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Informal home care and labor-force participation of household members

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Abstract In Germany, informal home care is preferred to professional care services in the public discussion as well as in legal care regulations. However, only minor importance is ascribed to the opportunity costs caregivers face. Therefore, this article explores the influence home care has on the labor supply of caregivers who cohabitate with the care recipient. I use data from the German Socio-Economic Panel from 2001 to 2007, which allows researchers to merge the characteristics of both groups for the first time. Owing to diverging gender roles, I examine female and male caregivers separately. The results show that having an individual in need of care in the household does not decrease labor supply to an economically relevant quantity. As providing care might be endogenous to the labor-supply decision, I test for endogeneity by using characteristics of care recipients as instruments and I additionally test for sample attrition. Moreover, the panel structure allows me to control for unobserved heterogeneity.

Keywords Informal care · Labor supply · Endogeneity

JEL Classification J14 · J22 · D64

1 Introduction

Even though mandatory public care insurance has only been introduced in 1995 in Germany, its financial and social aspects are already of great political concern. The ongoing demographic change that increases the old-age dependency ratio burdens the pay-as-you-go insurance system. In 1999, the expenses of public care insurance

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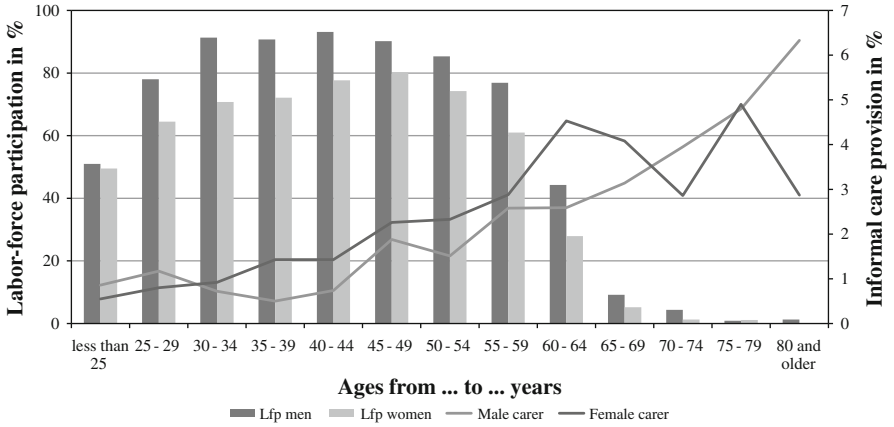

Fig. 1 The distribution of paid employment and home care by age groups *Note.* Own calculations. *Data source* SOEP 2007

exceeded the yearly contributions for the first time (Deutschland in Zahlen 2007). Some researchers state that morbidity is decreasing through technical progress in medicine. Others expect that people suffer from more severe illnesses like Alzheimer's and other senile dementia illnesses when they reach old age (Gilberg 2000). In any case, the mere change in the age structure of the German population is leading to a growing number of dependent persons. The rising demand for care would, therefore, increase costs for formal and institutional care and employed individuals are burdened with rising contributions. Schnabel (2007) forecasts that, until the year of 2050, the contributions to the public care insurance system will have to rise from 1.7–1.95 to 3–5.5%, depending on the demographic scenario to finance future expenses.

As these demographic relations were already known when public care insurance was introduced, the law emphasizes the importance of care within social networks such as families. Informal home care is given precedence to formal home care and formal home care is given precedence to institutional care (SGB XI §3; Rothgang 1997). The main political aim is to financially unburden the public care insurance system as well as the government's budget. However, the arguments in favor of family caregiving do not take into account the opportunity costs of caregivers. Psychological, physical, and social costs all have to be considered. Forgone earnings, decreasing productivity, and absenteeism from the workplace are some of the problems employed caregivers have to face (Fast et al. 1999). Some might even have to leave the labor market to provide the amount of care needed by an impaired individual. Figure 1 illustrates the labor-force participation of men and women by age (represented by bars) and the percentage of caregivers over the same age distribution (represented by lines) among Socio-Economic Panel (SOEP) respondents in 2007. The double time burden of work and care increases after the age of 45 and further rises until retirement. The public care insurance system is likely to cover only some of the expenses that come along with long-term impairments. It pays a care allowance to the care recipient when an

individual is classified into one of the German care levels.[1] However, the opportunity costs and the costs for formal and institutional care are expected to be too high to be completely covered by the insurance (Keese et al. 2010). Therefore, the decision on the type of care that is utilized must also consider what the care recipient and his family can afford.

So far, support for impaired individuals after the introduction of the compulsory care insurance system in Germany has not been examined satisfactorily. Therefore, this article focuses on the influence of informal home care on the labor-force participation of caregivers who live in the same household as the care recipient. However, I do not only regard elderly care recipients but I also consider all age groups of individuals in need of care as its influence on work occurs regardless of the age of the care recipient. In the empirical analyses, I test for endogeneity bias and panel attrition. Panel-estimation methods allow me to control for unobserved heterogeneity. The results illustrate that caregiving does not influence the probability of employment. However, weekly working hours are reduced by 35 min for women and by 48 min for men for a 10 h increase in care provision per week.

2 Literature review

2.1 Previous international literature

Most of the early literature on caregiving comes from the US in the 1980s and 1990s and calculates bivariate correlations. Overall, the results indicate a reduction in working hours (Muurinen 1986) but not in the probability of employment (Stone and Short 1990). In addition, working women provide significantly fewer care hours than non-working women (Brody and Schoonover 1986; Soldo and Hill 1995; Boaz 1996). Moen et al. (1994), however, report no effects when examining different cohorts of women. Multivariate studies can confirm these results although they depend on different samples, data, and estimation techniques. While Wolf and Soldo (1994) find no effect of care on work, Ettner (1995, 1996) and Stern (1995) support earlier bivariate findings when they use instruments. Other studies detect a modest reduction in working hours and employment probability (Doty et al. 1998; Pezzin and Schone 1999). The first panel analysis with data from the 1980s has been undertaken by Arber and Ginn (1995) and Pavalko and Artis (1997). While the first study states that care is not decreasing the probability of employment but raises the overall time burden of women, the latter provides correlations since the endogeneity problem is neglected. This is also true for the first European-wide study by Spiess and Schneider (2002). The latest study from the US has been undertaken by Johnson and Lo Sasso (2000) who use panel data of the HRS (Health and Retirement Study) from 1994 to 1996. In addition to their finding that caregiving has an economically large and negative effect on working hours of men and women, they also conclude that formal care purchased within the market is not an attractive substitute for family care. Bolin et al. (2008)

[1] See Federal Ministry of Health (ed.) (2008) for an overview of the most important services of the German public care insurance system.

confirm negative labor-supply effects with SHARE (Survey of Health, Ageing, and Retirement in Europe) data for Europe. For Great Britain, Carmichael and Charles (1998, 2003a,b) find that informal caregivers of both sexes who care for less than 20 h per week are more likely to participate in the labor market but work fewer hours than similar non-caregivers for GHS (General Household Survey) data. However, informal caregivers who care for more than 20 h per week are less likely to be employed. These results are confirmed by Heitmueller and Inglis (2004) with the BHPS (British Household Panel Survey). Heitmueller (2007) takes a close look at the problem of endogeneity concerning caregiving and employment. He finds a significant impact of caregiving on labor-force participation for co-residential care and concludes that the caregiver has less of a choice in caregiving under these circumstances.

2.2 Survey results for Germany

Empirical evidence for Germany is very scarce. The study of Schneekloth and Engels (2006) only provides descriptive statistics about care arrangements and their utilization and determines the characteristics of caregivers. Moreover, other descriptive studies with SOEP data find that having a daughter leads to a significantly greater use of formal and informal care (Himes et al. 2001) and that men provide 2.5 h of care on a usual weekday while women only perform a little more, namely 3 h (Schupp and Künemund 2004). They also illustrate that most people prefer providing and receiving care within the family. The only econometric analysis based on the SOEP was published by Schneider et al. (2001). Using event-history analysis, they examine how middle-aged married women change employment status due to caregiving responsibilities in the 1980s and early 1990s. They find a significantly higher propensity to leave the labor force but not a higher probability of changing to part-time work. Although they are using data from 1984 to 1996 (from 1991 for East Germany), they do not take changes due to the introduction of the care insurance in 1995 into account. A negative effect on the employment probability for Germany is also confirmed with eight waves of the ECHP (European Community Household Panel) by Viitanen (2005).

Compared to the existing literature, this article focuses on German SOEP data from 2001 to 2007 and, therefore, on the current care policy regime.[2] I am able to overcome some data limitations of past German studies. Since 2001, the survey of care data has become more reasonable. Additional variables like the number of hours an individual cares for somebody else help to identify a caregiver. The so-called care level, a measure of the degree of disability, has been recorded since 2001 as well.[3] Similar limitations as in the international concept of Activities of Daily Living (ADL;

[2] The *Pflege-Weiterentwicklungsgesetz* from the 1st of July 2008 does not change the implications of this system substantially (Federal Law Gazette (ed.) (2008)).

[3] The ranking is conducted by the Medical Review Board (MDK) or MedicProof. Care level 0: minor help, no care allowance from the care insurance. Care level I: help in two ADL once a day for at least 90 min, help needed in IADL for several times a week. Care level II: help in ADL three times a day for at least 3 h, help needed in IADL for several times a week. Care level III: help round-the-clock, help needed in IADL for several times a week.

e.g., dressing, shaving, washing, getting into and out-of-bed) and Instrumental Activities of Daily Living (IADL; e.g., errands outside the house, preparing meals) are also asked for to identify the needs of the impaired individual living in the household. The preparation of relevant data within the SOEP is still difficult. Only care recipients living within a SOEP household can be taken into account. Respondents who care for someone who is not living in the same SOEP household cannot be examined in the context of this paper as the characteristics of their care recipients are not surveyed. The analysis uses panel data and, therefore, controls for unobserved heterogeneity which is likely to be substantial in caregiving decisions. In addition, I take into account that care is endogenous to the employment decision. I also test for panel attrition.

In general, three different scenarios are identified by Schneider et al. (2001) that describe how labor-force participation can react to the start or the increase of caregiving tasks. First of all, the reorganization of household production might be sufficient to cope with caregiving. This means that time-intensive leisure activities are reduced first and that no influence of caregiving on paid employment can be detected. Second, if the opportunity costs of care are low for one person within the household, providing care can increase the value of household production more than the potential caregiver's unchanged labor supply. This scenario is more likely when the household has a high income in general so that the salary of the caregiver is not needed to maintain the standard of living of the household as a whole. Similarly, if the opportunity costs of formal care are higher than the potential caregiver's loss in earnings, the employment spell is terminated or the hours of work are reduced. Third, Schneider et al. (2001) refer to paragraphs of the German Social Code (SGB XI §1; 37). These stipulate that the respective care insurance fund pays pension contributions for a caregiver who does not work for more than 30 h per week in the labor market but provides care for at least 14 h per week. Therefore, this transfer increases the non-working income of the caregiver and leaving the labor market might be a favorable option for those who have reached ages near the retirement age or are working for a few hours only. Although I cannot differentiate between these scenarios with the variables in my data set, they provide useful explanations for the reasons why some individuals leave the labor force while others will not quit their jobs.

3 Data and descriptive statistics

The SOEP data is a representative longitudinal micro-data set covering a wide range of socio-economic information on randomly selected households in Germany. The first round of data was collected from approximately 6,000 families in former West Germany in 1984. After German re-unification in 1989, the SOEP has been extended by about 2,200 families from East Germany. In 2007, about 22,000 individuals in 11,000 households participated in the data set. For details on the sampling procedure, questionnaire contents, and fieldwork methodology, readers are referred to Wagner et al. (2007).

In contrast to Schneider et al. (2001), I am employing the waves for the years 2001–2007 to take advantage of the newly included variables on caregiving. Moreover,

I am able to merge the characteristics of the co-residing caregiver and care recipient. All respondents who declare that they care for an individual but who have no care recipient within their own household have to be dropped from the sample (3,410 observations or 5.46%) because I have no information on their care recipient's characteristics which I need in the further estimation process. In addition, the sample contains a large amount of data on employment status, income, education, and other individual characteristics. The sample contains about 62,414 observations consisting of 14,873 individuals living in 9,627 households. I examine women and men separately as their labor supply and care behavior are different, which can already be seen in Tables 1 and 2. Schupp and Künemund (2004) say that men are occupied with care to an extent that almost equals the one of women. Nevertheless, overall care hours are still 20% less for men than women in the SOEP. Other studies confirm that men take over responsibility in caregiving (Carmichael and Charles 2003b). However, Dwyer and Coward (1991) illustrate that men usually provide help in IADLs which are easier to arrange around the work schedule while women are helping with ADL needs that are more time consuming. In this data set, 31,437 female and 30,977 male observations between 36 and 64 years are included as the frequency of caregiving in this sample increases after reaching the age of 35 (Fig. 1).

3.1 The characteristics of potential caregivers

Tables 1 and 2 provide a detailed overview of characteristics of women and men by labor-force participation and time assistance in care across the years 2001–2007. Table 6 in the Appendix presents the pooled means and standard deviations.

Overall, 64.24% of women and 79.08% of men are in paid employment. 2.29% of women and 1.53% of men state that they give some time assistance to a disabled individual while the mean care hours per week are 33.39 and 21.08, respectively. Among female caregivers 50.35% are still working. 49.65% do not work but provide care. This difference is larger for male caregivers. 58.95% are in paid employment while 41.05% are not working. Compared to the whole gender-specific samples, non-working caregivers tend to be older. The distribution of age shows that women have to reconcile work and care earlier in life than men. A higher share of caregiving individuals is married compared to all individuals in the subsamples. This is an expected result. Individuals are likely to receive long-term care from their spouse or partner because of the emotional relationship and because of the household they share. A prerequisite is, of course, that the caregiving partner is still in good enough health to help with care. Accordingly, the share of divorced, separated, or widowed persons who provide care is less than when looking at all individuals together. Among those who are without a partner, men are more likely to provide care compared to women. Women are expected to be the most likely caregiver for their disabled children[4] or for their dependent husband. They tend to be younger when they get married and they are often in better health than men of the same age. Along with the

[4] Children and spouses are covered by the care insurance of their publicly insured parent or partner if they do not have to publicly insure themselves.

Table 1 Labor-force participation and care provision of women

Women	All	Workers	Caregivers		
			All	Workers	Non-workers
All	100	64.24	2.29	50.35	49.65
Care hours per week[a]	0.77	0.51	33.39	28.16	38.69
Age					
Ages 36–55	75.39	86.25	65.88	83.47	48.04
Ages 56–65	24.61	13.75	34.12	16.53	51.96
Marital status					
Married	74.51	72.48	86.54	85.67	87.43
Divorced/Single	21.15	24.29	11.52	13.23	9.78
Widowed	4.34	3.23	1.94	1.10	2.79
Household size[a]	2.90	2.92	3.38	3.51	3.25
Other household income (€/month)[a]	2,171	2,027	2,610	2,583	2,638
Number of children					
Younger than 7	8.46	6.84	5.27	5.23	5.31
Ages 7–16	31.01	34.33	26.21	30.85	21.51
Years of education[a]	11.85	12.22	11.57	12.00	11.13
Health status					
Very good	5.98	6.86	2.91	3.32	2.51
Good—satisfying	76.93	79.26	75.31	81.27	69.27
Poor	14.22	11.42	16.92	14.33	19.55
Very poor	2.87	1.45	4.86	1.10	8.67
Characteristics of care recipients					
Age[b]					
Ages 1–55	0.92	0.82	35.78	41.32	30.17
Ages 56–79	0.67	0.50	26.77	23.69	29.89
Ages 80 and older	0.43	0.32	16.78	15.98	17.60
Needs help with...					
... getting around outside the house	2.32	1.85	91.54	92.01	91.06
... household chores, preparing meals	2.12	1.66	85.95	85.40	86.31
... washing, dressing, etc.	1.85	1.38	76.42	71.90	81.01
... getting into and out-of-bed, etc.	0.91	0.63	37.45	32.51	42.46
Care level—0: person in need of help	0.82	0.74	29.54	33.87	25.14
Care level—I	0.84	0.63	34.54	33.06	36.03
Care level—II	0.58	0.48	23.58	24.52	22.63
Care level—III	0.30	0.16	12.34	8.64	16.20
Care allowance (€/month)[a]	5	4	196	184	209
Other sources of help	0.32	0.30	12.07	15.15	8.94
Observations	31,437	20,196	721	363	358

Data source SOEP subsample of women of the waves 2001–2007 (unweighted)

[a] These values are mean values for the respective samples, not percentages

[b] Does not sum up to 100% as information is only available for care recipients who fill in the individual questionnaire (∼ 80%)

Table 2 Labor-force participation and care provision of men

Men	All	Workers	Caregivers		
			All	Workers	Non-workers
All	100	79.08	1.53	58.95	41.05
Care hours per week[a]	0.32	0.18	21.08	15.48	29.12
Age					
Ages 36–55	74.67	83.41	59.58	77.14	34.36
Ages 56–65	25.33	16.59	40.42	22.86	65.64
Marital status					
Married	76.26	77.32	78.95	75.36	84.11
Divorced/Single	22.50	21.87	19.16	23.21	13.33
Widowed	1.24	0.81	1.89	1.43	2.56
Household size[a]	2.95	3.07	3.17	3.39	2.85
Other household income (€/month)[a]	1,342	1,162	1,803	1,465	2,289
Number of children					
Younger than 7	11.42	13.20	3.79	4.64	2.56
Ages 7–16	32.20	36.55	25.47	37.50	8.21
Years of education[a]	12.22	12.49	11.49	11.91	10.89
Health status					
Very good	6.13	6.96	4.63	6.44	2.05
Good—satisfying	78.09	81.97	73.69	78.21	67.18
Poor	12.84	9.76	16.21	12.50	21.54
Very poor	2.94	1.31	5.47	2.86	9.23
Characteristics of care recipient					
Age[b]					
Ages 0–55	1.04	0.99	40.63	47.86	30.26
Ages 56–79	0.50	0.27	24.42	13.57	40.00
Ages 80 and older	0.47	0.38	17.26	18.99	14.87
Needs help with...					
...getting around outside the house	2.27	1.87	94.32	93.93	94.87
...household chores, preparing meals	2.05	1.71	85.68	86.43	84.62
...washing, dressing, etc.	1.72	1.47	75.79	79.64	70.26
...getting into and out-of-bed, etc.	0.86	0.75	39.79	41.43	37.44
Care level—0: person in need of help	0.74	0.58	25.47	23.21	28.79
Care level—I	0.79	0.64	30.74	29.64	32.23
Care level—II	0.59	0.53	28.63	31.08	25.13
Care level—III	0.31	0.28	15.16	16.07	13.85
Care allowance (€/month)[a]	5	5	233	247	213
Other sources of help	0.52	0.44	25.47	27.50	22.56
Observations	30,977	24,497	475	280	195

Data source SOEP subsample of men of the waves 2001–2007 (unweighted)
[a] These values are mean values for the respective samples, not percentages. [b] Does not sum up to 100% as information is only available for care recipients who fill in the individual questionnaire (∼83%)

traditional gender roles, this assigns the main caregiver role to women. Old or oldest-old care recipients are also cared for by their own children who are middle-aged at that time. In general, households are larger if a care recipient lives within the household. Having young children may indicate an endogeneity problem of caregiving on the labor-market decision: If potential caregivers stayed at home to take care for their children, the individuals' opportunity costs are relatively lower today. First, caregiving skills have already been acquired and second, the earnings potential is lower than for a person who has been gainfully employed during all this time. This could determine the amount of time assistance that is provided to the care recipient (Heitmueller 2007). Caregivers report a lower health status in general but do so even more frequently if they are not working. This could again indicate the existence of a similar endogenous mechanism if individuals with low labor-market opportunity cost were more likely to become caregivers. However, the low health status could also result from a high physical or psychological caregiving burden (Fast et al. 1999). The household income of other individuals than the respective person varies slightly between the overall subsample of working individuals and the subsample of caregiving and employed individuals. The amount is higher for the latter group which is likely to result from the care allowance transfer that a care recipient receives if he is ranked into one of the three care levels. Women who are working and caring at the same time report an about €500 higher household income of other household members than the overall subsample of working females. The difference between men is €300.

3.2 Characteristics of care recipients

The care recipients of men who provide care and do not work are mainly between 56 and 79 years old. Compared to them, women are more occupied with those in the oldest-old category. As this information is surveyed in the individual questionnaire, answers on the care recipient's age are only available for those care recipients who fill it in. About 20% of the care recipients of men and women do not provide any personal information. A higher percentage of impaired individuals needs help in more time consuming and heavier tasks of daily living in the subsample of non-working women caregivers than in the one of working female caregivers. Tables 1 and 2 also suggest that the care recipients of non-working women are more likely to suffer from several care needs at the same time compared to those care recipients of working females. The same picture evolves for the care recipients of women at care level type III. Among the sample of women who reconcile care and work, 29.54% of care recipients do not receive any financial support from the long-term care insurance (see Care level—0). However, this percentage decreases to 25.14% for the care recipients of non-working women. The mean amount of care allowance per month is indeed a little higher for the care recipients of women who do not work but care.[5] Other sources

[5] The maximum care allowance that care recipients can receive from the public care insurance is about €665 if they are ranked into care level three and receive informal care at home only.

of help are more than twice as often available for men compared to the women's sample.

4 Empirical model

4.1 Dependent and independent variables

The dependent variable (y_{it}) in the labor-supply regression equation is a binary indicator of labor-force participation (lfp_{it}) which equals 1 if the individual is working in the labor market and 0 if otherwise. In addition, a linear measure of actual hours worked per week ($workh_{it}$) is regressed on the exogenous variables using the same econometric model.

As individual and household characteristics (x_{it}), the marital status and the health status are included into the regression equations. Being married and being in very good health serve as the reference groups. The age of individuals is controlled for by three different age categories. The lowest one (ages between 36 and 44) is the reference category while the other two categories for individuals between 45–54 and 55–64 years are included in the equation. I use categories to maximize the variation in the age information for the within-estimator of the fixed-effects model. In addition, the household size and the number of children are added. The latter is divided into those children which are younger than 7 years and into those aged seven to sixteen. The income measure comprises the net labor income from other household members as well as the household's non-labor income but not the labor income of the respective individual under consideration. This measure is an approximation of the minimum income that individuals fall back on within a household if they stop working. Although it is still endogenous to labor supply, it is used to mitigate the bias from reversed causality as it is very difficult to convincingly instrument income. Moreover, two care variables are added. These are the weekly amount of hours somebody provides care[6] ($care_{it}$), and the amount of care allowance the care recipient receives per month measured in hundred euros (included in x_{it}). Time dummies ($time_t$) are also included into the regression equations where 2001 serves as the reference period. The general model reads

$$y_{it} = \beta_1 care_{it} + \boldsymbol{x}'_{\boldsymbol{it}}\boldsymbol{\beta_2} + \boldsymbol{time}'_{\boldsymbol{t}}\boldsymbol{\beta_3} + \alpha_i + \epsilon_{it} \tag{1}$$

$$care_{it} = \boldsymbol{z}'_{\boldsymbol{it}}\boldsymbol{\gamma_1} + \boldsymbol{x}'_{\boldsymbol{it}}\boldsymbol{\gamma_2} + \boldsymbol{time}'_{\boldsymbol{t}}\boldsymbol{\gamma_3} + \delta_i + \nu_{it} \tag{2}$$

where y_{it} is either lfp_{it} or $workh_{it}$ and the second line is the first-stage regression equation for GMM estimation. The first-stage regression is not estimated when no correction for endogenous regressors is conducted. In that case, the variable $care_{it}$ is assumed to be exogenous in Eq. 1.

[6] Question: How many hours do you spend on the following activities on a typical weekday, Saturday, and Sunday? Care and support for persons in need of care: (Please give only whole hours. Use zero if the activity does not apply!); Source: SOEP 2001–2007, Individual questionnaire.

4.2 Unobserved heterogeneity, endogeneity, and panel attrition

An advantage of the panel structure is that unobserved heterogeneity, which is represented by α_i in Eq. 1 and δ_i in Eq. 2, can be taken into account. The motivation to work or keep working might have a high influence on the probability of employment. But within the context of care, the amount of labor supplied will additionally be affected by a feeling of responsibility and a feeling of generalized reciprocity of the caregiver to the impaired individual. This feeling becomes even more influential the closer the relationship is. These preferences are correlated with the weekly amount of care hours provided to a care recipient. Therefore, neglecting heterogeneity would lead to omitted-variable bias and thus to an inconsistent model estimator as the idiosyncratic errors ϵ_{it} and ν_{it} would be correlated with some of the exogenous regressors.

Living together with a care recipient can be a considerable burden and some individuals might refuse to answer the SOEP questionnaires for this reason. As I am dealing with a panel data set consisting of seven waves, it is important to examine whether a possible selection bias distorts the results due to panel attrition in the wake of caregiving. I regress a selection variable, which takes the value 1 if the individual is observed in the next year and 0 if otherwise, on the last period's exogenous variables of Eq. 1 and on various characteristics of the care recipient. A variable which contains the year of death of a SOEP participant is also included. For each time period in the panel data set ($t = 1, \ldots, T-1$), I then conduct cross-sectional probit regressions and test whether the care variables and the characteristics of care recipients have a significant impact on leaving the panel data set in the next year. However, the results do not give a uniform picture on their influence: While a few care variables and characteristics of care recipients indeed lead to a decrease in the probability of participating in the next wave of the survey, others point to the opposite direction. These findings are irrespective of the intensity of the physical or emotional burden that can be assigned to these variables. It is often the case that the signs of the associations of a single regressor change over several probit regressions. Therefore, I conclude that panel attrition due to caregiving does not distort the values of the estimated coefficients in a systematic pattern.[7]

As in the analyses of Ettner (1995, 1996); Stern (1995) (US), Heitmueller (2007) (Great Britain), and Bolin et al. (2008) (11 European countries), the endogeneity bias has to be solved. Individuals could be reluctant to provide a high amount of care hours if they were employed. Other household members might decide to care for more hours because they are not working in the labor market. Another option is to purchase formal care in the market if the time cost of the caregiver is higher than the price of care services (Ettner 1996). In addition, labor supply can be reduced if caregiving is started or its burden becomes higher. Therefore, causality could lead into both directions. I use a linear probability model (LPM) with efficient GMM estimation with fixed effects for instrumenting the endogenous regressor in both labor-supply specifications. The predicted values of the dependent variable are not restricted to lie between 0 and 1. Therefore, the effect on labor-force participation has to be interpreted

[7] The results are available from the author on request.

as the latent propensity to work in the labor market. Nevertheless, the LPM can be seen as a good approximation of underlying employment probabilities (Wooldridge 2002). The conditional mean and the variance of the LPM estimator show that it is consistent but heteroskedastic. Therefore, robust standard errors have to be estimated. The LPM can also control for unobserved heterogeneity as the individual-specific term is eliminated by the within transformation of the fixed-effects estimator. If both endogenous regressors and heteroskedasticity are present, GMM estimation is necessary to obtain efficient estimates (Wooldridge 2002).

Good instruments should be correlated with the endogenous number of weekly care hours and should be uncorrelated with the error of the labor-supply regression equation. Natural sets of instruments are the characteristics of the impaired individual which are likely to have a direct effect on the amount of hours they are cared for but only an indirect one on labor supply. Therefore, the four categories of ADL and IADL in which the impaired individual needs help are used as instruments and represented by z_{it} in Eq. 2.[8] The variable which indicates whether disabled individuals are present in the household[9] is added to this list. It is exogenous if living together with them in one household cannot be chosen by other household members. Therefore, these instruments are only valid if individuals do not change their living arrangement by moving in with the care recipient. If individuals lose their job due to other reasons than caregiving, they could nevertheless decide to share a household with a dependent person which might be (financially) advantageous for both parties. Therefore, the sample is further restricted to those potential caregiver and care recipient households which did not move in together in the year before caregiving started. 684 individuals (1.1% of the sample) are lost to this procedure.

The results of the first-stage IV regressions for women and men can be seen in Table 7 in the Appendix. The effect of living with a disabled individual is almost equal for both sexes and increases the hours of care per week by more than 8 h. In the case of women, three of the four categories in which help is needed have a significantly positive effect on care hours. Help in everyday household tasks raise them by 4 h per week. If the care recipient needs care in the lowest ADL category (help with washing, dressing, etc.), the hours of care increase by about 8 h per week while the effect of the highest ADL category (help to get into and out-of-bed etc.) reaches more than 10 h. For male caregivers, not the household tasks but only the ADL categories have a significantly positive effect on the time intesity of care of more than 2 and 3 h per week, respectively. Although the care allowance is not used as an instrument here, it should be noted that its effect on the care hours of females is significantly positive but not as strong as the categories in which help is needed. The hours of care that men provide per week are not influenced by the statutorial insurance payment.

Table 3 presents the most important test statistics for instrumental-variable estimation. The potential weakness of instruments is tested by an F-test which examines the joint explanatory power of the excluded instruments. As a rule of thumb, its value

[8] Question: (In) which of the following activities does he or she need assistance?; Source: SOEP 2001–2007, Household questionnaire.

[9] Question: Does someone in your household need care or assistance on a constant basis due to age, sickness or medical treatment?; Source: SOEP 2001–2007, Household questionnaire.

Table 3 Test statistics for GMM estimation

	Women		Men	
	Labor-force participation	Working hours	Labor-force participation	Working hours
Hours of care per week	−0.000	−0.046	0.000	−0.036
	(0.001)	(0.038)	(0.002)	(0.099)
F-test on weakness of instruments	30.94	30.94	18.30	18.30
	(0.000)	(0.000)	(0.000)	(0.000)
Overidentification test	0.813	1.444	3.748	3.242
	(0.937)	(0.837)	(0.441)	(0.518)
Test for exogeneity	1.906	0.028	0.869	0.158
	(0.168)	(0.867)	(0.351)	(0.691)
Observations	30,202	30,202	29,768	29,768

Standard errors in *round brackets*; *P* values in *square brackets*. *Data source* SOEP 2001–2007

should be larger than ten for one endogenous regressor. Otherwise, there is doubt about the strength of the instruments although the test statistic is significant and the sample size is large (Staiger and Stock 1997). This rule of thumb is fulfilled for all labor-supply specifications. The null hypothesis of the overidentification test (Sargan test) cannot be rejected which implies that the instruments are uncorrelated with the error term of the labor-supply equation. Note, that this test is only conducted for all but one instrument. It is still crucial to argue that labor supply does not influence the instruments. Because all of them represent exogenous health shocks and, therefore, cannot be influenced by the caregiver, reversed causality can be ruled out here and both requirements are fulfilled. Table 3 illustrates that regardless whether you are male or female, hours of care per week do not have a significant influence on labor supply in both GMM-labor-supply specifications, respectively. I also test for exogeneity of the endogenous regressor when using efficient GMM estimation. The test compares instrumental-variable estimates to non-IV estimates. If the suspected endogenous regressor is in fact exogenous, GMM estimates will be less efficient than those of non-IV estimation while the latter are not inconsistent as would be the case under an endogeneity bias (Cameron and Trivedi 2005). The null hypothesis that the variable can in fact be treated as exogenous cannot be rejected in any of the labor-supply regressions. Therefore, I present and interpret panel-logit-fixed-effects results for the effect on the binary labor-supply measure (Column (2) in Tables 4 and 5) and linear-panel-fixed-effects results (Column (4) in Tables 4 and 5) for the effect on actual hours worked per week without instrumental-variable estimation (Wooldridge 2002). These results are presented in addition to the GMM-fixed-effects results in the next section.

5 Results

Tables 4 and 5 present the empirical results. The focus is on Columns (2) and (4) because the test statistic on the endogeneity of the endogenous regressor implies that

the hours of care regressor can be treated as exogenous. The effect of care hours on labor supply is not significant for the probability of leaving the labor market for both sexes. However, caring ten hours more per week decreases the working hours by 35 min per week for women and by 48 min for men in the regression equations without controlling for endogeneity. The impact on working hours is, therefore, economically small.

The amount of social security support through the care allowance does not have a significant influence on the decision to supply labor for both sexes. This result is not surprising as the care allowance that a care recipient might receive for informal care over the different care levels only ranges from €215 to €665 per month (Federal Ministry of Health (ed.) (2008)) which is often not sufficient to cover the costs of care (Keese et al. 2010). In this case, it is also unlikely that the caregiver receives any money while providing care at home. Forgone employment opportunities and earnings, less social contact, and emotional and physical well-being costs make care very expensive to the caregiver (Carmichael and Charles 1998, 2003a,b; Fast et al. 1999). The amount of financial support from the care allowance, payments to the caregiver from the care recipient, and the prospect of a possible bequest might be too low to compensate these costs and, therefore, strong reactions cannot be expected.

The household size is positively associated with the women's and men's labor supply (Tables 4 and 5, Columns (2)). The probability of employment decreases for men and women who are between 55 and 64 years old compared to those who are between 36 and 44 years old. Children who are younger than 16 years have a significantly negative association with the employment probability and working hours of women. Having young children up to the age of 7 has no influence on the labor supply of men but only on their working hours. Compared to women who are married, those who are single have a positive association with working hours per week. The coefficients of the marital status variables in the men's regression results have no effect on both labor-supply measures. Only a very bad health status is negatively associated with the employment probability and working hours of women. Similarly for men, having a poor or very poor health status decreases the probability of paid employment as well as the working hours per week compared to a man in very good health. The coefficient of the logarithmized household income of other household members is negative throughout the estimation results. Thus, the higher the income an individual can fall back on within the household, the lower is the probability and time intensity of work.

6 Conclusion

I only find significant effects of care provision on hours worked. They are, however, economically small. The amount of care hours has a significantly negative effect, reducing the hours of work for men by 48 min if 10 h of care are additionally provided per week. The negative effect for women is less compared to the one for men (35 min per week). The care allowance that a disabled individual in a household might receive has no influence on the labor-supply decision of the caregiver.

Bolin et al. (2008), who use a European data set for individuals aged 50 and over, only find significantly negative effects for the labor-force participation of men and

Table 4 Regression results on labor-supply measures: women

	Labor-force participation (Panel GMM FE) (1)	Labor-force participation (Panel-logit FE) (2)	Actual hours worked per week (Panel GMM FE) (3)	Actual hours worked per week (Panel OLS FE) (4)
Hours of care per week	0.000	−0.002	−0.046	−0.058***
	(0.001)	(0.002)	(0.038)	(0.020)
Household size	0.038***	0.207***	1.381***	1.379***
	(0.006)	(0.026)	(0.198)	(0.219)
Age between 45 and 54	−0.003	−0.033	−0.417	−0.417***
	(0.007)	(0.040)	(0.268)	(0.297)
Age between 55 and 64	−0.064***	−0.236***	−2.207***	−2.212***
	(0.012)	(0.070)	(0.417)	(0.466)
Children younger than 7	−0.106***	−0.292***	−3.495***	−3.491***
	(0.012)	(0.045)	(0.318)	(0.345)
Children between ages 7–16	−0.017***	−0.060**	−1.285**	−1.283**
	(0.006)	(0.029)	(0.194)	(0.215)
Divorced/separated	−0.011	0.014	0.198	0.195
	(0.018)	(0.087)	(0.618)	(0.671)
Single	0.019	0.030	2.541***	2.540***
	(0.038)	(0.173)	(1.294)	(1.400)
Widow	−0.020	−0.070	−1.695	−1.784
	(0.033)	(0.154)	(1.058)	(1.185)
Very poor health	−0.057***	−0.214***	−1.528**	−1.534**
	(0.018)	(0.063)	(0.574)	(0.585)
Poor health	−0.008	−0.036	0.015	0.014
	(0.012)	(0.056)	(0.380)	(0.384)
Fair health	0.006	0.018	0.192	0.190
	(0.010)	(0.046)	(0.326)	(0.323)
Good health	0.004	0.009	0.207	0.204
	(0.009)	(0.047)	(0.295)	(0.290)
Other household income	−0.109***	−0.671***	−4.219***	−4.219***
(in €1,000/month, log)	(0.006)	(0.039)	(0.257)	(0.278)
Care allowance	−0.002	0.002	0.217	0.257
(in €100/month)	(0.007)	(0.029)	(0.224)	(0.209)
Constant				20.050***
				(0.745)
Observations	30,202	8,298	30,202	30,202
Chi^2 statistic		432.75		
F statistic	29.62		29.21	25.15

All columns present average marginal effects. *Data source* SOEP 2001–2007. Standard errors in *parentheses*
$^{*}P < 0.1, ^{**}P < 0.05, ^{***}P < 0.01$

Table 5 Regression results on labor-supply measures: men

	Labor-force participation (Panel GMM FE) (1)	Labor-force participation (Panel-logit FE) (2)	Actual hours worked per week (Panel GMM FE) (3)	Actual hours worked per week (Panel OLS FE) (4)
Hours of care per week	0.000	−0.006	−0.036	−0.080***
	(0.002)	(0.006)	(0.099)	(0.029)
Household size	0.041***	0.217***	1.828***	1.838***
	(0.005)	(0.023)	(0.223)	(0.244)
Age between 45 and 54	−0.000	−0.002	−0.078	−0.079
	(0.006)	(0.041)	(0.318)	(0.344)
Age between 55 and 64	−0.045***	−0.145**	−2.424***	−2.435***
	(0.010)	(0.061)	(0.495)	(0.547)
Children younger than 7	−0.015**	−0.080	−0.848***	−0.851***
	(0.006)	(0.045)	(0.316)	(0.324)
Children between ages 7–16	−0.008*	−0.086***	−0.378*	−0.388
	(0.005)	(0.024)	(0.228)	(0.243)
Divorced/separated	0.023*	0.078	0.577	0.579
	(0.013)	(0.067)	(0.647)	(0.691)
Single	0.048***	0.150	1.524	1.535
	(0.022)	(0.111)	(1.093)	(1.151)
Widow	−0.060	−0.010	−4.582*	−4.535
	(0.049)	(0.191)	(2.447)	(2.780)
Very poor health	−0.094***	−0.257***	−3.713***	−3.734***
	(0.017)	(0.057)	(0.799)	(0.818)
Poor health	−0.051***	−0.213***	−1.811***	−1.809***
	(0.010)	(0.055)	(0.486)	(0.501)
Fair health	−0.012	−0.050	−0.258	−0.244
	(0.008)	(0.047)	(0.399)	(0.404)
Good health	−0.007	−0.020	−0.165	−0.153
	(0.007)	(0.042)	(0.356)	(0.359)
Other household income	−0.107***	−0.767***	−4.767***	−4.765***
(in €1,000/month, log)	(0.004)	(0.040)	(0.198)	(0.214)
Care allowance	0.012	0.053	0.053	0.509
(in €100/month)	(0.007)	(0.034)	(0.412)	(0.407)
Constant				31.222***
				(0.858)
Observations	29,768	6,195	29,768	29,768
Chi^2 statistic		510.50		
F statistic	48.05		44.40	37.05

All columns present average marginal effects. *Data source* SOEP 2001–2007. Standard errors in *parentheses*
$^{*}P < 0.1, ^{**}P < 0.05, ^{***}P < 0.01$

women. As far as actual working hours are concerned, they do not estimate a significant influence of care hours. My study also differs compared to the results of Ettner (1995, 1996) and Stern (1995), who only estimate significantly negative effects after controlling for endogeneity. But, the expectation of Schneider et al. (2001) that the introduction of the mandatory public care insurance will lower the (non-economic) costs of caregiving seems to be confirmed when our results for women are compared to each other because I do not find an effect of care on their labor-force participation. Public care insurance services like care-related therapeutic appliances, counseling, and free courses in care for caregivers are some examples which can facilitate care provision. Unfortunately, I cannot explain which of these services to care recipients and their families have contributed to this cost reduction due to data limitations. Nevertheless, it is likely that the first pathway described by Schneider et al. (2001) is true when looking at the caregiving workforce in general: As I cannot find economically significant negative effects of care hours on labor supply, time spend on leisure might be reduced before working hours are. Therefore, the results illustrate that the compatibility of care and employment is less of a problem in this sample.

However, representative surveys like the ones of Schneekloth and Engels (2006) and questions in the SOEP make clear that most people want to stay at home if care becomes necessary and that this also implies that most caregivers try to fulfill this wish as long as possible. The amendment of the care insurance regime between 1999 and 2008 by the German *Pflege-Weiterentwicklungsgesetz*, which came into force on 1st of July 2008, reflects this fact. It facilitates the reconciliation of caregiving and working by introducing a so-called time for care for employees. After this law, they can get up to 6 months of unpaid leave with a guarantee on a similar position in their firm. A reduction in working hours is also an option. It is also possible to take up to 10 days off in emergencies (Federal Law Gazette (ed.) (2008)). Nevertheless, the nationwide supply of services, like day care or substitutional care, remains crucial, and has to be flexible. From the employer's side, this should be complemented with more flexible work arrangements for those employees who have to look after a care recipient.

To build an understanding of the needs of the care recipient which go beyond the medical ones and to support the caregiver in organizing work and care commitments, further research is necessary in Germany. More people have to be surveyed to ensure that a sufficient number of families, which have a care recipient among themselves, are observed. Little is known about the concrete organization of day-to-day care in an informal setting and about its individual out-of-pocket costs. It is also important to scrutinize population-subgroups and their differing behavior in using care insurance services. For instance, the combination of work and care is likely to be more difficult for those individuals and their families which only have a low income to their disposal.

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Appendix

See Tables 6 and 7.

Table 6 Means and standard deviations

Variable	Women		Men	
	Mean	SD	Mean	SD
Labor-force participation	0.64	0.48	0.79	0.41
Actual weekly working hours	20.11	18.34	34.89	19.92
Care recipient in household	0.03	0.16	0.03	0.15
Care hours per week	0.77	7.32	0.32	3.94
Age	48.55	8.36	48.63	8.41
Household size	2.90	1.25	2.95	1.30
Number of children				
Younger than 7	0.10	0.35	0.14	0.42
Ages 7–16	0.48	0.80	0.49	0.81
Other household income (€/month)	2,171	1,509	1,342	1,091
Health status				
Very good	0.06	0.24	0.06	0.24
Good	0.41	0.49	0.43	0.49
Fair	0.36	0.48	0.35	0.48
Poor	0.14	0.35	0.13	0.33
Very poor	0.03	0.17	0.03	0.17
Years in education	11.85	2.50	12.22	2.69
Marital status				
Married	0.75	0.44	0.76	0.43
Single/Divorced	0.07	0.25	0.23	0.42
Widowed	0.04	0.20	0.01	0.11
Observations	31,437		30,977	
Characteristics of care recipient				
Other care available	0.83	0.38	0.74	0.44
Gender	0.38	0.49	0.72	0.45
Age	51.99	27.42	50.73	28.56
Married	0.25	0.43	0.23	0.42
Care level and help needed with...				
...getting around outside the house	0.91	0.28	0.93	0.25
...household chores, preparing meals	0.83	0.37	0.84	0.37
...washing, dressing, etc.	0.73	0.44	0.71	0.46
...getting into and out-of-bed, etc.	0.36	0.48	0.35	0.48
Care level 0	0.32	0.49	0.30	0.46
Care level I	0.33	0.47	0.32	0.47

Table 6 continued

Variable	Women		Men	
	Mean	SD	Mean	SD
Care level II	0.23	0.42	0.24	0.43
Care level III	0.12	0.32	0.13	0.33
Care allowance (€/month)	189	232	203	235
Observations	798		755	

Own calculations. *Data source* SOEP 2001–2007. The gender and age of the care recipients are based on the individual SOEP questionnaire. The numbers of observations of care recipients differ compared to Tables 1 and 2 because not every care recipient in a household receives informal care. However, informal care is the prerequisite to be included in Tables 1 and 2

Table 7 First-stage regression results on labor-supply measures

	Women Hours of care per week (Panel GMM FE)	Men Hours of care per week (Panel GMM FE)
Care recipient in household	8.992**	8.904***
	(3.572)	(3.072)
Help to get around outside the house	0.986	−2.325
	(3.418)	(2.291)
Help with household chores, preparing meals	4.084*	0.554
	(2.249)	(2.032)
Help with washing, dressing, etc.	8.410***	2.207*
	(2.280)	(1.324)
Help to get into and out-of-bed, etc.	10.610***	3.635*
	(3.151)	(2.055)
Household size	−0.201*	−0.054
	(0.122)	(0.041)
Age between 45 and 54	0.069	0.058
	(0.114)	(0.106)
Age between 55 and 64	0.068	0.093
	(0.136)	(0.137)
Children younger than 7	0.264	0.043
	(0.179)	(0.035)
Children between ages 7 to 16	−0.060	0.040
	(0.098)	(0.035)
Divorced/seperated	−0.295	0.040
	(0.184)	(0.063)
Single	−0.187	0.042
	(0.114)	(0.051)
Widow	−0.934	−0.179
	(0.761)	(0.120)

Table 7 continued

	Women Hours of care per week (Panel GMM FE)	Men Hours of care per week (Panel GMM FE)
Very poor health	−0.028	−0.594**
	(0.279)	(0.291)
Poor health	−0.109	−0.250***
	(0.135)	(0.083)
Fair health	−0.083	−0.088
	(0.108)	(0.063)
Good health	−0.012	−0.083*
	(0.082)	(0.049)
Other household income	0.075	0.032*
(in €1000 /month, log)	(0.071)	(0.017)
Care allowance	1.298*	0.214
(in €100/month)	(0.703)	(0.378)
Constant	0.757*	0.260**
	(0.407)	(0.109)
Observations	30,202	29,768
F statistic	10.84	5.41

The first-stage regression results of the panel GMM models, where hours of care per week are treated as endogenous, correspond to Columns (1) and (3) of Tables 4 and 5 for women and men, respectively. The sex-specific first-stage results are the same irrespective of the regressand of the second stage. All columns present average marginal effects. *Data source* SOEP 2001–2007. Standard errors in *parentheses*
$^{*}P < 0.1, ^{**}P < 0.05, ^{***}P < 0.01$

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