(1.15)	(1.16)	(1.31)
Pre-shock employment (female)	0.70	0.62	0.72	0.78
	(0.46)	(0.48)	(0.45)	(0.41)
Pre-shock employment (male)	0.84	0.85	0.83	0.84
	(0.36)	(0.36)	(0.37)	(0.37)
Individuals	8,522	3,648	2,176	2,698

Notes: Averages during health shock ($t=0$). Standard deviations are in parentheses.

Table A.3: Parental health shock impacts, individuals aged 25-34

	Daughters			Sons		
	(1) Family	(2) Market	(3) Gov.	(4) Family	(5) Market	(6) Gov.
Employment	-0.059**	0.008	0.009	-0.005	0.043**	-0.001
	(0.027)	(0.035)	(0.026)	(0.019)	(0.018)	(0.019)
Mean	*0.654*	*0.742*	*0.767*	*0.837*	*0.824*	*0.817*
Effect as % of mean	-9.0%	1.1%	1.2%	-0.6%	5.2%	-0.2%
Observations	3,206	1,778	2,388	3,509	1,925	2,640
# individuals	940	566	707	1,032	617	781

Notes: This table shows the average impacts of parental health shock on children's employment by type of caregiving system based on Eq. (5), for individuals aged 25-34. Columns (1)-(3) present the impact on daughters' employment in family-based care, market-based care, and government-based care countries, respectively. Columns (4)-(6) present the impact on sons' employment in family-based care, market-based care, and government-based care countries, respectively. Standard errors are clustered at the parental household level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.4: Parental health shock impacts by daughters' siblings

	(1) Has siblings	(2) Same-sex siblings	(3) Mixed-sex siblings
Employment	-0.059***	0.062	-0.086***
	(0.022)	(0.048)	(0.025)
Mean	*0.638*	*0.681*	*0.626*
Effect as %	-9.2%	9.1%	-13.7%
Observations	3,610	806	2,804
# individuals	935	209	726

Notes: This table shows the impacts of parental health shock on daughters' employment in family-based care countries by daughter's siblings' gender composition based on Eq. (5). Standard errors are clustered at the parental household level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.5: Parental health shock impacts by sons' siblings

	(1) Has siblings	(2) Same-sex siblings	(3) Mixed-sex siblings
Employment	0.044**	0.023	0.053**
	(0.019)	(0.022)	(0.025)
Mean	*0.838*	*0.875*	*0.822*
Effect as %	5.3%	2.6%	6.5%
Observations	1,737	535	1,202
# individuals	467	144	323

Notes: This table shows the impacts of parental health shock on sons' employment in market-based care countries by sons' siblings' gender composition based on Eq. (5). Standard errors are clustered at the parental household level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.6: Parental health shock impacts by parents gender and marital status

	Parent's gender		Parent's marital status	
	(1) Father	(2) Mother	(3) Married	(4) Unmarried
Employment	-0.060*	-0.057**	-0.040*	-0.094**
	(0.032)	(0.024)	(0.022)	(0.037)
Mean	*0.667*	*0.599*	*0.640*	*0.592*
Effect as % of mean	-8.9%	-9.6%	-6.3%	-15.9%
Observations	2,715	3,083	4,518	1,176
# individuals	815	897	1,329	350

Notes: This table shows the impacts of parental health shock on daughters' employment in family-based care countries by parents' gender and marital status based on Eq. (5). Standard errors are clustered at the parental household level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.7: Parental health shock impacts by parents' education and insurance status

	Parent's education		Parent's insurance status	
	(1) HS and less	(2) More than HS	(3) No voluntary insur.	(4) Voluntary insur.
Employment	-0.064***	0.134	-0.065***	0.076
	(0.020)	(0.084)	(0.023)	(0.069)
Mean	*0.629*	*0.648*	*0.624*	*0.647*
Effect as % of mean	-10.2%	20.7%	-10.5%	11.8%
Observations	5,351	331	3,142	569
# individuals	1,569	106	810	177

Notes: This table shows the impacts of parental health shock on daughters' employment in family-based care countries by parents' education and insurance status based on Eq. (5). Standard errors are clustered at the parental household level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.8: Parental health shock impacts by daughter's fertility and residential distance

	Daugther's fertility		Daugther's distance from parents	
	(1) Has children	(2) No children	(3) Distance $<$ 100 km	(4) Distance $\geq$ 100 km
Employment	-0.057**	-0.050*	-0.077***	-0.020
	(0.023)	(0.028)	(0.027)	(0.069)
Mean	*0.655*	*0.626*	*0.627*	*0.638*
Effect as % of mean	-8.6%	-8.0%	-12.3%	-3.1%
Observations	3,901	1,962	3,305	391
# individuals	1,136	559	1,039	119

Notes: This table shows the impacts of parental health shock on daughters' employment in family-based care countries by daughter's fertility and residential distance based on Eq. (5). Standard errors are clustered at the parental household level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.9: Parental health shock impacts, excluding immigrants

	Daughters			Sons		
	(1) Family	(2) Market	(3) Gov.	(4) Family	(5) Market	(6) Gov.
Employment	-0.055***	-0.013	0.019	-0.010	0.044**	-0.009
	(0.020)	(0.026)	(0.018)	(0.015)	(0.018)	(0.014)
Mean	*0.633*	*0.723*	*0.808*	*0.848*	*0.844*	*0.855*
Effect as % of mean	-8.7%	-1.7%	2.3%	-1.1%	5.3%	-1.1%
Observations	5,646	2,776	3,912	6,187	2,688	4,342
# individuals	1,664	891	1,162	1,828	870	1,278

Notes: This table shows the average impacts of parental health shock on children's employment by type of caregiving system based on Eq. (5), excluding children whose parents immigrated to their country of residence. Columns (1)-(3) present the impact on daughters' employment in family-based care, market-based care, and government-based care countries, respectively. Columns (4)-(6) present the impact on sons' employment in family-based care, market-based care, and government-based care countries, respectively. Standard errors are clustered at the parental household level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.10: Parental health shock impacts, excluding the year 2007

	Daughters			Sons		
	(1) Family	(2) Market	(3) Gov.	(4) Family	(5) Market	(6) Gov.
Employment	-0.056**	-0.020	-0.002	-0.013	0.030	0.006
	(0.023)	(0.027)	(0.021)	(0.018)	(0.019)	(0.017)
Mean	*0.636*	*0.716*	*0.805*	*0.845*	*0.833*	*0.853*
Effect as % of mean	-8.8%	-2.8%	-0.3%	-1.5%	3.6%	0.7%
Observations	4,883	2,796	3,532	5,238	2,826	3,850
# individuals	1,435	894	1,033	1,546	896	1,116

Notes: This table shows the average impacts of parental health shock on children's employment by type of caregiving system based on Eq. (5), excluding children whose parents experienced a health shock in the year 2007. Columns (1)-(3) present the impact on daughters' employment in family-based care, market-based care, and government-based care countries, respectively. Columns (4)-(6) present the impact on sons' employment in family-based care, market-based care, and government-based care countries, respectively. Standard errors are clustered at the parental household level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.11: Parental health shock impacts by health condition

	Daughters, family-based			Sons, market-based		
	(1) Stroke & Parkinson's	(2) Heart attack & Lung disease	(3) Cancer	(4) Stroke & Parkinson's	(5) Heart attack & Lung disease	(6) Cancer
Employment	-0.073*	-0.052**	-0.079*	0.058	0.051***	0.023
	(0.044)	(0.024)	(0.043)	(0.043)	(0.018)	(0.030)
Mean	*0.748*	*0.745*	*0.730*	*0.810*	*0.772*	*0.776*
Effect as % of mean	-9.7%	-7.0%	-10.8%	7.2%	6.7%	2.9%
Observations	977	4,208	909	577	2,075	818
# individuals	293	1,234	278	181	676	258

Notes: This table shows the average impacts of parental health shock on children's employment by health condition based on Eq. (5). Columns (1)-(3) present the impact on daughters' employment in family-based care countries. Columns (4)-(6) present the impact on sons' employment in market-based care countries. Standard errors are clustered at the parental household level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

B Figures

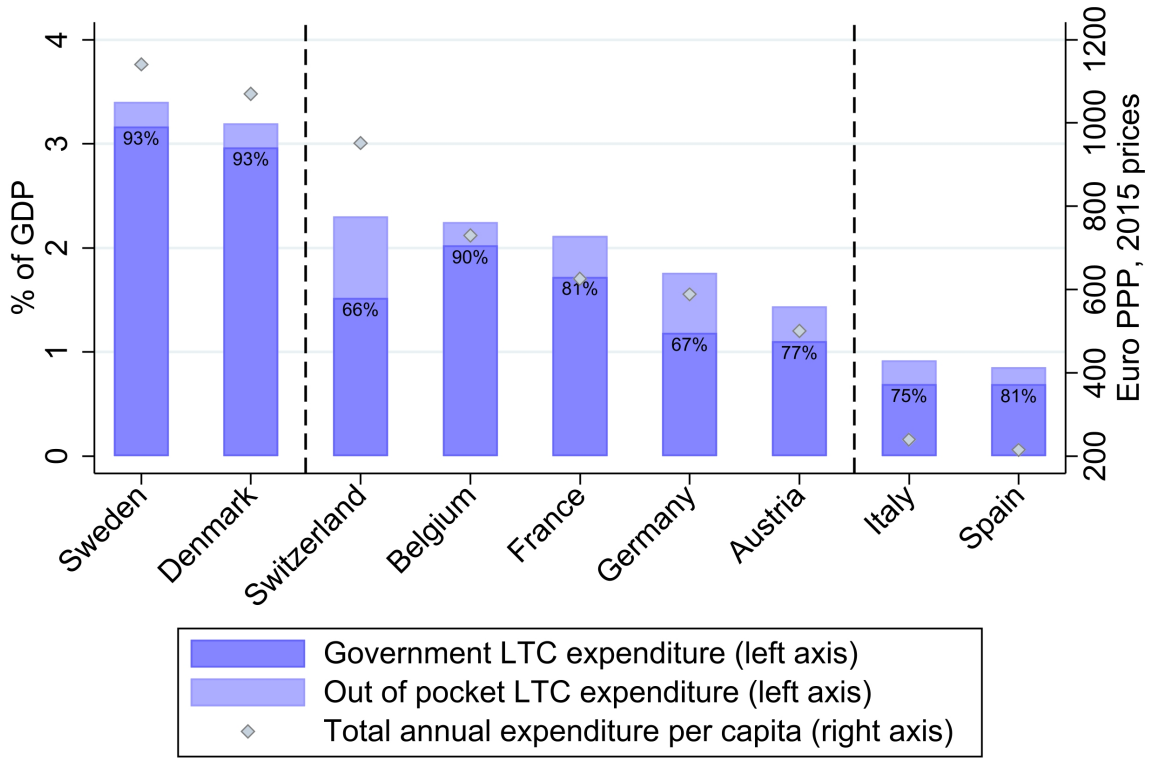


Figure B.1: Long Term Care (LTC) expenditure by country, 2004-2019.

Notes: This figure displays the average LTC expenditure for each country during the years 2004-2019. The left vertical axis shows government and out-of-pocket LTC expenditure as a percentage of GDP, while the right vertical axis shows the total annual LTC expenditure per capita in Purchasing Power Parities (PPP) at Euro 2015 prices. *Source:* Authors' calculations, OECD Health expenditure and financing data, 2004-2019.

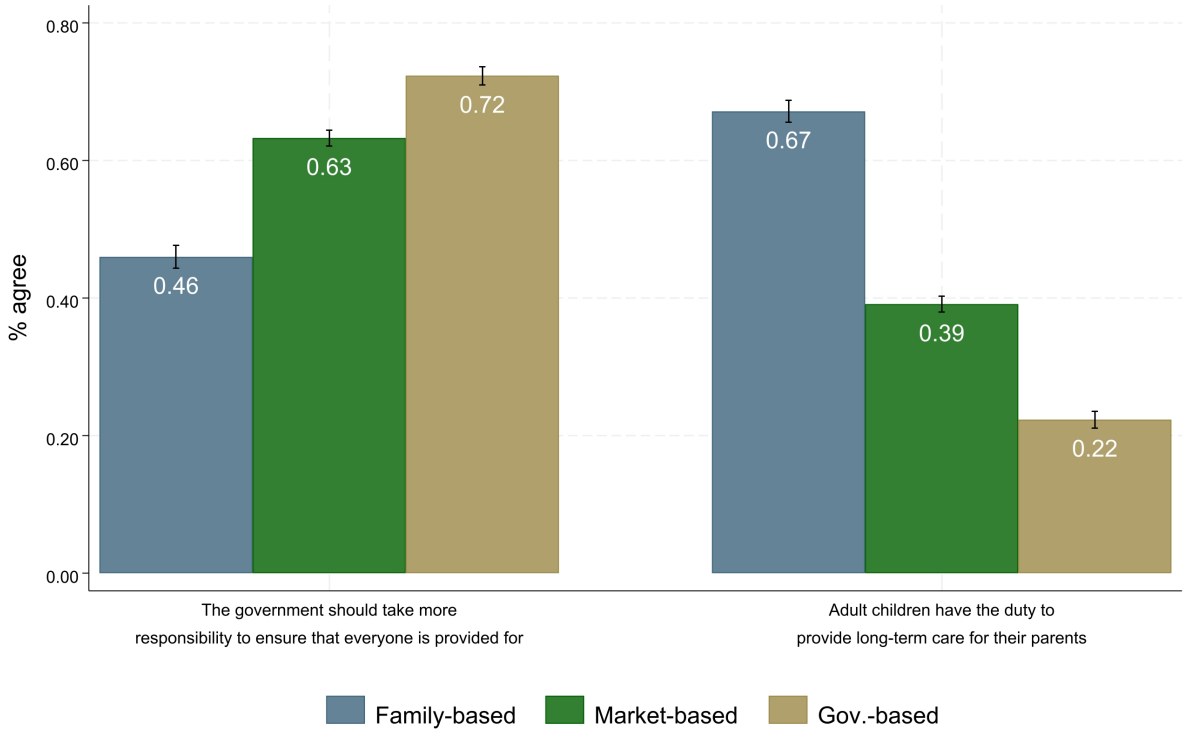


Figure B.2: Views on caregiving roles by type of caregiving system.

Notes: The figure is based on data from the joint World Values Survey and European Values Study Wave 7 (2017-2022) available at https://search.gesis.org/research_data. Each set of bars shows the percentage of respondents in each type of caregiving system who answered either "agree" or "agree strongly" to the question indicated at the bottom.

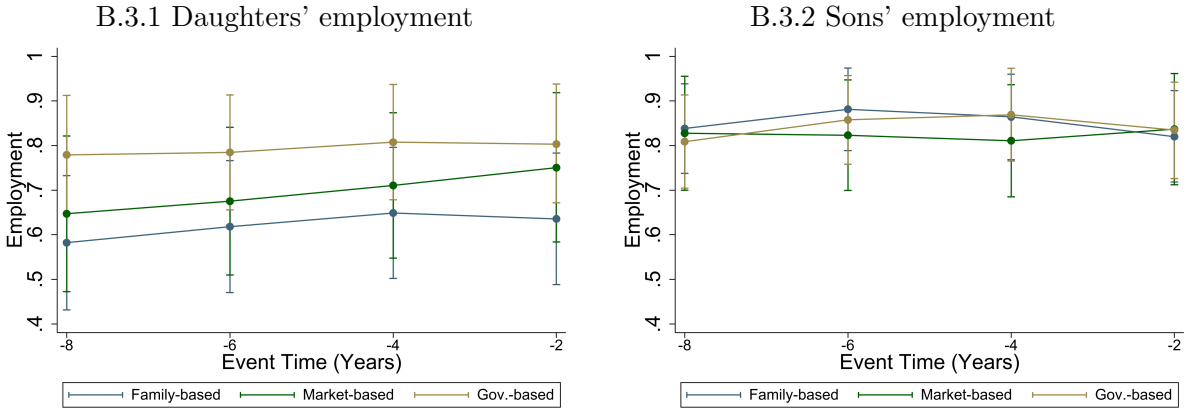
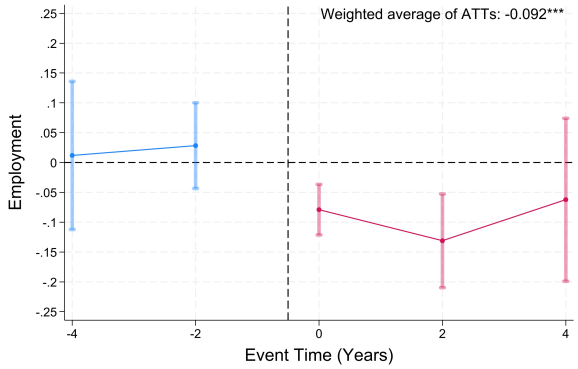


Figure B.3: Employment prior to parental health shock.

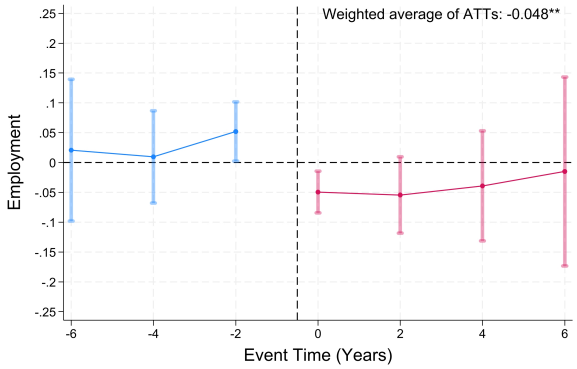
Notes: These figures examine the trend in child employment before their parents' health shock by type of caregiving system. Subfigure B.3.1 pertains to daughters' employment, while subfigure B.3.2 pertains to sons' employment. All estimates control for country, calendar year, and year of birth fixed effects. Including 95 percent confidence intervals, with standard errors clustered at the parental household level.

Panel A - Daughters' employment in family-based care countries

B.4.1 Comparison group: not-yet-treated

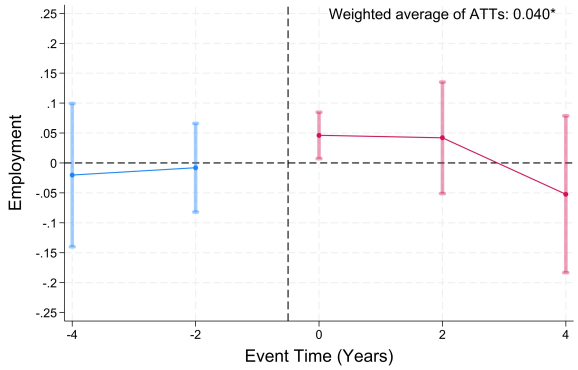


B.4.2 Comparison group: never-treated



Panel B - Sons' employment in market-based care countries

B.4.3 Comparison group: not-yet-treated



B.4.4 Comparison group: never-treated

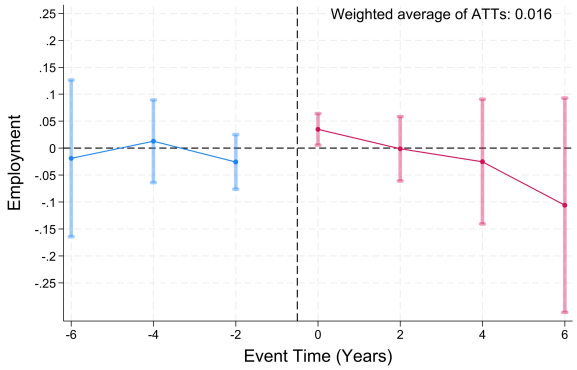


Figure B.4: Parental health shock impacts on children's employment.

Notes: This figure shows the impacts of parental health shock on children's employment by type of caregiving system. Panel A presents the impacts on daughters' employment in family-based care countries, and panel B on sons' employment in market-based care countries. Each subfigure shows the event-study coefficients estimated of the parent health shock on children's employment using the method proposed by Callaway and Sant'Anna (2021) (including 95 percent confidence intervals). The weighted average of the ATTs is presented in the upper right corner of each subfigure. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

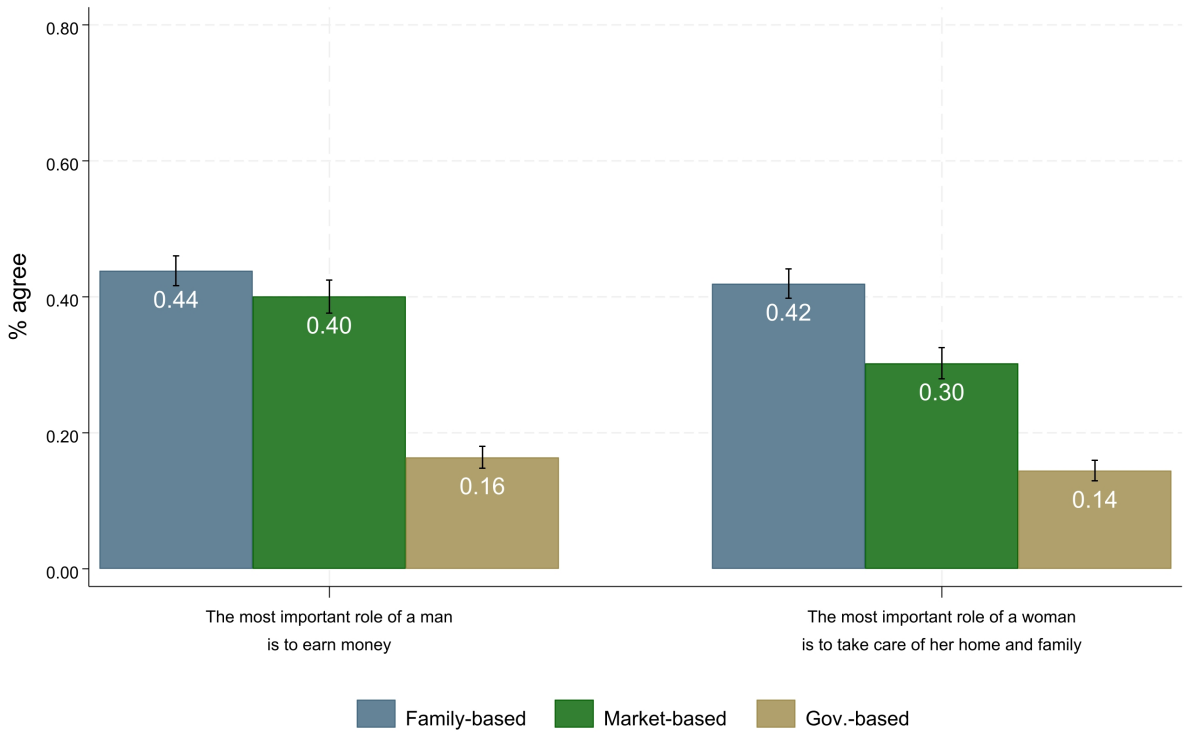
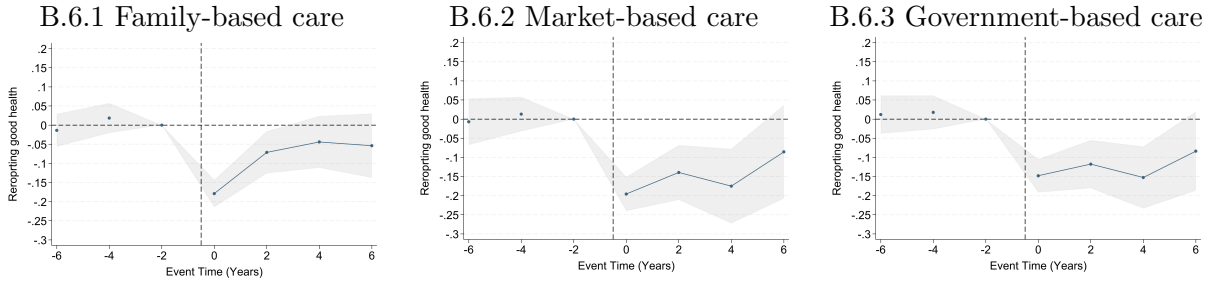


Figure B.5: Views on gender roles by type of caregiving system.

Notes: The figure is based on data from Eurobarometer "Perception of Security, and Gender Equality" questionnaire (2017) available at https://search.gesis.org/research_data. Each set of bars shows the percentage of respondents in each type of caregiving system who answered either "agree" or "agree strongly" to the question indicated at the bottom.

Panel A - Reporting good health



Panel B - Taking medications

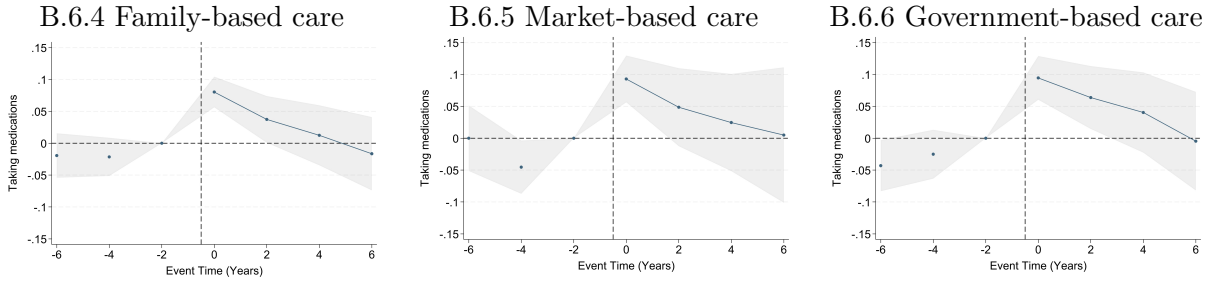


Figure B.6: Parental health shock impacts on parents' health indicators.

Notes: This figure shows the impacts of parental health shock on parents' health indicators by type of caregiving system. Panel A presents the impacts on the probability of reporting good health, and panel B on the probability of taking medications at least once a week. Each subfigure shows the event-study coefficients estimated from Eq. (1) of the parental health shock on their health indicators. Including 90 percent confidence intervals, standard errors are clustered at the individual level.

C Variable definition

Variable	Description
Help from children	Equals 1 if the parent indicated a child had provided them with help or personal care in the past 12 months, 0 otherwise.
Professional or paid help	Equals 1 if the parent indicated he had received professional or paid help with domestic tasks in the last 12 months, 0 otherwise.
Health expenditure	Parents' out-of-pocket expenditure in the last twelve months for inpatient care, nursing home, outpatient care and medications. In euro, in terms of Germany's prices in 2015.
Disability benefits	Equals 1 is a parent reported they received any disability or sickness benefit from a public source in the past 12 months, 0 otherwise.
Age at the time of shock	The age of the parent/child in years at the year the parent indicated they were diagnosed with a health condition.
More than high school	Equals 1 if the parent/child has at least a high school diploma, 0 otherwise.
Number of children	The number of children the parent/child has.
Employment	Equals 1 if the parent/child is full-time, part-time, self-employed, or working for their family business and 0 otherwise.
Event time	The number of years relative to the parental health shock.
Reporting good health	Equals 1 if the parent reports good or excellent health, 0 otherwise.
Taking medications	Equals 1 if the parent indicated they currently take any medication at least once a week for a health condition, 0 otherwise.
Child's distance from parents	Equals 1 if the parent indicated their child resides less than 100 KM away, 0 otherwise.
Married	Equals 1 if the parent/child is married, living together with a spouse or in a registered partnership, 0 otherwise.
Voluntary insurance	Equals 1 if the parent has any voluntary, supplementary or private health insurance, 0 otherwise.