LUND UNIVERSITY
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Master in Economic Development and Growth

Who cares for mom and dad?

Evidence on informal caregiving and labour supply of mature working-age population in contemporary Europe

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Abstract: Population ageing affects most European countries, placing increasing pressure on publicly funded Long Term Care (LTC) systems. Informal care is often seen as a low-cost alternative to formal care services, yet it may induce unwelcome reductions in labour supply. This study presents evidence on the relationship of informal care provision, employment probability, and work hours of mature caregivers in Europe. Data from the Survey of Health, Retirement, and Ageing in Europe (SHARE) for the period 2004-2015 is analysed through Ordinary Least Squares and Two-Stage Least Squares estimation. Findings suggest that informal care provision is associated with a drop in the likelihood of being in paid employment for women in a number of Central and Southern European countries. A positive relationship is found for women in Eastern Europe and certain Northern European countries, as well as Switzerland. For some employed caregivers, a positive association with caregiving and work hours is found. The results are partly in line with previous literature, and differences can be in part attributed to differences in methodology.

Key words: Labour supply, female labour supply, informal care, ageing populations, Europe, SHARE, endogeneity

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1 Introduction

Population ageing affects today most countries around the world. Especially across developed countries, longer life expectancies and declining fertility rates mean that elderly people constitute an increasing share of the population. In Europe, the highest increases are projected for Spain, Portugal, and Greece, where nearly 40% of the population will be over the age of 65 by 2050. The population over the age of 80 is projected to grow even more dramatically, and is projected to more than double between 2015 and 2050 in Italy, Spain, Portugal, and Germany (OECD, 2017). These increases place increasing pressure on Long Term Care (LTC) systems, as the demand for care and related expenditures are expected to rise. On the other hand, the labour force is expected to decline, which will lead to decreases in revenues from payroll taxes. This makes it more difficult for countries to maintain or expand government spending on health care systems, placing pressure on families to provide informal care to elderly relatives who continue to live in their own homes (OECD, 2017). Informal care is often seen as a low-cost alternative to formal care services, and currently adult children around Europe provide varying degrees of help to their elderly parents in a growing number of families. While informal care is by definition unpaid and therefore does not incur direct costs for the care recipient, it does incur indirect costs for care providers, who may experience negative effects in terms of health, family dynamics, or work (Bauer & Sousa-Poza, 2015). Relying on informal care provision instead of formal care may therefore be considerably more expensive from a societal point of view than thought. If the total costs of informal care provision are underestimated, policymakers may promote informal care more than what is optimal. Furthermore, shrinking family sizes and increased requirements for labour force participation for especially women, who constitute the most important group of informal care providers, mean the supply of informal care may be diminishing. In sum, policymakers face two potentially conflicting objectives. On the one hand, increased labour force participation is needed to replace the retiring workforce and to cover the costs of expanding health care services. On the other hand, families are expected to provide informal care to elderly relatives as a low-cost substitute for formal LTC services. The trade-off concerns especially mature women, who are the principal care providers for the elderly.

Much of the existing literature on informal care and work is focused on the United States and the United Kingdom. Results generally indicate a negative association between unpaid care and labour market outcomes (Lilly, Laporte & Coyte, 2007; Bauer & Sousa-Poza, 2015). Literature on Europe also points to the direction of a negative relationship between providing care and working. Differences in the effects have been found between genders as well as countries (Spiess & Schneider, 2003; Bolin, Lindgren & Lundborg, 2008; Kotsadam, 2011; Ciani, 2012; Crespo & Mira, 2014; Schmitz & Westphal, 2017; Kolodziej, Reichert & Schmitz, 2018). However, the direction of causality or the magnitudes of the effects have not

been established. The estimated differences are sensitive to methodological choices, which calls for practicing care when making comparisons between studies. Overall, international comparisons are lacking in numbers, and evidence for Eastern European countries is scarce altogether (Genet et al., 2011).

Adding to the literature, I examine the relationship of informal care provision and labour market outcomes of mature caregivers in Europe who help an elderly parent. Elderly parents are the most common recipients of informal care for the mature working population, as opposed to for example spouses (Bolin et al., 2008). More specifically, I study the effect of regularly helping a parent who lives in a different household on the employment status and weekly work hours of the care provider. The question has been addressed before, but new data have been released and offer a chance for expanding on previous contributions. As an important aspect of my study, I look for evidence on whether caregiving and work status are jointly determined. This is made possible by expansion of available data. Finally, while many previous studies place emphasis on the amount of informal care provided, I examine the effects of caregiving at the extensive margin. In other words, I study caregiving effects at the lowest threshold of care provision, as non-intensive care constitutes a significant portion of the total amount of informal care provided in Europe. I highlight the role of gender in my theoretical reasoning as well as the empirical analysis, and look for diverging patterns across European regions. While countries are individually responsible for their LTC regimes, there are important possibilities for collaboration at the level of the European Union and its research and policy organs. By looking at the region as a whole, I have the chance to study the impact of policy context in mediating the labour market outcomes of caregivers.

I analyse data collected between 2004 and 2015 by the Survey of Health, Retirement, and Ageing in Europe (SHARE), using both Ordinary Least Squares (OLS) and Two-Stage Least Squares (TSLS) estimation techniques. The latter approach employs instrumental variables in order to account for endogeneity. I find evidence of endogeneity for women in Central and Southern European countries, as well as men in a group consisting of Northern European countries and Switzerland. Main regression findings indicate that informal care provision is associated with a drop in the likelihood of being in paid employment for women in a number of Central and Southern European countries. However, a positive relationship is found for Eastern European women and women in the group of Northern European countries and Switzerland. In addition, employed care providers are found to work longer hours in the case of men in the group of Northern European countries and women in Eastern Europe. I conclude that for women in Central and especially Southern Europe, the results are in line with previous research and contribute to the debate on whether caregiving and employment status are jointly determined by providing evidence on the relationship. In addition, the effect of care provision on work was found to be opposite for two regions that both have a limited availability of formal LTC services, namely Eastern and Southern Europe. Based on this, I argue there are other factors in addition to availability of formal care at play that mediate the relationship of care provision and work. The results are sensitive to methodological choices, and arguably a part of the differences to previous literature can be attributed to my relatively broad definition of informal care provision.

The study is organised as follows. Section 2 reviews previous empirical evidence on informal care provision and labour supply effects and explains how this study contributes to the literature. Section 3 presents theoretical viewpoints on how care provision is determined for individuals in a family context, taking into account gender dynamics and differences in institutions between countries. Section 4 provides a discussion of the SHARE data and outlines the empirical methodology, and section 5 presents results from regression analyses as well as a discussion of the main findings. Section 6 concludes and reflects on the limitations of the study.

2 Literature review

2.1 Informal care and the endogeneity question

Before outlining previous literature, it is useful to define the concept of informal care that I refer to throughout the study. In general, informal care can be defined through for example the common characteristics of care providers. Bauer and Sousa-Poza (2015) suggest a definition whereby a typical informal caregiver has a close relationship to the care receiver, no professional training, no working contract, no equivalent pay, a wide range of caregiving duties, no officially defined working hours, and no entitlement to social rights. The Organisation for Economic Co-operation and Development (OECD) (2017) defines informal carers as "people who provide help to older family members, friends, and people in their social network, living inside or outside of their household, who require help with everyday tasks". I follow these definitions, focusing on care from adult children to their elderly parent(s) who live(s) in a different household. This group is especially relevant from a policy perspective; the amount of people who care for other relatives, such as spouses or a parent living within the same household, has previously been found to be negligible in the context of Europe (Bolin et al., 2008).

Determining the effect of caregiving on labour market outcomes is not straightforward because of endogeneity. More specifically, people may choose to become caregivers partly based on the size of their opportunity cost that consists of forgone earnings from employment. Part of the existing literature attempts to account for endogeneity, whereas other studies fail to find evidence for it or lack the appropriate data structure to account for it. The existing estimates of the effects of interest have to be examined carefully with regard to the methodology used. If caregiving is exogenous, estimates that do not account for endogeneity can be interpreted as the causal effect of caregiving. On the other hand, if caregiving is endogenous, the causal effect has to be estimated using experimental or quasi-experimental methods that reduce the bias from reverse causality. Recent developments in availability of data on unpaid care work, such as the creation of the SHARE database, have improved the possibilities to conduct quantitative analyses on informal caregivers that address potential endogeneity issues.

2.2 Studies on SHARE data

Factors that influence the organisation of care duties at home, such as availability of formal care, often reflect differences in norms, traditions, and preferences that vary across countries. Therefore, the estimates of caregiving effects on labour market outcomes have to be viewed through a country- or region-specific lens, leading me to focus my attention to studies that have been conducted in the European region. In order to tie my analysis closely to the current discussion on caregiving and employment, I take as a starting point the studies that have previously presented analyses of SHARE data. I focus on reviewing the most cited literature that relates to the discussion of caregiving and employment or hours worked.

At least three studies have leveraged SHARE data for studying informal care provision and labour market outcomes. An early SHARE study closely related to mine from Bolin, Lindgren, and Lundborg (2008) draws on the first data release wave, for which data collection took place in 2004 and 2005. The results suggest that when the decision to provide care is treated as exogenous, it is negatively associated with employment status and hours worked for both men and women. When separating countries into Nordic, Central, and Southern European regions, some differences are found in the caregiving effect. In order to take into account potential endogeneity, the authors employ an instrumental variables approach. However, they find no evidence of endogeneity, which leads them to conclude OLS estimates should be preferred to instrumental variables estimates. Their point estimate of the negative effect of caregiving on employment is 3.7 percentage points, with the estimated effect being a negative 2.6% for weekly hours worked. A second study from Crespo and Mira (2014) draws on the first two waves of SHARE, providing evidence of changes in employment status among women between the ages of 50 and 60 who provide daily unpaid care to their elderly parents. Through instrumental variables estimation, they conclude that the loss of employment from caregiving is negligible in Northern and Central Europe, but not in Southern Europe. They estimate that 20% of women in Southern countries become daily caregivers and that between 45 and 65% of these women consequently drop out of paid employment. A third study by Kolodziej, Reichert, and Schmitz (2018) that leverages SHARE data from waves 1 through 5, takes a slightly different approach to the question. While Bolin et al. (2008) and Crespo and Mira (2014) take the caregiver to be the focal person of the analysis, Kolodziej and co-authors set the focus on the care receiver instead. They use information on respondents' adult children and their employment outcomes; this way they may analyse outcomes for caregivers who are under the age of 50 and therefore not included in the target population of SHARE. Through an instrumental variables approach, the authors find evidence suggesting that caregiving has a negative effect on employment probability. They estimate persons who take on caregiving duties to become, on average, 14 percentage points less likely to be in paid employment regardless of gender. When running the analyses by country groups, the authors trace the effects to Southern and Eastern European countries.

2.3 Other pan-European and country-specific studies

A number of studies draw on European data other than SHARE, presenting somewhat mixed results. The principal data source available to researchers before SHARE was the European Community Household Panel (ECHP), which provides information on for example health, social networks, and the socio-economic background of respondents in 13 European countries[1] for the period 1994-2001. Ciani (2012) draws on these data and employs a fixed effects model as well as an instrumental variables method to account for endogeneity. Results indicate that informal care provision is associated with only small negative effects on employment, and that the effects are larger in Southern Europe compared to other European regions. At least three other studies conduct analyses on the same data, focusing on labour market effects for women. Spiess and Schneider (2003), whose data cover the 13 countries of the ECHP in years 1994 and 1996, take advantage of having access to information about individuals' caregiving and work status in two distinct periods. They look for changes in respondents' caregiving and work patterns from the first to the second year of observation, and find evidence suggesting that starting and increasing the amount of unpaid care is associated with a decrease in work hours. The effects are found to be larger for Southern European countries and Ireland compared to Central European and Nordic countries. Viitanen (2010) leverages the ECHP survey to study the relationship of caregiving and women's labour force participation, using panel data techniques to account for unobserved caregiver characteristics. Results indicate a negative association between caregiving and labour force participation in Germany, but no evidence is found for such an association in remaining countries. A third contribution that draws on the ECHP survey and where the method is aimed at accounting for endogeneity shows caregiving to be related to lower employment probability in Southern Europe, and to a lesser extent in Central and Northern Europe (Kotsadam, 2011).

Analyses relying on national data are often in line with pan-European studies. For example, a study that relies on data from the German Socio-Economic Panel between 2001 and 2013 suggests that for women, caregiving is related to reduced work hours (Schmitz & Westphal, 2017). The authors find a negative effect of 4 percentage points on employment probability that persisted over time and was mainly driven by switches to part-time work. Kotsadam (2012), who uses an instrumental variables approach, shows that in the case of Norway, only intense caregiving is associated with a reduced probability to work. This is in line with pan-European analyses, which generally find small or no caregiving effects for Nordic countries.

In sum, while no consensus has been reached on the magnitude of the effect of care provision on employment status and hours worked, evidence gathered at the European level suggests that the effects of caregiving on work are overall negative. The SHARE data have so far been used to derive inconclusive evidence on the relationships of interest, both in terms of gender and country strata, as well as the potential endogeneity of caregiving and work. As for gender differences, caregiving appears to affect employment probability of both men and women, although the evidence suggest the effect is only present in countries of Southern and possibly Eastern Europe. Studies conducted on data from the ECHP show a negative association

between caregiving and employment probability especially in Southern Europe. Evidence for work hours is scarcer than evidence on employment status, but existing analyses suggest the effect to be negative. The preferred method has been to account for endogeneity of caregiving and work whenever the data have allowed for it.

Importantly, some country-level studies provide insights on how the intensity of caregiving mediates its effect on work outcomes. For example, in the case of Spain, negative effects have been traced to intensive caregivers (Casado-Marín et al., 2011)[2]. Several studies focus on caregiving and labour supply effects in the United Kingdom, a country that is not represented in the SHARE data. Intensive caregiving[3] especially is suggested to have a negative effect on the probability of being employed for both men and women (Arber & Ginn, 1995; Carmichael & Charles, 2003a). Several studies indicate that the amount of time spent providing unpaid care is negatively associated with time spent in paid employment also for those who do not drop out completely, and that the effect is magnified as the time-intensity of care duties increases (Carmichael & Charles, 1998; Carmichael et al., 2008; King & Pickard, 2013). As an interesting aspect of British studies, there is some evidence suggesting that non-intensive caregiving is, in fact, associated with an increased probability to work (Carmichael & Charles, 1998; Charmichael & Charles, 2003b). In other words, evidence indicates that people who perform low levels of care work are more likely to be employed than their non-caregiver counterparts are, although this idea has been tested only on British data. However, the effect seems to become reversed as care duties take up more time, with both employment probability and weekly work hours of caregivers affected in a negative way. The intensity of caregiving thus appears to be an important factor in mediating its relationship with labour market outcomes, and I return to the topic in section 5.3.3.

2.4 Reviews of previous literature on caregiving and work

Reviews of previous empirical work highlight the most commonly found associations between unpaid care and work, and reveal gaps in existing knowledge. First, Lilly, Laporte, and Coyte (2007) review 34 of studies published between 1986 and 2006, the vast majority of which are based on data from the United States and United Kingdom. They draw three conclusions; first, caregivers are in general as likely to be in paid employment as non-caregivers are. Second, caregivers are more likely to work fewer hours, especially if care duties are heavy, and third, caregiving poses a threat to labour market participation only in cases where care duties are heavy. A more recent review by Bauer and Sousa-Poza (2015) takes into account additional 18 studies from Australia, the United States, Canada, United Kingdom, Norway, and the Netherlands. The main conclusion regarding employment and hours worked is that while caregiving is associated with lower levels of employment, the effects are small because the affected labour force is small. A third review that focuses on studies conducted in Europe concludes with the following statements: while there are

differences in the organisation of formal and informal care between countries, international comparisons have been conducted only to a limited extent, and Eastern European countries remain understudied (Genet et al., 2011). Finally, Moussa (2018) reviews studies published between 2006 and 2016 on the effects of caregiving in their respective policy contexts. The evidence generally points towards a reduction in working hours among mid-life, female informal care providers. The author suggests that studies finding only modest effects on employment status are either lacking in their method of controlling for caregiving intensity, or apply only to subpopulations that are less likely to be affected by policies. In sum, despite numerous studies having examined the relationship of caregiving and labour supply, there is no consensus on whether an economically relevant effect exists, or what the magnitude of the effect is. Much of the existing work is focused on non-European countries, and results on Eastern Europe are especially scarce due to limitations in data coverage.

2.5 Gaps in existing knowledge

Based on findings from pan-European studies and country-specific studies on Europe, as well as the remarks from researchers who reviewed a large number of previously published studies, four key gaps in current knowledge emerge. First, the causality of the relationship between informal care provision and employment status has not been established. In other words, there is no consensus about whether working age people who take on caregiving duties are more likely to drop out of paid employment or not, and the extent to which people self-select into caregiving based on their previous work status has not been determined. Some studies treat caregiving as exogenous to previous work status (Arber & Ginn, 1995; Carmichael & Charles, 1998; Carmichael & Charles, 2003b; Carmichael et al., 2008; Bolin et al., 2008; Casado-Marín et al., 2011; King & Pickard, 2013). Others conclude that people who are less attached to the labour market are more likely to become caregivers (Crespo & Mira, 2014; Kolodziej et al., 2018; Carmichael & Charles, 2003a; Spiess & Schneider, 2003; Viitanen, 2010; Kotsadam, 2011; Ciani, 2012; Kotsadam, 2012; Schmitz & Westphal, 2017). The same applies for hours worked, for which evidence is scarcer than for employment status. Second, the potential gender and country differences in the European context have not been defined to the extent that clear differences in the effects can be said to exist. Evidence varies when considering employment and hours worked, with the majority of the evidence pointing towards the effects being more pronounced for women than they are for men. Part of the existing literature has focused on the labour supply effects for women (Spiess & Schneider, 2003; Viitanen, 2010; Casado-Marín et al., 2011; Kotsadam, 2011). However, men form an important group of informal care providers in Europe, and will potentially become more important in the future as women's participation in paid work increases. Third, the question of regional differences has not been settled, apart from the relatively strong evidence of greater reductions in labour supply among caregivers in Southern European countries compared to other European regions. As pointed out before, studies regarding Eastern European caregivers are scarce and extensions of previous studies have been called for. Fourth, there is a lack of

knowledge about how the intensity of caregiving mediates its relationship with paid work at the pan-European level.

Taking the study from Bolin and co-authors (2008) as a starting point, I draw on a research question that focuses on the provision of informal care in a parent-child context and the effects of care provision on the labour market outcomes of the caregiver. I contribute to the existing body of literature in four distinct ways, addressing the knowledge gaps described above. First, as the SHARE data have been expanded over time to cover a larger population as well as a group of Eastern European countries, I provide an extension of the study by Bolin and co-authors (2008). This may produce more accurate estimates of the causal relationships of interest. Because the debate on whether caregiving is exogenous to labour market outcomes or not has not been settled, I explicitly test for endogeneity in the data. If the estimates are to be used for developing better policy measures that counteract the potential negative employment effects for informal caregivers, it is essential that a consensus be achieved on the endogeneity question, a topic to which I return in section 6. Second, I run analyses on subsamples of women and men, providing additional evidence on gender differences in the effects of caregiving. Third, I follow the existing literature and separate the data into subsamples of countries to highlight regional differences. This also enables providing estimates for the group of Eastern European countries represented in SHARE. As a final contribution, while the previous studies conducted on SHARE data focus on estimating effects of intensive care, defined as care taking place daily or almost daily, my analysis involves also less frequent caregiving. A significant portion of the European informal caregivers falls into this category. Reasons to why less frequent care may be associated with changes in employment status or hours worked include increased worry and stress for a parent who is becoming more dependent, or pressures experienced due to time spent making arrangements for care arrangements, or travelling back and forth to the household of the dependent parent. Therefore, it is important to gain an understanding of the effects of caregiving for this group.

3 Theoretical framework

3.1 Theories of time allocation and family bargaining

I describe caregiving first through a microeconomic time allocation model, complementing it with a family bargaining model as well as a more intuitive family framework. Previous studies focusing on the labour supply effects of informal caregiving often refer to Becker's (1965) theory of time allocation, whereby people allocate their scarce time to different activities, such as paid work, caregiving, and leisure. The process that underlies the relationships of the key variables in this individual-centric model has been outlined in, for example, Spiess and Schneider (2003). According to this framework, decisions on employment status, work hours, and informal care provision are interrelated and compete for the caregiver's time. Caregivers derive different amounts of utility from different activities; utility from paid work may emerge in the form of earnings or self-esteem, and caregiving may generate "emotional returns". The model then predicts caregivers to allocate their time between these activities so that an additional hour of time spent in any of the activities generates the same amount of utility. Factors that influence the marginal value of caregiving include for example the health status of the care recipient, hours of care provided by third parties, and the prices and availability of market substitutes for informal care. In a similar manner, changes in the marginal value of work influence the relative attractiveness of allocating time to informal care activities and leisure. The value of an hour spent in paid employment is proxied by the wage rate, implying that a higher wage rate increases the opportunity cost of paid work. Hence, it raises the shadow price of time spent in other activities, such as informal care. It can be argued that the strength of the trade-off between work and caregiving evolves over time and depends on individuals' work and caregiving histories, because learning-by-doing and specialisation may increase the productivity of either. For example, a person who has over time developed a strong skill set in paid work will be more productive in that area, and will likely have a higher wage rate and shadow price for other activities than a person who has previously spent relatively more time in caregiving activities.

While the time allocation model describes the decision-making process from the perspective of an individual, in reality decisions are taken in a family context. The process can then be understood for example through a game-theoretic model that explicitly accommodates the possibility of multiple caregivers, an alternative that has been explored by for example Byrne and co-authors (2009). In this narrative, each family member participates in the decision-making process, so that a Nash equilibrium is established in which utility is maximised for the individual, given a budget constraint and the behaviour of other family members. Family

members can contribute financially to formal care, or allocate time into informal care work. The choice for an individual is then between paid work, informal care, and leisure, and utility is derived from consumption, leisure, and the health quality of the care recipient(s), of which the latter depends on the amount of formal and informal care provided. The allocation of care duties will then vary across families based on three factors. First, if some family members experience caregiving as burdensome, they have an incentive to freeride on one another in care provision. Second, the quality of care provided may vary across family members. Third, choices about care provision will vary according to differences in the opportunity costs of forgone earnings among family members.

Heitmueller (2007) gives an intuitive description of the decision-making process that takes place within families using the concept of opportunity cost. The reasoning outlines to whom informal care duties are allocated when there are multiple family members who are potential caregivers, the amount of care each member ends up providing, as well as the consequent decision regarding labour force participation of the carer(s). First, the potential caregiver has to either accept or decline the caregiving position as the need emerges. The decision to provide care is influenced by the shadow price of care, which in turn is determined by, for example, the individual's current work status, his/her (potential) wage rate, the price and availability of other forms of care, and the corresponding characteristics of other potential caregivers in the family, such as spouse or siblings. To give an example, persons who work full-time, earn high wages, and have other potential caregivers in the household or within a reasonable radius of the care recipient, may decline caregiving duties in favour of paid employment. They may even increase their work hours in order to compensate for the costs of purchasing care services, or opt to forgo an inheritance to allow the parent to pay for such services. Overall, working persons who decide to take on care duties face the decision of whether to remain in paid employment, and whether to adjust their working hours to accommodate caregiving duties or not. On the other hand, persons who have a low attachment to the labour market due to low earnings potential, or who are un- or underemployed, may be more likely to accept care duties than their counterparts with a high opportunity cost of giving up paid work. Given these theoretical considerations, I expect informal care and paid work to be substitutes. This is also shown by empirical evidence (Bonsang, 2009; van Houtven & Norton, 2004; Pickard, 2012). Then, as a person begins to allocate time into caregiving activities, they will allocate less time into working. They may also drop out of paid employment completely if the care duties are sufficiently demanding. On the other hand, because I take formal and informal care to also be substitutes, a dynamic may emerge whereby working individuals whose parent has a need for care increase their work hours in order to pay for care services. In the empirical estimations, I control for the family context of individual caregivers, as theory suggests it plays an important role in the decisions of individuals and causes variation between families.

While the time allocation theory and related family-based explanations give a clear reasoning for modelling the causal relationships of interest, they may oversimplify reality. The assumptions behind these models are similar to any microeconomic theory; they assume perfect market information, and rational, unrestricted, and voluntary choice. Spiess and

Schneider (2003) argue that there are several reasons to why these assumptions can be contested in the case of informal care. Choices may be restricted and partly involuntary, and the assumption of rational decision-making may fail due to lack of information or emotional impact from the shock of a family member becoming dependent on care. This may lead to rushed and less-than-optimal decisions about care and work. The second reason to why the assumptions may be unrealistic are the likely limitations to what combinations of care and work are possible for a caregiver to execute. Such limitations can emerge, for example, when carers would prefer purchasing formal care services but are not able to because services are not available to a sufficient extent, are out of reach for financial reasons, or are not the preferred care option of the family. The lack of formal care services may be resolved if there are other potential caregivers in the social network of the care recipient. However, when alternatives to informal care are limited and the the potential caregiver is emotionally committed to the dependent person, the choice to provide care is not free. Arber and Ginn (1995, cited in Spiess & Schneider, 2003) argue that caregiving is more likely to influence employment participation when the caregivers choice set is very restricted. This has implications for policy intervention, as the root cause of reduced labour supply is then the lack of viable care options. I return to this topic in section 6.

3.2 Institutions and access to formal care in models of caregiving and work

The principal source of between-country variation in informal care provision and its labour supply effects is perhaps rooted in differences in institutional settings regarding the price and availability of formal care services. According to the European Social Network (2008), there are stark differences in the availability of formal care across European countries, with availability being much lower in Southern and Eastern European countries compared to Nordic and Central European countries. In my empirical specifications, I follow the previous literature and separate the sample into country groups according to the availability and coverage of formal LTC schemes in order to reveal these differences.

LTC can here be understood as ”care for people needing support in many facets of living over a prolonged period of time … [t]ypically, this refers to help with so-called activities of daily living, such as bathing, dressing, and getting in and out of bed, which are often performed by family, friends and lower-skilled caregivers or nurses” (Francesca et al., 2011, p. 39). This type of work can typically be performed by either carers who are not trained in any medical profession, such as family members, or by carers from outside the family who are receive a financial compensation for their efforts. Differences between countries can then be understood through the time allocation model, where care provided informally by family members and care purchased at a care labour market are viewed as substitutes. In countries with well-developed formal LTC systems and universal health care coverage, relying in formal care is relatively more attractive than in countries with relatively more expensive

formal care services. Families are incentiviced to take advantage of care schemes because their price is relatively lower compared to the value of lost earnings from paid work. Different benefit schemes have been introduced across Europe, shifting incentives. Generally, the elderly prefer continuing to live at home as opposed to being institutionalised, which has resulted in many countries promoting different forms of home care. Some countries offer benefits in cash to promote informal care, such as personal budgets for care assistants, payments to the dependent person that can be spent as they prefer, or payments directly to informal carers (European Social Network, 2008). The reliance of the elderly population on informal care also depends on how well the publicly funded care services are aligned with corresponding needs of the population. If the schemes are insufficient to meet demand, people will rely more on either private care services or informal care within the family. Damiani and colleagues (2011) identify a high alignment between old age related expenditure and the perceived needs of the elderly for Nordic countries and a number of countries in the Central European region, namely the Netherlands, Belgium, Luxembourg, Austria, and Germany. A lower alignment was found for Southern and Eastern European countries. This suggests that people in the latter two regions likely have to rely more on informal care than people in the two formerly mentioned country groups. In sum, I expect there to be differences in the effect of caregiving on labour supply between countries because there are differences in the availability of formal care that substitutes for informal care.

A second channel that may produce differences between countries is that of informal institutions. Intangible institutional arrangements, such as social norms and traditions, influence the expectations of how informal care work is assigned within households as well as whether formal or informal care is preferred (OECD, 2017). Intergenerational care is more prevalent in countries with more familialistic cultures (Haberkern & Szydlik, 2010; Kalmijn & Saraceno, 2008). Suanet and co-authors (2012) describe the relationship of cultural context and preferences over care, as well as legal obligations to care for relatives that prevail in some countries. The authors argue that cultural norms and preferences are likely to guide the choices of families, and that a stronger preference towards informal care can be expected for more family-oriented countries. While many Northern, Central, and Eastern European countries are associated with weak family ties, strong ties can be found in Southern countries (Alesina & Giuliano, 2010). Therefore, I expect to find a distinction especially between the Southern European region and the rest of the sampled countries. In some countries, namely Spain, Italy, Germany, Austria, France, and Belgium, the social norm over who should provide care is enforced by law (Suanet et al., 2012). These laws primarily dictate an obligation to finance the use of care services that the dependent person cannot afford themselves, which may shift the incentive structure and cause families to favour informal care over formal care services.

3.3 Gender perspectives on caregiving and labour supply

While gender has been an important factor in previous analyses of caregiving and work, I place more theoretical emphasis on it than many previous studies. I draw on recent contributions that attempt to explain why significant gender differences are found in empirical studies in both selection into informal caregiving and its labour market consequences. Women may be more likely than men to substitute paid and unpaid work for a number of reasons, some of which are related to differences in the shadow prices of care, such as (potential) wage rates or the accumulation of previous care or work experience. Other important factors are less tangible, and may be better described by delving deeper into the concept of utility that features in microeconomic models, or examining the potential failures of the assumptions that underlie such models.

Intangible factors that fall under the concept of utility may include, for example, social norms and expectations. In their relatively recent paper, Crespo and Mira (2014) propose a behavioural model for describing the relationship of employment and caregiving in the case of adult daughters who care for their elderly parents. In this model, daughters derive utility from consumption, parental welfare, and leisure. Suppose that the potential utility from parental welfare to be derived is, for some reason, larger for women than for men. Then, utility-maximising daughters would end up providing more care and reducing their labour supply more than sons would. In an unpublished paper, Barigozzi, Cremer, and Roeder (2017) suggest expanding the family bargaining model with a parameter in the utility function of women that captures the psychological cost of deviating from social norms in terms of care provision. They argue that women are subject to a social norm that demands they provide more care than the average amount provided by adult children in any given society. Deviating from the norm will cause feelings of guilt, which acts as an externality and leads to women providing more care than what would be optimal from a societal point of view.

The importance of social and psychological factors that are not necessarily captured by traditional economic models can be explained in a more general and systematic way through models of identity economics (Akerlof & Kranton, 2000). Identity models of the allocation of unpaid household work predict an asymmetric division of labour between married opposite-sex couples, explaining it better than time allocation models. The latter suggest any asymmetry to be rooted simply in differences in the opportunity cost of paid work. However, in empirics, we see that women undertake a larger share of household duties even when they work more hours outside the home. The role of identity in decision-making is here the key factor determining gender differences in, first, the propensity to perform unpaid work, and second, the propensity to substitute unpaid and paid work. Assume two prescriptions of identity, one dictating that men should not do ”women’s work” in the household, and another saying that men should earn more than their wives. In this model, a husband loses identity when he undertakes unpaid housework and when his wife earns more than half of the

household income. A balance is restored when the wife takes on more housework than the husband. Applied to the context of informal caregiving, the theory predicts that women will provide more informal care than men regardless of their initial job status or work hours. Assuming then that the prediction of the time allocation model holds, women will be more likely than men to allocate time away from paid work and into caregiving activities, ending up reducing their labour supply.

The identity model involves the standard assumption of microeconomic models that people choose a combination of work and caregiving that allows them to maximise utility. Gender differences in caregiving can also be explained outside of the framework of microeconomic models, with focus on how the underlying assumptions may fail, especially for female caregivers. According to Spiess and Schneider (2003), relevant sociological literature has highlighted the role of gender and differences in the restrictions on choice sets. In this view, social norms and customs or traditions impose differing restrictions on men and women, so that the choice of whether to provide care or not is not as free for adult daughters as it is for adult sons. Women just below the retirement threshold can be argued to generally experience higher social pressures than their male counterparts to engage in care duties. The authors also note that the literature has hypothesised the transition from full-time to part-time employment to be easier for women than for men, encouraging reductions especially in the female labour supply. This is linked to an ideology of a male-breadwinner family structure, an idea closely related to the structures described above through the identity model. Such an ideology may prevent married men below the retirement age from taking on time-consuming caregiving duties that would interfere with their participation in paid work (Arber & Ginn, 1997, cited in Spiess & Schneider, 2003). If social norms and traditions impose restrictions on the abilities of women and men to choose the amount of time spent in paid work and giving care, the resulting work-care combinations will then not maximise utility in the sense that they are assumed to do in microeconomic models.

Regardless of whether we integrate the factors that cause gender variation in care provision and labour supply effects into our model of choice, or view them as failures of the undelying assumptions of the model, it is clear that gender differences are expected to be found in empirical analysis. Women may be more likely to become caregivers in the first place due to their pre-existing caractericts and comparative advantage within their families. We may also expect women who become informal caregivers to be more likely to either reduce work hours or drop out of paid employment compared to their male counterparts, as social norms dictate they should allocate more time into caregiving duties. Male caregivers may also have stronger incentives to remain in paid employment and a disincentive to perform unpaid care work. These effects may also vary across countries. I expect to find gender differences especially for countries where people adhere to traditional gender norms and have traditionally had strong family ties, as Alesina and Giuliano (2010) note that the strength of family ties correlates with an unequal division of family work between men and women.

4 Methodology and data

4.1 SHARE data and key variables

SHARE constitutes a multidisciplinary and cross-national panel database, thus far covering more than 120 000 individuals aged 50 or above in 27 European countries and Israel. The data consist of face-to-face interviews and contain information on health-related variables, such as physical and cognitive functioning, mental health, and behavioural risks; indicators of socioeconomic status, such as employment and pensions, housing, consumption, and assets; as well as variables relating to social and family networks, such as demographics and social and financial support. The database is harmonised with both the United States Health and Retirement Study (HRS) and the English Longitudinal Study of Ageing (ELSA), and has with its model inspired several other ageing surveys worldwide. SHARE is aimed to grasp the dynamic character of ageing through a multidisciplinary approach and to permit international comparisons in Europe and the United States[4].

I draw on data release waves 1, 2, 4, 5, and 6, for which interviews took place between 2004 and 2015. All countries are not featured in all waves, and therefore I present the distribution of the utilised countries and years over waves and data collection years in Table 1. In the analysis, I follow Kolodziej and co-authors (2018) and divide the countries into four subgroups according to the share of their respective LTC expenditures in their Gross Domestic Product (GDP), using data from the Organisation for Economic Co-operation and Development (2018). In the case of Croatia, the LTC expenditure statistic is from the European Commission (2016). The resulting country groups are the following: high expenditure (>2%), which includes Sweden, the Netherlands, Denmark, Switzerland, and Belgium; medium expenditure (between 1 and 2%), including Austria, Germany, France, Ireland, and Luxembourg; low expenditure, Southern Europre (<1%), which consists of Spain, Italy, Greece, Israel, and Portugal; and low expenditure, Eastern Europe (<1%), with the Czech Republic, Poland, Hungary, Slovenia, Estonia, and Croatia forming this group. As discussed in section 3.2, this division is aimed at capturing country variation originating from both differences in the availability of formal care and cultural norms. While I am not expecting the two to correlate fully, I assume the division will result in an adequate representation of cultural regions in Europe. I prioritise availability of formal care over differences in culture and norms in order to follow previous studies, although focusing on the cultural dimension would undoubtedly also provide new insights on the topic.

Table 1. List of countries, waves, and fieldwork times in SHARE, grouped by level of public spending in Long Term Care.

	Wave 1	Wave 2	Wave 4	Wave 5	Wave 6
High Long Term Care expenditure (>2% of Gross Domestic Product)					
Sweden	2004	2006/2007	2011	2013	2015
Netherlands	2004	2007	2011	2013	-
Denmark	2004	2006/2007	2011	2013	2015
Belgium	2004/2005	2006/2007	2011	2013	2015
Switzerland	2004	2006/2007	2011	2013	2015
Medium Long Term Care expenditure (1-2% of Gross Domestic Product)					
Austria	2004	2006/2007	2011	2013	2015
Germany	2004	2006/2007	2011/2012	2013	2015
France	2004/2005	2006/2007	2011	2013	2015
Ireland	-	2007	-	-	-
Luxembourg	-	-	-	2013	2015
Low Long Term Care expenditure (<1% of Gross Domestic Product), Southern Europe					
Spain	2004	2006/2007	2011	2013	2015
Italy	2004	2006/2007	2011	2013	2015
Greece	2004/2005	2007	-	-	2015
Israel	2005/2006	2009/2010	-	2013	2015
Portugal	-	-	2011	-	2015
Low Long Term Care expenditure (<1% of Gross Domestic Product), Eastern Europe					
Czech Republic	-	2006/2007	2011	2013	2015
Poland	-	2006/2007	2011/2012	-	2015
Hungary	-	-	2011	-	-
Slovenia	-	-	2011	2013	2015
Estonia	-	-	2010/2011	2013	2015
Croatia	-	-	-	-	2015

Note: Data on Long Term Care expenditure retrieved from the OECD (2018) and in the case of Croatia from the European Commission (2016).

I derive two dependent variables from the source data, the first of which is *employment status*. This variable is dichotomous and takes on the value 1 if the respondent reports to be currently in paid employment or self-employed, and 0 if the respondent is unemployed or a homemaker. I restrict the sample to persons available on the labour market, in other words respondents who had not yet retired and were not permanently sick or disabled. I also exclude respondents over the age of 64 to account for respondents who were homemakers and had no job to retire from. The variable captures the effect of caregiving at the extensive margin. The second dependent variable is *hours worked*, which gives the estimated weekly working hours reported by the respondent, regardless of their basic contracted hours, and excluding meal breaks but including any paid or unpaid overtime. Examining changes in this variable provides an overview of whether caregiving has an effect on work at the intensive margin, which would be the case if a caregiver adapts his/her workload to accommodate for time spent in informal care activities. Regressions where the dependent variable is *hours worked* are run conditional on the respondent being employed, in other words they have to have

reported at least some work hours in the observed period. I transform the variable into its natural logarithm in order to obtain a more smooth distribution of observations (Wooldridge, 2012, p. 41), as has previously been done by, for example, Bolin and co-authors (2008).

The main explanatory variable in my baseline OLS regressions is an *informal care provision dummy*, which takes the value 1 if the respondent reports having provided personal care in the past 12 months to a parent, parent-in-law, or step-parent living in a different household, and 0 if the respondent does not report having provided any such care[5]. "Personal care" refers to long-term regular help with activities such as personal hygiene, getting out of bed, or dressing. I limit the analysis to respondents who have at least one living parent, as only these people had potential to become caregivers. I do not exclude cases of other type of caregiving than parental care from the data, although such measures could be discussed further in sensitivity analyses. The data include information on the intensity of care, as respondents who reported providing informal care were asked to estimate how often they engaged in care duties. Because care intensity is an important aspect to consider in analyses of caregiving and labour market outcomes, I present the distribution of the frequency of care in Table 2. I return to the topic in section 5.3.3.

Other explanatory variables included are whether the respondent is female (0) or male (1), age and its square, whether the respondent is married (1) or not (0), or lives together with a partner (1) or not (0), years spent in full-time education[6], being a citizen in the country of interview (1) or not (0), total number of children, number of children under the age of 15, net household wealth[7], whether the respondent had bad self-reported health (1) or not (0), the number of health conditions the respondent had been diagnosed with[8], country fixed effects, and year fixed effects. In regressions where the dependent variable is *hours worked*, I also control for whether the respondent works in the public sector (1) or not (0).

Table 2. Summary statistics on the frequency of informal care provided, conditional on respondent having provided some parental care.

	Women		Men	
How often provided care to a parent	Frequency	Share	Frequency	Share
About daily	1,524	0.21	544	0.14
About weekly	2,854	0.40	1,359	0.35
About monthly	1,540	0.22	1,088	0.28
Less often	1,206	0.17	933	0.24
Total	7,129		3,927	

4.2 Endogeneity and instrumental variables

Caregiving and work outcomes may be endogenous, meaning people may select into caring for their elderly parents based on unobserved, pre-existing attributes that relate to their labour market outcomes. For example, individuals with limited employment opportunities or weaker ties to the labour market may be more likely to take on care duties in the family. The decision

to provide informal care and the decision to work are then jointly determined, making it difficult to disentangle the causal effect of caregiving on labour market measures in econometric analyses. Therefore, I employ an instrumental variables method to isolate the variation in the outcome variable that is related to informal caregiving, but not the unobserved error term.

The first of my instruments is a dichotomous variable indicating whether or not the respondent's biological mother is in poor health, the reasoning here being that having a mother with bad health should increase the likelihood of a person providing informal care, but not affect his/her labour supply through any channel other than caregiving. In the original data, each respondent evaluates the health status of their mother on a 4- or 5-point scale, given that the mother is alive. I use the answers to derive a dichotomous variable indicating whether the respondent's mother was in poor health (1) or not (0)[9]. If the mother was deceased, the indicator also takes the value 0, indicating that the mother was not in need of care. A corresponding variable is derived to indicate the health status of the respondent's father, constituting my second instrument. While an alternative would be to combine the variables into one parental health metric, I choose to follow the approach of Bolin and co-authors (2008), where the two are separated. A third instrument indicates whether the biological mother lives far away, as a respondent whose mother does not live nearby should be less likely to engage in informal care. I construct the variable from the original data by creating a dummy that takes on the value 1 if the respondent's mother lived more than 100 kilometres away, and 0 if not, or if the parent was deceased. Here, a different cutoff point could be chosen but I choose to follow Bolin and co-authors (2008) for the sake of comparability. Next, I construct two dummy variables indicating whether the respondent's biological mother or father, respectively, was deceased (1) or not (0). A parent who is no longer alive is not in need of care, and respondents with a deceased parent should therefore be less likely to become caregivers. Finally, I add measures for respondents' total number of alive brothers and sisters, respectively. The reason for including these variables as instruments is that having more siblings may be related to a decreased care burden, as duties may be shared (Ettner, 1996). Hence, my analysis relies on eight instruments to account for endogeneity in the relationship of informal care provision and labour market outcomes. Table 3 shows summary statistics on the key variables for each country by caregiving status and gender of respondents, and Table 4 presents summary statistics for the full set of variables[10].

4.3 Empirical models

For my baseline specification, I employ an OLS estimation procedure, which is equivalent to a Linear Probability Model when the dependent variable is *employment status*. The determinants of a person's employment status can then be written formally in the following manner:

$$ES_i = f(IC_i + X_i + H_i + I_c + T_k + \varepsilon_i) \quad (1)$$

Table 3. Descriptive statistics on employment and weekly hours worked by caregiving status.

	In paid employment or self-employed								Hours worked per week[1]							
	Caregiver				Non-caregiver				Caregiver				Non-caregiver			
	Women		Men		Women		Men		Women		Men		Women		Men	
Country	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Sweden	0.95	0.21	0.96	0.20	0.95	0.22	0.93	0.25	37.59	9.35	42.25	9.31	37.90	10.43	41.56	9.67
Netherlands	0.68	0.47	0.96	0.20	0.59	0.49	0.93	0.26	25.76	12.14	40.72	10.31	25.03	12.37	40.52	12.08
Denmark	0.91	0.28	0.95	0.22	0.90	0.30	0.93	0.25	34.60	8.75	39.91	10.27	35.37	10.37	39.92	9.70
Belgium	0.69	0.46	0.93	0.25	0.64	0.48	0.86	0.34	31.28	12.39	41.40	12.09	30.59	12.56	40.75	13.15
Switzerland	0.84	0.36	0.97	0.17	0.73	0.44	0.98	0.14	27.98	14.35	43.59	12.32	27.77	15.29	42.72	13.45
Austria	0.81	0.39	0.93	0.26	0.63	0.48	0.90	0.30	31.41	14.40	41.14	10.89	30.59	12.99	43.80	11.11
Germany	0.77	0.42	0.91	0.29	0.71	0.46	0.87	0.34	30.97	13.27	42.65	12.33	30.13	13.96	40.98	10.47
France	0.77	0.42	0.90	0.30	0.80	0.40	0.84	0.36	33.87	10.85	40.95	11.72	34.53	12.81	39.80	10.58
Ireland	0.64	0.49	1.00	0.00	0.77	0.44	1.00	0.00	29.92	10.08	45.00	11.08	25.27	14.40	47.11	12.14
Luxembourg	0.59	0.49	0.97	0.16	0.63	0.49	0.93	0.27	30.65	10.14	42.41	9.00	34.74	12.14	42.68	9.08
Spain	0.49	0.50	0.80	0.40	0.38	0.49	0.81	0.40	36.13	12.31	40.65	15.36	31.56	13.60	41.53	12.96
Italy	0.54	0.50	0.92	0.27	0.44	0.50	0.96	0.20	32.73	11.40	41.45	13.27	33.79	11.06	37.84	13.24
Greece	0.47	0.50	0.92	0.27	0.38	0.49	0.95	0.22	34.03	16.57	40.66	19.52	39.27	20.08	42.83	16.55
Israel	0.75	0.43	0.97	0.17	0.71	0.45	0.95	0.22	33.09	14.22	45.52	15.25	31.66	14.50	44.37	16.39
Portugal	0.57	0.50	0.76	0.44	0.55	0.50	0.63	0.50	23.81	19.55	33.06	17.80	19.89	21.34	36.70	22.46
Czech Republic	0.90	0.30	0.94	0.23	0.86	0.34	0.92	0.28	40.09	9.28	44.01	9.63	40.02	11.30	42.14	10.41
Poland	0.74	0.44	0.91	0.30	0.62	0.49	0.73	0.45	39.96	14.13	41.59	10.58	38.11	13.81	44.97	13.77
Hungary	0.85	0.36	0.83	0.38	0.73	0.44	0.74	0.44	42.64	8.38	41.35	10.56	40.12	9.90	41.12	11.33
Slovenia	0.86	0.35	0.76	0.43	0.74	0.44	0.86	0.35	40.13	7.78	43.22	7.51	40.82	8.25	44.21	11.68
Estonia	0.91	0.29	0.89	0.32	0.89	0.31	0.83	0.38	39.16	8.23	42.38	11.41	38.57	10.23	41.43	10.82
Croatia	0.67	0.48	0.89	0.32	0.57	0.50	0.72	0.45	39.47	7.39	42.29	3.72	39.07	10.24	40.59	11.81
Total	0.76	0.43	0.92	0.26	0.71	0.46	0.90	0.31	33.61	12.26	41.74	11.83	33.59	13.26	41.15	11.80
Observations	7,133		3,927		4,617		3,640		5,462		3,611		3,299		3,246	

[1]Hours worked per week reported conditional on respondent being in paid employment or self-employed.

Table 4. Descriptive statistics on dependent, independent, and instrumental variables.

		Mean	S.D.
Dependent variables			
Employment status	1 if in paid employment or self-employed	0.81	0.40
Weekly hours worked[1]	Estimated weekly working hours	37.05	12.89
Independent variables			
Informal care provision dummy	1 if provided any informal care to a parent	0.57	0.49
Male	1 if male	0.39	0.49
Age	Age in years	56.09	3.66
Married	1 if married	0.38	0.49
Cohabiting	1 if living together with a partner	0.02	0.15
Years of education	Total years spent in full-time education	12.82	4.23
Citizen in country of residence	1 if citizen in country of interview	0.97	0.18
Number of children	Total number of children	1.92	1.38
Number of young children	Number of children under the age of 15	0.06	0.29
Wealth	Net household wealth in Euro[2]	35.85	56.38
Bad self-reported health	1 if respondent has poor self-reported health	0.02	0.15
Number of health conditions	Number of respondent's diagnosed health conditions	0.97	1.09
Public sector employee[1]	1 if employed in the public sector	0.34	0.47
Sweden		0.09	0.28
Netherlands		0.07	0.25
Denmark		0.11	0.31
Belgium		0.13	0.34
Switzerland		0.06	0.24
Austria		0.03	0.18
Germany		0.10	0.30
France		0.07	0.26
Ireland		0.00	0.06
Luxembourg		0.01	0.11
Spain		0.04	0.18
Italy		0.06	0.23
Greece		0.04	0.18
Israel		0.03	0.16
Portugal		0.01	0.08
Czech Republic		0.06	0.23
Poland		0.01	0.10
Hungary		0.01	0.08
Slovenia		0.02	0.14
Estonia		0.06	0.23
Croatia		0.01	0.10
Instruments			
Mother has bad health	1 if the child reports mother to have poor health	0.14	0.35
Father has bad health	1 if the child reports father to have poor health	0.06	0.24
Mother lives far away	1 if mother lives more than 100km away	0.11	0.31
Father lives far away	1 if father lives more than 100km away	0.06	0.24
Mother deceased	1 if mother deceased	0.67	0.47
Father deceased	1 if father deceased	0.85	0.36
Number of brothers alive	Total number of brothers alive	1.09	1.20
Number of sisters alive	Total number of sisters alive	1.07	1.22

[1]Conditional on respondent being in paid employment or self-employed.

[2]Net household wealth scaled by 10 000 for presentation.

Here, ES_i stands for employment status, IC_i for informal care provision, X_i for a vector of demographic and socioeconomic factors, H_i the health status of the respondent, I_c for the institutional framework and other country-specific factors, T_k for year fixed effects, and ε_i for the residual error.

Similarly, hours worked can be written as:

$$HW_i = f(IC_i + X_i + J_i + H_i + I_c + T_k + \varepsilon_i) \quad (2)$$

Here, HW_i stands for hours worked, IC_i for informal care provision, X_i for a vector of demographic and socioeconomic factors, J_i for job characteristics, H_i the health status of the respondent, I_c for the institutional framework and other country-specific factors, T_k for year fixed effects, and ε_i for the residual error.

In the second part of my analysis, I employ a TSLS estimation procedure described in Wooldridge (2012, p. 529) to account for potential endogeneity between caregiving and employment status or hours worked. A TSLS estimator is used when the analysis features multiple instruments, and is obtained in two stages. The first step is to regress the endogenous explanatory variable on the chosen set of instruments, which creates fitted values of the regressor that have been "purged" of the unwanted simultaneity bias:

$$y_2^* = \pi_0 + \pi_1 z_1 + \pi_2 z_2 + \pi_3 z_3 \quad (3)$$

The coefficients here are estimates as long as we do not know the true population parameters. Second, the outcome variable of interest is regressed on the fitted values obtained from the first step, which produces consistent and unbiased estimates of the causal effect of interest:

$$y_1 = \beta_0 + \beta_1 y_2^* + \beta_2 X + u_1 + \beta_1 v_2 \quad (4)$$

Here, X represents a vector of exogenous covariates, with u_1 standing for the residual error and v_2 for the error that emerged in the first step.

In the case such as mine, where the model is endogenous and both dependent and key explanatory variables are limited, Angrist and Pischke (2008, p. 148) suggest employing a standard linear model estimated by a TSLS procedure. In a related contribution, Angrist (2001) argues that conventional TSLS estimates using a Linear Probability Model in the first stage are consistent whether or not the first-stage conditional expectation function is linear, so it is generally safer to use a linear first stage as opposed to fitting the data with a nonlinear model. Based on this argument, as well as a comprehensive discussion of the strengths and weaknesses of using different methods in this context (Angrist & Pischke, 2008, p. 147), I judge using the "plain" TSLS to be appropriate for my purposes[11]. I employ the same procedure in the case of my second dependent variable, *hours worked*, even though the variable is continuous and TSLS thus may be less efficient than a more sophisticated method would be.

4.4 Interpretation of estimates and instrument validity

A brief discussion about the broader framework for interpretation as well as a discussion about the validity of the estimates are merited before I present results from estimations. If there is reverse causality in the relationship of informal care provision and employment status and/or hours worked, the instrumental variables (IV) approach should be preferred over OLS. Then, the estimated effect of interest should be interpreted in a manner that takes into account potential heterogeneity of the treatment effects, with ”treatment” referring to being a caregiver. For all the persons in the data who have at least one alive elderly parent, the uptake of ”treatment” can be argued to differ across individuals. In other words, we may expect only some people who have an elderly parent to begin providing informal care. Then, the IV estimates will only capture the effect of caregiving on the labour market outcomes of those who actually become caregivers due to having an elderly parent and who would otherwise not have done so. The estimated effect is called a Local Average Treatment Effect (LATE), of which a detailed description can be found in Angrist and Pischke (2008, p. 111). I return to the topic of interpreting LATE estimates in section 5.3.2.

There are four conditions that need to be fulfilled in order for the LATE estimates to be considered valid. The first is the conditional independence assumption (Angrist & Pischke, 2008, p. 38), which requires that the instruments are independent of both potential outcomes and potential treatment assignments, conditional on observed covariates. In the case of potential outcomes, think of two respondents, one of whom is in paid employment and the other one not. If we pick the instrument *number of sisters alive* for inspection, then the condition implies that a respondent with six alive sisters should have the same likelihood of being in paid employment than a person with one alive sister would have if they had six alive sisters. If persons with more alive sisters had been more likely to be in paid employment even if they had had fewer alive sisters, then the estimates would be biased. In the case of potential treatment assignments, consider the instrument *mother has bad health*. Take for two respondents, only one of whom has a mother with poor health. The first respondent should have the same likelihood of becoming a caregiver than the second respondent if his/her mother were in bad health. In a similar vein, a respondent with six alive sisters should have the same likelihood of becoming a caregiver than a person with one alive sister if the latter had had six alive sisters. However, because we can only observe one outcome and treatment assignment for each individual, the independence has to be assumed rather than tested in some manner.

The second condition is dubbed the exclusion restriction (Angrist & Pischke, 2008, p. 84), and requires that the only reason for a relationship between the instrument and the outcome variable runs through the first stage, in other words the correlation of the instrument and the endogenous explanatory variable. The condition cannot be tested, and thus has to be assumed to hold based on a reasoning of the likely relationships of the variables. Starting with the health status of an individual’s parents, or whether they are alive or not, I argue that there should not be any direct relationship between the condition of the parent and the work status

of the adult child. This assumption may fail for example if there is correlation in the health status of the parent and the health of the potential caregiver, so that the caregiver is less likely to work due to bad health. However, I control for health status of the respondent in my specifications and the assumption may therefore be considered fulfilled. In the case of the number of alive siblings, the restriction may fail if family size is somehow correlated with employment opportunities, or preferences regarding work. For example, we could argue for the existence of some kind of relationship between unobserved ability and family size. I assume this is not a significant factor in my analyses, as I control for years of education, which serves as a proxy for ability. We could also argue that people's attitudes towards work and family may depend on their family size. For example, people from larger families may be more prone to prioritise caregiving over paid employment. While I have no means to test either of these ideas, I assume there to be no relationship between the number of alive siblings and the labour market outcomes of any given individual. Last, the instrument indicating whether parents live far away or not may be the weakest one with regards to the exclusion restriction. It may well be that adult children move geographically closer to parents as the need for care emerges, which may in turn be related to the initial labour market situation of the caregiver. On the other hand, people may at any point in their lives move house for a job, which may increase the distance to their parents. While I assume that the respondents have not moved closer to, or further away from their parents during the observed time period, the possibility should be kept in mind while interpreting the results.

Third, I assume monotonicity of the treatment effect (Angrist & Pischke, 2008, p. 114), meaning that respondents whose labour market outcomes are influenced by caregiving should all be influenced in the same way. In other words, I assume that helping a parent has a negative effect on labour market outcomes, so that no-one takes on a job or increases their work hours, for example in order to help the parent financially. This assumption may be unrealistic, given that I consider all levels of caregiving intensities in my analyses. As I discussed in section 2.3, there is some evidence on British non-intesive care providers increasing their labour supply, potentially to compensate for the cost of care purchased from third parties. It is possible that a similar relationship exists in some of the sampled countries. This idea is worth looking into in future studies. For now, I keep the monotonicity assumption due to the vast majority of existing evidence on Europe suggesting that caregiving has a negative effect on labour supply.

Fourth, the instruments must have a clear effect on the causal variable of interest, in this case the *informal care provision dummy*. This relationship is referred to as the first stage (Angrist & Pischke, 2008, p. 86). To test the relationships, I conduct OLS regressions of my set of instruments on the care provision dummy, with results shown in Table 5. I use the full sample in column 1, then split women and men into separate groups in columns 2 and 3. The signs and the magnitudes of the coefficients appear logical; health status of parent(s) has a positive effect on caregiving likelihood, whereas parent(s) living far away, one parent being deceased[12], and the number of alive siblings all have a negative effect on caregiving likelihood. The F-values from each regression exceed the commonly used rule-of-thumb value of 10 by a considerable margin, indicating that each regression has explanatory power

over the *informal care provision dummy*. Based on these arguments, which Angrist and Pischke (2008, p. 157) have suggested for evaluating the strength of the first stage, I consider the relationship to be sufficiently strong for the instruments to be used in TSLS estimation.

Table 5. Results from Ordinary Least Squares regressions of instruments on informal care provision (first stage).

	Full sample	Women	Men
Mother has bad health	0.164***	0.168***	0.148***
	(0.009)	(0.011)	(0.016)
Father has bad health	0.150***	0.150***	0.139***
	(0.014)	(0.017)	(0.025)
Mother lives far away	-0.106***	-0.096***	-0.117***
	(0.013)	(0.016)	(0.020)
Father lives far away	-0.085***	-0.078***	-0.099***
	(0.018)	(0.022)	(0.028)
Mother deceased	-0.098***	-0.100***	-0.099***
	(0.008)	(0.010)	(0.013)
Father deceased	-0.009	0.000	-0.030*
	(0.011)	(0.014)	(0.017)
Number of brothers alive	-0.016***	-0.014***	-0.020***
	(0.003)	(0.004)	(0.005)
Number of sisters alive	-0.028***	-0.029***	-0.027***
	(0.003)	(0.004)	(0.005)
Constant	0.677***	0.701***	0.650***
	(0.011)	(0.014)	(0.017)
Observations	19,316	11,750	7,566
R-squared	0.044	0.047	0.042
F-test	127.4***	83.73***	45.08***

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

5 Results and discussion

5.1 Results from Ordinary Least Squares regressions

I first run OLS regressions to estimate the relationship of informal care provision and employment status/hours worked. This approach assumes that the key variables are exogenous. In other words, conditional on covariates, the labour market status of any given respondent is assumed to not influence their decision to become a caregiver, so that a person takes on caregiving duties solely because their elderly parent needs assistance. If the assumption holds, OLS estimation will provide a causal estimate of the effect of caregiving on the employment status and the weekly work hours of the caregiver.

Table 6 shows regression results with *employment status* as the dependent variable. The three panels show the same regressions being run on different subsamples, with the highest panel showing results for both genders, the second for women, and the lowest one for men. All regressions control for gender (when both men and women are included), age and age squared, marital status, cohabiting status, years of education, citizenship, total number of children, number of young children, household wealth, health status, and number of diagnosed health conditions. The signs and magnitudes of the coefficients for control variables were as expected, and are hidden for the sake of saving space (the full versions of all regression tables are shown in the Appendix, Tables A1-A12). Column 1 shows the effect of the *informal care provision dummy* on employment status of all caregivers in the sample. Informal care provision is positively associated with employment probability in all three panels, and the effect is approximately the same magnitude for both genders (β=0.023 for the full sample, β=0.022 for women, β=0.020 for men). The effect is statistically significant at the 1%-level for all three regressions. The result suggests that at the pan-European level, being an informal caregiver is associated with a 2.3 percentage point increase in employment probability compared to non-caregivers. Columns 2 to 5 show corresponding regressions for country groups, with group names referring to the level of public spending on LTC schemes. Column 2 shows that there is a positive and statistically significant effect from being a caregiver on employment probability for the combined sample (β=0.027, p<0.01), as well as women (β=0.023, p<0.05) and men (β=0.025, p<0.01) separately in countries belonging to group *High*. Column 5 shows that an effect can be found for the combined groups of women and men (β=0.026, p<0.05) and for women (β=0.033, p<0.10) in countries *Low, East*. These results are unexpected given the previous literature on the topic and the theoretical reasoning presented in section 3. I discuss possibilities for explaining them in section 5.3.1.

Table 7 follows the same structure as Table 6, with the distinction of the dependent variable being *hours worked*. The regressions control for the same covariates as regressions in Table 6, as well as the employment sector of the respondent. The regressions are run on respondents who were either in paid employment or self-employed at the time of their participation in SHARE. Column 1 shows results at the pan-European level, suggesting only small and statistically insignificant effects from informal care provision on hours worked, with no effects found for either women or men. When the full sample is separated into country groups in columns 2 to 5, the coefficient of the *informal care provision dummy* appears as significant and with a positive sign (β=0.035, p<0.05) for the group *Low, East*. The effect appears for the female subsample (β=0.039, p<0.10), but not for men. These results are, again, unexpected, and I discuss possible explanations in section 5.3.1.

Table 6. Results from Ordinary Least Squares regressions of informal care provision on employment status.

Full sample	Europe	High	Medium	Low, South	Low, East
Informal care provision dummy	0.023***	0.027***	0.013	0.015	0.026**
	(0.006)	(0.007)	(0.012)	(0.016)	(0.013)
Observations	18,381	8,462	4,014	2,955	2,950
R-squared	0.169	0.161	0.100	0.265	0.102
Women	**Europe**	**High**	**Medium**	**Low, South**	**Low, East**
Informal care provision dummy	0.022***	0.023**	0.007	0.028	0.033*
	(0.008)	(0.011)	(0.018)	(0.022)	(0.017)
Observations	10,990	4,826	2,414	1,981	1,769
R-squared	0.199	0.186	0.099	0.207	0.123
Men	**Europe**	**High**	**Medium**	**Low, South**	**Low, East**
Informal care provision dummy	0.020***	0.025***	0.022	-0.019	0.019
	(0.007)	(0.008)	(0.015)	(0.019)	(0.020)
Observations	7,391	3,636	1,600	974	1,181
R-squared	0.069	0.069	0.080	0.064	0.097

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.
Note: Regressions control for gender, age, age squared, marital status, cohabiting status, years of education, citizenship, total number of children, number of young children, household wealth, respondent's health status, number of diagnosed health conditions, country fixed effects, and year fixed effects.

5.2 Results from Two-Stage Least Squares regressions

In order to test and account for potential endogeneity between caregiving and work status, I run TSLS regressions for the full sample, country groups, and women and men separately. I formally test the key relationships for endogeneity because if the variables are exogenous, OLS estimation is more efficient than TSLS (Wooldridge, 2012, p. 534). I perform Wooldridge's (1995) robust score test and a robust regression-based test, the results of which are presented together with the regression results. Any statistically significant result suggests

that the key variables should be treated as endogenous[13]. In the TSLS regressions, I control for the same covariates as in the OLS regressions, hiding the coefficients for the sake of brevity.

Table 8 follows the same structure as Table 6, so that the three panels show the same regressions being run on the full sample and subsamples of women and men. The dependent variable is *employment status* for all specifications. Column 1 shows the estimated effect of being an informal caregiver on employment status, with the F-statistic from an endogeneity test being reported at the bottom of each panel. The tests suggest that caregiving is endogenous when the regression is run on the full sample ($p<0.01$) and on women only ($p<0.01$). Therefore, TSLS estimates should be preferred over OLS estimates for these groups. The coefficient of the *informal care provision dummy* is negative and statistically significant for both groups (β=-0.063, $p<0.05$ for full sample, β=-0.092, $p<0.05$ for women).

For men, the estimated effect is negative but not significant, and the p-value of the endogeneity test does not exceed the threshold of statistical significance. Therefore, for men, the OLS estimate should be preferred at the pan-European level. Columns 2 to 5 show corresponding regressions by country groups. Columns 3 and 4 show statistically significant F-statistics for the endogeneity tests of the full sample ($p<0.05$), as well as women ($p<0.05$) of country group *Medium*, and the full sample ($p<0.10$) and women ($p<0.05$) of country group *Low, South*. The preferred estimates for these groups are then the TSLS estimates. For group

Table 7. Results from Ordinary Least Squares regressions of informal care provision on hours worked, conditional on respondent being in paid employment or self-employed.

Full sample	Europe	High	Medium	Low, South	Low, East
Informal care provision dummy	0.009	0.002	0.005	0.022	0.035**
	(0.008)	(0.012)	(0.020)	(0.029)	(0.016)
Observations	11,289	5,334	2,523	1,258	2,174
R-squared	0.131	0.161	0.152	0.070	0.032
Women	**Europe**	**High**	**Medium**	**Low, South**	**Low, East**
Informal care provision dummy	0.011	0.004	0.018	-0.006	0.039*
	(0.012)	(0.017)	(0.031)	(0.040)	(0.022)
Observations	6,346	2,916	1,430	712	1,288
R-squared	0.138	0.163	0.073	0.046	0.030
Men	**Europe**	**High**	**Medium**	**Low, South**	**Low, East**
Informal care provision dummy	0.013	0.008	-0.013	0.055	0.029
	(0.011)	(0.014)	(0.023)	(0.043)	(0.022)
Observations	4,943	2,418	1,093	546	886
R-squared	0.030	0.042	0.050	0.069	0.026

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.
Note: Regressions control for gender, age, age squared, marital status, cohabiting status, years of education, citizenship, total number of children, number of young children, household wealth, respondent's health status, number of diagnosed health conditions, employment sector (private vs. public), country fixed effects, and year fixed effects.

Medium, the coefficient of the *informal care provision dummy* is negative and significant for both the full sample (β=-0.104, p<0.10) and for women (β=-0.162, p<0.05). The corresponding estimates for group *Low, South* are also negative and statistically significant (β=-0.150, p<0.10 for full sample, β=-0.181, p<0.10 for women). The results imply that selection into caregiving based on previous labour market status may take place for women in countries with a medium level of LTC expenditure, and in countries with a low level of LTC expenditure located in Southern Europe. The results also imply that for women in these countries, being an informal caregiver is associated with a lower probability of being in paid employment, with the point estimate being 16.2 percentage points for group *Medium* and 18.1 percentage points for group *Low, South*.

Table 9 follows the same structure as Table 7, so that the three panels show the same regressions being run on the full sample and subsamples of women and men. The dependent variable is *hours worked* for all specifications, and the control variables are the same as in Table 7. The regressions are again run on respondents who were either in paid employment or self-employed at the time of their participation in SHARE. Column 1 shows results at the pan-European level, with the F-statistics from endogeneity tests offering no support for reverse causation existing between informal care provision and hours worked. However, the lowest panel and column 2 show evidence of endogeneity for men in country group *High* (p<0.10). The coefficient of the *informal care provision dummy* is positive and significant (β=0.150, p<0.10), a result that is contrary to what I expected. Furthermore, column 4 and the middle panel suggest endogeneity for women of group *Low, South* (p<0.01). The estimated effect of informal care provision on hours worked for this group is large, positive, and statistically significant (β=0.504, p<0.01). For all groups that are not assigned a statistically significant value on the endogeneity test, OLS estimates should be preferred. I discuss all of the results and preferred specifications in detail in section 5.

5.3 Validity and interpretation of main findings

The analyses presented in sections 5.1 and 5.2 show both expected and unexpected results. First of all, the results offer new insights on the question of whether informal caregiving and labour market outcomes are jointly determined or not. My analyses provide support for the idea that caregiving and work are in some cases endogenously determined. In the following subsections, I provide a discussion of the validity and relevance of the findings. I also link the findings to my theoretical frameworks, and present a discussion of how the findings relate to previous studies.

5.3.1 Findings when OLS is the preferred method

Whenever no evidence of endogeneity is found, OLS estimates are preferred over TSLS estimates because they provide greater efficiency when the key variables are exogenous. In

Table 8. Results from Two-Stage Least Squares regressions of informal care provision on employment status.

Full sample	Europe	High	Medium	Low, South	Low, East
Informal care provision dummy	-0.063**	-0.029	-0.104*	-0.150*	0.027
	(0.032)	(0.045)	(0.058)	(0.090)	(0.074)
Observations	18,380	8,461	4,014	2,955	2,950
R-squared	0.158	0.155	0.080	0.245	0.102
Endogeneity test, F-statistic	7.863***	1.587	4.369**	3.820*	0.000
Women				Low,	Low,
	Europe	High	Medium	South	East
Informal care provision dummy	-0.092**	-0.034	-0.162**	-0.181*	0.063
	(0.044)	(0.066)	(0.080)	(0.109)	(0.095)
Observations	10,990	4,826	2,414	1,981	1,769
R-squared	0.184	0.182	0.065	0.182	0.121
Endogeneity test, F-statistic	7.230***	0.747	5.066**	4.170**	0.106
Men				Low,	Low,
	Europe	High	Medium	South	East
Informal care provision dummy	-0.015	0.002	-0.003	-0.067	-0.087
	(0.038)	(0.050)	(0.070)	(0.129)	(0.106)
Observations	7,390	3,635	1,600	974	1,181
R-squared	0.065	0.067	0.079	0.089	0.075
Endogeneity test, F-statistic	0.907	0.219	0.122	0.188	1.000

Robust standard errors in parentheses, clustered by household.

*** p<0.01, ** p<0.05, * p<0.1.

Note: Regressions control for gender, age, age squared, marital status, cohabiting status, years of education, citizenship, total number of children, number of young children, household wealth, respondent's health status, number of diagnosed health conditions, country fixed effects, and year fixed effects.

OLS regressions, evidence of a caregiver effect was found for two country groups, and the effect had a sign opposite to what was expected in both cases. For group *High*, which consists of Sweden, the Netherlands, Denmark, Belgium, and Switzerland, being a caregiver was associated with an increase of 2.3 percentage points in the likelihood of being in paid employment for the subsample of women. This is odd, as theory presented in section 3 predicts caregiving to reduce employment likelihood due to reallocation of time from paid work to caregiving. In order to link the result back to my theory, I consider the relatively intuitive explanation offered by Heitmueller (2007). In this view, potential caregivers accept or decline the caregiving position based on their labour market position, earnings, availability and price of other types of care, as well as the availability of other potential caregivers in the family. Heitmueller suggests that persons with high incentives to remain in paid employment may decline a caregiving position, and even increase work hours in order to finance formal care expenditures. However, the reasoning does not directly explain why caregivers would be more likely to work than non-caregivers. We may build on the train of thought and argue that becoming a caregiver somehow incentivices people to start work, perhaps because the parent requires also formal care that has to be paid for. As the effect could be traced to women, it appears that a gender dynamic is at play here. Looking at the summary statistics in Table 3, we see that in the majority of these countries, non-caregiving women are somewhat less likely to work than their male counterparts. Then, it may be that the effect on women's employment runs primarily through financial considerations, as expressed in the framework of a utility-

Table 9. Results from Two-Stage Least Squares regressions of informal care provision on hours worked, conditional on respondent being in paid employment or self-employed.

Full sample	Europe	High	Medium	Low South	Low East
Informal care provision dummy	0.062	0.082	-0.078	0.274*	-0.029
	(0.048)	(0.068)	(0.098)	(0.164)	(0.087)
Observations	11,288	5,333	2,523	1,258	2,174
R-squared	0.128	0.153	0.146	0.020	0.025
Endogeneity test, F-statistic	1.274	1.432	0.762	2.663	0.520
Women				Low	Low
	Europe	High	Medium	South	East
Informal care provision dummy	0.082	0.081	-0.185	0.504***	0.046
	(0.067)	(0.100)	(0.142)	(0.192)	(0.114)
Observations	6,346	2,916	1,430	712	1,288
R-squared	0.133	0.158	0.043		0.030
Endogeneity test, F-statistic	1.202	0.610	2.178	9.780***	0.004
Men				Low	Low
	Europe	High	Medium	South	East
Informal care provision dummy	0.029	0.150*	-0.077	-0.159	-0.086
	(0.061)	(0.081)	(0.112)	(0.291)	(0.103)
Observations	4,942	2,417	1,093	546	886
R-squared	0.029	0.002	0.043	0.043	
Endogeneity test, F-statistic	0.073	3.074*	0.339	0.656	1.236

Robust standard errors in parentheses, clustered by household.
*** p<0.01, ** p<0.05, * p<0.1.
Note: Regressions control for gender, age, age squared, marital status, cohabiting status, years of education, citizenship, total number of children, number of young children, household wealth, respondent's health status, number of diagnosed health conditions, employment sector (private vs. public), country fixed effects, and year fixed effects.

maximising family, rather than through social norms that require women to work less than their husbands. Even if a social norm is in place requiring that women earn less and perform more household work than their husbands, they may increase their labour supply because they were working less than their husbands in the first place. The family will thus maximise the joint utility through women's increased participation in paid work that results from the need to cover the costs of purchasing care. A pitfall of this reasoning is that these countries have a high level of LTC expenditure, in which case the majority of the expenditures for formal care should generally be covered by the state. Alternatively, the results may be biased due to some variables having been omitted from the regressions. For example, there may be some individual-specific factors that correlate with both the likelihood of having a job and the likelihood to help a parent. In any case, future studies could focus on this relationship and provide a more insightful explanation for the phenomenon.

Combining the reasoning of Heitmueller with the argument of gender dynamics presented in section 3.3 may be more appropriate in the case of the findings for group *Low, East*. In this case, a 3.3 percentage point increase in the employment likelihood of women was found. When the dependent variable was *hours worked*, the *informal care provision dummy* had an effect of around 3.9% for women. The group consists of countries in Eastern Europe, namely the Czech Republic, Poland, Hungary, Slovenia, Estonia, and Croatia, which have low levels

of public LTC spending. Therefore, it seems logical that in these countries, persons with a dependent parent engage in informal care and also increase their working hours/go into paid employment in order to financially compensate for any formal care required to supplement informal care.

5.3.2 Findings when TSLS is the preferred method

In this study, the main reason for employing an IV estimation method was to account for selection into caregiving that may occur based on the pre-existing labour market position of potential caregivers. The results below should be interpreted as approaching causal estimates of the effect of caregiving on employment and hours worked. When the dependent variable was *employment status*, an effect could be found for women in country group *Medium*, for which the point estimate of the coefficient of the *informal care provision dummy* was a 16.2 percentage point decrease. The group consists of Austria, Germany, France, Ireland, and Luxembourg, countries that spend a moderate share of their GDP on LTC schemes. This result may be interpreted according to the time allocation model as well as the family bargaining model, taking into account gender dynamics. First, if the availability of formal care is less than what would be needed to cover the needs of a dependent parent, families may allocate time into informal caregiving. Second, if there are social norms requiring that women undertake the majority of caregiving activities, leading to women reallocating a sufficient amount of time away from paid employment, some of them may end up withdrawing their labour supply from the labour market altogether.

In a similar manner, for women in country group *Low, South*, the caregiver effect was estimated to be an 18.1 percentage point reduction in employment likelihood. However, when the dependent variable was *hours worked*, an increase of 50.4% was found for the same group. The countries here are Spain, Italy, Greece, Israel, and Portugal, all having low levels of public spending on LTC schemes. The latter result could be explained through the same train of thought as the positive effect of caregiving on hours worked for women in Eastern Europe. As Southern European countries also spend a low share of their GDP on LTC schemes, persons with a dependent parent may increase their working hours in order to financially compensate for any formal care required to supplement the informal care. The contrast in the estimated results for employment status and working hours may be related to, for example, family- and spouse-specific factors that were left unaccounted for in my analysis, such as the earnings potential of spouses. In families where the husband earns a high wage, the family may afford to have the wife stay at home to care for a parent. In families with less earnings potential or with only one provider, a female carer may have to increase her working hours. On the other hand, the result may be biased, as the sample size is only 712, and IV estimates are known to be biased for small sample sizes (Angrist & Pischke, 2008, p. 153). Therefore, I do not discuss this result any further in the upcoming sections. In any case, more attention should be paid to these dynamics, as there appear to be more factors at play behind the labour market outcomes than thought.

Another group for which the TSLS estimates were the preferred option was men in country group *High*, for whom the estimated effect of caregiving on hours worked was a 15% increase. This group consists of Sweden, the Netherlands, Denmark, Belgium, and Switzerland, and is characterised by high levels of public spending on LTC schemes. In a similar veing to the reasoning presented in section 5.3.1, it appears that becoming a caregiver incentivices people to work more, perhaps to cover the costs of formal care. The results for women in this country group also suggest an increase in labour supply. Therefore, I conclude that in these countries, there are either unobserved factors that correlate with both labour supply and willingness to provide informal care, or the availability and coverage of public LTC schemes is not related to informal care provision in the manner suggested in section 3.2. In other words, the evidence potentially does not support the idea that widely available and publicly funded LTC services prevent people from having to rely on private care providers, the cost of which in turn has to be covered by working more. If the latter idea were correct, it would be an interesting topic for future research especially from a policy perspective. If not, more accurate analyses should be performed to estimate the true caregiving effect.

A discussion on the interpretation of LATE estimates is merited before moving on to relating the results to existing literature. Because the treatment effects are heterogenous, meaning that not everyone who has an elderly parent in need of care will take on caregiving duties, the IV estimation only captures the caregiving effect on those who were actually influenced by the instruments. People whose caregiving status was changed by the instruments are called compliers, and the estimated LATE applies only to them. Angrist and Pischke (2008, p. 115) provide a discussion about the usefulness of such estimates. The main weakness of relying on LATE is that the estimates do not tell us anything about the average effect of being a caregiver for those who would have become caregivers in any case. However, I argue that the estimates are still meaningful, because compliers have potential to be influenced by policy (Duflo et al., 2007, p. 3940). However, we need theory to explain who the compliers are. Based on my TSLS results and relevant theory, I interpret the group of compliers to consist mainly of female caregivers who have limited access to other forms of care and face a social expectation of providing care. An effective policy intervention would then be directed at supporting the continued labour force participation of female caregivers in these countries.

A weak point of the analysis is the potential failure of the monotonicity assumption, as discussed in section 4.4. According to this assumption, caregiving should not both push some people into employment or to work longer hours, *and* cause some people to drop out of employment or to reduce their work hours. If the monotonicity assumption is not fulfilled, the estimated treatement effect may be attenuated in the second step of TSLS, as the opposite effects cancel each other out (Angrist & Pischke, 2008, p. 115). However, even if the assumption fails, some of my TSLS estimates suggest a statistically significant effect from caregiving on work status. Then, it may be that my results underestimate the true effect of caregiving. I suggest future studies look into the issue, potentially looking for the threshold of caregiving intensity where the effects on labour supply turn negative, as has been done in the case of caregivers in the United Kingdom (Carmichael & Charles, 1998; Charmichael & Charles, 2003b).

An aspect to note when comparing studies that employ different instruments is that the estimated LATEs may differ depending on the choice of instruments. The results may simply reflect treatment heterogeneity across different groups of compliers and not differences in the caregiving effect *per se*. This influences the generalisability of estimates on other population groups, but not their internal validity (Angrist & Pischke, 2008, p. 111). It may also be that using the same instrument in different settings yields differing results due to differences in the number of people in each specific population whose caregiving status is influenced by the instrument. Because of this sensitivity of the results to methodological differences, I do not emphasise the estimated magnitude of the effects in the interpretation below, but instead focus on the existence of an effect whenever applicable.

5.3.3 Findings in the context of previous empirical studies

In short, my findings suggest informal caregiving to be associated with increases in the likelihood of being in paid employment for women in high LTC expenditure countries and low LTC expenditure countries in Eastern Europe, and reductions for women in medium expenditure countries and low expenditure countries in Southern Europe. As for hours worked, the results suggest caregiving to be associated with increases in work time for women in Eastern and Southern Europe, as well as men in high LTC expenditure countries. Table 10 shows the main findings in a structured manner.

Table 10. Main findings from Ordinary Least Squares and Two-Stage Least Squares regressions of informal care provision on employment probability and hours worked[1] for women and men in Europe, with countries grouped by level of public spending on Long Term Care.

Country group		High	Medium	Low, South	Low, East
Employment probability	Women	+2.3 %-points	-16.2 %-points[2]	-18.1 %-points[2]	+3.3 %-points
	Men	-	-	-	-
Hours worked	Women	-	-	+50.4 %[2]	+3.9 %
	Men	+15.0%[2]	-	-	-

[1]Findings for hours worked conditional on respondent being in paid employment or self-employed.
[2]Informal care provision and labour supply endogenous, TSLS estimate reported.

The results are partly in line with previous evidence, as they suggest there is a clear north-south gradient in the relationship of caregiving and labour market outcomes in Europe. Comparing the results to those of other studies that draw on SHARE data, they are somewhat different from for example those of Bolin and colleagues (2008), who found a negative effect for the hours worked of women in what they define as Central European countries[14]. For some European regions, they find negative effects on the employment probability and hours worked of men, which my results do not support. My regressor being a dummy for informal care provision may have caused some of the differences, as Bolin and co-authors (2008) employ a continuous measure of care instead. Evidence from non-SHARE studies has previously suggested the key relationships to be overall negative, with a negative effect having been

found for men and women in Southern and Eastern European countries. Previous evidence on hours worked suggests a negative effect from caregiving, although evidence has been scarce. My findings only support a negative effect for two groups in the case of employment status, and do not offer any support for the caregiving effect being negative for hours worked. I attribute these differences to methodological choices, especially my decision to include all intensity levels of caregiving under the definition of informal care provision.

The estimated effect that I find to be most robust, is the estimated negative effect on women's employment status in country groups *Medium* and *Low, South*, with point estimates of around 16 and 18 percentage points. The point estimate for Southern European women appears to be in line with the study from Crespo and Mira (2014), whose results suggest that between 45 and 65% of the 20% of women who become daily caregivers in Southern Europe drop out of paid employment. It is logical that my point estimates are lower than theirs, because the caregiving dummy marks also non-intensive caregivers. The third reference study that uses SHARE data by Kolodziej and co-authors (2018) found a 25% drop in employment probability for both women and men who provided daily care, which is lower than my result or that of Crespo and Mira. I attribute this difference to their methodology, which allows them to cover the population of caregivers who are under the age of 50, as well as differences in their choice of instruments.

The findings suggesting caregiving to be related to increases in the labour supply of women in Eastern Europe but reductions in Southern Europe (disregarding the increase for work hours in column 3 of Table 10) is interesting from the perspective of seeing the availability of formal care as an important factor mediating the relationship of caregiving and work. It raises the question of whether there are some factors in these countries that have been left unaccounted for, such as differing living arrangements, for example the prevalence of inter-generational households, or arrangements of hiring outside help that falls outside the formal-informal care spectrum considered here. A noteworthy detail upon inspection of the summary statistics in Table 3 is that the employment rates of women in Eastern European countries are generally much higher than those of women in Southern Europe. It may be that women in Southern Europe have a lower attachment to the labour market for some reason, for example culture, and drop out of paid work more easily than their Eastern European counterparts. Given that evidence on Eastern Europe remains scarce, this is an aspect future studies could zoom in on.

Another dimension of the debate that requires more attention based on findings from other studies is the importance of the intensity of caregiving in mediating its effect on labour supply. Based on previous evidence from non-SHARE studies presented in section 2.3, it seems likely that separating different degrees of caregiving intensity is important. An interesting follow up to this study would be an analysis where regressions were run on subsamples of caregivers who reported how often they had provided care. As for my results on hours worked, I suspect that the main reason to why the results are mixed is my care provision dummy variable being too broad and forcing intensive and less intensive care under the same dummy variable. Perhaps care intensity varies systematically across European

regions, producing differences in my estimates. Gaining an understanding of where the threshold lies is interesting from a policy perspective, providing guidance over which groups are most affected by caregiving duties.

6 Conclusion

The aim of this study was to produce up-to-date estimates of the relationship of informal caregiving and the probability of being in paid employment as well as weekly working hours for the mature working-age population in 21 European countries. The key research questions answered are (a) whether engaging in informal care has a negative effect on the labour supply of caregivers, (b) whether significant gender differences can be found in the effects, and (c) to what extent institutional context, especially the availability of formal LTC services, mediates the relationship of caregiving and work. I discussed potential reverse causality between previous work status and the decision to take on informal caregiving duties, highlighted gender differences through theory and empirics, and linked differences in the availability and prices of formal LTC services between countries to patterns that emerged in the results. In my analyses, I considered a broad measure of informal caregiving, including not only caregivers who perform daily care duties, but also carers who help a parent less often. This appears to have influenced the results, as main findings are only partly in line with previous literature on the topic.

Through employing OLS estimation techniques when no evidence of endogeneity was found and TSLS procedures whenever there was evidence of endogeneity, I found both expected and unexpected results. The findings are best described at the level of country groups, as there are significant differences in both the direction and magnitudes of the estimated effects. First, in countries that are characterised by high levels of public expenditure on LTC schemes, being an informal caregiver was associated with an increased employment probability for women and increased weekly working hours for men. This suggests either that there are unobserved factors that bias the results, such as individual characteristics, or that there are factors at play that incentivise caregivers to work more than their non-caregiving counterparts. Because previous literature has found overall effects from caregiving on work to be negative, but often considers only intensive caregiving, the findings call for further analyses of the relationships of interest for carers who provide moderate or low levels of care. Second, I find a relatively large drop in the employment probability of female caregivers in countries that are characterised by a moderate or low level of public spending on LTC services. These countries are located either in Central or Southern Europe. The result is in line with previous studies, providing support for policy decisions about whether to promote formal or informal care in these regions. Third, I explore the relationships of interest for the Eastern European region, for which evidence has previously been scarce. Findings suggest that women in these countries increase their labour supply in response to an elderly parent becoming dependent. This may indicate that families make decisions primarily based on cost considerations, as the increases in work may be due to the necessity to cover costs of formal care that complements informal care.

The study has limitations in terms of data coverage and quality, as well as the population covered. SHARE targets only people over the age of 50, and my analyses therefore lack all younger caregivers. The information provided on caregiving and labour market outcomes is limited, and future studies could expand on the level of detail by leveraging other data. One suggestion would be to utilise the panel dimension of SHARE, which requires performing for example attrition analyses, but would potentially reduce bias originating in the unobserved characteristics of individual respondents. Methodological limitations include the potentially weak generilisability of the estimates to other countries or regions due to results being dependent on the sampled group, as well as the choice of instruments. In addition, the results are sensitive to the definition of informal caregiving, and straighforward comparisons to other studies are somewhat limited because I have used a broader definition of caregiving than most studies.

As a conluding remark, the question about the labour supply impacts of informal caregiving continues to increase in relevance for the vast majority of European countries, and the relationship of formal and informal care will have to be studied in more detail in different country contexts. The effects of caregiving are expected become more pronouced as the European populations continue to age and the demand for informal care rises. At the same time, greater numbers of women seek to increase their participation in paid work, possibly implying reductions in the supply of informal care. Therefore, continued research on the topic is required at both national and pan-European levels.

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Appendix

Table A1. Results from Ordinary Least Squares regressions of informal care provision on employment status (full version of Table 6, upmost panel).

Full sample	Europe	High	Medium	Low, South	Low, East
Informal care provision dummy	0.023***	0.027***	0.013	0.015	0.026**
	(0.006)	(0.007)	(0.012)	(0.016)	(0.013)
Male	0.154***	0.142***	0.137***	0.340***	0.012
	(0.005)	(0.007)	(0.012)	(0.015)	(0.013)
Age	0.071***	0.078**	0.103*	0.083	-0.058
	(0.023)	(0.031)	(0.056)	(0.061)	(0.054)
Age squared	-0.001***	-0.001***	-0.001**	-0.001	0.001
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
Married	-0.016**	-0.014	-0.042***	-0.057***	0.059***
	(0.007)	(0.009)	(0.015)	(0.018)	(0.017)
Cohabiting	0.019	0.028	-0.041	0.135	0.087***
	(0.017)	(0.022)	(0.041)	(0.093)	(0.033)
Years of education	0.015***	0.010***	0.012***	0.031***	0.019***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Citizen in country of residence	0.050***	0.060***	0.053	0.009	0.020
	(0.017)	(0.023)	(0.037)	(0.111)	(0.032)
Number of children	-0.005**	-0.000	-0.002	-0.006	-0.012**
	(0.002)	(0.003)	(0.005)	(0.006)	(0.005)
Number of young children	-0.029***	-0.042***	-0.013	-0.017	-0.041
	(0.010)	(0.012)	(0.020)	(0.022)	(0.032)
Wealth	0.000***	0.000***	0.000***	0.000	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Bad self-reported health	-0.163***	-0.286***	-0.154***	0.025	-0.137***
	(0.024)	(0.045)	(0.055)	(0.051)	(0.043)
Number of health conditions	-0.018***	-0.014***	-0.019***	-0.031***	-0.013**
	(0.003)	(0.004)	(0.006)	(0.007)	(0.006)
Observations	18,381	8,462	4,014	2,955	2,950
R-squared	0.169	0.161	0.100	0.265	0.102

Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

Note: Regressions control for country fixed effects and year fixed effects.

Table A2. Results from Ordinary Least Squares regressions of informal care provision on employment status for women (full version of Table 6, middle panel).

Women	Europe	High	Medium	Low, South	Low, East
Informal care provision dummy	0.022***	0.023**	0.007	0.028	0.033*
	(0.008)	(0.011)	(0.018)	(0.022)	(0.017)
Age	0.063**	0.061	0.094	0.076	-0.033
	(0.032)	(0.045)	(0.078)	(0.079)	(0.069)
Age squared	-0.001***	-0.001*	-0.001	-0.001	0.000
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Married	-0.045***	-0.049***	-0.076***	-0.081***	0.034
	(0.009)	(0.013)	(0.021)	(0.024)	(0.022)
Cohabiting	0.059**	0.051	0.034	0.173*	0.074
	(0.023)	(0.032)	(0.054)	(0.095)	(0.048)
Years of education	0.018***	0.011***	0.015***	0.039***	0.016***
	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)
Citizen in country of residence	0.048**	0.087**	0.040	-0.157	0.004
	(0.025)	(0.034)	(0.051)	(0.189)	(0.042)
Number of children	-0.013***	-0.009**	-0.006	-0.011	-0.017**
	(0.003)	(0.004)	(0.007)	(0.007)	(0.008)
Number of young children	-0.060***	-0.078***	-0.052	-0.072	-0.037
	(0.022)	(0.029)	(0.048)	(0.060)	(0.055)
Wealth	0.000	0.000*	0.000	0.000	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Bad self-reported health	-0.148***	-0.269***	-0.071	0.014	-0.187***
	(0.031)	(0.059)	(0.066)	(0.061)	(0.058)
Number of health conditions	-0.021***	-0.018***	-0.016*	-0.025***	-0.021***
	(0.004)	(0.006)	(0.008)	(0.009)	(0.008)
Observations	10,990	4,826	2,414	1,981	1,769
R-squared	0.199	0.186	0.099	0.207	0.123

Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

Note: Regressions control for country fixed effects and year fixed effects.

Table A3. Results from Ordinary Least Squares regressions of informal care provision on employment status for men (full version of Table 6, lowest panel).

Men	Europe	High	Medium	Low, South	Low, East
Informal care provision dummy	0.020***	0.025***	0.022	-0.019	0.019
	(0.007)	(0.008)	(0.015)	(0.019)	(0.020)
Age	0.058**	0.077**	0.110	0.061	-0.117
	(0.029)	(0.036)	(0.072)	(0.077)	(0.089)
Age squared	-0.001**	-0.001**	-0.001	-0.001	0.001
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Married	0.030***	0.029***	0.022	-0.011	0.101***
	(0.008)	(0.010)	(0.021)	(0.022)	(0.026)
Cohabiting	-0.003	0.008	-0.083	-0.130	0.121**
	(0.023)	(0.028)	(0.060)	(0.210)	(0.047)
Years of education	0.007***	0.006***	0.005***	0.008***	0.020***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)
Citizen in country of residence	0.054**	0.044	0.097*	0.147	0.024
	(0.022)	(0.028)	(0.053)	(0.110)	(0.051)
Number of children	0.006**	0.008***	-0.000	0.008	-0.004
	(0.003)	(0.003)	(0.007)	(0.007)	(0.007)
Number of young children	-0.020**	-0.033***	0.006	0.014	-0.048
	(0.010)	(0.012)	(0.018)	(0.015)	(0.037)
Wealth	0.000***	0.000***	0.000***	0.001**	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Bad self-reported health	-0.179***	-0.308***	-0.301***	0.075	-0.067
	(0.039)	(0.073)	(0.089)	(0.057)	(0.062)
Number of health conditions	-0.013***	-0.008*	-0.028***	-0.031***	-0.001
	(0.004)	(0.004)	(0.009)	(0.011)	(0.009)
Observations	7,391	3,636	1,600	974	1,181
R-squared	0.069	0.069	0.080	0.064	0.097

Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

Note: Regressions control for country fixed effects and year fixed effects.

Table A4. Results from Ordinary Least Squares regressions of informal care provision on hours worked, conditional on respondent being in paid employment or self-employed (full version of Table 7, upmost panel).

Full sample	Europe	High	Medium	Low, South	Low, East
Informal care provision dummy	0.009	0.002	0.005	0.022	0.035**
	(0.008)	(0.012)	(0.020)	(0.029)	(0.016)
Male	0.250***	0.275***	0.348***	0.204***	0.083***
	(0.008)	(0.011)	(0.019)	(0.029)	(0.016)
Age	0.068*	0.082*	-0.012	0.183	0.078
	(0.035)	(0.048)	(0.087)	(0.115)	(0.076)
Age squared	-0.001**	-0.001*	0.000	-0.002	-0.001
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Married	-0.020**	-0.027*	-0.015	0.016	-0.034*
	(0.010)	(0.014)	(0.025)	(0.032)	(0.020)
Cohabiting	0.073***	0.092***	0.098**	0.049	-0.011
	(0.020)	(0.026)	(0.048)	(0.102)	(0.040)
Years of education	0.008***	0.009***	0.009***	0.007*	0.004
	(0.001)	(0.002)	(0.002)	(0.004)	(0.003)
Citizen in country of residence	-0.007	-0.013	-0.031	-0.076	0.029
	(0.022)	(0.032)	(0.052)	(0.156)	(0.035)
Number of children	-0.008***	-0.001	-0.012	-0.023*	-0.012*
	(0.003)	(0.004)	(0.007)	(0.012)	(0.007)
Number of young children	-0.012	-0.028*	-0.002	-0.023	0.014
	(0.014)	(0.017)	(0.030)	(0.060)	(0.036)
Wealth	0.000	0.000	0.000	0.000	-0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Bad self-reported health	-0.057*	-0.222***	-0.086	0.055	0.021
	(0.034)	(0.074)	(0.098)	(0.087)	(0.036)
Number of health conditions	-0.018***	-0.021***	-0.025**	-0.017	-0.006
	(0.004)	(0.006)	(0.011)	(0.014)	(0.007)
Public sector employee	0.038***	0.014	0.107***	0.017	0.032**
	(0.008)	(0.012)	(0.019)	(0.028)	(0.015)
Observations	11,289	5,334	2,523	1,258	2,174
R-squared	0.131	0.161	0.152	0.070	0.032

Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

Note: Regressions control for country fixed effects and year fixed effects.

Table A5. Results from Ordinary Least Squares regressions of informal care provision on hours worked for women, conditional on respondent being in paid employment or self-employed (full version of Table 7, middle panel).

Women	Europe	High	Medium	Low, South	Low, East
Informal care provision dummy	0.011	0.004	0.018	-0.006	0.039*
	(0.012)	(0.017)	(0.031)	(0.040)	(0.022)
Age	-0.028	-0.057	-0.063	0.134	0.006
	(0.050)	(0.066)	(0.138)	(0.177)	(0.093)
Age squared	0.000	0.000	0.000	-0.001	-0.000
	(0.000)	(0.001)	(0.001)	(0.002)	(0.001)
Married	-0.044***	-0.054***	-0.064*	-0.007	-0.050*
	(0.015)	(0.020)	(0.038)	(0.048)	(0.028)
Cohabiting	0.117***	0.139***	0.125*	0.057	0.027
	(0.028)	(0.040)	(0.068)	(0.116)	(0.056)
Years of education	0.011***	0.012***	0.015***	0.008*	0.003
	(0.002)	(0.003)	(0.004)	(0.005)	(0.004)
Citizen in country of residence	0.016	0.008	-0.029	0.118	0.078
	(0.036)	(0.051)	(0.079)	(0.300)	(0.059)
Number of children	-0.016***	-0.007	-0.030***	-0.031*	-0.015
	(0.005)	(0.006)	(0.011)	(0.016)	(0.012)
Number of young children	-0.031	-0.020	-0.144*	0.060	0.081
	(0.034)	(0.040)	(0.077)	(0.087)	(0.076)
Wealth	-0.000	-0.000	0.000	-0.000	-0.001
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Bad self-reported health	-0.068	-0.279***	-0.076	0.005	0.031
	(0.050)	(0.106)	(0.131)	(0.130)	(0.047)
Number of health conditions	-0.021***	-0.028***	-0.017	-0.038*	-0.007
	(0.005)	(0.007)	(0.014)	(0.020)	(0.009)
Public sector employee	0.059***	0.018	0.165***	0.061*	0.051**
	(0.012)	(0.017)	(0.029)	(0.033)	(0.020)
Observations	6,346	2,916	1,430	712	1,288
R-squared	0.138	0.163	0.073	0.046	0.030

Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

Note: Regressions control for country fixed effects and year fixed effects.

Table A6. Results from Ordinary Least Squares regressions of informal care provision on hours worked for men, conditional on respondent being in paid employment or self-employed (full version of Table 7, lowest panel).

Men	Europe	High	Medium	Low, South	Low, East
Informal care provision dummy	0.013	0.008	-0.013	0.055	0.029
	(0.011)	(0.014)	(0.023)	(0.043)	(0.022)
Age	0.164***	0.210***	0.055	0.304**	0.157
	(0.047)	(0.064)	(0.093)	(0.152)	(0.129)
Age squared	-0.002***	-0.002***	-0.001	-0.003**	-0.001
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Married	0.018	0.002	0.063*	0.045	-0.015
	(0.013)	(0.018)	(0.032)	(0.042)	(0.029)
Cohabiting	0.037	0.037	0.109	0.017	-0.048
	(0.027)	(0.033)	(0.067)	(0.061)	(0.058)
Years of education	0.003**	0.003	0.002	0.005	0.005
	(0.001)	(0.002)	(0.002)	(0.005)	(0.005)
Citizen in country of residence	-0.016	0.015	-0.027	-0.237**	-0.008
	(0.025)	(0.037)	(0.062)	(0.101)	(0.039)
Number of children	0.002	0.004	0.016*	-0.015	-0.010
	(0.004)	(0.005)	(0.008)	(0.019)	(0.007)
Number of young children	-0.019	-0.038**	0.023	-0.051	-0.016
	(0.014)	(0.018)	(0.022)	(0.069)	(0.039)
Wealth	0.000**	0.000***	0.000	0.001*	-0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)
Bad self-reported health	-0.029	-0.143	-0.131	0.188**	0.007
	(0.045)	(0.110)	(0.126)	(0.075)	(0.055)
Number of health conditions	-0.016***	-0.015*	-0.043***	0.011	-0.002
	(0.006)	(0.008)	(0.016)	(0.018)	(0.009)
Public sector employee	-0.031***	-0.049***	0.017	-0.068	-0.009
	(0.011)	(0.015)	(0.019)	(0.050)	(0.020)
Observations	4,943	2,418	1,093	546	886
R-squared	0.030	0.042	0.050	0.069	0.026

Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

Note: Regressions control for country fixed effects and year fixed effects.

Table A7. Results from Two-Stage Least Squares regressions of informal care provision on employment status (full version of Table 8, upmost panel).

Full sample	Europe	High	Medium	Low, South	Low, East
Informal care provision dummy	-0.063**	-0.029	-0.104*	-0.150*	0.027
	(0.032)	(0.045)	(0.058)	(0.090)	(0.074)
Male	0.146***	0.136***	0.127***	0.332***	0.012
	(0.006)	(0.009)	(0.014)	(0.017)	(0.015)
Age	0.083***	0.088***	0.120**	0.090	-0.058
	(0.024)	(0.033)	(0.057)	(0.063)	(0.055)
Age squared	-0.001***	-0.001***	-0.001**	-0.001*	0.001
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
Married	-0.009	-0.009	-0.031*	-0.052***	0.059***
	(0.007)	(0.010)	(0.016)	(0.018)	(0.018)
Cohabiting	0.024	0.032	-0.030	0.126	0.087***
	(0.017)	(0.022)	(0.043)	(0.094)	(0.033)
Years of education	0.016***	0.010***	0.012***	0.031***	0.019***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Citizen in country of residence	0.061***	0.067***	0.073*	0.077	0.020
	(0.019)	(0.026)	(0.043)	(0.119)	(0.033)
Number of children	-0.007***	-0.001	-0.006	-0.013**	-0.012**
	(0.002)	(0.003)	(0.005)	(0.006)	(0.005)
Number of young children	-0.030***	-0.042***	-0.018	-0.014	-0.041
	(0.011)	(0.013)	(0.020)	(0.022)	(0.042)
Wealth	0.000***	0.000***	0.000***	0.000	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Bad self-reported health	-0.174***	-0.293***	-0.172***	0.002	-0.137***
	(0.025)	(0.045)	(0.059)	(0.053)	(0.043)
Number of health conditions	-0.019***	-0.014***	-0.020***	-0.035***	-0.013**
	(0.003)	(0.004)	(0.006)	(0.008)	(0.006)
Observations	18,380	8,461	4,014	2,955	2,950
R-squared	0.158	0.155	0.080	0.245	0.102

Robust standard errors in parentheses, clustered by household.

*** p<0.01, ** p<0.05, * p<0.1.

Note: Regressions control for country fixed effects and year fixed effects.

Table A8. Results from Two-Stage Least Squares regressions of informal care provision on employment status for women (full version of Table 8, middle panel).

Women	Europe	High	Medium	Low, South	Low, East
Informal care provision dummy	-0.092**	-0.034	-0.162**	-0.181*	0.063
	(0.044)	(0.066)	(0.080)	(0.109)	(0.095)
Age	0.084**	0.073	0.136*	0.083	-0.032
	(0.033)	(0.048)	(0.082)	(0.083)	(0.068)
Age squared	-0.001***	-0.001**	-0.001**	-0.001	0.000
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Married	-0.035***	-0.044***	-0.061***	-0.071***	0.031
	(0.010)	(0.015)	(0.022)	(0.024)	(0.023)
Cohabiting	0.062***	0.053*	0.042	0.161	0.075
	(0.023)	(0.031)	(0.057)	(0.103)	(0.048)
Years of education	0.018***	0.011***	0.016***	0.040***	0.016***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Citizen in country of residence	0.060**	0.092**	0.061	-0.026	0.003
	(0.028)	(0.040)	(0.062)	(0.201)	(0.042)
Number of children	-0.015***	-0.010**	-0.012	-0.020**	-0.017**
	(0.003)	(0.005)	(0.008)	(0.008)	(0.008)
Number of young children	-0.063***	-0.080***	-0.065	-0.055	-0.036
	(0.022)	(0.031)	(0.047)	(0.058)	(0.053)
Wealth	0.000*	0.000*	0.000	0.000	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Bad self-reported health	-0.161***	-0.273***	-0.094	-0.018	-0.183***
	(0.032)	(0.058)	(0.072)	(0.064)	(0.057)
Number of health conditions	-0.022***	-0.018***	-0.017**	-0.033***	-0.021***
	(0.004)	(0.006)	(0.009)	(0.010)	(0.008)
Observations	10,990	4,826	2,414	1,981	1,769
R-squared	0.184	0.182	0.065	0.182	0.121

Robust standard errors in parentheses, clustered by household.

*** p<0.01, ** p<0.05, * p<0.1.

Note: Regressions control for country fixed effects and year fixed effects.

Table A9. Results from Two-Stage Least Squares regressions of informal care provision on employment status for men (full version of Table 8, lowest panel).

Men	Europe	High	Medium	Low, South	Low, East
Informal care provision dummy	-0.015	0.002	-0.003	-0.067	-0.087
	(0.038)	(0.050)	(0.070)	(0.129)	(0.106)
Age	0.060**	0.080**	0.108	0.062	-0.107
	(0.030)	(0.038)	(0.072)	(0.077)	(0.092)
Age squared	-0.001**	-0.001**	-0.001	-0.001	0.001
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Married	0.032***	0.031***	0.025	-0.010	0.109***
	(0.009)	(0.011)	(0.022)	(0.022)	(0.029)
Cohabiting	0.000	0.011	-0.079	-0.156	0.129***
	(0.024)	(0.029)	(0.061)	(0.177)	(0.049)
Years of education	0.007***	0.006***	0.005***	0.007***	0.021***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.004)
Citizen in country of residence	0.060***	0.049*	0.103*	0.133	0.017
	(0.023)	(0.030)	(0.055)	(0.125)	(0.051)
Number of children	0.006**	0.008**	-0.000	0.010	-0.005
	(0.003)	(0.003)	(0.007)	(0.008)	(0.008)
Number of young children	-0.021*	-0.033**	0.004	0.009	-0.054
	(0.012)	(0.013)	(0.019)	(0.015)	(0.050)
Wealth	0.000***	0.000***	0.000***	0.001**	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Bad self-reported health	-0.184***	-0.312***	-0.305***	0.061	-0.075
	(0.039)	(0.073)	(0.088)	(0.056)	(0.061)
Number of health conditions	-0.013***	-0.008*	-0.029***	-0.026**	-0.002
	(0.004)	(0.004)	(0.009)	(0.011)	(0.009)
Observations	7,390	3,635	1,600	974	1,181
R-squared	0.065	0.067	0.079	0.089	0.075

Robust standard errors in parentheses, clustered by household.

*** p<0.01, ** p<0.05, * p<0.1.

Note: Regressions control for country fixed effects and year fixed effects.

Table A10. Results from Two-Stage Least Squares regressions of informal care provision on hours worked, conditional on respondent being in paid employment or self-employed (full version of Table 9, upmost panel).

Full sample	Europe	High	Medium	Low, South	Low, East
Informal care provision dummy	0.062	0.082	-0.078	0.274*	-0.029
	(0.048)	(0.068)	(0.098)	(0.164)	(0.087)
Male	0.255***	0.283***	0.341***	0.222***	0.077***
	(0.010)	(0.014)	(0.021)	(0.033)	(0.018)
Age	0.060*	0.069	0.004	0.166	0.088
	(0.036)	(0.049)	(0.088)	(0.118)	(0.078)
Age squared	-0.001*	-0.001	-0.000	-0.001	-0.001
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Married	-0.024**	-0.033**	-0.007	0.014	-0.030
	(0.011)	(0.015)	(0.026)	(0.032)	(0.022)
Cohabiting	0.069***	0.085***	0.111**	0.041	-0.011
	(0.020)	(0.027)	(0.049)	(0.118)	(0.040)
Years of education	0.008***	0.009***	0.010***	0.005	0.005
	(0.001)	(0.002)	(0.002)	(0.004)	(0.003)
Citizen in country of residence	-0.013	-0.021	-0.015	-0.220	0.031
	(0.023)	(0.032)	(0.056)	(0.183)	(0.036)
Number of children	-0.007**	0.000	-0.015*	-0.023*	-0.013*
	(0.003)	(0.004)	(0.008)	(0.013)	(0.007)
Number of young children	-0.011	-0.027	-0.006	-0.012	0.014
	(0.014)	(0.017)	(0.030)	(0.057)	(0.036)
Wealth	0.000	0.000	0.000	0.000	-0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Bad self-reported health	-0.051	-0.207***	-0.093	0.071	0.013
	(0.035)	(0.075)	(0.100)	(0.091)	(0.038)
Number of health conditions	-0.017***	-0.020***	-0.027**	-0.012	-0.007
	(0.004)	(0.006)	(0.010)	(0.014)	(0.007)
Public sector employee	0.037***	0.012	0.111***	0.025	0.028*
	(0.008)	(0.013)	(0.019)	(0.031)	(0.016)
Observations	11,288	5,333	2,523	1,258	2,174
R-squared	0.128	0.153	0.146	0.020	0.025

Robust standard errors in parentheses, clustered by household.

*** p<0.01, ** p<0.05, * p<0.1.

Note: Regressions control for country fixed effects and year fixed effects.

Table A11. Results from Two-Stage Least Squares regressions of informal care provision on hours worked for women, conditional on respondent being in paid employment or self-employed (full version of Table 9, middle panel).

Women	Europe	High	Medium	Low, South	Low, East
Informal care provision dummy	0.082	0.081	-0.185	0.504***	0.046
	(0.067)	(0.100)	(0.142)	(0.192)	(0.114)
Age	-0.042	-0.071	0.019	0.064	0.006
	(0.051)	(0.066)	(0.148)	(0.196)	(0.093)
Age squared	0.000	0.001	-0.000	-0.001	-0.000
	(0.000)	(0.001)	(0.001)	(0.002)	(0.001)
Married	-0.050***	-0.063***	-0.050	-0.031	-0.050*
	(0.015)	(0.023)	(0.038)	(0.051)	(0.030)
Cohabiting	0.114***	0.137***	0.160**	-0.002	0.028
	(0.028)	(0.040)	(0.072)	(0.145)	(0.055)
Years of education	0.011***	0.012***	0.016***	0.004	0.003
	(0.002)	(0.003)	(0.004)	(0.006)	(0.004)
Citizen in country of residence	0.007	-0.001	-0.003	-0.249	0.077
	(0.038)	(0.053)	(0.083)	(0.333)	(0.060)
Number of children	-0.015***	-0.006	-0.039***	-0.032*	-0.015
	(0.005)	(0.006)	(0.013)	(0.018)	(0.012)
Number of young children	-0.030	-0.020	-0.164**	0.042	0.081
	(0.034)	(0.040)	(0.080)	(0.105)	(0.075)
Wealth	-0.000	-0.000*	0.000	-0.000	-0.001
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Bad self-reported health	-0.062	-0.269**	-0.096	0.021	0.031
	(0.051)	(0.107)	(0.134)	(0.129)	(0.050)
Number of health conditions	-0.020***	-0.027***	-0.018	-0.032	-0.007
	(0.006)	(0.008)	(0.014)	(0.021)	(0.010)
Public sector employee	0.058***	0.015	0.172***	0.076*	0.052**
	(0.012)	(0.018)	(0.030)	(0.039)	(0.021)
Observations	6,346	2,916	1,430	712	1,288
R-squared	0.133	0.158	0.043		0.030

Robust standard errors in parentheses, clustered by household.

*** p<0.01, ** p<0.05, * p<0.1.

Note: Regressions control for country fixed effects and year fixed effects.

Table A12. Results from Two-Stage Least Squares regressions of informal care provision on hours worked for men, conditional on respondent being in paid employment or self-employed (full version of Table 9, lowest panel).

Men	Europe	High	Medium	Low, South	Low, East
Informal care provision dummy	0.029	0.150*	-0.077	-0.159	-0.086
	(0.061)	(0.082)	(0.112)	(0.291)	(0.103)
Age	0.163***	0.195***	0.048	0.286*	0.180
	(0.047)	(0.065)	(0.092)	(0.148)	(0.134)
Age squared	-0.002***	-0.002***	-0.000	-0.002*	-0.002
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Married	0.017	-0.004	0.071**	0.062	-0.009
	(0.013)	(0.019)	(0.031)	(0.043)	(0.030)
Cohabiting	0.036	0.017	0.119*	0.006	-0.043
	(0.028)	(0.036)	(0.068)	(0.080)	(0.060)
Years of education	0.003*	0.002	0.002	0.003	0.007
	(0.001)	(0.002)	(0.002)	(0.005)	(0.005)
Citizen in country of residence	-0.018	0.000	-0.010	-0.145	-0.010
	(0.027)	(0.039)	(0.072)	(0.182)	(0.040)
Number of children	0.003	0.008	0.014	-0.023	-0.012
	(0.004)	(0.005)	(0.009)	(0.021)	(0.008)
Number of young children	-0.019	-0.037**	0.019	-0.054	-0.014
	(0.014)	(0.018)	(0.023)	(0.067)	(0.041)
Wealth	0.000**	0.000***	0.001	0.001	-0.001
	(0.000)	(0.000)	(0.000)	(0.001)	(0.002)
Bad self-reported health	-0.026	-0.108	-0.135	0.131	-0.008
	(0.046)	(0.110)	(0.126)	(0.085)	(0.059)
Number of health conditions	-0.016***	-0.016**	-0.045***	0.013	-0.003
	(0.006)	(0.008)	(0.015)	(0.018)	(0.009)
Public sector employee	-0.031***	-0.052***	0.020	-0.071	-0.019
	(0.011)	(0.015)	(0.019)	(0.050)	(0.021)
Observations	4,942	2,417	1,093	546	886
R-squared	0.029	0.002	0.043	0.043	

Robust standard errors in parentheses, clustered by household.

*** p<0.01, ** p<0.05, * p<0.1.

Note: Regressions control for country fixed effects and year fixed effects.

[1] Countries covered are Austria, Belgium, Denmark, Finland, France, Germany, Ireland, the Netherlands, United Kingdom, Greece, Italy, Portugal, and Spain.

[2] Casado-Marín and colleagues (2011) define 'intensive caregiving' as care exceeding a threshold of 28 hours per week.

[3] 'Intensive caregiving' is defined here through a 10-hours-per-week threshold.

[4] A full description of the data and its strengths and weaknesses can be found in Börsch-Supan and co-authors (2013), with wave-specific methodologies discussed in Börsch-Supan and Jürges (2005), Börsch-Supan and co-authors (2008), and Malter and Börsch-Supan (2013, 2015, 2017).

[5] One of the earliest studies that uses SHARE data to estimate the effect of caregiving on labour market outcomes (Bolin et al., 2008) employs an instrumental variables probit method to accommodate the binary dependent variable and a continuous explanatory variable measuring informal care. The study draws on the first wave of SHARE data, in which the respondents were inquired about the amount of care they had provided during the past 12 months. However, this question was dropped from the questionnaire from the second wave onwards, which is why I rely on a binary indicator to capture the effect of caregiving.

[6] For some waves the variable was directly given in SHARE, whereas for some, only a metric called *ISCED1997* was available. In these cases, I impute the years of education from the value given in the *ISCED1997* metric.

[7] The variable measuring net household wealth is derived from raw data by the SHARE team (Börsch-Supan & Jürges, 2005, p. 115), and estimates net household worth as the sum of real assets (which include the value of the primary residence net of the mortgage, the value of other real estate, the owned share of own business and owned cars) and net financial assets (which include the sum of the values of bank accounts, government and corporate bonds, stocks, mutual funds, individual retirement accounts, contractual savings for housing and life insurance policies owned by the household, minus financial liabilities).

[8] Conditions considered are the following: a heart attack including myocardial infarction or coronary thrombosis or any other heart problem including congestive heart failure; high blood pressure or hypertension; high blood cholesterol; a stroke or cerebrovascular disease; diabetes or high blood sugar; chronic lung disease such as chronic bronchitis or emphysema; asthma; arthritis, including osteoarthritis, or rheumatism; osteoporosis; cancer or malignant tumour, including leukaemia or lymphoma, but excluding minor skin cancers; stomach or duodenal ulcer, peptic ulcer; Parkinson disease; cataracts; hip fracture or femoral fracture; other conditions. The answer categories vary across waves, and not all conditions are given their own category in all waves. If a condition appearing as its own category is missing in another wave, I place it under other conditions.

[9] The evaluation scale varies across waves. For wave 1, I mark the health status as poor if the respondent rated the mother's health status as 'Poor' or 'Very poor'. For waves 2, 4, 5, and 6, I mark it as poor if the respondent answered with 'Poor'.

[10] In the case of longitudinal respondents, certain time fixed information, such as years of education, is only recorded for the first interview. For such variables, I impute information missing information in later waves from the first wave the respondent appeared in.

[11] As my explanatory variable is also dichotomous, it may seem appropriate to use TSLS with probit estimation in both stages instead of standard linear TSLS estimation. Probit models limit the outcome variable to the range 0-1. However, Angrist (2001) clarifies that with an endogenous model, second-stage estimates are then inconsistent if the first stage is not correctly specified and a linear first stage is generally safer.

[12] In the case of father being deceased, the instrument has no statistically significant effect on care provision for the combined sample of women and men or the subsample of women. Nevertheless, I leave the variable in the regressions, assuming it has no importance for the estimates.

[13] Some might argue that another relevant test in the context of IV estimation would be to test for overindetification restrictions (Wooldridge, 2012, p. 535). However, in practice testing the validity of instruments by assuming that one or more of them is already valid is doubtful for several reasons. One of them is that a rejection of an overidentification statistic may point to treatment effect heterogeneity rather than identification failure (Angrist & Pischke, 2008, p. 109). Therefore, I rely on argumetation rather than testing to convince the reader of the validity of my instruments.

[14] Central Europe is here defined as Germany, Austria, the Netherlands, France, and Switzerland.