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Long-term Care Responsibility and its Opportunity Costs

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Ruhr Graduate School in Economics

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Annika Meng[1]

Long-term Care Responsibility and its Opportunity Costs

Abstract

This paper analyzes the relationship between long-term care provision and the average individual wage rate. In addition, the effects of the number of hours spent on caregiving on the probability of employment as well as on the number of hours worked are examined. Data from the Survey of Health, Ageing and Retirement (SHARE) of 2004 and 2006 is used to analyze caregiving effects on the European labor market. Descriptive statistics show a positive correlation between hours of care and the wage rate for those working. In the regression analysis, sample-selection models combined with instrumental-variable estimation are used to estimate the causal effects of hours of care on wages. The results illustrate that care for parents has a large negative impact on the individual's wage rate. Test results show that controlling for sample selection is reasonable. Finally, the probability of employment is only decreased in the female sample. Although the hours worked are not signicantly affected.

JEL Classification: J11, J22, C01

Keywords: Informal care; labor-market outcomes; sample selection

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1 Ruhr Graduate School in Economics (RGS Econ) and University of Duisburg-Essen. *– I am grateful to Reinhold Schnabel, Matthias Keese, Alfredo R. Paloyo, and Hendrik Schmitz for valuable comments. Financial support by the Ruhr Graduate School in Economics is gratefully acknowledged. – This paper uses data from SHARE release 2.3.0, as of November 13th 2009. SHARE data collection in 2004–2007 was primarily funded by the European Commission through its 5th and 6th framework programmes (project numbers QLK6-CT-2001-00360; RII-CT-2006-062193; CIT5-CT-2005-028857). Additional funding by the US National Institute on Aging (grant numbers U01 AG09740-13S2; P01 AG005842; P01 AG08291; P30 AG12815; Y1-AG-4553-01; OGHA 04-064; R21 AG025169) as well as by various national sources is gratefully acknowledged (see http://www.share-project.org for a full list of funding institutions).* *– All correspondence to Annika Meng, Ruhr Graduate School in Economics, c/o University of Duisburg-Essen, Chair of Public Economics, Prof. Dr. Reinhold Schnabel, 45117 Essen, Germany, e-mail: annika.meng@uni-due.de.*

1 Introduction

Europe will face multiple social and economic challenges from an ageing society in the next decades. Population projections illustrate that the old-age dependency ratio will be rising. The reasons for this development are the increasing life expectancy and the decreasing fertility rate (OECD, 1998). Besides serious concerns about financing health and pension expenses in the wake of this development, possible long-term care needs of the frail elderly are receiving more attention in calculating social security budgets. In addition, this trend is affected by more independent living arrangements, which results in smaller household sizes. This further contributes to financial insecurities as more individuals may have to rely on formal care services if they become disabled in the future.

Nevertheless, it is currently widely noticed that the majority of both potential carers and care recipients prefer informal care to professional or institutional care (Huber and Hennessy, 2005). Although professional services might be of better quality, the dignity of the impaired individual and feelings of general reciprocity might be the main reasons for this preference. In addition, the costs of professional and institutional care are often higher than what the care recipients and their families can afford to pay. Therefore, a lot of people affected will have to rely on public subsidies from (and beyond) long-term care policy programs. At the same time, long-term care and disability policies throughout Europe emphasize the importance of informal caregiving to relieve their social security budget (Jenson and Jacobzone, 2000).

However, the opportunity costs of carers are usually not considered by care laws. Like in the case of child care, employee-friendly work arrangements are often difficult to implement. Foregone earnings due to reasons like decreased productivity, foregone pension entitlements, and less mobility through time constraints could lead to major financial opportunity costs to carers. This could then translate to a decrease in work hours or in the termination of labor supply altogether (Fast et al., 1999). Thus, although most potential caregivers would like to provide informal care, family members in their late working life might be economically affected to a quite large extent. There-

fore, this study focuses on the current impact of informal care giving on their wages and labor supply.

This paper extends the previous work of Bolin et al. (2008). I use an updated and corrected version of data from the SHARE waves 1 (2004) and 2 (2006) which allows me to additionally analyze data for Belgium, Poland, and the Czech Republic. Like in Bolin et al. (2008), the sample is designed to analyze the provision of care to parents but is not restricted to non-retired individuals as early retirement can also be interpreted as a labor-supply decision which might be heavily affected by care obligations. Therefore, excluding retirees could underestimate the effect that care provision might have on labor-market outcomes. The endogenous relation between caregiving and employment has to be addressed as well: individuals with relatively lower opportunity costs might be more willing to provide care. On the other hand, more formal care services could be bought if the caregivers' opportunity costs were higher than the price of professional services. Thus, I present instrumental-variable results to retrieve causal effects of hours of care on labor supply and wages. In contrast to Bolin et al. (2008), I account for the selection into labor supply because ignoring the self-selection into employment could result in inconsistent coefficient estimates. To combine the methodological advantages of both instrumental-variable estimation and sample selection, I correct the coefficients and standard errors of the respective hours of care variable. It is the first time that these two methods are jointly used for estimating labor-market decisions under care obligations in a European context.

In Section 3, descriptive results illustrate that a substantial part of the sample is occupied with caregiving to some extent while only a small fraction of individuals is providing care for more than 20 hours per week. The participation rate of individuals is decreasing with a rise in care hours though. A positive correlation between hours of care and the wage rate for those working suggests that caregivers still keep their jobs if their opportunity costs of losing their work place are high. However, the sample-selection results with instrumental-variable regression show a negative impact of long-term care on the individual's wage rate. Therefore, individuals have to bear forgone earnings when they provide care. Testing for the existence of a selection bias shows

that controlling for sample selection is reasonable. The probability of employment is only decreased in the female sample. The hours worked are not significantly affected in any instrumental-variable regression though.

After a short literature review in Section 2, the construction of the dataset and descriptive statistics are provided in Section 3. The empirical methods are explained in Section 4 while their results are discussed in Section 5. Section 6 concludes the analysis.

2 Literature review

Evidence on the monetary opportunity costs of informal care is quite detailed for the UK. Foregone earnings and wage differentials have been estimated systematically by Heitmueller and Inglis (2004, 2007) and Carmichael and Charles (1998, 2003*a*,*b*). The latter two authors use a Heckman two-stage procedure in all of their publications. In their first paper from 1998, Carmichael and Charles looked at women in the General Household Survey (GHS). Women's wages are depressed by 4% if they look after an elderly individual in need of care. If more than 20 hours of care have to be provided, this negative effect amounts to 10%. Participation in the labor market is increased by care responsibilities though, while work hours per week decrease by 1.7 hours. With the GHS of 1990, Carmichael and Charles (2003*b*) find that those who care for more than 10 hours per week earn 10% less compared to carers who spend less time on care. Individuals with less than 10 hours of care responsibilities also have to face a 6% reduction in wages. This impact on women is also present in their first publication from 2003 (Carmichael and Charles, 2003*a*). However, men only suffer from an indirect wage effect as far as their labor-force participation is concerned. Their wages are reduced by as much as 18%. In addition, co-residential care has a twice-as-large negative effect on wages for men and even more for women compared to extra-residential care. Heitmueller and Inglis (2004) use the British Household Panel Survey (BHPS) for their analyses and estimate that care for more than 20 hours per week has, in contrast to any caregiving, a substantial negative effect on employment of 13.58 percentage points

(pp). Caring for parents has a positive effect though (+ 11.9 pp) while caring for a spouse has a negative impact as it leaves the carer with less choices for providing care (-29.64 pp). The logarithmized hourly wage is also negatively affected for carers who are working. The incidence of care decreases hourly wages by 2.66% while an additional year of care decreases it by 2.5%. In their 2007 paper, the authors have calculated wage disadvantages which amount to 10 log pp for the overall sample and by 13 log pp for females which mainly affects those who received less than average hourly wages.

The only study from the US which looks at wages in relation to care provision estimates a very low rise in daily provided care hours of 0.34% for a 1% increase in the hourly wage rate for those informal caregivers who are working (White-Means and Chang, 1994). Thus, the relation is at least not negative. This is also the only study which uses hours of care as the dependent variable while the hourly wage rate is one of the regressors.

Bolin et al. (2008) have conducted a labor-market analysis for some continental European countries with the early SHARE data from 2004. Besides labor supply outcomes, they also estimate the effect of care hours on hourly wages for a sample of employed individuals who might have care obligations towards an elderly parent. However, instrumental-variable regression shows insignificant effects only. Although I also use SHARE data, the present study has several advantages over the methodology and empirical method of Bolin et al. (2008). The latest release of the SHARE allows me to use corrected survey data. Contrary to Bolin et al. (2008), I take the selection bias into labor-market participation into account and estimate sample-selection models. I account for the endogenous relationship between the dependent labor-market variables and the hours-of-care regressor and conduct the necessary correction of standard errors and marginal effects. Fortunately, the new release of data brings about stronger *F*-tests on weakness of instruments which enhances the likelihood of estimating unbiased coefficients in instrumental variable regression.

As far as the results on labor supply are concerned, empirical evidence on the impact of informal care on the probability of employment and work hours of caregivers is mixed for the US. The studies are difficult to compare as results strongly depend

on the dataset and sample methodology as well as on the definition of care variables. On the one hand, Stone and Short (1990); Wolf and Soldo (1994), and Arber and Ginn (1995) find no significant effect on the probability of employment.[1] On the other hand, Ettner (1995, 1996), Doty et al. (1998), as well as Pezzin and Schone (1999) find a significantly negative effect in this respect. The latter two authors also detect a negative effect on work hours. While the estimated impact in the aforementioned studies is only modest, Johnson and Lo Sasso (2000) calculate a relatively large significant reduction in work hours. If women increased informal care hours by 100 over the last twelve months, work hours would be reduced by 459 hours in the same year.

First European evidence is presented by Viitanen (2005) with the European Community Household Panel (ECHP). However, she only finds a significantly negative impact on the employment probability for Germany. When Viitanen (2005) looks at different sub-samples by age and marital status, she discovers that the impact of caregiving on labor-force participation is largest for women at mid-life as well as for single women in some European countries. The already mentioned study by Bolin et al. (2008) looks at caregiving for elderly parents living outside the respondent's own household. The probability of employment is reduced by 3.7 pp and weekly work hours by 0.26% for a 10% increase in weekly hours of care.[2] While the impact on labor-force participation is also significantly negative in gender-specific estimation, this is not the case as far as work hours are concerned.

Evidence from German Socio-Economic Panel data (SOEP) illustrates that care provision within households does not influence the employment probability but has a significantly negative impact on actual work hours in panel linear probability models which account for unobserved heterogeneity by using fixed effects. The effect is, however, small as work hours are only reduced by about half an hour for men as well as women (Meng, 2009).

[1] For a more detailed and extended literature review see, Meng (2009).

[2] Bolin et al. (2008) say that the effect of a 10% increase in weekly hours of care leads to a 2.6% decrease in weekly work hours. However, the log-log specification of variables and the coefficient of -0.026 suggests that the coefficient has been misinterpreted.

3 Methodology and descriptive statistics

This paper analyzes data on 13 European countries from the Survey of Health, Ageing and Retirement in Europe (SHARE). SHARE is a multidisciplinary panel database of micro data on health, socio-economic status, and social as well as family networks of more than 30,000 individuals aged 50 or over. The first wave was collected in 2004 with eleven participating European countries. Three additional countries joined the sample in 2006 and 2007 when the second wave of SHARE was surveyed. For details on the sampling procedure, questionnaire contents, and fieldwork methodology, readers are referred to Börsch-Supan and Jürges (2005).

I use data from both waves available in SHARE. Pooled estimation with cluster-robust standard errors in households is used here as the variation, necessary for panel fixed-effects estimation, is too low in the data. I look at children who might give assistance to elderly parents living outside their own household where assistance is defined as needing care in Activities of Daily Living (ADL; e.g., bathing, dressing, eating, using the toilet), in Instrumental Activities of Daily Living (IADL; e.g., shopping, laundry, food preparation, medication), and paperwork. Unfortunately, the impact of impaired individuals living in the carer's household cannot be analyzed in detail as the SHARE questionnaire does not ask for care hours and types of help in this respect. I restrict the data set to individuals aged 50 to 65 which is the official retriement age in most European countries. Contrary to Bolin et al. (2008), early retirees are not deleted in this analysis as the decision for early retirement is also a labor-supply decision which can be related to caregiving. In this study, I concentrate on a joint sample of men and women as well as on a sample where only women are included. I refrain from estimating separate results for men as instrumental-variable estimation for them alone is not reliable enough due to a weak correlation of the instruments with the endogenous regressor. Knowledge on the long-term care impact on labor and wages for men would have to remain incomplete which can also be seen in the results presented in the study of Bolin et al. (2008). One reason for this might lie in an unequal occupation of men and women with long-term care. Although a similar percentage of men reports to care

for a frail elderly, they are often not the primary caregiver. In addition, women usually provide help with heavier tasks of daily living while men are predominatly occupied with household maintenance (Jenson and Jacobzone, 2000).

Before turning to the estimation procedure, a descriptive overview of labor-market participation and the average hourly gross wage rate over the distribution of care hours is presented in Table 1. The statistics are based on the sample that allows individuals to care for their parents only. Means and standard deviations for all variables can be found in Table 5 in the Appendix.

Table 1: A positive correlation between wages and care hours

Self-assessed care hours per week (1)	Number of carers (% of all carers) (2)	Participation rate of carers (3)	Average wage rate per hour (in €) (4)
Less than 5	58.01	65.22	16.52
5 to 9	17.27	44.53	17.89
10 to 19	11.75	35.71	17.75
20 to 29	6.57	26.06	19.37
30 to 39	2.27	15.38	22.45
40 to 49	1.78	21.57	21.21
50 or more	2.10	21.67	25.99
All carers	(2,860) 28.16	(1,507) 35.78	17.06
Non carers	(7,298) 71.84	(2,705) 64.22	17.88
Full sample	(10,158) 100		(4,212) 41.46

Notes: For wages: Average over those working.
Source: SHARE 2004, 2006.

In this sample, 28% out of 10,158 children report to care for one or two of their parents. The hours that are spent on helping either with ADL, IADL, or paperwork decline steadily with the number of care hours. As can be seen in Column 2 of Table 1, nearly 90% of caregivers provide care for less than 20 hours per week. The participation rate of carers in the labor market also diminishes over the care hour categories although it remains fairly stable for those who care for more than 40 hours per week. This is in line with what one would expect when the care burden increases: individuals who are obliged to give care either stop working or those individuals who are unemployed are more likely to supply a higher amount of care hours. This endogenous relation

Table 2: A positive correlation between wages and care hours - Women

Self-assessed care hours per week (1)	Number of carers (% of all carers) (2)	Participation rate of carers (3)	Average wage rate per hour (in €) (4)
Less than 5	52.41	59.13	14.88
5 to 9	17.60	38.68	18.14
10 to 19	13.56	32.24	19.49
20 to 29	8.47	22.22	21.72
30 to 39	2.88	11.54	20.24
40 to 49	2.38	18.60	26.17
50 or more	2.43	18.18	20.94
All carers	(1,807) 29.85	(819) 39.26	16.29
Non carers	(4,247) 70.15	(1,267) 60.74	16.60
Whole subsample	(6,054) 100		(2,086) 34.46

Notes: For wages: Average over those working.
Source: SHARE 2004, 2006.

between employment and care has to be scrutinized further in the empirical analysis. Overall, 41.46% of sample members provide care and are employed at the same time. Column 4 presents their average wages. It increases over the care hour categories. While the lowest category receives an average wage of €16.52 per hour, it rises to more than €21 for those who care for more than 30 hours per week. As these numbers illustrate correlations, some children who care for a parent seem to stay in the labor market because they receive high earnings. The average wage for the whole sample of non-caring individuals is €17.88 per hour. The average wage of those who are working and caring is somewhat lower and reaches €17.06 per hour. Therefore, I expect to find no or only a modest significant effect of care hours on wages in the empirical analysis.

Table 2 illustrates a similar descriptive statistics for the 6,054 women in the sample. The distribution of caring and working individuals shows the same trends as in the full-sample case. The variation in wages is larger though. The participation rate of women who provide care is 3.5 pp higher than in the full sample (Column 3). However, the overall labor force participation rate is about 7 pp lower for women (Column 4). The average wage rates are lower by about €1. Like in the full sample, wages rise with care-hour categories.

4 Empirical methods

4.1 Dependent and independent variables

The first dependent variable which has to be considered in the analysis is a binary indicator of labor-force participation (*lfp*). It takes on the value of one if the individual is employed and zero otherwise. With a second dependent variable, which contains the number of contractual hours worked per week (*workh*), the analysis sheds light on some additional information on what the impact of care on employment implies in terms of work hours. However, this equation is not used in the sample-selection model. The third dependent variable is the logarithmised wage rate (*lnwage*). It is the ratio of the individual's gross labor income and its contractual working time.

The logarithmized household income of all household members except the respective individual is one of the exogenous variables of the first and second regression equations. It is available in the SHARE data and used here to minimize the potential endogenous relationship with the dependent variable as it is difficult to instrument household income. Along with the other's household income, the household size, the number as well as the mean age of children, it is only included into the probability-of-employment equation to better identify the sample-selection model. Other control variables are the age and age squared of the individuals, a dummy which shows if they are married and if they are in bad health. Furthermore, the highest level of schooling is captured by a set of dummy variables which are offered in ISCED-97 coding in the SHARE data. The degree of urbanisation[3] as well as country dummies are included to capture institutional labor market, care policy, and cultural differences in Europe. As I use pooled data for regression, a dummy labelling the year 2004 as 0 and the year 2006 as 1 is also included. All monetary values are adjusted by the SHARE data's purchasing power parity index to make the monetary cross-country values comparable to each other. The main interest lies in the care variable which is restricted to non-co-residential care. I use weekly hours of care which comprises the general information on the number of

[3]The base category city is defined as a big city or the suburbs and outskirts of a big city. The category town consists of large and small towns. The category village is defined as a village or rural area.

hours per week in which an individual provides care to one or both of its parents.

The first and second equation are both regressed on the same set of explanatory variables. However, the characteristics of children as well as the household size and the other's household income are not included into the third regression equation to identify the sample-selection model. Both variables which are measured in hours are restricted to a maximum of 112 hours per week to mitigate measurement error and, in the case of care provision, the problem of double counting.

4.2 Potential endogeneity problem

The care-hours variable is an endogenous regressor. Therefore, it has to be instrumented to retrieve unbiased estimates on labor-market outcomes. Several reasons for an endogeneity problem between care and labor supply (and therefore also wages) are possible. First, individuals can be reluctant to give many care hours if they are employed because they take their higher opportunity cost into account. Second, this argument does not only hold for starting care provision but also for an increase in its time burden. Third, it can be advantageous to purchase formal care services if its price is lower than the opportunity cost of the otherwise care giving individual. This argument does not only hold for the binary labor-force-participation-dummy but also for working hours and the wage rate.

Although one would expect that coefficients without instrumental-variable (IV) estimation are underestimated when looking at care and labor supply and wages only, this is not clear at the outset in multiple regression analysis. This can also be seen in the literature that uses instruments in this respect. Two studies using American data (Stern, 1995; Ettner, 1996) as well as the paper using German SOEP data (Meng, 2009) find that the effect of care on work hours is only significantly negative if instruments for the care variable are used. In Ettner (1995), the effect becomes smaller when endogeneity is considered. The study on British data of Heitmueller (2007), on the contrary, finds no significant effect of extra-residential care after instruments are used. In the study of Bolin et al. (2008) with the SHARE data, coefficients for care giving outside the own household turn insignificant when using IV estimation.

An instrument has to be highly correlated with care provision but has to be unrelated to the labor-supply decision and wages. Like Bolin et al. (2008), I use binary information on having a mother or father in bad health as instruments. First of all, parents are the most likely care recipients next to an individual's spouse. Second, a bad health status of parents is likely to increase hours of care as the potential caregivers are at least 50 years old. Consequently, the youngest parents are about 70 years old and they are fairly likely to become impaired in personal and everyday activities. Third, it is not problematic that both the probability of having a parent in bad health and leaving the labor force is increasing with the child's age as age is one of the control variables. These instruments are in addition not correlated with the error term of the respective regression equation as the health status of parents is exogenous and not affected by the labor-supply decision or wages of children.

Table 3 illustrates that the instruments are strong enough over the different care-hour specifications and samples in the regression models. Their (joint) F-statistic is above 10 and, therefore, fulfills the rule of thumb regarding weak instruments (Staiger and Stock, 1997).

Table 3: Endogeneity test results confirm a substantial correlation to care hours

	Labor force participation	Work hours per week	Hourly wage rate (log)
Full sample	$\chi^2(2)$	$\chi^2(1)$	$F(1, 3559)$
Weekly hours of care			
F-test on weakness of instruments	110.17	23.70	16.69
	(0.000)	(0.000)	(0.001)
Women	$\chi^2(2)$	$\chi^2(1)$	$F(1, 1960)$
Weekly hours of care			
F-test on weakness of instruments	97.45	16.96	10.62
	(0.000)	(0.000)	(0.034)

SHARE 2004, 2006.

The χ^2-statistic has to be divided by the degrees of freedom to compute the F-statistic.

4.3 Estimation procedure

An OLS regression of the wage-rate equation for those being employed could lead to inconsistent coefficients due to sample selection. Therefore, I take the probability of being in paid employment into account. I follow the classical sample-selection approach of Heckman (1976, 1979). The equation which has the binary labor-force-participation indicator as its dependent variable is the selection equation while the wage-rate equation is named the outcome equation. Although this model is identified by its distributional assumptions, I follow Smith and Blundell (1986) and additionally identify the model with the other household member's income as well as with general household characteristics, namely the household size, the number of children and their overall mean age.

The coefficents and standard errors of the wage-rate equation need to be corrected. To combine the sample-selection approach with the instrumental-variable estimation, I predict the care variable from the first stage instrumental variable regression and then insert the predicted value $\widehat{careiv}_{ji}$, with $j = 1, 2$, $i = 1...n$, into the selection and outcome equation before estimating the sample-selection system. The selection-correction model thus reads as

$$\begin{aligned} lfp_{1i} = \quad & cons'_{1i} * \beta_{11} + \widehat{careiv}'_{1i} * \beta_{12} + exo'_{1i} * \beta_{13} + hh'_{1i} * \beta_{14} + e_{1i} \\ lnwage_{2i} = \quad & cons'_{2i} * \beta_{21} + \widehat{careiv}'_{2i} * \beta_{22} + exo'_{2i} * \beta_{23} + s_{12} * \lambda(x'_{1i} * \widehat{\beta}_1) + e_{2i} \end{aligned} \tag{1}$$

where $cons_{ji}$ is a constant and exo_{ji} denotes all exogenous variables except for the predicted hours of care regressor $\widehat{careiv}_{ji}$ and the instruments that help identify the selection-correction model hh_{1i}. $\lambda(x'_{1i} * \widehat{\beta}_1)$ is the estimated inverse Mills ratio and a Wald test on the hypothesis $s_{12} = 0$ (or $rho = s_{12}/s_2$) is used to test whether the error terms of the two regression equations e_{ji} are correlated. If the null hypothesis is rejected, sample-selection correction is needed. The regression equation on work hours is

$$workh_i = cons'_i * \beta_1 + \widehat{careiv}'_i * \beta_2 + exo'_i * \beta_3 + hh'_i * \beta_4 + e_i \tag{2}$$

To assess the significance of hours of care, I then correct the standard errors from the

predicted hours of care variable to compute appropriate t-statistics by a standard-error-correction method presented in Gujarati (2003). It weights the estimated standard error of $\widehat{careiv_{ji}}$ with a ratio of the unpredicted to predicted standard deviation of the outcome equation's regression error:[4]

$$\frac{\widehat{se}_{careiv_{2i}}}{\widehat{se}_{\widehat{careiv_{2i}}}}$$

In addition, the conditional marginal effects of the wage-rate equation that are presented in the following tables are corrected for the selection effect by using the delta method (Vance, 2009). If the selection and outcome equation are correlated with each other, it would be incorrect to interpret the coefficient of the outcome equation alone (Sigelman and Zeng, 1999).

For calculating the effect on contractual work hours per week, tobit and instrumental variables tobit estimators are used for those actually working. All regressions are conducted with pooled data and cluster-robust standard errors by households (Moulton, 1986).

5 The effects of long-term care on labor market outcomes

Table 4 presents the effects of weekly hours of care on the three different dependent variables respresenting labor supply, namely being in paid employment or not, contractual work hours, and the logarithmized wage rate. The results only illustrate the effect of caregiving for parents. Even column numbers illustrate the results for the respective instrumental-variable estimation which are the results of most interest here as they allow me to present causal effects. Complete estimation results can be found in Table 6 and Table 7 in the Appendix.

[4]The standard errors of all coefficients in the outcome equation are automatically corrected for the two-stage estimation procedure in the selection-correction model by Stata's `heckman` command.

Table 4: The wage rate is negatively affected for children who care for their parents

	Employment	Employment IV	Work hours	Work hours IV	Wage rate (log)	Wage rate (log) IV
	(1)	(2)	(3)	(4)	(5)	(6)
Full sample						
Weekly hours of care	−0.003***	−0.003	−0.049**	−0.333	0.001	−0.037***
	(0.001)	(0.006)	(0.022)	(0.253)	(0.002)	(0.013)
Rho					37.70	38.54
					(0.000)	(0.000)
Observations	10,158	10,158	4,212	4,212	10,158	10,158
Female sample						
Weekly hours of care	−0.003***	−0.01**	−0.051*	−0.256	0.001	−0.027*
	(0.001)	(0.005)	(0.030)	(0.267)	(0.003)	(0.015)
Rho					31.44	33.30
					(0.000)	(0.000)
Observations	6,054	6,054	2,086	2,086	6,054	6,054

SHARE 2004, 2006. All columns present marginal effects.
Standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Columns (1), (2), (5) and (6) present sample selection model results.
See Table 6 and Table 7 in the Appendix for full results.

Column (2) and (4) show that the coefficients of weekly hours of care for the binary labor-supply equation and for the work-hour regression are insignificant in the IV regression equations. Both coefficients are significantly negative when mere correlations are considered (Columns (1), (3)). Caring for ten more hours per week decreases the probability of employment by 3 pp and is therefore economically small. Column (3) illustrates that caring ten hours more per week is associated with a 29 minutes decline in work hours which is of small economic importance as well.

Like in the British empirical results (Carmichael and Charles, 1998, 2003*a,b*; Heitmueller and Inglis, 2004, 2007), a significantly negative effect of weekly hours of care on the log wage rate is detected in Column (6) which does account for the endogenous relation between care and opportunity costs. Caring one more hours per week decreases the wage rate by 3.7%. This effect is in line with the British findings. As Columns (5) and (6) present conditional marginal effects from a sample selection estimation, this result shows the effect for those individuals who are working. The carergivers among

them thus seem to be less productive than the employees who do not provide care.

The IV regression results of the female sample are slighlty different form the full sample. Here, the probability of employment decreases by 10 pp for caring ten more hours a week. The impact on work hours in Column (4) is again insignificant. The wage rate is less affected by care provision though. It decreases by 2.7% for an additional care hour. It is either less for women than in the full sample because women tend to leave their jobs more often or because they might achieve a reconciliation of work and care more easily.

The results on labor supply are similar to the results of Bolin et al. (2008) as far as non-IV regression results are concerned. While the probability of employment in Bolin et al.'s sample is reduced by 3.7 pp for a ten-percent increase in care hours, it is decreased by 3 pp in this sample. The same is true for the female sample. The impact on work hours is relatively large in this study but still economically small. It is 0.26% for a ten percent increase in care hours around its mean in Bolin et al.'s study and 2.57% for those working in the present paper.[5] This can be expected as I do not use OLS but a tobit model for estimation. The difference between our results becomes larger when looking at women only. Contrary to their finding, the effect of care on the probability of employment in Column (2) is still significantly negative under IV regression. However, the most important difference in both samples is the negative impact that care provision of children to their parents has on the logarithmised wage rate. While Bolin et al. (2008) do not find any significant effect, an additional hour of care does lower the wage rate significantly in the present paper.

Overall, the marginal effects of the sample-selection models are economically significant and illustrate that an increased care burden leads to a substantial increase in opportunity costs due to foregone earnings. The Wald test on the correlation between the error terms of the selection and outcome equation do rejected the null hypothesis of independent equations for any of the specifications.

Other regressors of the three dependent variables provide some additional insight

[5]The mean of hours of care and work hours for those working in the full sample are 1.84 and 35.02, respectively. The effect for a 10% increase is thus calculated as $-0.049 \times 10 \times (1.84/35.02) \times 100 = -2.57$.

into the labor supply behavior of European individuals older than 50. I discuss only IV regression coefficients in the following. Gender has a negative effect of 22 pp on the employment probability. Age has a positive effect. As can be expected, being in bad health leads to a drop in labor-force participation as well. The decrease is substantial and as large as 28 pp. A higher educational degree raises the probability of employment. An additional child has only a modest negative effect of 1 pp which is not surprising in a sample of individuals who are older than 50. Living in a town or village compared to a big city, leads to a reduction in labor supply by 5 pp. Women work more than 5 hours less than men in the full sample. Being married or in bad health leads to a drop in working time of a little bit more than 1 hour. A negative effect can also be found for living in a town. The impact is only small though. The wage rate is 16.9% less for women. Those who are married are paid 5.7% less than other employees. Bad health does not seem to lead to lower payments due to decreased productivity. The effect of age is not significant. Having an upper tertiary degree after the ISCED 97-scale, rises the wage rate by more than 50%. There is no wage effect for individuals living in a town or village.

Contrary to the full sample, being married has a negative effect of 4 pp on the probability of employment in the sample of women. However, a wage effect cannot be found. The highest ISCED 97 degree leads to a larger rise in wages of 60%, about 10 pp more than in the full sample. The effect of being in bad health has a similar negative effect on labor supply for women as in the full sample. However, the negative impact of the number of children is larger. It is likely that the effect of children represents a lock-in effect which persists since the woman gave birth to her children. The impacts of living in a town or village compared to a city is more differentiated in the female sample where living in a village has a more negative impact.

6 Conclusion

The analysis here looks at the impact that care provision to elderly parents has on the labor supply of their caregiving children. Data from the SHARE is used which

interviews individuals who are older than 50 only and who, therefore, are more likely to be burdened by caregiving responsibilities. Labor supply is measured as a binary decision to participate in the labor market, as well as by the contractual number of hours that are offered. The impact on the individual's wage rate is assessed by estimating sample-selection models. After a detailed descriptive analysis of the relation between long-term care and employment, different samples consisting of both men and women and of women only are estimated using the number of weekly hours of care as the main explanatory variable of interest.

The descriptive analysis illustrates that about 28% of children in the dataset care for a parent while 41% of them are employed at the same time. The majority of caregivers cares for less than 20 hours a week. The participation rate among affected individuals is decreasing with a rise in hours of care. A positive trend is found in the average wage rate of working individuals. This could have several reasons. First, individuals could be reluctant to exit their jobs although their caregiving burden rises because their opportunity costs are high. Second, those who keep on working might be more productive and thus they are able to reconcile care provision and work in the labor market. Third, this could be promoted by flexible work arrangements. All these data characteristics are also found if only women are considered for the analysis.

Contrary to Bolin et al. (2008), coefficients of hours of care in the wage rate regression from instrumental-variable estimation are significant. Given the test statistic obtained in this study, the estimate of the causal impact here seems more reliable. Care for parents only leads to a significant deacrease in the probability of employment for women by 10%. The hours worked are not significantly affected. When I combine sample selection and IV methods, the average individual wage rate is falling considerably: caring an additional hour decreases the wage rate by 3.7% in the full sample and by 2.7% when only women are considered. Therefore, the positive descriptive correlation cannot be found in the causal analysis. In addition, testing for independence of equations in the selection-correction model shows that correcting for sample selection is reasonable.

Overall, it can be concluded that those who are only slightly affected by care respon-

sibilities have only small difficulties in arranging work and care in their time schedule. Therefore, it should be analyzed if leisure time is more likely to be reduced. For children looking after their frail parents, the loss in wages is huge. This could not only result from a loss in productivity but also from a job change due to a forced change in the living arrangement or region where the child works. Future research should therefore focus on the effect that caregiving has on these two aspects. However, this is only reasonable with longer panel data. Another interesting aspect which is worth looking at is the impact of care on early retirement decisions of potential caregivers. Some aspects of care policies in Europe are already designed to financially disburden the caregiver. Direct care allowance payments to care providers or contributions to their retirement schemes are the leading examples. However, it is not known if these measures are sufficient to compensate the loss in foregone earnings. This is also the case because individual out-of-pocket costs of caring for another person are not seriously surveyed yet.

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Appendix

Table 5: Descriptive summary statistics

	All individuals		Employed caregivers only	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Employed	0.41	0.49	1.00	0.00
Wage rate in €(PPP)	7.29	18.22	17.06	24.07
Work hours per week	14.54	18.33	34.30	9.25
Weekly hours of care	2.37	8.00	5.15	9.60
Married	0.80	0.40	0.81	0.39
Age	57.30	3.85	55.19	3.09
Bad health	0.18	0.39	0.05	0.21
Primary school	0.20	0.40	0.06	0.23
Secondary school	0.54	0.50	0.54	0.50
Tertiary school	0.26	0.44	0.40	0.49
Other household income (log)	0.12	1.03	0.16	1.23
Household size	2.46	1.06	2.47	1.01
Number of children	2.04	1.26	1.97	1.16
Mean age of children	24.68	10.77	22.20	10.26
Lives in urban area	0.50	0.50	0.53	0.50
Lives in a small town	0.23	0.42	0.23	0.42
Lives in a village	0.25	0.43	0.22	0.42
Germany	0.09	0.28	0.10	0.30
Austria	0.05	0.23	0.02	0.15
Sweden	0.10	0.30	0.20	0.40
Netherlands	0.11	0.31	0.13	0.34
Spain	0.06	0.24	0.02	0.14
Italy	0.10	0.29	0.04	0.18
France	0.09	0.29	0.09	0.29
Denmark	0.07	0.26	0.14	0.35
Greece	0.10	0.30	0.05	0.21
Switzerland	0.03	0.18	0.05	0.22
Belgium	0.14	0.34	0.11	0.31
Poland	0.03	0.16	0.01	0.11
Czech Republic	0.03	0.17	0.04	0.18
Observations	10,158		1,507	

Table 6: Effects of care to parents on labor market outcomes of children

	Employment	Employment IV	Work hours	Work hours IV	Wage rate (log)	Wage rate (log) IV
	(1)	(2)	(3)	(4)	(5)	(6)
Weekly hours of care for parents	−0.003***	−0.003	−0.049**	−0.333	0.001	−0.037***
	(0.001)	(0.006)	(0.022)	(0.253)	(0.002)	(0.013)
Female	−0.222***	−0.222***	−5.884***	−5.595***	−0.223***	−0.169***
	(0.013)	(0.015)	(0.289)	(0.405)	(0.028)	(0.033)
Married	0.001	0.000	−1.081***	−1.125***	−0.052	−0.057*
	(0.017)	(0.017)	(0.382)	(0.392)	(0.032)	(0.032)
Age	0.481***	0.481***	−0.187	0.193	−0.148	−0.109
	(0.052)	(0.052)	(1.356)	(1.414)	(0.140)	(0.140)
Age squared	−0.005***	−0.005***	0.000	−0.003	0.001	0.001
	(0.000)	(0.000)	(0.012)	(0.013)	(0.001)	(0.001)
Bad health	−0.284***	−0.284***	−1.189*	−1.202*	0.015	0.005
	(0.013)	(0.013)	(0.626)	(0.645)	(0.069)	(0.069)
Secondary school	0.143***	0.143***	−0.358	−0.115	0.184***	0.222***
	(0.018)	(0.018)	(0.546)	(0.586)	(0.048)	(0.050)
Tertiary school	0.310***	0.311***	−0.870	−0.622	0.490***	0.531***
	(0.021)	(0.022)	(0.569)	(0.609)	(0.052)	(0.054)
Other household income (log)	−0.006	−0.006	−0.013	−0.036		
	(0.005)	(0.005)	(0.087)	(0.089)		
Household size	−0.004	−0.004	−0.292*	−0.245		
	(0.007)	(0.007)	(0.166)	(0.176)		
Number of children	−0.010*	−0.010*	0.033	0.009		
	(0.006)	(0.006)	(0.138)	(0.142)		
Mean age of children	−0.001	−0.001	−0.008	−0.006		
	(0.001)	(0.001)	(0.017)	(0.018)		
Time dummy	−0.189***	−0.189***	−1.055***	−1.092***	0.342***	0.328***
	(0.012)	(0.012)	(0.319)	(0.327)	(0.039)	(0.039)
Lives in a small town	−0.050***	−0.050***	−0.935***	−0.811**	0.015	0.038
	(0.015)	(0.015)	(0.342)	(0.368)	(0.035)	(0.035)
Lives in a village	−0.035**	−0.035**	−0.423	−0.506	−0.013	−0.010
	(0.015)	(0.016)	(0.382)	(0.400)	(0.035)	(0.035)
Country dummies	yes	yes	yes	yes	yes	yes
Rho					37.70	38.54
					(0.000)	(0.000)
Observations	10,158	10,158	4,212	4,212	10,158	10,158
Wald chi2(27)			773.16			
Chi-squared	2,467.97	2,459.69		773.16	14,138.01	14,128.05

SHARE 2004, 2006. All columns present marginal effects.
Standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Columns (1), (2), (5) and (6) present sample selection model results.

Table 7: Effects of care to parents on labor market outcomes of children - Women

	Employment	Employment IV	Work hours	Work hours IV	Wage rate (log)	Wage rate (log) IV
	(1)	(2)	(3)	(4)	(5)	(6)
Weekly hours of	−0.003***	−0.010**	−0.051*	−0.256	0.001	−0.027*
care for parents	(0.001)	(0.005)	(0.030)	(0.267)	(0.003)	(0.015)
Married	−0.042**	−0.042**	−2.082***	−2.086***	−0.059	−0.059
	(0.019)	(0.019)	(0.522)	(0.529)	(0.042)	(0.042)
Age	0.345***	0.352***	−0.394	0.265	−0.206	−0.147
	(0.058)	(0.058)	(1.963)	(2.167)	(0.191)	(0.192)
Age squared	−0.003***	−0.004***	0.001	−0.005	0.002	0.001
	(0.001)	(0.001)	(0.017)	(0.019)	(0.002)	(0.002)
Bad health	−0.218***	−0.218***	−1.076	−1.009	−0.002	0.003
	(0.014)	(0.014)	(0.808)	(0.837)	(0.100)	(0.099)
Secondary school	0.120***	0.126***	−0.087	0.136	0.260***	0.290***
	(0.020)	(0.020)	(0.912)	(0.940)	(0.072)	(0.075)
Tertiary school	0.302***	0.309***	−0.002	0.198	0.571***	0.609***
	(0.027)	(0.027)	(0.931)	(0.946)	(0.077)	(0.081)
Other household	−0.005	−0.005	0.086	0.053		
income (log)	(0.007)	(0.007)	(0.159)	(0.161)		
Household size	−0.019**	−0.019**	−0.532*	−0.480*		
	(0.009)	(0.009)	(0.277)	(0.291)		
Number of	−0.022***	−0.023***	0.269	0.274		
children	(0.007)	(0.007)	(0.210)	(0.212)		
Mean age	0.001	0.001	−0.024	−0.019		
of children	(0.001)	(0.001)	(0.026)	(0.027)		
Time dummy	−0.168***	−0.174***	−0.771	−0.894*	0.385***	0.358***
	(0.014)	(0.014)	(0.488)	(0.521)	(0.057)	(0.057)
Lives in	−0.031*	−0.026	−1.351***	−1.306**	0.126**	0.145***
a small town	(0.017)	(0.017)	(0.520)	(0.533)	(0.050)	(0.051)
Lives in	−0.038**	−0.036**	−0.98	−1.148*	0.008	0.016
a village	(0.017)	(0.017)	(0.606)	(0.664)	(0.051)	(0.052)
Country dummies	yes	yes	yes	yes	yes	yes
Rho					31.44	33.30
					(0.000)	(0.000)
Observations	6,054	6,054	2,086	2,086	6,054	6,054
Wald chi2(26)			492.73			
Chi-squared	1,364.31	1,450.21		492.73	6,322.09	6,274.78

SHARE 2004, 2006. All columns present marginal effects.
Standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Columns (1), (2), (5) and (6) present sample selection model results.