INFORMAL CAREGIVING & LABOUR OPPORTUNITY COSTS ACROSS EUROPE

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Abstract

Previous research provides evidence of a negative relationship between informal caregiving and employment. However, little is known about the labour opportunity costs male and female informal caregivers incur across different European countries. Using data from the European Community Household Panel (1994-2001), this thesis sheds lights on the effects of informal caregiving on labour market outcomes, such as working hours and wages. A distinction between Northern and Southern European countries is made to examine a possible north-south gradient. Fixed effects models are estimated in order to control for unobserved individual heterogeneity and Tobit models are estimated to control for censoring. The sample is restricted to middle aged working men and women living in 11 European Union countries. The findings of this study suggest that different dynamics and intensities of informal caregiving bring significant labour opportunity cost for male and female caregivers living in Northern and Southern European countries. In addition, different dynamics and intensities of informal caregiving cause substantial differences between the Northern and Southern European caregivers. The results suggest that the effect of different informal care dynamics on working hours is more negative in Southern countries. No effect is found for the different informal care dynamics on wages. Moreover, working hours and wages are easier to maintain when providing low or medium levels of intensity informal care in Southern Europe. These differences are believed to be caused by different institutional settings, macro-economic conditions, and cultures.

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List of Abbreviations

BHPS	British Household Panel Survey
CBS	Centraal Bureau voor de Statistiek
ECHP	European Community Household Panel
e.g.	example given
EU	European Union
FE	Fixed effects
GLS	Generalised Least Squares
HRS	Health and Retirement Study
i.e.	in other words
INE	Instituto Nacional de Estadistica
NLTCS	National Long-Term Care Survey
NLS	National Longitudinal Survey of Mature Women
NSFH	National Survey of Families and Households
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
RE	Random effects
SHARE	Survey of Health Ageing and Retirement in Europe
UK	United Kingdom
US	United States

1 Introduction

European governments face growing expectations of their populations for access to better quality long-term care services at affordable costs. The demand for long-term care services will rise steeply when the baby-boom generation reaches older age groups over the next few decades (OECD 2005). Long term care can be provided formally or informally. Formal care is provided by professionals at home or at health institutions. Informal care is provided by family and volunteers without any form of compensation. However, it is seen as an indispensable component of care for elderly with long-term care needs, as approximately 80% of all long-term care is provided informally (RVZ 2006). Forecasts show that informal care will be an increasingly important source of care in the near future (Johnson and Lo Sasso 2000; Crespo and Mira 2010). There are both supply and demand factors that might influence this growing dependency. Increasing longevity, rising rates of disability and demographic ageing in all European countries will undoubtedly continue to increase the demand for formal and informal care services. Changing aspects in family structures, such as increasing female labour force participation, fewer children, greater mobility, lower marriage rates, and declines in intergenerational co residence are expected to affect the supply of informal care (Heitmueller 2007; Casado-Marin et al. 2009). Moreover, current European economic conditions force national governments to initiate austerity measures; cuts in public budgets related to long-term care systems are seen throughout Europe. As a consequence, it is expected that the demand for, and pressure on, informal caregivers will increase. However, the growth of informal care as a substitute for formal care has economic consequences because many individuals combine (paid) work and caring responsibilities, often at the expense of career prospects, leisure time, income, and pension entitlements (Brouwer et al. 1997; Carmichael and Charles 2003; Heitmueller 2007). Evaluating these labour opportunity costs is relevant in the debate of the design of optimal public long-term care systems and in the implementation of informal care support programs.

The analysis of the question how different European governments cope with the abovementioned factors is of particular interest, as preceding literature provides evidence of a European north-south gradient with respect to the design of long-term care systems and cultural differences (Bolin et al. 2008). Northern (European) countries distinguish themselves by having generous and universal long-term care systems. In Northern countries, demographic ageing is expected to increase future public expenditures that will be hard to meet, especially during economic crisis. To reduce pressures on public expenditures, policy makers see a solution in the incentivisation and intensification of informal care. Southern (European) countries distinguish themselves by covering only the basic needs of the poorest elderly individuals and relying more extensively on informal care, especially provided by middle aged women. By expanding the public coverage Southern governments try to strike a new bal-

ance between formal and informal care that is compatible with higher (female) labour force participation rates (Casado-Marin et al. 2009; Crespo and Mira 2010).

As described it is clear that the provision of informal care has economic consequences in Northern and Southern countries. Incentivising informal care in order to reduce the pressure on public budgets might result in lower labour force participation rates, whereas improving labour force participation rates can drive necessary expansion of expanding public budgets. A sound understanding of the relationship between informal caregiving and labour market behaviour to predict informal care cost in terms of labour opportunity costs is therefore crucial.

Despite ample evidence that informal caregiving affects employment negatively in Europe the existing literature suffers from two main problems. The most significant concern is the (possible) endogeneity problem that leads to biased estimates of the causal effect of informal caregiving on labour market behaviour. Different estimation methods are used within the existing literature to address this potential problem; however mixed conclusions are drawn about its existence. Second, much literature focuses on the effects of the extensive margin, or measures the impact of informal caregiving on labour opportunity costs but does not measures the differences between genders and European regions. Given the lack of consensus about the effect informal caregiving has on labour market behaviour, it is difficult to pool estimates across different studies to have a good understanding of the effect informal caregiving has on labour market behaviour. This study strives to fill that gap in the literature by analysing the effect of various characteristics of caregiving on approximations of labour opportunity costs to provide insight into the potential costs of informal caregiving and differences within Europe. The panel structure of the ECHP is exploited, allowing for the presence of unobserved individual heterogeneity, to estimate a fixed effects model. In this regard a method similar to Van Houtven et al. (2010), who control for possible endogeneity using an instrumental variables approach with fixed effects models, is followed.

The structure of this thesis is as follows: Chapter 2 starts with an overview of the existing literature related to the field of interest and highlights methods for valuing labour opportunity costs. Chapter 3 presents the methodology and models. Chapter 4 provides details about the data, the sample selection criteria and important variables. Chapter 5 presents the results related to the effect informal caregiving has on weekly working hours and yearly wages, estimated separately for men and women living in Southern or Northern countries. The thesis ends with a discussion on the main findings, policy implications, and a conclusion.

2 Literature review

A lot of research has been done to examine the extent informal caregivers incur labour opportunity costs resulting from the initiation, continuation, termination, or increase of informal caregiving, both in terms of forgone employment possibilities and income. In this chapter, the existing knowledge about the topic is analysed in order to put the research question in a broader perspective. However, before proceeding to the description of the prior research done in the United States and Europe (paragraph 2.2) first the endogeneity problem is introduced in paragraph 2.1. In section 2.3 an overview of the existing valuation methods concerning productivity costs is presented. Finally in paragraph 2.4 hypotheses are drafted which link the existing literature with the results in chapter 5.

2.1 The endogeneity problem

The most simplified model to analyse the relationship between informal care and labour market behaviour assumes that informal care can be treated exogenous. However, more advanced and realistic models recognize informal care as endogenous. This endogeneity is likely to arise from two types of elements, reversed causality and unobserved individual heterogeneity, which are visualised in Figure 2.1 (Ettner 1996; Casado-Marin et al. 2010).

Figure 2.1 The endogeneity problem
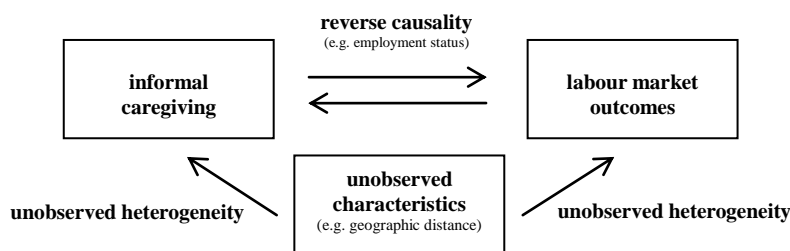
First, models that treat informal care as exogenous assume that informal caregiving affects labour market outcomes. The endogeneity of informal caregiving, however, presumes that this causal relationship might (also) be reversed. For example, adult children who are more efficient in market production may be less willing to provide informal care; as a result those children will prefer more parental institutionalisation (Léger 2004). Also informal caregiving could affect employment status, however, employment status could affect the willingness to provide informal care as well (Ettner 1996). And second, individuals might posses unobserved characteristics, correlated with both propensities to

care for a disabled parent and to participate on the labour market (such as geographical distance). Those unobserved characteristics might influence the effect of caregiving on labour market behaviour. By employing econometric techniques that control for reverse causality and unobserved individual heterogeneity a more reliable causal relationship between informal care and labour market behaviour can be given (Léger 2004; Casado-Marin et al. 2010). An overview of the techniques exploited by the studies which are described in paragraph 2.2 is given in Table 2.1. Thereby, providing an instrument to judge which studies present more reliable outcomes.

Table 2.1 Econometric techniques used to correct for the endogeneity problem

Research:	Tackling:	Solution
Stern 1992; Wolf and Soldo 1994; Ettner 1995, 1996; Pavalko and Artis 1997; Heitmueller 2007; Bolin et al. 2008	reverse causality and heterogeneity	an instrumental variables approach
Crespo 2007; Crespo and Mira 2010	reverse causality	a bivariate probit model
Spies and Schneider 2002, 2003	heterogeneity	a difference-in-difference model
Viitanen 2005; Casado-Marin et al. 2011	heterogeneity	a dynamic ordered probit model
Van Houtven et al. 2010	reverse causality and heterogeneity	an instrumental variable approach with fixed effects models
Johnson and Lo Sasso 2000, 2006	reverse causality and heterogeneity	a simultaneous equation model
Michaud et al. 2010	reverse causality and heterogeneity	a dynamic bivariate probit model

Source: author based

2.2   Previous research

Researchers from the United States (US) are the first to study the relationship between informal care and labour market behaviour (subparagraph 2.2.1). Based on their study designs, methodology, and experiences European research is performed years later (subparagraph 2.2.2). All these studies can be classified according to whether they control for both reverse causality and unobserved individual heterogeneity, or only one of them. In both subparagraphs this classification is used to provide insight into what studies present more reliable results.

2.2.1   United States

A first group of American studies attempts to tackle the possible endogeneity by estimating the labour equations of interest with instrumental variables (Stern 1992; Wolf and Soldo 1994; Ettner 1995, 1996; Pavalko and Artis 1997). In these studies the health status of the parents of caregiving and non caregiving women and the number of siblings these women have are used as instruments. Except for Stern (1992) and Wolf and Soldo (1994), the results obtained by this first group of studies tend to confirm the existence of labour opportunity costs associated with informal care for women, while using different databases which refer to different time periods and states.

Stern (1992) is one of the first to analyse the relationship between caregiving and labour supply. Using lagged dependent variables, from the National Long-Term Care Survey (NLTCS), as instruments Stern examines the effects of various parent and child characteristics, such as labour force participation, on the choice of care arrangement for the parent. He argues that care decisions may affect the child's labour force participation and that it is likely that the labour participation of the child will also reduce the probability of the child providing informal care to the parent. However, a child who feels responsible for providing informal care could decide to leave job or work less. Therefore, the author concludes that there is no rationale in handling that characteristic as exogenous. The results of the Stern study show that without accounting for endogeneity the employment status of the child has significant explanatory value on the provision of informal care. However, employment status is no longer significant when the author corrects for endogeneity.

As Stern also Wolf and Soldo (1994) find no effect on the probability of being employed or of reduced conditional hours of work, due to the provision of parental care. Using the 1987-88 National Survey of Families and Households (NSFH) they examine the association between time spent caring for a disabled parent and time spent at the labour market, amongst married women in the US.

Ettner (1995, 1996) obtains different results while also using the NSFH. She examines the effect of providing informal care to a co residential and non co residential parent on the number of hours adult men and women work. Ettner finds a significantly lower participation rate for women providing informal care to a co residential parent. Furthermore, although women who provide informal care outside the household do not experience lower participation rates their working hours, however, are also lower than for women who do not provide informal care at all. Providing informal care to non co residential parents reduces the hours of paid work for women by as much as 650 hours per year (Ettner 1996, 1996).

Pavalko and Artis (1997) examine the causal relationship between employment and providing informal care to a disabled relative using the National Longitudinal Survey (NLS) of Mature Women. They extend the previous research by showing that the likelihood of being a caregiver is independent of employment status; and secondly, by showing that the effect of caregiving on working hours is asymmetrical, meaning that starting caregiving while staying employed negatively affects working hours, whereas stopping care does not immediately result in resuming usual working hours. Hence, the causal relationship between employment and caregiving is mainly unidirectional.

A second set of US studies attempts to control for endogeneity by not only concentrating on reverse causality but also on unobserved individual heterogeneity, thereby presenting more reliable outcomes (Johnson and Lo Sasso 2000, 2006; Van Houtven et al. 2010).

Johnson and Lo Sasso (2000) examine the time transfers to disabled parents and their impact on the labour supply for children at midlife (ages 53 to 65). Using the longitudinal data of the Health and Retirement Study (HRS) (1992-2008) they employ full-information maximum likelihood techniques to

estimate a simultaneous equation model with panel data examining the time trade off providing informal care and hours of paid work. They find that providing informal care to parents substantially reduces the labour supply for both men and women at midlife. Their results indicate that the annual labour supply is 28% lower for men and 43% lower for women who provide informal care, compared to non-carers. Moreover, Johnson and Lo Sasso (2000) show that, despite the fact that only 11% of women and 6% of men in 1994 devoted more than 100 hours per year on informal care, the costs for those who provide informal care are high. On average women will work 459 hours less per year, which means a wage loss of $7,800.- annually. Similar results are found in their 2006 research. Using a different sample (women aged 55 to 67) but with the same methodology the authors conclude that female caregivers work 367 hours less as result of providing informal care, a reduction of on average 41% (Johnson and Lo Sasso 2006).

Conversely, also exploiting longitudinal data from the HRS Van Houtven et al. (2010) find that there are no changes in the intensive margin of work behaviour, meaning that informal care does not result in reducing working hours, taking on fewer responsibilities or forgoing a promotion to fulfil caregiving obligations. These differences between studies occur as Johnson and Lo Sasso (2006) only use two waves of data and include non-caregivers in the model, while Van Houtven et al. (2010) use nine waves of data and exclude non-caregivers in the model. Van Houtven et al. (201), however, do find changes in the extensive work margin as they identify that the labour force participation rate for men and women drops as a consequence of informal caregiving. The labour force participation rate drops with 1.2 to 2.4 percentage points for women and with 1.7 to 2.3 percentage points for men. Moreover, the authors report the existence of wage penalties ($0.40 per hour) for female caregivers and wage premiums ($2.20 per hour) for male caregivers who recently initiated or terminated caregiving responsibilities. Van Houtven et al. (2010) control for possible endogeneity using an instrumental variable approach, to address the potential reversed causality, with a fixed effects model to control for possible unobserved individual heterogeneity. However, the authors do not find evidence of endogeneity in their study, despite the use of strong instruments. They conclude that a selection bias may not be a major concern in this line of research once one controls for unobserved individual heterogeneity with fixed effects (Van Houtven et al. 2010).

2.2.2 Europe

This subparagraph addresses the European researches done in the field of interest. Of special interest is the difference in outcomes between Northern and Southern European countries. Before describing these differences, first the theories that have led to the recognition that differences occur within Europe are introduced in subparagraph 2.2.2.1.

2.2.2.1 The north south classification

Based on the amount of public coverage of long-term care, the mix between formal and informal care and the evolution of female labour force participation Bonsang (2007) recognises a Nordic group (the Scandinavian countries and the Netherlands), a Southern group (Mediterranean countries) and a Central group (Germany, Austria and France) of European countries (Bonsang 2007; Casado-Marin et al. 2009). Bolin et al. (2008) underpins these conclusions. They examine the differences in estimates between different European countries according to a north-south gradient. The north-south gradient is a result of cultural differences between Northern and Southern European countries. These differences could be of importance when studying the provision of informal care and labour market behaviour. They argue that Southern European countries are often seen as "strong family ties countries", where loyalty, authority, intra-generational co residence and support for the elderly are important cornerstones. It is contrasted by the Northern European countries which are seen as "weak family ties countries". The Continental European countries are categorized in the centre of the "weak-strong" dichotomy (Reher 1998; Kohli et al. 2005; Bolin et al. 2008). Evidence for this occurrence is also found when analysing the public spending on long-term care within the European countries of interest. Northern countries spend more resources on long-term care than Southern countries do, reflecting the more extensive reliance on informal care provision at Southern European countries (Bolin et al. 2008). In addition, Casado-Marin et al. (2011) report that throughout Southern Europe the family is the most important pillar in the provision of care. They highlight that in the particular case of Spain the needs of almost 75% of all dependent people are met by an informal caregiver.

Spiess and Schneider (2002, 2003) present a classification which only includes a Northern and Southern group of European countries. The Continental or Central group and the United Kingdom are included in the Northern group. The authors base this classification on the fact that all these countries have well developed institutional care and formal help services, whereas the Southern countries and Ireland are characterised by having relatively little institutional care and formal home-help services, and in which family support and intergenerational households are more common (Spiess and Schneider 2003).

2.2.2.2 Previous research within Europe

A first group of European studies is characterised by concentrating on unobserved individual heterogeneity using longitudinal data (Spiess and Schneider 2002, 2003; Viitanen 2005; Casado-Marin et al. 2009, 2011).

The first to conduct a study about the effects of caregiving responsibilities on labour market estimates within Europe are Spiess and Schneider (2002, 2003). Using the European Community Household Panel (ECHP) surveys of 1994 and 1996 they estimate difference-in-difference models, which control for fixed individual unobserved heterogeneity, to examine the association between caregiving

and changes in weekly working hours amongst women aged 45-69 in Europe during the mid 1990s. The authors show that there is a negative correlation between changes in informal caregiving hours and changes in weekly working hours. More specifically they show that initiating or intensifying the provision of informal care is accompanied by a decrease of weekly working hours, compared to women who do not provide informal care at all. No such association emerges for women stopping or reducing their informal care responsibilities. These findings suggest that women aged 45-69 do not return to the labour market, or resume their former working hours when they terminate or decrease their provision of informal care. In addition the authors show that this negative association between initiating caregiving hours and changes in working hours is only significant in Northern countries, whereas the increase in caregiving hours only has a significant effect on working hours in Southern countries. Spiess and Schneider suggest that this pattern reflects the bigger substitution opportunities in the Northern countries, such as institutional formal care, and the strong family boundaries in Southern countries (Spiess and Schneider 2002, 2003).

Using all eight waves of the ECHP (1994-2001) Viitanen (2005) estimates a dynamic ordered probit model to examine the effects of informal care on labour market behaviour of women aged between 20 and 59 across 13 European countries, while controlling for unobserved individual heterogeneity (random effects). Unlike Spiess and Schneider (2002, 2003) Viitanen's estimates are country specific and show that informal caregiving only has a negative influence on the probability of being employed in Germany. Additionally, analysing sub-samples for different age groups and for different marital statuses within the ECHP Viitanen (2005) reports two other findings. First, informal care responsibilities increase with age and tend to constrain middle aged women of participating in the labour force in Belgium, Finland, and Germany. Second, female single caregivers in the Netherlands, Germany, Italy, and Greece have a higher risk of old-age poverty as a result of lower pensions and savings.

Viitanen's results are confirmed in part by Casado-Marin et al. (2009) who analyse the effects of caregiving on different labour market outcomes of women aged between 30 and 60 within the ECHP. Dividing Europe into three groups of countries (Southern, Continental, and Scandinavian) these authors also find that there is no (statistically significant) change of employment status for women who were employed before becoming an informal caregiver. Moreover, Casado-Marin et al. (2009) show that, except for low educated women at Southern countries, informal caregiving affects income negatively. These income losses tend to be compensated by a parallel increase of social benefits. More recently, using a similar theoretical framework as Viitannen (2005), Casado-Marin et al. (2011) explore what the labour opportunity costs are for Spanish women who provide informal care. Using all eight waves of the ECHP, the authors reveal the existence of costs in terms of forgone employment for women who provide informal care more than 28 hours per week, and/or reside with the dependent person. In addition, they show that Spanish women experience negative effects on employment when caregiving exceeds a one year threshold. They also find that Spanish women do not experience prob-

lems re-entering the labour market after finishing an episode of informal care. It is concluded that, for women who provide informal care, the changes in the intensive margin (hours worked) are dominated by the changes in the extensive margin (labour force participation) of employment.

A second group of European studies attempts to tackle the possible endogeneity, as a result of reverse causality, by estimating the labour equations of interest with instrumental variables (Bolin et al. 2008; Heitmueller 2007) or using a bivariate probit model (Crespo 2007; Crespo and Mira 2010). As the US studies the results obtained by this second group tend to confirm the existence of labour opportunity costs as a consequence of informal caregiving.

Bolin et al. (2008) use data from the Survey of Health, Ageing and Retirement in Europe (SHARE) to address the question whether the supply of informal care transfers costs to the caregiver in terms of forgone labour market opportunities. In addition, they investigate if the institutional context is important in this respect. The authors hypothesize that people who provide significant amounts of informal care might be more absent from work or will be less committed to their careers, resulting in lower wage rates. This effect could be influenced by country specific institutional settings, and therefore differs between European countries and regions (Bolin et al. 2008). The results of this study indicate that informal caregiving reduces the probability of employment and the number of hours worked for both genders. In addition, the authors show that informal caregiving has a bigger impact on the decrease of working hours for men in Northern Europe than in other parts of the continent. As explanation the authors reason that in Northern European countries there is less acceptance amongst employers for employees who are more absent at work, in order to provide informal care. Moreover, the results indicate that providing informal care has no significant effect on wage rates. Therefore, the authors suggest that providing informal care is associated with significant costs in terms of foregone labour market opportunities, but not directly in wage losses. Although Bolin et al. (2008) attempt to address the potential endogeneity of informal care by using the health status of the respondent's parents, the age of the parents, whether the parents live nearby and the number of siblings as instruments none of them provide evidence that informal care should be treated endogenously.

Within the same empirical framework, Heitmueller (2007) uses data from the British Household Panel Survey (BHPS) (1991-2001) to analyse the effect of caregiving both inside and outside the household on labour force participation. His results show that work is more often substituted for caregiving by co residential carers. Moreover, his results show that not accommodating for endogeneity may significantly overestimate the impact of informal care on labour market behaviour (Heitmueller 2007).

Exploiting only the first wave of the SHARE data Crespo (2007) calculates the effects of informal caregiving on women's labour force participation in a Northern and in a Southern group of European countries, by estimating a bivariate probit model that controls for the possible reverse causation of the caregiving decision. Her results show that providing intense levels of informal care lowers the prob-

ability of participating in the labour force for women in both groups of European countries (Crespo 2007). Using the first two waves of SHARE Crespo and Mira (2010) estimate a similar bivariate probit model to analyse the prevalence of informal caregiving by European women aged between 50 and 60, and the effect of intense caregiving on their employment status. The authors find that the aggregate loss of employment which can be attributed to informal caregiving for middle aged women in Northern and Central European countries is negligible. In Southern European countries, however, approximately 20% of the daughters are willing to take up informal care and about 50% of those women drop out of employment. Stronger and more significant impacts are found for specific combinations of daughter characteristics (low skilled daughters) and parental disability conditions (parents who suffer from dementia) (Crespo and Mira 2010).

Michaud et al. (2010) tackle the issue of reverse causality and unobserved individual heterogeneity by estimating a dynamic bivariate probit model, thereby presenting less biased outcomes. Using data from the BHPS (2000-2005) they analyse the dynamics in employment and informal care outcomes amongst women in England. Their findings suggest a negative effect of co residential caregiving on future employment and a negative effect of employment on future co residential and extra residential caregiving. Furthermore, the authors conclude that there no direct relationship between informal caregiving and employment. However, in particular for co residential caregivers the disincentives to either return to employment or continue working could be important in relative terms (Michaud et al. 2010).

Despite ample evidence that informal caregiving affects employment negatively in Europe no research is done which compares the effects of informal caregiving on (lost) earnings for men and women living in Northern or Southern European countries. Those (lost) earnings could be seen as labour opportunity costs and a measure of productivity. This study extends the previous literature by analysing the effect of various characteristics of caregiving (different dynamics of informal caregiving and the number of hours of care) on approximations of labour opportunity costs (how to calculate those is described in paragraph 2.3) to provide insight into the potential costs of informal caregiving and differences within Europe. The panel structure of the ECHP is exploited, allowing for the presence of unobserved individual heterogeneity, to estimate a fixed effects model. In this regard, a method similar to Van Houtven et al. (2010) is followed. The only difference is that no instruments are used to control for possible reverse causality, as Van Houtven et al. (2010) suggest that controlling for heterogeneity is a sufficient approach in this field of interest. In addition Tobit models are exploited to control for censoring.

2.3   Productivity costs

The provision of informal care has economic consequences, such as productivity losses and productivity costs (Brouwer et al. 1997). Wanless (2006) describes this process. He argues that informal caregivers face difficulties combining work with their informal care responsibilities, resulting in changes of labour market behaviour. It is possible that the informal caregivers are confronted with a loss of income if they forgo employment opportunities and are (more) absent from work, inevitably resulting in productivity losses and costs. Valuing these economic consequences can be done using different approaches. Traditionally the human capital method is used to measure productivity costs in health care. More recently the friction cost method is proposed as an appropriate alternative. An overview of both methods is presented below.

2.3.1   Human capital method

Traditionally the human capital method is the most common used method to estimate productivity costs. It is a straightforward method in which the informal caregivers perspective is applied (Brouwer et al. 1997; Van den Hout 2009). As an approximation of productivity costs the gross wage a person would have earned during the period of absence is used. The human capital method's theoretical fundament is based on the neoclassical perspective that wage rates are the equivalent of the value of marginal productivity. Therefore, an hour not worked can be seen as an hour of productivity loss and thus as productivity costs (Brouwer et al. 1997).

Within the field of health economics it is not exceptional to use gross wage rate as an approximation of productivity costs. In their study Spiess and Schneider (2002) state that informal caregivers allocate their time in a way that an extra hour of time in either caregiving or work generates the same utility. Therefore, the authors value an hour of informal care equal to an hour worked. Also Heitmueller (2007) argues that the wage rate of an individual can be used as an approximation of the opportunity costs of informal care.

Koopmanschap et al. (1995) criticizes the human capital method. They state that the human capital method estimates the potential production lost, assuming full productivity, which could overestimate the actual production lost to a substantial size (Koopmanschap et al. 1995; Hutubessy et al. 1998; Van den Hout 2009). According to Koopmanschap et al. (1995) the real production loss to society is expected to be lower. Production losses and costs are expected to be lower due to colleagues taking over work (in case of short term absence), reallocating existing employees and replacement by unemployed (both in case of long-term absence) (Verstappen et al. 2005). As a result of these arguments the friction cost method is developed.

2.3.2 Friction cost method

The friction cost method distinguishes two periods: a friction period, in which productivity losses occur, and an additional period where the absentee has been replaced. By accounting these separate periods the friction cost method allows for disequilibria in economies, such as unemployment (Brouwer et al. 1997). The rationale behind the friction cost method is that the amount of production lost, due to the absence, depends on the time-span companies need to restore the original production level (Koopmanschap et al. 1995). Hence, from a societal perspective the only period where productivity costs occur using the friction cost method is the friction period. Within the friction period the productivity costs are the value of production that is missed until replacement of the absentee or the return of the absentee. Possible replacement costs can be included in the productivity costs. Within the additional period (the period beyond the friction period) the lost income of the absentee is now earned by the former unemployed person and no production costs occur (Brouwer et al. 1997).

Studies that obtain productivity costs using both the human capital method and the friction cost method conclude that the productivity costs are significantly lower when using the friction cost method (Hutubessy et al. 1998; Verstappen et al. 2005). Despite the fact that productivity costs might be overestimated using the human capital method not all research is in favour of the friction cost method. Johannesson and Karlsson (1996) argue that the friction cost method is not based on plausible assumptions supported by neoclassical economic theory. They therefore do not recommend it as an alternative to estimate productivity costs. The friction cost method questions the neoclassical economic assumption that the (marginal) value of an employee equals labour costs, which consequence is an overestimation of the productivity costs as proposed by Koopmanschap et al. (1995). However, Johannesson and Karlsson (1996) claim that an underestimation of the productivity costs seems just as likely. For example, when the employer finds difficulties in replacing key personnel and extra costs occur. In addition, Brouwer et al. (1997) mention that the comparison of productivity costs between countries is complex. Differences in unemployment rates between countries can influence the estimates of the friction cost method. These differences should be detected and corrected before any comparisons between countries can be made (Brouwer et al. 1997).

As the human capital method is the most conventional method within health economics to calculate productivity costs, and the comparison of productivity costs between countries is more complex when using the friction cost method it is chosen for this study to obtain the approximations of productivity costs using the human capital method.

2.4 Hypotheses

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Previous research offers insight into what extent informal caregivers incur labour opportunity costs as a result of informal caregiving. Based on these insights, hypotheses are drafted regarding the effect of the initiation, continuation, termination, or increase of informal caregiving on working hours and wages. In subparagraphs 2.4.1 and 2.4.2 hypotheses regarding the sign and magnitude of the coefficients are drawn for the different informal caregiving measures. Hypotheses concerning the expected differences between Northern and Southern Europe are described in paragraph 2.4.3. Although literature foresees that the coefficients associated to informal caregiving differ between genders no further hypotheses are drawn for those expected differences as it is not of specific interest for this research.

2.4.1 Hypotheses related to the dynamics of informal caregiving

Based on previous research it is expected that working hours and wages are negatively affected by starting or continuing caregiving responsibilities, compared to non-carers. In addition, a number of studies reveal that terminating caregiving responsibilities do not directly affect labour market behaviour positively. Therefore, it is hypothesised that terminating caregiving responsibilities also affect weekly working hours and yearly wages negatively, compared to non-carers. Although stopping informal care does not immediately results in resuming usual working hours it is expected that it affects them the least. Wages are expected to follow that trend. The magnitude of stopping informal care is therefore expected to be smallest. Continuing informal care is expected to have the biggest negative effect on working hours and wages, compared to non-carers. Providing informal care more than one year in a row is expected to have a bigger negative influence than initiating informal caregiving has.

2.4.2 Hypotheses related to the amount of informal caregiving

Using insights from Casado-Marin et al. (2011), and Spiess and Schneider (2002 & 2003) it is hypothesised that increasing caregiving responsibilities are associated with higher negative effects on working hours and wages. Corresponding to the idea that employment is easier to combine with low-intensity caregiving.

2.4.3 Hypotheses related to the differences between Northern and Southern Europe

As described in paragraph 2.2.2.2, European research regarding the differences between Northern and Southern regions is ambiguous. Considering the different conclusions it is hypothesised that the signs of all coefficients corresponding to informal caregiving are similar for all Europeans. It is expected, however, that the magnitudes of those coefficients do differ between the regions. Spiess and Schneider (2003) argue that starting and continuing a caregiving commitment significantly reduces working hours only in Northern Europe, while increasing informal care hours has a bigger negative impact on

working hours in Southern Europe. In addition, Casado-Marin et al. (2011) reveal the absence of labour opportunity costs when Spanish women provide less than 28 hours of care per week. However, when the 28 hour threshold is surpassed the probability of not working rises significantly, corresponding to the idea that informal care is easier to combine with low intensity caregiving than with high intensity caregiving in Southern Europe. Based on these insights it is expected that starting and continuing informal care responsibilities have a more negative effect in Northern Europe. Additionally providing informal care up to 28 hours per week also is expected to have a more negative effect in Northern Europe; however, surpassing the 28 hour threshold is expected to have a bigger negative effect in Southern Europe.

3 Methodology

Lost earnings as a measure of productivity costs are assumed to be determined according to the human capital method. To approximate lost earnings during the period of informal caregiving data related to weekly working hours and logged yearly wages are exploited. Generally the productivity outcomes are written as

$$y_{it+1} = f\ (IC_{it}, X_{it}, \delta_i, \epsilon_{it}) \tag{3.1}$$

where y_{it+1} is the approximation of weekly working hours or yearly wages for individual i ($\forall\ i = 1, 2, \dots, N$) at year/wave $t+1$ ($\forall\ t = 1,\ 2, \dots, T$)[3]; IC_{it} is a measure of informal care, which can be defined as the informal care dynamics or the amount of informal caregiving; X_{it} is a vector of demographic, country, time, and socioeconomic control variables which can vary depending on the outcome of interest; δ_i is a time-invariant individual specific error component; and ϵ_{it} is an individual- and time-varying error component, clustered at the individual level. The time-invariant individual unobserved heterogeneity is modelled using fixed and random effects, allowing δ_i to be correlated with IC_{it} and X_{it}. The fixed and random effect capture individual characteristics such as taste for informal caregiving or labour market behaviour. There may be concern, however, that the individual- and time varying ϵ_{it}, is correlated with the measures of informal caregiving, IC_{it}. To address this potential endogeneity some authors suggest the use of instrumental variables which are correlated with the measure of informal caregiving and are uncorrelated with the individual and time-varying error component. Despite strong instruments, however, Van Houtven et al. (2010) find no evidence of endogeneity between labour market outcomes and informal caregiving, suggesting that controlling for individual heterogeneity with fixed (or random) effects is a sufficient approach for examining the effect of informal caregiving on labour market outcomes, such as wages and working hours (Van Houtven et al. 2010). Besides Van Houtven et al. (2010), also Bolin et al. (2008), and Heitmueller (2007) are not able to reject exogeneity of informal care with respect to work, whereas Johnson and Lo Sasso (2006) can only reject the exogeneity at borderline significance levels. Moreover, some instruments are weak or their own exogeneity has been called into question (Bolin et al. 2008; Heitmueller 2007).

For the working hours and log wage specifications the outcomes are modelled as linear regressions with fixed and random effects. The fixed effects model is formalised as

$$(y_{it+1} - \overline{y_\iota}) = \beta_1\ (IC_{it} - \overline{IC_\iota}) + \beta_2\ (X_{it} - \overline{X_\iota}) + \beta_3\ (\delta_i - \overline{\delta_\iota}) + (\epsilon_{it} - \bar{\epsilon}_i) \tag{3.2}$$

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[3] Working hours and wages could also affect the willingness to provide informal care. To control for that kind of reverse causality data related to the dependent variables is required the year after informal care is given.

where $\bar{y}_i = \frac{1}{T}\sum_{t=1}^{T} y_{it}$, $\overline{IC_i} = \frac{1}{T}\sum_{t=1}^{T} IC_{it}$, $\bar{X}_i = \frac{1}{T}\sum_{t=1}^{T} X_{it}$, and $\bar{\epsilon}_i = \frac{1}{T}\sum_{t=1}^{T} \epsilon_{it}$ under the assumption that $E\left(\epsilon_{it} \mid IC_{it}, X_{it}, \delta_i\right) = 0$. Since δ_i is time-invariant $\bar{\delta}_i = \delta_i$ the effect is eliminated.

The random effects model is estimated using Generalised Least Squares (GLS). The GLS tries to exploit the error term components structure and is more efficient than Ordinary Least Squares (OLS). It is the weighted average of the within (Equation 3.2) and between estimator (Equation 3.3)

$$\bar{y}_i = \mu + \beta_1(\overline{IC_i}) + \beta_2\left(\bar{X}_i\right) + \beta_3\left(\bar{\delta}_i\right) + \bar{\epsilon}_i \tag{3.3}$$

The random effects model is formalized as

$$y_{it+1} = \mu + \beta_1(IC_{it}) + \beta_2(X_{it}) + \beta_3(\delta_i) + \epsilon_{it} \tag{3.4}$$

where μ is the overall intercept term. This approach assumes that $E\left(\epsilon_{it} \mid IC_{it}, X_{it}\right) = 0$. Although the fixed and random effects models share similar features, they do differ. Most importantly, random effects models lead to more efficient estimators than the fixed effects models, resulting in smaller standard errors, and hence enabling the detection of smaller effects. However, if there is correlation between the unobserved effect and the explanatory variables application of the random effects model will bias the coefficients and possibly undermine the results. Fixed effects, however, allow for these kinds of correlations. The Hausman Test is a way of determining the plausibility of the fixed- versus the random effects model. Formally the test is

$$Hausman = \left(\hat{\delta}_{RE} - \hat{\delta}_{FE}\right)'\left[\widehat{avar}\left(\hat{\delta}_{FE}\right) - \widehat{avar}\left(\hat{\delta}_{RE}\right)\right]^{-1}\left(\hat{\delta}_{RE} - \hat{\delta}_{FE}\right) \tag{3.5}$$

where $\hat{\delta}_{RE}$ and $\hat{\delta}_{FE}$ are respectively the coefficient estimates of the random effects model and fixed effects model. The $\widehat{avar}\left(\hat{\delta}_{FE}\right)$ is the estimate of the variance and covariance of $\hat{\delta}_{FE}$, and $\widehat{avar}\left(\hat{\delta}_{RE}\right)$ represents the same but then for $\hat{\delta}_{RE}$. The Hausman Test statistics follows a chi-squared distribution, with M degrees of freedom, where M is the number of coefficients. The null hypothesis is that the random effects estimates are consistent, i.e. the unobserved effect is uncorrelated with the explanatory variables (Bolland and Brand 2008).

Additionally, for the hours of work specification the data are also modelled as a Tobit regression. Analysing the distribution for working hours it can be seen in Figure 3.1 that the distribution is left censored.[4] Including or excluding the censored observations in a normal OLS will result in biased and inconsistent estimates. Tobit models, however, provide consistent estimates while exploiting all available data, including information related to the censored observations. The Tobit model is formalised as

$$y_i^* = f\left(IC_i, X_i, \delta_i, \epsilon_i\right) \tag{3.6}$$

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[4] Approximately 5% of the sample works zero hours per week.

$$y_i = \begin{cases} y_i^* \, if \, y_i^* > 0 \\ 0 \; if \; y_i^* \leq 0 \end{cases}$$

where $\epsilon_i \sim N(0, \sigma^2)$, y_i^* is a latent variable observed for values greater than zero, and censored other-wise, y_i is the observed dependent variable. Since wages are only observed for those who work no Tobit models are estimated for the effect of informal caregiving on yearly wages, as no "zero" wages are observed in the sample.

Figure 3.1 Distribution of working hours and wages
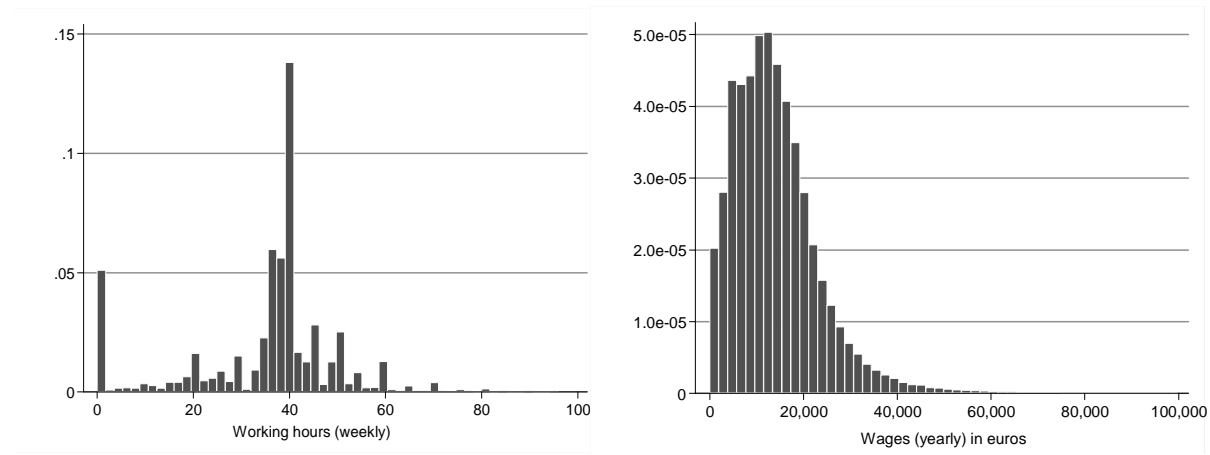
To interpret the Tobit estimation results, the marginal effects of the latent and uncensored observations should be examined. The marginal effects of the latent variable is obtained using Equation 3.7, where $E[y^*] = \beta_1(IC_i) + \beta_2(X_i) + \beta_3(\delta_i)$. To estimate the marginal effect on the expected value for the uncensored observations Equation 3.8 is used, where $\partial E[y|y > 0] = \beta_1(IC_i) + \beta_2(X_i) + \beta_3(\delta_i) + \sigma\lambda(\alpha)$, and $\lambda(\alpha) = \dfrac{\phi\left(\frac{\beta_1(IC_i) + \beta_2(X_i)\,\beta_3(\delta_i)}{\sigma}\right)}{\Phi\left(\frac{\beta_1(IC_i) + \beta_2(X_i)\,\beta_3(\delta_i)}{\sigma}\right)}$.

$$\frac{\partial E[y^*]}{\partial x_k} = \beta_k \tag{3.7}$$

$$\frac{\partial E[y|y > 0]}{\partial x_k} = \beta_k \left\{ 1 - \lambda(\alpha) \left[\frac{\beta_1(IC_{it}) + \beta_2(X_i) + \beta_3(\delta_i)}{\sigma} + \lambda(\sigma) \right] \right\} \tag{3.8}$$

The Tobit estimates assume that the idiosyncratic errors are independent and identically distributed. However, this assumption is frequently not satisfied in panel applications, due to correlation over time for a given individual. Therefore so-called clustered robust standard errors are used under the weaker assumption that errors are independent across individuals and that N$\rightarrow$ ∞.

4 Data and sample selection

In this chapter the data used for this study is presented. First, in paragraph 4.1 a brief description of the panel survey is given. Subsequently, the sample selection criteria and the construction of the dependent and explanatory variables are described in paragraphs 4.2, 4.3 and 4.4. This chapter ends with a descriptive analysis in paragraph 4.5.

4.1 The European Community Household Panel

The analysis in this study is based on the eight waves (1994-2001) of the European Community Household Panel (ECHP), a large-scale longitudinal survey set up and funded by the European Union (EU). The first wave of the ECHP contains data for 12 EU member states: Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain and the United Kingdom (UK). Starting from 1995 Austria also participated in the ECHP. Thereafter Finland joined the ECHP in 1996, and Sweden in 1997.

The ECHP provides considerable advantages for this study. It contains ample information related to an individual's labour market activity, household composition, health status, education and demographic characteristics. Besides, a small range of questions is also related to adult informal caregiving, thereby offering insight into the amount of informal caregiving hours per week and enabling to distinguish between caregiving to adults living in the same household and adults living elsewhere. In addition, although the Survey of Health Ageing and Retirement in Europe (SHARE) would seem more appropriate to use, because it provides more detailed information on caregivers and care recipients, it does not contain data to analyse the outcomes of interest for individuals below the age of 50. The ECHP is the only source of longitudinal data that provides that information. Furthermore, the majority of all national panels in Europe focuses only on childcare and consequently would not be sufficient for this study, while panels that do account for adult care do not always provide a measure of intensity. Moreover, compared to other (European) panels the ECHP is relatively large (in 1994 127,000 individuals aged above 16 years living in 61,106 households participated the ECHP). Lastly, the comparability of results across the European countries is ensured via the concept of "input harmonisation" that forms the basis of the data collection.[5]

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[5] Despite the effort to standardise the input via input harmonisation cross-national comparative research has limitations. Its limitations are a consequence of the use of different definitions for the same variable. For instance: collecting income data showed that all countries but France collected information on after-tax income, whereas France only collected information on gross income.

4.2   Sample selection criteria

Men and women are examined separately, given their different attachment to the labour force. Sample members include respondents aged between 25 and 65. The lower cut-off of 25 years is chosen to exclude most full time students and the upper bound of 65 years is chosen to exclude most retirees. Both groups are not of interest in the hours and wage models, because additional factors are involved in determining labour behaviour within these two age cohorts (Casado-Marin et al. 2011). Additionally, the sample is restricted to those observed to have worked at least once during the survey and with reported earnings greater or equal to zero. These restrictions are used in order to focus on individuals whose employment decisions might be influenced by informal caregiving. Moreover, missing observations related to the informal care measures are excluded from the sample. Furthermore, based on the availability of data for each EU member state a choice is made for admission in this dataset. Data from France is dropped due to a different definition of the income variable in the survey.[5] Data from Sweden is dropped because of the non coherent use of personal identification numbers. As no German and Luxembourgish informal carers remain in the sample, data from those countries is also dropped. In addition, there is no ECHP data from the UK available for the waves 4-8. To correct for the missing waves the national panel BHPS is used instead. Following the argumentation of Viitanen (2005) all waves of the BHPS are combined with the available ECHP data for the UK. To finalize the sample, it only includes individuals who participated in at least four consecutive waves of the survey.[6] The above standing transformations result in an unbalanced panel of 439,262 observations associated to 76,749 individuals living in 11 European countries.

4.3   Dependent variables

To approximate labour opportunity costs, weekly working hours and yearly wages are used as dependent variables. Within the ECHP the wage data is lagged, which means that a wage observation for a person in the year 2001 corresponds to the wage that person earned in the year 2000. Therefore, the data is transformed in such manner that the survey year and wage data match. In addition, the wage data is corrected for inflation (see Figure 8.1 in Appendix I). Another correction of the wage data concerns the converting of different national currencies into the euro. To convert the data into euros the exchange rates of 31 December 2001 are used.[7] It should be noted that the exchange rates for Denmark

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[6] Two consecutive waves are necessary to construct the informal care measures (see paragraph 4.4). Additionally two more waves are needed to estimate the effect of informal caregiving on yearly wages and correct for possible reverse causality.

[7] The exchange rates which are used to convert national currencies into euros: Austrian schilling 13.7603, Belgian franc 40.3399, British pound sterling 0.6085 (28-12-2001), Danish krone 7.46038 (28-12-2001), Dutch guilder 2.20371, Finnish markka 5.94573, Irish pound 0.78756, Italian lira 1936.27, Greek drachma 340.750, Portuguese escudo 200.482 and Spanish peseta 166.386.

and the UK (non euro countries) have fluctuated through time and do not represent current value.[8] Also non applicable and missing data are dropped. Finally to control for outliers and to interpret the coefficients as semi-elasticities the wage data is transformed using a natural logarithm.

4.4 Explanatory variables

Table 4.1 provides an oversight of the complete list of dependent and explanatory variables. Following the operationalisation of informal caregiving suggested by Casado-Marin et al. (2011) two alternative classifications are used.[9] First, as Spiess and Schneider (2003) suggest that the effects of informal caregiving on labour market behaviour change over time, all participants are divided into four dynamic states between t and t+1: "starting caregiving", "stopping caregiving", "continuing caregiving" and "no informal care given in either period". Second, research shows that labour opportunity cost might only appear above a certain threshold of caregiving hours (Heitmueller 2007). In this respect anyone who does not provides informal care is categorised as non-carer, and those providing informal care less than 14 hours per week, or between 14 and 28 hours per week, or more than 28 hours per week are categorised respectively as "little hours", "medium hours" and "most hours".

All models include the same set of control variables: age, age squared, education, and marital status. Increasing age is expected to have a positive effect on wages. Additionally, it is suspected that the effect of age is not equal for all ages. To investigate if age has a nonlinear effect it is squared. Education could affect the potential wage one can earn, influence the total hours of work and also could affect underlying attitudes towards providing parental care. Therefore, to control for the effects of education the sample is coded by means of a categorical variable which divides the sample into the groups: "university", "second stage", "first stage", "less than first" and "education other". Marital status is recoded into a binary variable which takes value 1 if a person is married and value 0 if a person is single.

To capture the influence of the macroeconomic conditions and the institutional settings country dummies are included. Additionally, the effects of informal caregiving are examined separately for Northern and Southern European countries to analyse the north-south gradient as proposed by Bolin et al. (2008). Following the classification as suggested by Spiess and Schneider (2002, 2003) Europe is divided into a group of Northern European countries, which distinguish themselves by all having well

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[8] The current exchange rate for euro to British pound sterling is approximately 0.8. The current exchange rate for euro to Danish krone is approximately 7.4 (European Central Bank 2012).

[9] Since it is shown that whether or not the care receiver co resides with the caregiver effects labour market behaviour (Heitmueller 2007), a third classification could be possible, dividing the sample into participants who reside with the care receiver and participants who do not reside with the care receiver. However, after running a F-test to examine if co residing affects the dependent variables it was concluded that these variables have no significant effect on yearly wages and weekly working hours, and therefore are excluded from the model.

developed formal home-help services and institutional care, and a group of Southern European countries, which are typified by all having less accessible formal home-help services and institutional care. In those countries intergenerational households are more common and care is more often provided by family. The Northern country group comprises of Belgium, Denmark, Finland, the Netherlands and the UK. The Southern country group comprises of Greece, Ireland, Italy, Spain and Portugal. These groups are respectively named "North" and South". Finally, wave dummies control for time trends and macroeconomic shocks.

Table 4.1 Variables included in the analysis

Variable	Description
Dependent variables	
wage	Wage and salary earnings after taxes in euros in the same year of the survey (continuous)
hours	Weekly working hours (continuous)
Informal care variables	
starting	1 if starting informal caregiving to an adult, 0 if otherwise
stopping	1 if stopping informal caregiving to an adult, 0 if otherwise
continuing	1 if continuing informal caregiving to an adult, 0 if otherwise
no informal care given	1 if not providing informal care in either period to an adult, 0 if otherwise
non-carer	1 if not providing informal care to an adult, 0 if otherwise
little hours	1 if providing informal care to an adult less than 14h/week, 0 if otherwise
medium hours	1 if providing informal care to an adult between 14 and 28h/week, 0 if otherwise
most hours	1 if providing informal care to an adult more than 28h/week, 0 if otherwise
Control variables	
age	Age in years
age2	A squared variable of age
university	1 if person has a university degree or is post graduate, 0 if otherwise
second stage	1 if person completed second stage education, 0 if otherwise
first stage	1 if person completed first stage education, 0 if otherwise
less than first	1 if person completed less than first stage education, 0 if otherwise
single	1 if single, 0 otherwise
married	1 if married, 0 otherwise
North	1 if region of residence is Northern Europe, 0 if otherwise
South	1 if region of residence is Southern Europe, 0 if otherwise
Denmark	1 if country of residence is Denmark, 0 if otherwise
the Netherlands	1 if country of residence is the Netherlands, 0 if otherwise
Belgium	1 if country of residence is Belgium, 0 if otherwise
UK	1 if country of residence is the UK, 0 if otherwise
Ireland	1 if country of residence is Ireland, 0 if otherwise
Italy	1 if country of residence is Italy, 0 if otherwise
Austria	1 if country of residence is Austria, 0 if otherwise
Finland	1 if country of residence is Finland, 0 if otherwise
Spain	1 if country of residence is Spain, 0 if otherwise
Portugal	1 if country of residence is Portugal, 0 if otherwise
Greece	1 if country of residence is Greece, 0 if otherwise
dwave1	1 if year of filling in survey is 1994, 0 if otherwise
dwave2	1 if year of filling in survey is 1995, 0 if otherwise
dwave3	1 if year of filling in survey is 1996, 0 if otherwise
dwave4	1 if year of filling in survey is 1997, 0 if otherwise
dwave5	1 if year of filling in survey is 1998, 0 if otherwise

dwave6	1 if year of filling in survey is 1999, 0 if otherwise
dwave7	1 if year of filling in survey is 2000, 0 if otherwise
dwave8	1 if year of filling in survey is 2001, 0 if otherwise

Source author based on ECHP.

4.5 Descriptive analysis

There are large differences in the percentage of informal caregivers across groups defined by age, gender and region as shown in Figures 4.1 and 4.2. The average prevalence rate among Southern women was thrice that of Southern men (5% versus 1.6%). That same period the total prevalence among Northern women was almost twice that of Northern men (4.2% versus 2.4%). Furthermore, Figure 3.1 shows that prevalence rates differ between regions. In addition, it can be seen that middle aged cohorts show highest prevalence rates, especially for women. Hence, the exclusion of individuals aged below 25 and above 65 years is not only justified because their labour market decisions could be influences by other aspects, but also because they do not include most carers. Focusing on the incidence rates pictured in Figure 4.2, again notable differences can be seen between regions, genders and age cohorts. In particular middle aged women show high incidence rates. This indicates that the probability of having a dependent parent or spouse is greatest for men and women aged between 40 and 65. In addition, women are more likely to provide that care than men do. However, these differences tend to become smaller for older age cohorts.

Figure 4.1 Percentage of informal carers across Europe categorised into age groups, 1994-2001
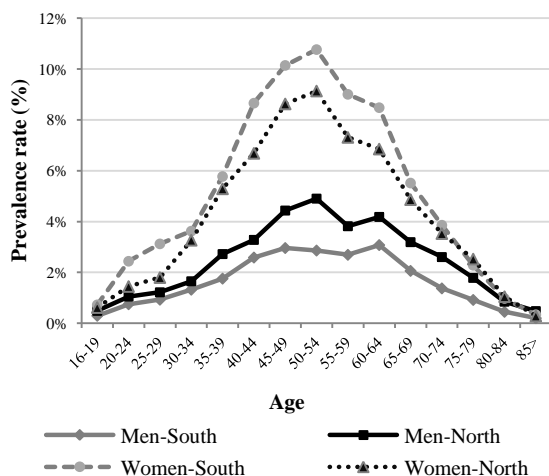
Figure 4.2 Incidence rate of new carers across Europe categorised into age groups, 1994-2001
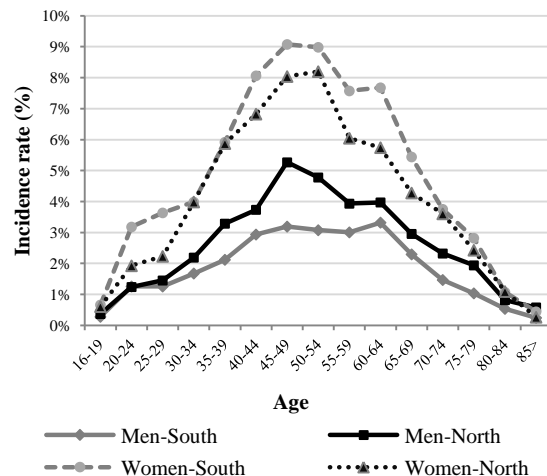
Source author, based on ECHP

Table 4.2 displays a sample breakdown of caregivers by the amount and dynamics (starting, stopping, continuing and not providing) of informal caregiving. It can be noticed that there is a negative association between providing informal care and the amount of hours worked. In addition, it can be seen that for both males and females living in both Northern and Southern countries, the average number of hours worked is almost similar for those individuals who start caregiving compared to those who stop and continue caregiving. In Northern Europe the average number of hours worked is lowest for those who start caregiving. In Southern Europe the average number of hours worked is lowest for those who continue caregiving. Also note the differences between Northern and Southern men. In general it can be seen that Northern men work more hours per week and that there is a smaller negative association between providing informal care and the amount of hours worked.

The lower part of Table 4.2 reveals that increasing numbers of caregiving hours are related to a declining number of weekly working hours. In more detail, providing informal care up to 14 hours per week is associated with a small decline of working hours per week, for all groups. In addition surpassing the 28 hours informal caregiving threshold is most negatively associated with the amount of hours worked in both Southern and Northern Europe for both men and women.

Table 4.2 A sample breakdown of caregivers by amount and dynamics of informal caregiving

Hours worked per week	North				South			
	female		male		female		male	
Informal caregiving dynamics								
start caregiving	26.727	(16.149)	39.255	(16.870)	27.700	(16.485)	36.446	(16.564)
continue caregiving	27.003	(16.706)	39.776	(17.635)	27.546	(15.766)	36.312	(15.370)
stop caregiving	27.951	(16.221)	39.978	(16.409)	29.234	(15.611)	36.976	(14.973)
no care given	29.388	(14.707)	40.671	(13.866)	31.032	(15.012)	39.169	(14.418)
Hours of informal caregiving								
little hours (<14 hours)	27.552	(16.441)	40.419	(17.045)	29.973	(14.671)	38.389	(15.122)
medium hours (14-28 hours)	23.957	(16.778)	35.933	(17.052)	28.615	(16.343)	35.729	(16.189)
most hours (>28 hours)	23.623	(16.242)	33.910	(20.125)	23.986	(17.185)	31.240	(18.363)
non-carer (no hours)	29.372	(14.914)	40.605	(14.137)	30.974	(15.146)	39.177	(14.615)

Standard deviations in *parentheses*   *Source* author based on ECHP

Table 4.3 presents average yearly wages, calculated for each group separately. It can be seen that informal caregiving is negatively related to yearly wages for both males and females living in both Northern and Southern countries. Initiating informal care responsibilities is more negatively associated with a drop of wages in Northern Europe, as differences between starting and not providing informal care are larger than in Southern Europe. Terminating a caregiving responsibility is least negatively associated with a drop of wages in Northern Europe, whereas continuing the provision of informal care is least negatively associated with a drop of wages in Southern Europe. Also note the difference in wages between Northern and Southern Europeans.

Analysing the association between the amount of informal caregiving and wages in Northern Europe reveals that there are small differences in wages between non-carers and carers who provide up to 14 hours of care per week, indicating a small negative association between providing informal care and yearly wages. Differences in yearly wages between caregivers and non-carers, however, become much larger when surpassing the 14 hours of informal care threshold in Northern Europe, indicating a negative association between increasing caregiving hours and yearly wages. Southern Europeans who provide informal care less than 14 hours per week have higher wages than non-carers. However, there is a negative association between providing care up to 28 hours per week and wages. Providing informal care more than 28 hours per week is most negatively associated with wages, as yearly wages are on average lowest for all Europeans.

Table 4.3 A sample breakdown of caregivers by amount and dynamics of informal caregiving

Yearly wages (in euros)	North				South			
	female		male		female		male	
Informal caregiving dynamics								
start caregiving	11,917.04	(7,964.30)	19,694.68	(13,963.68)	7,619.93	(5,653.59)	11,417.65	(8,533.66)
continue caregiving	11,711.66	(8,687.29)	18,976.37	(22,844.37)	7,720.80	(5,420.21)	12,004.47	(8,609.83)
stop caregiving	11,992.35	(8,398.69)	20,185.72	(12,643.72)	7,676.55	(5,369,17)	11,972.81	(8,773.28)
no care given	13,245.37	(9,363.87)	21,069.66	(13,512.66)	8,124.21	(5,595.77)	12,328.75	(7,954.00)
Hours of informal caregiving								
little hours	11,952.89	(8,479.57)	20,462.32	(18,759.37)	8,504.42	(5,520.26)	11,979.27	(8,966.58)
medium hours	10,298.71	(7,598.89)	17,553.26	(14,812.50)	7,415.80	(5,457.09)	10,912.30	(7,803.56)
most hours	10,568.19	(6,794.21)	16,956.50	(8,585.88)	6,201.03	(4,912.62)	10,292.50	(5,987.72)
non-carer	12,950.58	(9,103.64)	20,587.77	(13,203.49)	7,902.92	(5,525.84)	11,013.42	(7,819.28)

Standard deviations in *parentheses*.　　　*Source* author based on ECHP.

Table 4.4 presents descriptive statistics of all the variables used in the analysis, calculated separately for individuals that provide informal care (caregivers) over the various waves of the ECHP and individuals that did not (non-carers). Main features characterising the whole sample are: wages of non-carers are between 5% and 11% higher than that of carers, carers work less hours per week than non carers (between 1 and 2.4 hours less in Northern Europe and 2.7 and 3.2 hours less in Southern Europe), carers are approximately 5 years older than non-carers, and almost 75% of the sample is married. Focussing on the Northern statistics reveals that there are more female caregivers (9,587) than male caregivers (5,101). Approximately 81% of the female caregivers provide informal care up to 14 hours per week, only 7.2% of those females provide more than 28 hours of care per week. Of those females 47.3% have the British nationality and only 7.5% have the Austrian nationality. The female non-carers are more evenly distributed. Approximately 84% of the Northern male caregivers provide care up to 14 hours per week; a minority of 5.5% provide informal care more than 28 hours per week. Also the British men are overrepresented in the group of carers, 46.9% of the male carers have the

British nationality, which makes it possible that the results for Northern carers are driven by the UK data. Only 5% of the Northern male carers have the Austrian nationality. Northern male non-carers are more evenly distributed. Focussing on the Southern statistics shows that there are more female (12,289) than male caregivers (3,721). Moreover, it can be seen that most Southern male carers (55.6%) provide informal care up to 14 hours per week, 16.1% of them provide more than 28 hours of care per week. That statistic is almost twice as high (28.9%) for Southern female carers. Most Southern caregivers have the Italian nationality.

Table 4.4 Descriptive statistics of all variables included

	Northern Europe				Southern Europe			
	Men		Women		Men		Women	
	Carers	Non-carers	Carers	Non-carers	Carers	Non-carers	Carers	Non-carers
Dependent variables								
wage	20,062.29	20,987.77	11,653.88	12,950.58	11,103.84	11,913.42	7,478.51	7,902.92
	(18,048.62)	(13,203.49)	(8,288.31)	(9,103.64)	(8,305.21)	(7,819.28)	(5,409.93)	(5,525.84)
hours	39.605	40.606	26.980	29.372	36.484	39.177	27.792	30.974
	(14.115)	(14.137)	(16.510)	(14.914)	(16.184)	(14.615)	(16.175)	(15.146)
Informal care variables								
starting	0.510	0.000	0.447	0.000	0.596	0.000	0.504	0.000
	(0.500)	(0.000)	(0.497)	(0.000)	(0.491)	(0.000)	(0.500)	(0.000)
stopping	0.000	0.025	0.000	0.039	0.000	0.017	0.000	0.037
	(0.000)	(0.156)	(0.000)	(0.194)	(0.000)	(0.129)	(0.000)	(0.190)
continuing	0.490	0.000	0.553	0.000	0.404	0.000	0.496	0.000
	(0.500)	(0.000)	(0.497)	(0.000)	(0.491)	(0.000)	(0.500)	(0.000)
no care given	0.000	0.975	0.000	0.961	0.000	0.983	0.000	0.963
	(0.000)	(0.156)	(0.000)	(0.194)	(0.000)	(0.129)	(0.000)	(0.190)
non-carer	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
little hours	0.844	0.000	0.807	0.000	0.556	0.000	0.381	0.000
	(0.363)	(0.000)	(0.394)	(0.000)	(0.491)	(0.000)	(0.500)	(0.000)
medium hours	0.101	0.000	0.120	0.000	0.283	0.000	0.330	0.000
	(0.301)	(0.000)	(0.325)	(0.000)	(0.451)	(0.000)	(0.470)	(0.000)
most hours	0.055	0.000	0.072	0.000	0.161	0.000	0.289	0.000
	(0.245)	(0.000)	(0.259)	(0.000)	(0.368)	(0.000)	(0.453)	(0.000)
Explanatory variables								
age	46098	41.683	46.160	40.784	45.030	41.679	44.458	39.813
	(9.209)	(9.600)	(8.872)	(9.513)	(8.926)	(10.177)	(8.936)	(9.602)
age2	2,209.758	1,829.705	2,209.489	1,753.810	2,107.327	1,840.715	2,056.301	1,677.302
	(833.139)	(828.667)	(805.299)	(810.145)	(798.970)	(882.794)	(793.029)	(812.772)
university	0.018	0.031	0.019	0.038	0.026	0.016	0.017	0.025
	(0.133)	(0.172)	(0.138)	(0.191)	(0.158)	(0.127)	(0.129)	(0.155)
second stage	0.002	0.004	0.006	0.006	0.004	0.001	0.003	0.003
	(0.042)	(0.064)	(0.078)	(0.078)	(0.064)	(0.038)	(0.054)	(0.056)
first stage	0.003	0.002	0.003	0.003	0.001	0.001	0.001	0.001
	(0.057)	(0.046)	(0.059)	(0.058)	(0.023)	(0.028)	(0.024)	(0.034)
less than first	0.001	0.001	0.001	0.001	0.000	0.000	0.001	0.001
	(0.038)	(0.023)	(0.028)	(0.027)	(0.014)	(0.016)	(0.034)	(0.028)
single	0.257	0.279	0.266	0.323	0.245	0.217	0.293	0.287
	(0.437)	(0.449)	(0.442)	(0.467)	(0.430)	(0.413)	(0.455)	(0.452)
partner	0.743	0.720	0.734	0.677	0.755	0.783	0.707	0.713
	(0.437)	(0.449)	(0.442)	(0.468)	(0.430)	(0.413)	(0.455)	(0.452)
Denmark	0.091	0.131	0.099	0.141	0.000	0.000	0.000	0.000
	(0.288)	(0.338)	(0.299)	(0.348)	(0.000)	(0.000)	(0.000)	(0.000)
Netherlands	0.174	0.255	0.150	0.231	0.000	0.000	0.000	0.000
	(0.379)	(0.436)	(0.357)	(0.422)	(0.000)	(0.000)	(0.000)	(0.000)
Belgium	0.109	0.144	0.094	0.136	0.000	0.000	0.000	0.000
	(0.311)	(0.351)	(0.292)	(0.343)	(0.000)	(0.000)	(0.000)	(0.000)
UK	0.469	0.200	0.473	0.243	0.000	0.000	0.000	0.000

	(0.499)	(0.400)	(0.499)	(0.429)	(0.000)	(0.000)	(0.000)	(0.000)
Austria	0.050	0.137	0.075	0.100	0.000	0.000	0.000	0.000
	(0.219)	(0.344)	(0.263)	(0.300)	(0.000)	(0.000)	(0.000)	(0.000)
Finland	0.107	0.132	0.109	0.149	0.000	0.000	0.000	0.000
	(0.309)	(0.339)	(0.312)	(0.356)	(0.000)	(0.000)	(0.000)	(0.000)
Ireland	0.000	0.000	0.000	0.000	0.133	0.111	0.117	0.131
	(0.000)	(0.000)	(0.000)	(0.000)	(0.340)	(0.314)	(0.321)	(0.337)
Italy	0.000	0.000	0.000	0.000	0.443	0.278	0.360	0.270
	(0.000)	(0.000)	(0.000)	(0.000)	(0.497)	(0.448)	(0.480)	(0.444)
Spain	0.000	0.000	0.000	0.000	0.146	0.156	0.140	0.135
	(0.000)	(0.000)	(0.000)	(0.000)	(0.353)	(0.363)	(0.347)	(0.341)
Portugal	0.000	0.000	0.000	0.000	0.205	0.246	0.221	0.214
	(0.000)	(0.000)	(0.000)	(0.000)	(0.404)	(0.431)	(0.415)	(0.410)
Greece	0.000	0.000	0.000	0.000	0.073	0.209	0.162	0.250
	(0.000)	(0.000)	(0.000)	(0.000)	(0.260)	(0.407)	(0.369)	(0.433)
Number of observations								
totals	5,101	81,264	9,587	85,594	3,721	121,310	12,289	120,396

Standard deviations in *parentheses. Source* author based on ECHP

5 Results

In this chapter the results are presented. First, in paragraph 5.1, insight is given into the effects of informal caregiving on weekly working hours for men and women living in Northern and Southern European countries. Thereafter, in 5.2, it is described how a drop in weekly working hours translates to a drop in yearly wages as a consequence of informal caregiving. In both paragraphs the Northern and Southern coefficients are compared in order to examine if differences occur within Europe. A short overview of the effects of the different control variables is given in section 5.3.

5.1 The effect of informal care on working hours

Table 5.1 provides an overview of the effects of informal caregiving on weekly working hours. In section 5.1.1 the coefficients of the fixed effects (FE) and random effects (RE) models are discussed. Subsequently the marginal effects of the Tobit models are discussed in section 5.1.2.

5.1.1   The effect of informal care on working hours (FE and RE models)

As seen in Table 5.1 the Hausman Tests reveals that the estimates of all RE models are biased, therefore only the FE estimates are explained. The significant FE estimates suggest that individuals who provide or have previously provided informal care, work less hours compared to individuals who do not provide informal care, ceteris paribus. The estimates suggest that continuing care affects weekly working hours negatively by 0.14 hours for Northern men and by 0.50 hours for Southern women, compared to non-carers. As a consequence of initiating informal care responsibilities Southern women work 0.58 hours less per week, compared to female non-carers.

Moreover, the FE models suggest that carers work lee hours compared to non-carers when informal care responsibilities increase, ceteris paribus. Comparing different groups of Southern women it can be seen that working hours are most affected for women who provide more than 28 hours of informal care per week; they work 0.55 hours less per week than Southern female non-carers. Southern women who provide care between 14 and 28 hours per week work 0.43 hours less per week than Southern female non-carers. Working hours are most negatively affected (-1.73) for Southern men who provide more than 28 hours of informal care per week.

Not all matching Northern and Southern FE coefficients are significant. An overview of the matching (significant) coefficients is provided in Table 5.2. In Table 5.2 it can be seen that the FE coefficients of Southern and Northern women providing more than 28 hours of care per week are both significant and negative and that providing informal care more than 28 hours per week affects working

hours more negatively for Northern females than for Southern females. This suggests that high intensity caregiving is less easy to combine with employment for Northern women than for Southern women. Furthermore Table 5.2 shows that the negative effect of starting, continuing, and providing informal care between 14 and 28 hours per week on weekly working hours is largest for Southern women. For men it can be seen that the effect of providing informal care above the 28 hours per week threshold is largest for those living in Southern Europe.

5.1.2   The effect of informal care on working hours (Tobit models)

The marginal effects of the Tobit models in Table 5.1 underpin the conclusions above. It can be seen that individuals who have, or used to have informal care responsibilities, work less hours per week compared to individuals who do not provide informal care, ceteris paribus. The effect of informal caregiving on working hours shows a similar pattern across Europe; working hours decrease when starting-, decrease more when continuing-, and do not immediately catch up when terminating informal care responsibilities. Comparing the censored and the uncensored marginal effects shows that exclusively including positive observations results in lower effects. Moreover, analysing the results in Table 5.2 shows that all dynamics of informal caregiving affect working hours more negatively in Southern Europe than in Northern Europe, except for men who stop caregiving. This suggests that employment is easier to combine with informal caregiving responsibilities in Northern Europe than in Southern Europe. Analysing the differences in working hours between carers who start and carers who stop providing informal care it can be seen that this difference has increased in Northern Europe, and has reduced in Southern Europe. These marginal effects suggest that Southern Europeans resume working hours more easily. Additionally, the marginal effects in Tables 5.1 and 5.2 suggest that low intensity caregiving is easier to combine with employment in Southern Europe than in Northern Europe, while high intensity caregiving affects working hours more negatively in Southern Europe compared to Northern Europe. Below the details of these conclusions are elaborated.

Given the censoring of the observed values, the estimates in Table 5.1 provide significant evidence that as a consequence of starting informal caregiving in Northern Europe, men and women work on average respectively 1.81 and 1.63 hours less per week than non-carers. In Southern Europe the number of working hours is reduced by 3.49 hours for men and 2.47 hours for women once starting to provide informal care. Northern men and women continuing informal care work respectively 3.82 and 2.44 hours less per week, whereas Southern men and women who continue to provide informal care work respectively 5.27 and 3.78 hours less per week. Stopping informal caregiving does not immediately result in taking on more work responsibilities as it can be seen that Northern Europeans (men -2.25 and women -1.69 hours) and Southern Europeans (men -2.19 and women -2.02 hours) still work less than non-carers, however Southern Europeans who stop caregiving, work more hours per week than Southern Europeans who start or continue caregiving. This effect is not seen in Northern Europe.

Furthermore, the estimates in Table 5.1 suggest that surpassing the 28 hour threshold affects working hours more negatively in Southern Europe (men -11.09 and women -9.36) than in Northern Europe (men -8.93 and women -8.41), while providing informal care between 14 and 28 hours affects working hours more negatively in Northern Europe. Note the difference between men and women. In general, men experience bigger decreases in working hours than women. Although the coefficients of the un-censored Tobit models are smaller they do underpin the findings above.

Table 5.1 The effect of informal caregiving on weekly working hours

Hours	FE		RE		Tobit censored[10] *(marginal effects (dy/dx))*		Tobit uncensored[10] *(marginal effects (dy/dx))*	
	Women	Men	Women	Men	Women	Men	Women	Men
Northern Europe								
Informal care dynamics								
starting	-0.229 (0.214)	0.408 (0.301)	-0.433* (0.208)	-0.007 (0.290)	-1.629* (0.420)	-1.805* (0.597)	-1.152* (0.296)	-1.554* (0.509)
stopping	0.133 (0.216)	0.046 (0.305)	-0.125 (0.210)	-0.344 (0.294)	-1.686* (0.412)	-2.251* (0.619)	-1.192* (0.290)	-1.933* (0.526)
continuing	-0.040 (0.269)	-0.137* (0.417)	-0.435** (0.249)	-0.977* (0.378)	-2.443* (0.588)	-3.818* (1.085)	-1.725* (0.413)	-3.255* (0.907)
Amount of informal care								
little hours	-0.063 (0.181)	0.082 (0.251)	-0.197 (0.175)	-0.205 (0.241)	-1.515* (0.605)	-2.026* (0.688)	-0.778* (0.306)	-1.740* (0.585)
medium hours	-0.408 (0.327)	-0.441 (0.561)	-0.722* (0.321)	-1.086* (0.549)	-6.333* (1.206)	-5.365* (1.462)	-3.081* (0.546)	-4.527* (1.198)
most hours	-0.726** (0.405)	-0.789 (0.726)	-1.141* (0.396)	-1.859* (0.712)	-8.410* (1.625)	-8.930* (1.820)	-3.995* (0.699)	-7.392* (1.433)
Southern Europe								
Informal care dynamics								
starting	-0.577* (0.200)	-0.543 (0.362)	-0.903* (0.194)	-1.044* (0.351)	-2.466* (0.341)	-3.487* (0.666)	-1.831* (0.258)	-2.799* (0.526)
stopping	-0.116 (0.186)	-0.400 (0.333)	-0.435* (0.181)	-0.776* (0.322)	-2.022* (0.329)	-2.194* (0.610)	-1.497* (0.247)	-1.772* (0.487)
continuing	-0.500* (0.245)	-0.185 (0.547)	-1.121* (0.230)	-1.205* (0.511)	-3.784* (0.447)	-5.269* (1.123)	-2.841* (0.347)	-4.192* (0.871)
Amount of informal care								
little hours	-0.328 (0.227)	-0.030 (0.369)	-0.315 (0.224)	-0.155 (0.360)	0.647 (0.495)	-0.805 (0.723)	0.471 (0.359)	-0.654 (0.584)
medium hours	-0.430* (0.219)	0.075 (0.453)	-0.643* (0.215)	-0.322 (0.445)	-3.815* (0.448)	-2.882* (0.937)	-1.341* (0.336)	-2.316* (0.742)
most hours	-0.553* (0.216)	-1.730* (0.562)	-1.124* (0.211)	-2.871* (0.548)	-9.361* (0.378)	-11.087* (1.316)	-4.916* (0.316)	-8.571* (0.966)

* Values are significantly different from zero at P<0.05
** Values are significantly different from zero at P<0.10
Note: all models include control variables (see Appendix II, Tables 8.1 and 8.2)

Note: Values of all Hausman test: prob>chi2 = 0.000
Note: Robust standard errors in parenthesis
Note: See Appendix II for number of observations

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[10] The uncensored marginal effects model only includes observations bigger than 0, whereas in the censored marginal effects model all observations are included.

Table 5.2 An overview of comparable significant coefficients – weekly working hours

Hours	Women				Men			
	FE	RE	Cen- sored[10]	Uncen- sored[10]	FE	RE	Cen- sored[10]	Uncen- sored[10]
Informal care dynamics								
starting	s	✓↓	✓↓	✓↓	x	s	✓↓	✓↓
stopping	x	s	✓↓	✓↓	x	s	✓↑	✓↑
continuing	s	✓↓	✓↓	✓↓	x	✓↓	✓↓	✓↓
Amount of informal care								
little hours	x	x	n	n	x	x	n	n
medium hours	s	✓↑	✓↑	✓↑	x	n	✓↑	✓↑
most hours	✓↑	✓↓	✓↓	✓↓	s	✓↓	✓↓	✓↓

✓: both Northern and Southern coefficients are significant   x: both Northern and Southern coefficients are not significant
↑ : coefficient has bigger negative impact in Northern Europe   n: only Northern coefficient is significant
↓ : coefficient has smaller negative impact in Northern Europe   s: only Southern coefficient is significant
Note: all significant coefficients are negative

5.2   The effect of informal care on wages

Tables 5.3 and 5.4 provide an overview of the effects of informal caregiving on yearly wages. This allows investigating how as a consequence of informal caregiving a drop in weekly working hours translates into a drop of yearly wages, or forces people to work same hours in a worse paid job. Hausman Tests reveal that all RE models are inconsistent, therefore, the FE models are interpreted. It can be seen that no significant relationship exists between the different dynamics of informal care and yearly wages for both males and females living in Northern and Southern countries. An explanation for this occurrence can be found in the fact that European legislation hinders the possibility for employers to lower wages during employment. A drop in the intensive margin (working hours) therefore does not (immediately) translates into a drop of income. Moreover, it could be that these results are primarily driven by the effects on the extensive margin (labour force participation).

Analysing the FE estimates in Table 5.3, however, does show significant estimates. The estimates suggest that wages of Northern men are more easily maintained when providing care up to 14 hours per week, compared to men providing care more than 14 hours per week. Wages are 0.9% lower for Northern men who provide informal care up to 14 hours per week, compared to non-carers. When the intensity of informal caregiving increases up to 28 hours per week consequentially wages are 7.8% lower, compared to non-carers. High intensity informal caregiving affects wages the most negative; wages are 10.9% lower when providing care more than 28 hours per week. Wages of Southern men providing care more than 28 hours per week experience a similar effect, their wages are 10.3% lower compared to non-carers. However, wages of Southern men providing informal care up to 28 hours per week are only 1.3% lower than those of non-carers. Hence, it can be concluded that providing care up to 28 hours per week and maintaining the same wages level is simpler in Southern Europe. In Southern countries tolerance among employers and employees seems to help carers to combine caregiving with employment. Surpassing the 28 hour threshold might result in switching jobs (part time instead of full

time) as combining employment with high intensity caregiving is untenable. The effect of providing care up to 14 hours per week is larger for Southern women as their wages are 3.2% lower compared to female non-carers. Different intensities of caregiving do not affect yearly wages of Northern women.

Table 5.3 The effect of informal caregiving on yearly wages

Wages	Northern Europe				Southern Europe			
	FE		RE		FE		RE	
	Women	Men	Women	Men	Women	Men	Women	Men
Informal care dynamics								
starting	0.005	0.012	-0.036*	-0.008	-0.015	-0.006	-0.036*	-0.009
	(0.017)	(0.015)	(0.017)	(0.015)	(0.017)	(0.019)	(0.017)	(0.018)
stopping	-0.005	0.004	-0.039*	-0.017	0.014	0.028	-0.021	0.027
	(0.017)	(0.016)	(0.017)	(0.015)	(0.017)	(0.018)	(0.016)	(0.017)
continuing	-0.002	0.010	-0.065*	-0.019	-0.003	0.025	-0.044**	0.013
	(0.023)	(0.023)	(0.021)	(0.021)	(0.024)	(0.031)	(0.023)	(0.029)
Amount of informal care								
little hours	0.014	-0.009**	-0.016	-0.020	-0.032**	0.004	-0.030**	0.009
	(0.014)	(0.013)	(0.013)	(0.012)	(0.017)	(0.018)	(0.017)	(0.018)
medium hours	-0.040	-0.078*	-0.100*	-0.046	-0.008	-0.013*	-0.023	-0.019
	(0.029)	(0.031)	(0.029)	(0.031)	(0.019)	(0.024)	(0.019)	(0.023)
most hours	-0.007	-0.109*	-0.026	-0.071**	0.022	-0.103*	-0.010	-0.106*
	(0.036)	(0.041)	(0.036)	(0.040)	(0.021)	(0.034)	(0.021)	(0.033)

* Values are significantly different from zero at P<0.05   Note: Values of all Hausman test: prob>chi2 = 0.000
** Values are significantly different from zero at P<0.10   Note: Robust standard errors in parenthesis
Note: all models include control variables (see Appendix II Tables 8.3 and 8.4)   Note: See Appendix II for number of observations

Table 5.4 An overview of comparable significant coefficients – yearly wages

(ln)Wages	Women		Men	
	FE	RE	FE	RE
Informal care dynamics				
starting	x	✓=	x	x
stopping	x	N	x	x
continuing	x	✓↑	x	x
Amount of informal care				
little hours	s	S	n	x
medium hours	x	N	✓↑	x
most hours	x	X	✓↑	✓↓

✓: both Northern and Southern coefficients are significant   x: both coefficients are not significant
↑ : coefficient has bigger negative impact in Northern Europe   n: only Northern coefficient is significant
↓ : coefficient has smaller negative impact in Northern Europe   s: only Southern coefficient is significant
Note: all significant coefficients are negative   =: Northern and Southern coefficient is even

5.3 The effects of other variables

In Appendix II the coefficients and marginal effects of all control variables are presented. It can be seen that all coefficients of age and age2 are significant. By calculating the extreme values using the derivative of the age functions it becomes clear that age affects weekly working hours positively for Northern Europeans, approximately till the age of 38 for women and 37 for men. The Southern coeffi-

cients are slightly different as age affects working hours positively till the age of 41 for Southern women and till the age of 39 for Southern men. Additionally, in Tables 8.3 and 8.4 it can be seen that age also affects wage positively. Wage is positively affected by age approximately till the age of 75 and 44 for respectively Northern women and men. In Southern Europe age affects wage positively till the age of 62.5 for women and till 77.5 for men. Hence, these coefficients suggest that an additional year of age increases working hours and wages by less as individuals age. In addition, age has a negative effect on working hours and wages for the groups above the described thresholds.

Furthermore, the significant coefficients related to education show that higher levels of education in general do not have a positive influence on working hours and wage. The coefficients suggest that educated Europeans have lower wages and work less hours per week than non-educated Europeans. This seems counterintuitive as it is expected that wage and education are positively correlated; educated persons are expected to have higher wages than non-educated persons.

Examining the marital status coefficients, it can be seen that being single affects working hours and wages positively for all European women. These estimates suggest that single women are more likely to work more hours per week and earn higher wages than married women. Differences between Northern and Southern women are negligible. In contrast, the effect of being single is smaller, or negative, for all European men.

The country dummies capture the influence of the macroeconomic conditions and institutional settings. As can be seen in the tables in Appendix II, differences occur between countries within the two European regions. Tables 8.1 and 8.2 show that within Northern Europe Finnish and Danish women and Finnish and British men work most hours per week. Both Dutch men and women work least hours per week. Furthermore, Tables 8.1 and 8.2 provide significant evidence for the fact that Irish and Greek men, and Portuguese women work most hours per week among Southern countries. Spanish women and Italian men work least hours per week among the Southern group. Tables 8.3 and 8.4 show that Northern wages are highest for women living in Denmark. Northern wages are highest for men living in the UK. Moreover, Southern wages are highest for women living in Italy and Ireland and lowest for men and women living in Portugal. In addition, Southern wages are highest for men living in Ireland. It should be noted that nationality is time invariant and thus no FE estimates are generated. Therefore, the wage related results are solely based on the (biased) RE results.

6 Discussion and conclusion

The main purpose of this chapter is twofold. First, in order to fully understand the findings and resulting (policy) implications the methodological and data limitations of this study are discussed in paragraph 6.1. Thereafter, the conclusions are presented in paragraph 6.2.

6.1 Discussion

Methodology

To address the possible endogeneity of informal care this study uses fixed and random effects to model the time-invariant unobserved individual heterogeneity. However, there may be concern that the individual- and time-varying error is still correlated with the measures of informal caregiving, To address this potential endogeneity problem, some studies propose an instrumental variables approach. With respect to this research instruments (Z_{it}) could have been used which are correlated with the provision of informal care but are assumed to be uncorrelated with the individual and time-varying error component. Additionally, to avoid that the effect of these instruments are captured in the fixed effect those instruments should be time-varying. Instruments that could have been used are measures of parental health as the variation in the health of a parent should directly vary he demand for informal care, but not directly affect labour market behaviour of the child other than through the informal path. Following this approach and using these instruments Van Houtven et al. (2010) and Van Houtven et al. (2013), however, do not find evidence of endogeneity between labour market outcomes and informal care despite the use of strong instruments. The authors suggest that controlling for unobserved individual heterogeneity with fixed effects is a sufficient approach for examining the effect of informal caregiving on labour market outcomes. Moreover, Bolin et al. (2008) and Heitmueller (2007) are also not able to reject possible exogeneity of informal care using an instrumental variables approach. Also Johnson and Lo Sasso (2006) use instruments, but are only able to reject the exogeneity at borderline significance levels. In light of the above it is chosen to control for endogeneity only using fixed and random effects.

A possible methodological drawback is the validity of the Hausman test. The fixed effects estimates may not be asymptotically normal as the within variation is small (see Appendix III Table 8.5), which invalidates the basic premise of the Hausman test (Hahn et al. 2010).

Another methodological limitation is the utilisation of Tobit models while exploiting panel data. As the distribution of weekly working hours is left censored, normal FE and RE estimates are less reli-

able. Tobit models, however, provide reliable marginal effects while exploiting all available data. Although the errors are clustered at the individual level, allowing for some correlation between the error terms of each individual, the Tobit models used in this study do not fully control for unobserved individual heterogeneity as RE models do. Therefore, Söderbom (2009) suggests that panel estimation techniques similar to those of probit models can also be used for Tobit models. Söderbom only considers a RE Tobit model, as the FE Tobit model does not exists.

Data

There are a number of drawbacks related to the data of this research. A first important data related drawback is that data of the ECHP could be outdated as it is collected in the period 1994-2001. During the subsequent years the institutional settings and macroeconomic conditions within the different European countries have changed, hence the findings of this study should be interpreted with some caution.[11] A more up to date European longitudinal survey such as SHARE could adjust the findings. However, as described in paragraph 3.1 the ECHP possess some considerable advantages making it more appropriate to use for analysing the effects of informal caregiving on labour market behaviour for European men and women aged 25-65 than other longitudinal surveys.

A second limitation is the potential problem with the objectivity of the ECHP. Typically, in surveys as the ECHP a number of questions retrospectively ask how much time a respondent has spent on informal caregiving, making the data less reliable. Time diaries might provide more valid estimations of time spent providing care. Collecting diary information, however, is costly and puts a burden on the respondents.

A third drawback is that no information is available about co-residential caregiving in this sample. Caregiving is reported as a total of hours caring inside and outside of the household. Specific information related to co-residential caregiving, which is expected to have a higher impact on employment (Ettner 1995; Casado-Marin et al. 2010), is unfortunately lost.

Additionally, although the results provide significant evidence that a negative association exists between informal caregiving and labour market outcomes the impact varies across Europe, suggesting that differences between regions occur. Nevertheless, this analysis does not (directly) allow for country specific effects. As a consequence of pooling the countries into a Northern and Southern group no policy conclusions for any specific country can be drawn. Moreover, the pooling of countries into two country groups is somewhat arbitrary, as it is assumed that the β's within the country pools are the same and macroeconomic conditions and institutional settings may vary across Northern and Southern European countries. For example the age structures of Italy and Spain are different, as displayed in

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[11] For example: Spain implemented a new universal scheme for long-term care in 2007, financed by the Central State and the Autonomous communities, This could influence the willingness to provide informal care, and thus change the results.

Appendix IV Figure 8.2. Italy faces a more aging population than Spain (CIA 2012). Consequentially the demand for formal and informal care is expected to be higher in Italy and subsequent costs associated with formal and informal care will differ between Italy and Spain, and thus within Southern Europe.

Another data related drawback is that within the Northern European group of caregivers British men and women are overrepresented, which makes it possible that the results for Northern caregivers are driven by the UK data. However, running the analysis after excluding the UK data shows that all general conditions hold.

6.2   Conclusion

The findings of this study suggest that the impact of informal caregiving on labour market outcomes differs across Europe. As hypothesised different dynamics and intensities of informal caregiving have varying effects on labour outcomes across Europe.

Providing care is found to decrease the number of working hours for both men and women living in Southern and Northern European countries. Even after terminating informal caregiving responsibilities former caregivers do not immediately resume usual working hours. As expected the continuation of the provision of informal care is found to have the most negative impact on working hours. It can be concluded that providing informal care for several consecutive years influences working hours most negatively. The effect of the different informal care dynamics on working hours is found to be more negative in Southern countries. Evidence for this is also found analysing the public spending on long-term care between Northern and Southern countries. Northern countries spend more resources on long-term care than Southern countries do, reflecting the more extensive reliance on the provision of informal care in Southern countries (Bolin et al. 2008).

Although fewer men take on caregiving responsibilities than women, male caregivers (in general) do experience greater losses of working hours. Furthermore, the findings suggest that higher levels of intensity caregiving affect working hours more negatively than low and medium levels of intensity caregiving in both Northern and Southern countries. Men and women in Northern Europe experience a significant decrease of weekly working hours when providing care up to 28 hours per week. In Southern Europe it is seen that weekly working hours significantly drop once surpassing a 28 hour threshold, suggesting that Southern men and women are more capable of combining work with low or medium intensities of informal caregiving. Surpassing that 28 hour threshold will force Southern men and women to take on fewer working hours or quit job. These findings are partly confirmed by Spiess and Schneider (2003) and Casado-Marin et al. (2011) who also show that an increase in caregiving hours has a significant influence on working hours once a 28 hour threshold is surpassed in Southern

Europe. Moreover, as it is more common in Southern countries to co-reside with a dependent elderly family member it seems easier to combine low and medium levels of informal caregiving with daily routines.[12]

Starting, continuing, and stopping the provision of care do not have an effect on the yearly wages of both men and women living in both Northern and Southern European countries. Labour laws within Europe might hinder the possibility for employers to lower wages during employment. However, the intensity of caregiving is found to have significant impacts on yearly wages. Increasing intensities of care result in lower yearly wages for Northern men compared to non-caregivers. Also wages of Southern men tend to become less when the intensity of caregiving rises. This suggests that men might switch or quit job sooner to provide informal care. A notable difference between Northern and Southern men is that the impact on the wages of Southern men is less (Northern men -7.8% versus Southern men -1.3%) when providing care up to 28 hours per week. This suggests that paid work is easier to combine with medium intensity caregiving in Southern Europe. This finding is confirmed by Bolin et al. (2008) they conclude that the adverse effects of informal care on labour market outcomes are less severe in countries with strong family ties, where norms on family loyalties and intra-generational support are also stronger. In those countries tolerance among employers and employees helps informal caregivers to combine paid work with the provision of informal care. Wages of both Northern and Southern men providing care more than 28 hours per week are most negatively affected. For those caregivers it is untenable to combine high intensity caregiving with their paid work. As a result those caregivers could decide to leave or switch jobs and as a result have lower wages.

As described in section 2.3.1 the human capital method values losses of wages and hours not worked as productivity losses and thus as productivity costs. In this study the effect of informal caregiving is analysed separately for both working hours and yearly wages. By doing so it is shown that informal caregiving affects working hours and wages differently and thus affects productivity differently. Based on losses of working hours productivity costs are higher in Southern countries and for men. Moreover, increasing intensities result in higher losses of productivity. In Southern countries productivity costs are seen once a 28 hour threshold is surpassed. However, as seen the impact of informal caregiving on wages is more negative in Northern countries, hence based on these wage results it could be concluded that productivity costs are higher in Northern countries as a consequence of informal caregiving.

Although this analysis does not directly allow for country specific effects, combining the findings of chapter 5 with data from European statistical organizations can provide a first country-specific insight into what extent informal caregivers incur labour opportunity costs.[13] To get a first indication of

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[12] In the sample 27.88% of the Northern carers co reside with a dependent elderly. Of the Southern carers 60.26% co reside with a dependent elderly.

[13] European statistical organisations such as: Eurostat, the Dutch CBS (Centraal Bureau voor de Statistiek), and the Spanish INE (Instituto Nacional de Estadistica).

the difference in labour opportunity costs between Northern and Southern countries the country specific costs are calculated for The Netherlands and Spain, and are presented in Appendix V Table 8.6.[14] These calculations show that the total labour opportunity costs of starting, continuing and stopping informal care responsibilities combined are roughly 27 million euros per week in the Netherlands and roughly 74.7 million euros per week in Spain. Calculated per informal caregiver this means that a Dutch informal caregiver incurs 38.23 euros of labour opportunity costs and a Spanish informal caregiver incurs 33.44 euros of labour opportunity costs per week. Different institutional settings, macroeconomic conditions and cultures, however, make it inappropriate to really compare these numbers. The message to policy makers, though, is that although informal care seems to be a good substitute of formal care to control for the expanding formal health care costs, it is not without costs. As shown, allocating time to informal care purposes is associated with labour opportunity costs; though informal health care costs are only a fraction of the formal health care costs they should not be neglected. It is hard to determine to what extent informal care is an efficient substitute, as labour opportunity costs do not increase gradually but exponentially. For example, this analysis shows that the labour opportunity costs due to informal caregiving significantly rises when a certain threshold of caregiving hours is surpassed. In that case it could be argued that formal care might be a less costly alternative. Further research could examine to what extent informal caregiving is a less costly alternative.

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[14] Costs per country are calculated as follows: total population of labour force * % of informal carers * β's informal care dynamics (Tobit censored marginal effects, see table 5.1) * country average wages. To correct for differences in price levels between The Netherlands and Spain the ratios of the purchasing power parities for private final consumption expenditure to exchange rates of the OECD is used.

7 References

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8 Appendices

Appendix I Inflation rates

Figure 8.1 Inflation rates across Europe (1994-2001)
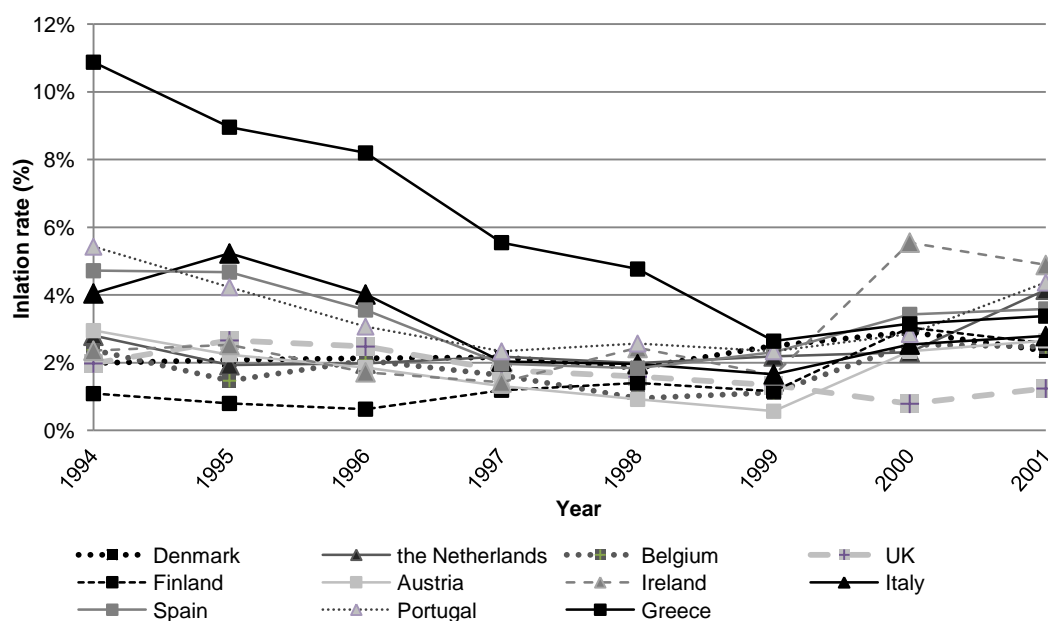
Source: Inflation.eu (2013)

Appendix II Control variables

Table 8.1 The effect of informal caregiving dynamics on different control variables – hours

Hours	Women				Men			
	FE	RE	Tobit censored[10] *(marginal effects (dy/dx))*	Tobit uncen-sored[10] *(marginal effects (dy/dx))*	FE	RE	Tobit censored *(marginal effects (dy/dx))*	Tobit uncen-sored[10] *(marginal effects (dy/dx))*
Northern Europe								
starting	-0.229	-0.433*	-1.629*	-1.152*	0.408	-0.007	-1.805*	-1.554*
	(0.214)	(0.208)	(0.420)	(0.296)	(0.301)	(0.290)	(0.597)	(0.509)
stopping	0.133	-0.125	-1.686*	-1.192*	0.046	-0.344	-2.251*	-1.933*
	(0.216)	(0.210)	(0.412)	(0.290)	(0.305)	(0.294)	(0.619)	(0.526)
continuing	-0.040	-0.435**	-2.443*	-1.725*	-0.137*	-0.977*	-3.818*	-3.255*
	(0.269)	(0.249)	(0.588)	(0.413)	(0.417)	(0.378)	-1085	(0.907)
age	1.944*	2.123*	3.803*	2.698*	3.548*	3.970*	5.421*	4.706*
	(0.109)	(0.076)	(0.118)	(0.084)	(0.131)	(0.084)	(0.131)	(0.116)
age2	-0.025*	-0.030*	-0.050*	-0.036*	-0.048*	-0.053*	-0.072*	-0.062*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)

university	1.520	2.387	13.598*	10.147*	3.134	3.242	0.381	0.331
	(2.439)	(2.414)	(6.350)	(5.023)	(2.694)	(2.656)	(6.895)	(6.007)
second stage	-0.367	0.290	7.018	5.101	-3.864	-3.727	-0.307	-0.266
	(2.487)	(2.461)	(6.053)	(4.524)	(2.795)	(2.755)	(6.959)	(6.023)
first stage	1.510	2.015	7.468	5.439	-2.392	-1.804	2.680	2.356
	(2.536)	(2.508)	(6.256)	(4.696)	(2.897)	(2.857)	(7.252)	(6.453)
single	1.792*	2.858*	4.220*	3.013*	-0.557**	-1.695*	-4.167*	-3.583*
	(0.253)	(0.192)	(0.319)	(0.230)	(0.299)	(0.218)	(0.355)	(0.301)
Denmark	-	-2.709*	-1.997*	-1.412*	-	-1.422*	-0.489	-0.424
		(0.506)	(0.472)	(0.332)		(0.501)	(0.580)	(0.502)
The Netherlands	-	-13.306*	-11.859*	-8.402*	-	-2.539*	-2.450*	-2.114*
		(0.419)	(0.357)	(0.257)		(0.423)	(0.494)	(0.423)
Belgium	-	-7.662*	-7.657*	-5.396*	-	-0.959*	-1.033**	-0.894**
		(0.513)	(0.451)	(0.319)		(0.482)	(0.580)	(0.499)
UK	-	-7.577*	-6.640*	-4.689*	-	0.601	1.025**	0.892**
		(0.425)	(0.416)	(0.294)		(0.433)	(0.553)	(0.483)
Austria	-	-8.849*	-8.702*	-6.136*	-	-0.762**	-1.043**	-0.902**
		(0.509)	(0.449)	(0.319)		(0.468)	(0.583)	(0.502)
Finland	-	-	-	-	-	-	-	-
wave 2	-	-1.437*	-1.958*	-1.384*	-	-0.263	-0.701*	-0.607*
		(0.148)	(0.204)	(0.144)		(0.170)	(0.244)	(0.211)
wave 3	0.051	-1.095*	-1.512*	-1.070*	0.241**	0.030	-0.341	-0.296
	(0.119)	(0.135)	(0.187)	(0.132)	(0.138)	(0.155)	(0.223)	(0.193)
wave 4	-0.015	-0.878*	-1.190*	-0.843*	0.259*	0.105	-0.188	-0.163
	(0.108)	(0.125)	(0.165)	(0.116)	(0.125)	(0.144)	(0.199)	(0.173)
wave 5	0.103	-0.475*	-0.686*	-0.486*	0.235**	0.125	-0.099	-0.086
	(0.106)	(0.123)	(0.147)	(0.104)	(0.123)	(0.141)	(0.178)	(0.154)
wave 6	0.027	-0.254*	-0.306*	-0.217*	0.220**	0.170	0.098	0.085
	(0.111)	(0.121)	(0.119)	(0.084)	(0.128)	(0.140)	(0.148)	(0.128)
Total observations	65,889	65,889	65,889	65,889	59,491	59,491	59,491	59,491
Southern Europe								
starting	-0.577*	-0.903*	-2.466*	-1.831*	-0.543	-1.044*	-3.487*	-2.799*
	(0.200)	(0.194)	(0.341)	(0.258)	(0.362)	(0.351)	(0.666)	(0.526)
stopping	-0.116	-0.435*	-2.022*	-1.497*	-0.400	-0.776*	-2.194*	-1.772*
	(0.186)	(0.181)	(0.329)	(0.247)	(0.333)	(0.322)	(0.610)	(0.487)
continuing	-0.500*	-1.121*	-3.784*	-2.841*	-0.185	-1.205*	-5.269*	-4.192*
	(0.245)	(0.230)	(0.447)	(0.347)	(0.547)	(0.511)	(1.123)	(0.871)
age	2.213*	1.604*	2.327*	1.700*	4.170*	3.545*	3.944*	3.218*
	(0.094)	(0.067)	(0.104)	(0.075)	(0.113)	(0.075)	(0.120)	(0.099)
age2	-0.025*	-0.023*	-0.032*	-0.024*	-0.052*	-0.046*	-0.053*	-0.043*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
university	1.063	0.980	0.877	0.637	0.014	-2.236	-7.456	-5.874
	(1.579)	(1.541)	(3.152)	(2.281)	(3.639)	(3.581)	(2.920)	(2.221)
second stage	1.837	1.941	2.451	1.768	1.673	1.541	0.388	0.317
	(1.790)	(1.750)	(3.570)	(2.548)	(3.854)	(3.791)	(3.740)	(3.063)
first stage	1.076	0.522	-4.836**	-3.688**	1.795	1.648	-1.288	-1.045
	(1.880)	(1.843)	(2.697)	(2.179)	(4.138)	(4.069)	(4.224)	(3.404)
single	1.847*	3.747*	6.394*	4.596*	-0.012	-3.549*	-6.868*	-5.502*
	(0.283)	(0.207)	(0.337)	(0.239)	(0.341)	(0.237)	(0.387)	(0.302)
Ireland	-	-8.993*	-6.564*	-5.030*	-	1.013*	1.089**	0.892**
		(0.448)	(0.328)	(0.266)		(0.456)	(0.597)	(0.491)
Italy	-	-8.454*	-7.718*	-5.799*	-	-5.174*	-5.486*	-4.428*
		(0.350)	(0.306)	(0.237)		(0.354)	(0.404)	(0.323)
Greece	-	-6.340*	-5.739*	-4.321*	-	0.679**	0.785**	0.642**
		(0.389)	(0.338)	(0.264)		(0.394)	(0.455)	(0.373)
Spain	-	-8.677*	-8.076*	-6.137*	-	-3.086*	-3.413*	-2.760*
		(0.367)	(0.303)	(0.242)		(0.372)	(0.434)	(0.348)
Portugal	-	-	-	-	-	-	-	-
wave 2	-	-2.071*	-2.027*	-1.494*	-	-0.490*	-0.819*	-0.667*
		(0.127)	(0.165)	(0.122)		(0.148)	(0.216)	(0.175)
wave 3	0.047	-1.609*	-1.521*	-1.118*	-0.125	-0.546*	-0.986*	-0.802*
	(0.097)	(0.122)	(0.156)	(0.116)	(0.116)	(0.143)	(0.201)	(0.163)
wave 4	0.069	-1.178*	-1.053*	-0.773*	-0.174	-0.496*	-0.843*	-0.686*
	(0.096)	(0.120)	(0.144)	(0.106)	(0.114)	(0.141)	(0.184)	(0.149)
wave 5	-0.039	-0.876*	-0.874*	-0.641*	-0.249*	-0.460*	-0.688*	-0.560*
	(0.100)	(0.119)	(0.129)	(0.095)	(0.118)	(0.140)	(0.165)	(0.134)

wave 6	0.030	-0.389*	-0.359*	-0.263*		-0.225**	-0.321*	-0.362*	-0.295*
	(0.106)	(0.117)	(0.106)	(0.078)		(0.126)	(0.138)	(0.139)	(0.113)
Total observations	93,109	93,109	93,109	93,109		87,275	87,275	87,275	87,275

* Values are significantly different from zero at P<0.05   Note: Values of all Hausman test: prob>chi2 = 0.000
** Values are significantly different from zero at P<0.10   Note: Robust standard errors in parenthesis

Table 8.2 The effect of the amount of informal caregiving on different control variables – hours

Hours	**Women**				**Men**			
	FE	RE	Tobit 1	Tobit 2	FE	RE	Tobit 1	Tobit 2
Northern Europe								
little hours	-0.063	-0.197	-1.515*	-0.778*	0.082	-0.205	-2.026*	-1.740*
	(0.181)	(0.175)	(0.605)	(0.306)	(0.251)	(0.241)	(0.688)	(0.585)
medium hours	-0.408	-0.722*	-6.333*	-3.081*	-0.441	-1.086*	-5.365*	-4.527*
	(0.327)	(0.321)	(1.206)	(0.546)	(0.561)	(0.549)	(1.462)	(1.198)
most hours	-0.726**	-1.141*	-8.410*	-3.995*	-0.789	-1.859*	-8.930*	-7.392*
	(0.405)	(0.396)	(1.625)	(0.699)	(0.726)	(0.712)	(1.820)	(1.433)
age	1.982*	2.007*	4.832*	2.517*	3.739*	3.923*	5.197*	4.505*
	(0.087)	(0.067)	(0.150)	(0.079)	(0.103)	(0.074)	(0.123)	(0.108)
age2	-0.025*	-0.029*	-0.065*	-0.034*	-0.050*	-0.053*	-0.069*	-0.060*
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
university	-2.888**	-2.944*	-6.776**	-3.288**	-4.375*	-5.130*	-7.755*	-6.475*
	(1.481)	(2.414)	(6.350)	(5.023)	(2.694)	(2.656)	(6.895)	(6.007)
second stage	-4.219*	-4.454*	-12.936*	-5.836*	-4.436*	-5.095*	-8.281*	-6.878*
	(1.543)	(1.532)	(4.265)	(1.647)	(1.896)	(1.879)	(3.815)	(3.028)
first stage	-1.943	-2.198	-10.189*	-4.738*	-4.489*	-4.495*	-4.783	-4.047
	(1.593)	(1.581)	(4.442)	(1.829)	(1.974)	(1.957)	(4.127)	(3.405)
single	2.136*	2.950*	5.764*	3.085*	0.412	-1.468*	-4.224*	-3.628*
	(0.217)	(0.175)	(0.401)	(0.222)	(0.251)	(0.197)	(0.339)	(0.287)
Denmark	-	-2.940*	-3.035*	-1.540*	-	-1.258*	-0.321	-0.278
		(0.498)	(0.654)	(0.323)		(0.491)	(0.564)	(0.488)
The Netherlands	-	-13.335*	-17.659*	-8.348*	-	-2.312*	-2.240*	-1.930*
		(0.456)	(0.587)	(0.252)		(0.415)	(0.480)	(0.412)
Belgium	-	-7.594*	-11.081*	-5.283*	-	-0.735*	-0.802	-0.694
		(0.506)	(0.726)	(0.312)		(0.473)	(0.562)	(0.484)
UK	-	-7.448*	-9.407*	-4.649*	-	0.881*	1.177*	1.023*
		(0.461)	(0.615)	(0.286)		(0.423)	(0.536)	(0.468)
Austria	-	-8.580*	-12.584*	-5.919*	-	-0.300*	-0.505	-0.437
		(0.502)	(0.750)	(0.315)		(0.459)	(0.567)	(0.490)
Finland	-	-	-	-	-	-	-	-
wave 1	-	-1.689*	-2.985*	-1.515*	-	-0.332**	-0.660*	-0.571*
		(0.158)	(0.303)	(0.149)		(0.179)	(0.254)	(0.219)
wave 2	0.169	-1.243*	-2.305*	-1.178*	0.270**	-0.020	-0.363	-0.314
	(0.127)	(0.144)	(0.275)	(0.138)	(0.147)	(0.164)	(0.232)	(0.200)
wave 3	0.055	-1.068*	-1.908*	-0.980*	0.137	-0.093	-0.425*	-0.368*
	(0.113)	(0.133)	(0.245)	(0.124)	(0.130)	(0.151)	(0.211)	(0.183)
wave 4	-0.002	-0.846*	-1.500*	-0.772*	0.279*	0.108	-0.150	-0.130
	(0.109)	(0.129)	(0.225)	(0.114)	(0.125)	(0.147)	(0.194)	(0.168)
wave 5	0.117	-0.442*	-0.784*	-0.406*	0.284*	0.171	0.046	0.040
	(0.110)	(0.126)	(0.196)	(0.101)	(0.126)	(0.145)	(0.173)	(0.150)
wave 6	0.028	-0.253*	-0.454*	-0.236*	0.257**	0.190	0.074	0.064
	(0.118)	(0.128)	(0.163)	(0.084)	(0.135)	(0.147)	(0.148)	(0.128)
Total observations	80,535	80,535	80,535	80,535	72,928	72,928	72,928	72,928
Southern Europe								
little hours	-0.328	-0.315	0.647	0.471	-0.030	-0.155	-0.805	-0.654
	(0.227)	(0.224)	(0.495)	(0.359)	(0.369)	(0.360)	(0.723)	(0.584)
medium hours	-0.430*	-0.643*	-3.815*	-1.341*	0.075	-0.322	-2.882*	-2.316*
	(0.219)	(0.215)	(0.448)	(0.336)	(0.453)	(0.445)	(0.937)	(0.742)
most hours	-0.553*	-1.124*	-9.361*	-4.916*	-1.730*	-2.871*	-11.087*	-8.571*
	(0.216)	(0.211)	(0.378)	(0.316)	(0.562)	(0.548)	(1.316)	(0.966)
age	2.067*	1.605*	2.232*	1.630*	4.148*	3.599*	3.798*	3.095*
	(0.075)	(0.058)	(0.097)	(0.070)	(0.091)	(0.066)	(0.112)	(0.092)
age2	-0.025*	-0.023*	-0.031*	-0.023*	-0.052*	-0.047*	-0.051*	-0.042*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)

university	0.121 (1.434)	0.106 (1.413)	0.050 (2.830)	0.037 (2.066)	0.105 (2.840)	-1.453 (2.805)	-5.694 (3.824)	-4.520 (2.955)
second stage	2.460 (1.591)	2.544 (1.569)	1.988 (3.248)	1.437 (2.327)	1.852 (3.004)	2.238 (2.969)	4.363 (4.461)	3.629 (3.786)
first stage	1.075 (1.722)	0.695 (1.702)	-4.446** (2.596)	-3.372 (2.066)	3.048 (3.290)	3.237 (3.249)	2.748 (4.525)	2.269 (3.785)
single	1.991* (0.241)	3.527* (0.189)	6.394* (0.326)	4.596* (0.231)	0.298 (0.293)	-3.046* (0.218)	-6.912* (0.372)	-5.534* (0.290)
Ireland	-	-9.090* (0.442)	-6.791* (0.318)	-5.210* (0.259)	-	0.731 (0.446)	0.809 (0.577)	0.662 (0.473)
Italy	-	-8.466* (0.345)	-7.842* (0.297)	-5.891* (0.230)	-	-5.352* (0.346)	-5.634* (0.387)	-4.541* (0.309)
Greece	-	-6.361* (0.383)	-5.851* (0.327)	-4.405* (0.256)	-	0.671** (0.385)	0.730** (0.437)	0.596** (0.357)
Spain	-	-8.783* (0.362)	-8.154* (0.296)	-6.193* (0.235)	-	-3.309* (0.364)	-3.587* (0.417)	-2.896* (0.333)
Portugal	-	-	-	-	-	-	-	-
wave 1	-	-1.962* (0.135)	-1.804* (0.171)	-1.329* (0.127)	-	-0.262** (0.157)	-0.544* (0.223)	-0.443* (0.181)
wave 2	-0.427* (0.102)	-2.066* (0.129)	-1.991* (0.161)	-1.468* (0.120)	-0.362* (0.116)	-0.560* (0.151)	-0.944* (0.211)	-0.767* (0.170)
wave 3	-0.293* (0.097)	-1.598* (0.125)	-1.485* (0.154)	-1.092* (0.114)	-0.295* (0.118)	-0.569* (0.147)	-0.997* (0.198)	-0.810* (0.160)
wave 4	-0.173** (0.099)	-1.149* (0.123)	-0.924* (0.142)	-0.678* (0.104)	-0.369* (0.122)	-0.445* (0.145)	-0.686* (0.181)	-0.557* (0.146)
wave 5	-0.222* (0.103)	-0.881* (0.121)	-0.835* (0.125)	-0.612* (0.092)	-0.269* (0.134)	-0.460* (0.144)	-0.624* (0.160)	-0.508* (0.130)
wave 6	-0.067 (0.112)	-0.394* (0.122)	-0.359* (0.107)	-0.263* (0.079)	0.279** (0.135)	-0.316* (0.146)	-0.388* (0.140)	-0.316* (0.113)
Total observations	112,897	112,897	112,897	112,897	106,153	106,153	106,153	106,153

* Values are significantly different from zero at P<0.05

** Values are significantly different from zero at P<0.10

Note: Values of all Hausman test: prob>chi2 = 0.000

Note: Robust standard errors in parenthesis

Table 8.3 The effect of informal caregiving dynamics on different control variables – wages

(ln)Wages	Northern Europe				Southern Europe			
	Women		Men		Women		Men	
	FE	RE	FE	RE	FE	RE	FE	RE
starts	0.005 (0.017)	-0.036* (0.017)	0.012 (0.015)	-0.008 (0.015)	-0.015 (0.017)	-0.036* (0.017)	-0.006 (0.019)	-0.009 (0.018)
stops	-0.005 (0.017)	-0.039* (0.017)	0.004 (0.016)	-0.017 (0.015)	0.014 (0.017)	-0.021 (0.016)	0.028 (0.018)	0.027 (0.017)
continues	-0.002 (0.023)	-0.065* (0.021)	0.010 (0.023)	-0.019 (0.021)	-0.003 (0.024)	-0.044** (0.023)	0.025 (0.031)	0.013 (0.029)
age	0.152* (0.010)	0.098* (0.006)	0.172* (0.008)	0.135* (0.006)	0.125* (0.010)	0.070* (0.006)	0.155* (0.007)	0.098* (0.005)
age2	-0.001* (0.000)	-0.001* (0.000)	-0.002* (0.000)	-0.002* (0.000)	-0.001* (0.000)	-0.001* (0.000)	-0.001* (0.000)	-0.001* (0.000)
hours	0.009* (0.000)	0.018* (0.000)	0.004* (0.000)	0.006* (0.000)	0.005* (0.000)	0.011* (0.000)	0.003* (0.000)	0.005* (0.000)
university	0.195 (0.186)	0.212 (0.187)	-0.148 (0.114)	-0.124 (0.113)	-0.030 (0.118)	-0.019 (0.118)	-0.110 (0.142)	-0.091 (0.140)
second stage	0.220 (0.189)	0.219 (0.191)	-0.166 (0.118)	-0.146 (0.117)	0.035 (0.128)	0.028 (0.128)	-0.016 (0.153)	-0.039 (0.150)
first stage	0.237 (0.194)	0.192 (0.196)	-0.166 (0.125)	-0.157 (0.123)	-0.164 (0.140)	-0.209 (0.140)	0.207 (0.167)	0.147 (0.163)
single	0.086* (0.018)	0.145* (0.013)	-0.012 (0.014)	-0.053* (0.012)	0.051* (0.020)	0.063* (0.014)	-0.001 (0.017)	-0.108* (0.012)
Denmark	-	0.214* (0.033)	-	0.395* (0.031)	-	-	-	-
The Netherlands	-	-0.303* (0.030)	-	0.304* (0.029)	-	-	-	-
Belgium	-	-0.111* (0.033)	-	0.225* (0.032)	-	-	-	-
UK	-	-0.103* (0.029)	-	0.427* (0.029)	-	-	-	-

	FE	RE	FE	RE	FE	RE	FE	RE
Austria	-	-0.174* (0.032)	-	-0.264* (0.032)	-	-	-	-
Finland	-	-	-	-	-	-	-	-
Ireland	-	-	-	-	-	0.496* (0.029)	-	0.855* (0.024)
Italy	-	-	-	-	-	0.652* (0.024)	-	0.580* (0.019)
Greece	-	-	-	-	-	0.166* (0.029)	-	0.141* (0.022)
Spain	-	-	-	-	-	0.323* (0.025)	-	0.477* (0.020)
Portugal	-	-	-	-	-	-	-	-
wave 2	-	-0.204* (0.010)	-	-0.131* (0.007)	-	-0.257* (0.009)	-	-0.205* (0.007)
wave 3	-0.001 (0.008)	-0.150* (0.009)	-0.001 (0.006)	-0.099* (0.007)	0.000 (0.007)	-0.191* (0.009)	0.000 (0.005)	-0.152* (0.006)
wave 4	-0.011 (0.007)	-0.108* (0.008)	0.002 (0.005)	-0.062* (0.006)	-0.011 (0.007)	-0.137* (0.008)	0.000 (0.005)	-0.101* (0.006)
wave 5	-0.015* (0.007)	-0.064* (0.008)	-0.012* (0.005)	-0.045* (0.006)	-0.014* (0.007)	-0.078* (0.008)	-0.004 (0.005)	-0.055* (0.006)
Total observations	33,193	33,193	35,904	35,904	27,302	27,302	39,712	39,712

* Values are significantly different from zero at P<0.05
** Values are significantly different from zero at P<0.10

Note: Values of all Hausman test: prob>chi2 = 0.000
Note: Robust standard errors in parenthesis

Table 8.4 The effect of the amount of informal caregiving on different control variables – wages

(ln)Wages	Northern Europe				Southern Europe			
	Women		Men		Women		Men	
	FE	RE	FE	RE	FE	RE	FE	RE
little hours	0.014 (0.014)	-0.016 (0.013)	-0.009** (0.013)	-0.020 (0.012)	-0.032** (0.017)	-0.030** (0.017)	0.004 (0.018)	0.009 (0.018)
medium hours	-0.040 (0.029)	-0.100* (0.029)	-0.078* (0.031)	-0.046 (0.031)	-0.008 (0.019)	-0.023 (0.019)	-0.013* (0.024)	-0.019 (0.023)
most hours	-0.007 (0.036)	-0.026 (0.036)	-0.109* (0.041)	-0.071** (0.040)	0.022 (0.021)	-0.010 (0.021)	-0.103* (0.034)	-0.106* (0.033)
age	0.149* (0.008)	0.094* (0.005)	0.181* (0.006)	0.139* (0.005)	0.125* (0.007)	0.069* (0.005)	0.155* (0.006)	0.098* (0.004)
age2	-0.001* (0.000)	-0.001* (0.000)	-0.002* (0.000)	-0.002* (0.000)	-0.001* (0.000)	-0.001* (0.000)	-0.001* (0.000)	-0.001* (0.000)
hours	0.009* (0.000)	0.017* (0.000)	0.005* (0.000)	0.006* (0.000)	0.005* (0.000)	0.010* (0.000)	0.004* (0.000)	0.005* (0.000)
university	0.063 (0.089)	0.106 (0.090)	-0.156* (0.077)	-0.139** (0.076)	-0.061 (0.100)	-0.018 (0.102)	-0.186** (0.112)	-0.147 (0.111)
second stage	0.084 (0.094)	0.110 (0.095)	-0.198* (0.081)	-0.184* (0.080)	0.007 (0.108)	0.018 (0.109)	-0.094 (0.121)	-0.087 (0.119)
first stage	0.078 (0.099)	0.100 (0.099)	-0.229* (0.085)	-0.225* (0.084)	-0.166 (0.122)	-0.174 (0.123)	0.099 (0.134)	0.089 (0.131)
single	0.113* (0.015)	0.155* (0.012)	-0.003 (0.012)	-0.039* (0.010)	0.051* (0.016)	0.061* (0.013)	0.010 (0.014)	-0.085* (0.011)
Denmark	-	0.231* (0.029)	-	0.445* (0.033)	-	-	-	-
The Netherlands	-	-0.292* (0.025)	-	0.364* (0.028)	-	-	-	-
Belgium	-	-0.101* (0.029)	-	0.272* (0.031)	-	-	-	-
UK	-	-0.098* (0.143)	-	0.457* (0.029)	-	-	-	-
Austria	-	-0.156* (0.145)	-	0.328* (0.032)	-	-	-	-
Finland	-	-	-	-	-	-	-	-
Ireland	-	-	-	-	-	0.508* (0.030)	-	0.850* (0.025)

Italy	-	-	-	-	-	0.634* (0.024)	-	0.557* (0.020)
Greece	-	-	-	-	-	0.160* (0.029)	-	0.122* (0.022)
Spain	-	-	-	-	-	0.330* (0.025)	-	0.480* (0.020)
Portugal	-	-	-	-	-	-	-	-
wave 1	-	-0.265* (0.010)	-	-0.185* (0.008)	-	-0.326* (0.009)	-	-0.286* (0.007)
wave 2	-0.004 (0.008)	-0.211* (0.009)	0.007 (0.006)	-0.140* (0.007)	-0.013* (0.007)	-0.273* (0.009)	0.005 (0.005)	-0.222* (0.007)
wave 3	-0.007 (0.007)	-0.160* (0.009)	0.004 (0.005)	-0.107* (0.007)	-0.005 (0.007)	-0.197* (0.009)	0.011* (0.005)	-0.158* (0.007)
wave 4	-0.012** (0.007)	-0.113* (0.008)	0.003 (0.005)	-0.069* (0.006)	-0.013** (0.007)	-0.139* (0.008)	0.012* (0.005)	-0.100* (0.006)
wave 5	-0.016* (0.007)	-0.066* (0.008)	-0.012* (0.006)	-0.048* (0.006)	-0.016* (0.007)	-0.079* (0.008)	0.002 (0.006)	-0.053* (0.006)
Total observations	42,645	42,645	46,410	46,410	34,664	34,664	50,951	50,951

* Values are significantly different from zero at $P<0.05$

** Values are significantly different from zero at $P<0.10$

Note: Values of all Hausman test: prob>chi2 = 0.000

Note: Robust standard errors in parenthesis

Appendix III Between and within variation

Table 8.5 The fixed effects within and between variation

	Northern Europe				Southern Europe			
	men		women		men		women	
	R^2 within	R^2 between	R^2 within	R^2 between	R^2 within	R^2 between	R^2 within	R^2 between
hours dynamics	0.0351	0.3129	0.0103	0.1595	0.0315	0.1869	0.0088	0.0383
hours amount	0.0422	0.3005	0.0127	0.1505	0.0379	0.1738	0.0110	0.0672
wages dynamics	0.0414	0.0058	0.0620	0.0203	0.0679	0.0044	0.0803	0.0005
wages amount	0.0574	0.0051	0.0709	0.0191	0.0901	0.0035	0.0991	0.0004

Appendix IV Age structures Italy and Spain in 2012

Figure 8.2 The age structures of Spain and Italy 2012
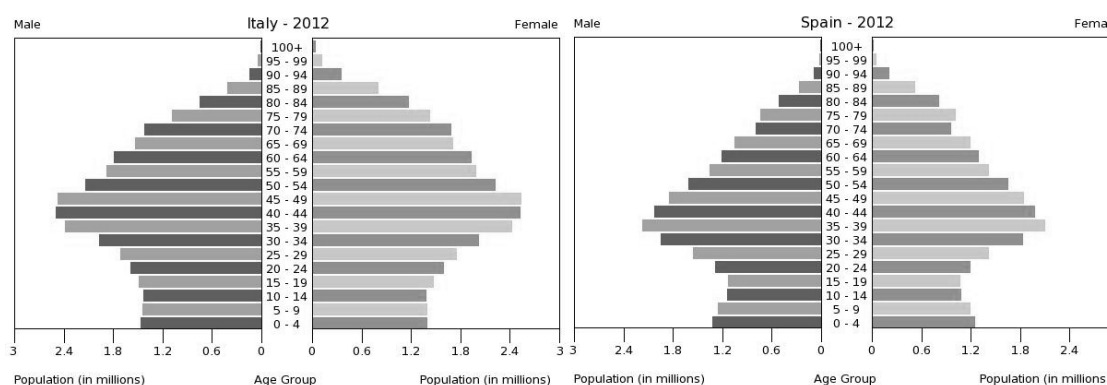
Analysing the different age groups it is found that in Italy 20.5% or the population is older 65, in Spain 17.3% of the population is older than 65 (CIA 2012).

Appendix V Labour opportunity costs due to the provision of care

Table 8.6 Costs of informal caregiving in The Netherlands and Spain

Costs (per week)	The Netherlands		Spain	
	Women	Men	Women	Men
Average yearly wage	€ 35,253	€ 46,427	€ 22,761	€ 28,059
Costs for "starting" informal caregiver	€ 24.57	€ 35.86	€ 26.98	€ 47.04
Costs for "stopping" informal caregiver	€ 25.43	€ 44.72	€ 22.13	€ 29.60
Costs for "continuing" informal caregiver	€ 36.85	€ 75.85	€ 41.41	€ 71.08
Costs per informal caregiver	€ 38.23		€ 33.44	
Costs per informal caregiver	€ 27.98	€ 49.39	€ 13.83	€ 43.57
Costs per member of the labour force	€ 2.96	€ 2.86	€ 3.82	€ 1.75
Total cost per country	€ 27,053,771.23		€ 74,694,786.72	

Note: Marginal effects of the censored Tobit model displayed in Table 5.1 are used to calculate costs