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## Informal Home Care and Labor Force Participation of Household Members

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Annika Meng

## Informal Home Care and Labor Force Participation of Household Members

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Annika Meng<sup>1</sup>

## Informal Home Care and Labor Force Participation of Household Members

### Abstract

*In Germany, informal home care is preferred to professional care services in the public discussion as well as in legal care regulations. However, they ascribe only minor importance to the opportunity costs care givers have to face. Therefore, this paper explores the influence home care has on the labor supply of carers who live together with their care recipient. I am using the German Socio-Economic Panel of the years 2001 to 2007 which allows the characteristics of both groups to be merged. Furthermore, I look at female and male care givers separately. The results show that having an individual in need of care in the household does not decrease labor supply to an economically relevant extent. As caring and the labor supply decision might be endogenous, I test for endogeneity by using characteristics of care recipients as instruments and I look at sample attrition. In addition, the panel structure allows to control for unobserved heterogeneity, which is probably strong for care.*

*JEL Classification: J14, J22, D64*

*Keywords: Informal care, labor supply, endogeneity*

*November 2009*

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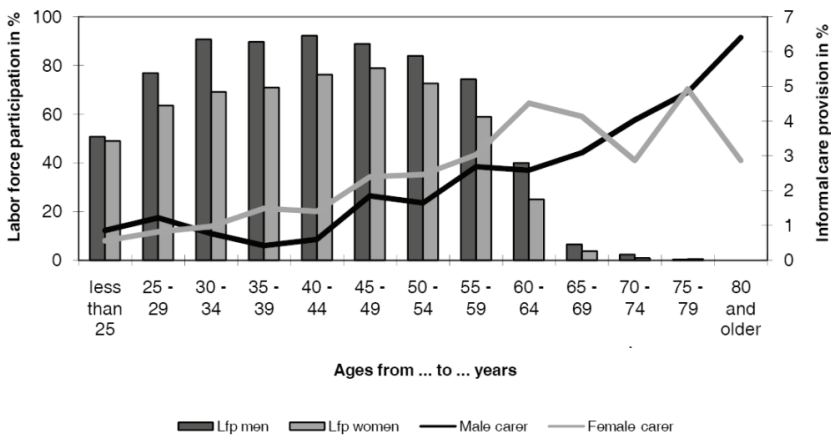
# 1 Introduction

The financing of the German pay-as-you-go system in the mandatory pension and health insurance has been a major political concern in recent years due to the demographic change. Nowadays, the mandatory public care insurance has joined this discussion under financial and social aspects. The absolute as well as the relative number of elderly individuals has been increasing rapidly whereas the number of the oldest old is rising even faster (Gilberg, 2000). While some researchers state that morbidity is decreasing through technical progress in medicine (theory of compression on morbidity), others expect that the increasing life expectancy of the elderly increases the need for care as people suffer from severe illnesses like Alzheimer's and other senile dementia illnesses when they reach old age (Gilberg, 2000). The rising demand for care would, therefore, increase costs for formal and institutional care on the care market. In 1999, the expenses of the public care insurance were larger than the yearly contributions for the first time since the social care insurance had been introduced in 1995 (Deutschland in Zahlen 2007). A recent forecast by Schnabel (2007) until the year of 2050 on behalf of the Federal Ministry for Family Affairs, Senior Citizens, Women, and Youth (BMFSFJ) has calculated that the contributions to the public care insurance have to rise from 1.7 % - 1.95 % to 3 % - 5.5 %, depending on the demographic scenario, to finance future expenses. The forecasts are based on constant care probabilities from the year 2005 and Schnabel (2007) predicts that the number of care recipients will increase up to 4.7 million individuals until 2050. As the compulsory care insurance is organized according to the German pay-as-you-go system as well, working individuals are charged with rising contributions, which then decreases their net wage. As these relations have already been known when the 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 financial relief of the social care insurance as well as the financial relief of the government's budget are one of the main reasons for this arrangement. The idea is that informal care is less

expensive and might be more effective than formal care.

In addition, the social aspect of care has been emphasized recently. The dignity and quality of life of the elderly is expected to be higher when they can stay in their usual environment and are attended to by their own family and friends (Heitmueller and Inglis, 2004).<sup>1</sup> However, this argument often forgets to take the opportunity costs of carers into account. Not only psychological, physical, and social costs have to be kept in mind. Forgone earnings, decreasing productivity, and absenteeism from the workplace are some of the problems working 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 in the bar graph and, at the same time, the percentage of caregivers over the same age distribution in the line graph among Socio-Economic Panel (SOEP) respondents. Obviously, the double time burden of work and care increases after the age of 45 and further rises until retirement.

Figure 1: The occupation with paid employment and home care by age



<sup>1</sup>Another demographic aspect is that the amount of potential carers is decreasing as well: Smaller family sizes through decreasing fertility, new household/family types (e.g. through divorces), increased mobility and a change in social norms, like responsibility and individualism, are some of the reasons for this development.



Economically speaking, two counteracting effects are determining labor supply. As time becomes scarce when looking after a disabled individual, the shadow wage rate of the carer increases and labor supply is reduced. This is the substitution effect. On the other hand, the opportunity costs of the carer are usually not fully reimbursed by the care recipient, which is an incentive to keep working. This is the income effect. If the first effect outweighs the second one, labor force participation will be reduced. The public care insurance is likely to cover only some of the arising expenses when an individual is ranked into one of the German care levels.<sup>2</sup> However, the opportunity costs and the costs for formal and institutional care are usually too high to be completely covered by this care allowance. Therefore, the decision about the type of care that is utilized must also consider what the care recipient and his family can afford.

Support to impaired individuals in Germany has only been examined by a few studies so far. Therefore, this paper focuses on the influence of informal home care on the labor force participation of carers in Germany who live in the same household as the care recipient. However, I do not only look at elderly care recipients, but also I do consider all age groups as the influence of care on work occurs regardless of the age of the care recipient. Parents are likely to be the carer for young children. Adults are also the most likely carers for their impaired spouse or partner. Old or oldest old care recipients are either also cared for by a spouse or partner if they are still alive and in relatively good health or by their own children who are middle-aged at that time. In the empirical analyses, I test for endogeneity bias and panel attrition. Panel estimation methods allow to control for unobserved heterogeneity. The results illustrate that caregiving does not influence the probability of employment. Working hours are reduced by 28 minutes for women and by 35 minutes for men, though.

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<sup>2</sup>See Federal Ministry of Health (ed.) (2008) for an overview of the most important services of the German public care insurance.

## 2 Literature review

Most of the early literature on caregiving comes from the U.S. in the 1980s and 90s and calculates bivariate correlations. Overall, the results indicate a reduction in work hours (Muurinen, 1986) but not in the probability of employment (Stone and Short, 1990). In addition, working women provide significantly fewer care hours (Brody and Schoonover, 1986; Soldo and Hill, 1995; Boaz, 1996). Moen et al. (1994), however, receive no effect when looking at 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 in their analyses. Other studies in this respect confirm a modest reduction in work 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 the overall time burden of women in particular, the latter provides correlations rather than estimation results as an examination of the endogeneity problem was neglected. This is also true for the first European wide study by Spiess and Schneider (2002). A recent publication by Bolin et al. (2008) with SHARE (Survey of Health, Ageing and Retirement in Europe) data confirms negative labor supply effects. They state that men in Northern and Southern Europe encounter stronger effects than those in Southern Europe. The latest study from the U.S. 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 work hours of men and women, they also come to the conclusion that formal care purchased within the market is not an attractive substitute for family care. As far as Great Britain is concerned, Carmichael and Charles (1998, 2003*a*), Carmichael and Charles (2003*b*) find that informal carers of both sexes who care for less than 20 hours per week

are more likely to participate in the labor market but work fewer hours than similar non-carers for GHS (General Household Survey) data. However, informal carers who care for more than 20 hours per week are less likely to be employed. These results are confirmed by Heitmueller and Inglis (2004) with the BHPS (British Household Panel Survey). In the same year Heitmueller (2007) published a study which takes a close look at the problem of endogeneity concerning caregiving and employment. On the one hand, he only finds a significant impact of caregiving on labor force participation for co-residence and concludes that the carer has less of a choice in caring under these circumstances. On the other hand, he argues that missing employment opportunities might abet caregiving when the disabled elderly does not live in the same house or when the needed number of care hours are only small. However, he does not find a significant effect in this respect.

Empirical evidence for Germany in particular is very scarce. The study of Schneekloth and Engels (2006) only provides descriptive statistics about care arrangements and their usage and tries to determine the characteristics of carers. Moreover, other descriptive studies from the SOEP present 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 hours of care on a usual week day while women only perform a little more, namely 3 hours (Schupp and Künemund, 2004). They also illustrate that most people prefer providing and receiving care within the family. Michaelis et al. (2005) look at the usage of care arrangements before and after the introduction of the care insurance in Germany in 1995. They find that the importance of types of informal care decreases while types of formal care are used more intensively. 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 90s. They find a significantly higher propensity to leave the labor force but can not indicate a higher probability to change to part time work to accommodate the caregiving burden. Although they are using data from 1984 for West Germany, and from 1991 for East Germany, to 1996, they do not take changes due to the introduction of the care insurance in 1995 into account. A negative effect

for Germany is also confirmed with eight waves of the ECHP (European Community Household Panel) by Viitanen (2005) who estimates a negative effect of caregiving on the employment probability for Germany.

Compared to the existing literature, this paper focuses on German SOEP data from 2001 to 2007 and, therefore, to the current care policy regime<sup>3</sup> By using these years, I am also able to overcome some data limitations of past studies. Most of the studies cited above suffer from different data limitations. Problems arise when the survey only contains answers of the care recipient or the carer because the relationship between care and employment should consider all characteristics of individuals, which are involved in bargaining over informal caregiving. The NLTCs (National Long Term Care Study) tries to solve this by asking the care recipient to name a care giver who is then interviewed as well (Pezzin and Schone, 1999). In most cases, empirical results cannot check for selectivity bias as there are only care recipients and their carers in the data set. Therefore, the decision of caregiving cannot be observed (Boaz, 1996; Johnson and Lo Sasso, 2000) and the estimated coefficients might be biased. In addition, the variables that are necessary for the analyses may suffer from vague questions in the survey or do not include questions concerning the intensity of care (Wolf and Soldo, 1994). The two British data sets only distinguish between a few categories of care intensity (Heitmueller, 2007; Carmichael and Charles, 2003*a,b*). In addition, the different definitions of care and caregivers are one important reason for the variance of research results and prevalence rates in the above cited studies. Variables on the carer's or care recipient's income or on their human capital investment are also often incomplete or missing although they are important determinants of labor supply (Johnson and Lo Sasso, 2000). Another problem is the small number of observations in some of the data sets (Pezzin and Schone, 1999; Stone and Short, 1990; Moen et al., 1994).

However, since 2001, the capture of care data has become more reasonable in Germany as well. Additional variables like the number of hours an individual cares for somebody else help to identify a caregiver in the SOEP. The so called care level, a

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<sup>3</sup>The Pflege-Weiterentwicklungsgesetz from the 1st of July 2008 does not change the implications of this system substantially (Federal Law Gazette (ed.) 2008).

measure of the degree of disability, has been captured since 2001 as well.<sup>4</sup> Activities of Daily Living (e.g. dressing, shaving, washing) and Instrumental Activities of Daily Living (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, however, still a problem. Only care recipients living within a SOEP household can be taken into account and some programming is necessary to merge the information of carer and care recipient. Respondents who care for someone who is not living in the same SOEP household cannot be examined, though.

The analysis uses panel data and, therefore, checks for unobserved heterogeneity which is likely to be substantial in caregiving decisions. In addition, the endogenous relation between employment and care is taken into account. I also test for panel attrition.

## 3 Theoretical approach

### 3.1 Different reasons for caregiving

The literature differentiates between three approaches to model care given to a disabled individual. These are the altruistic model according to Becker (1974), the strategic bequest motive formulation from Bernheim et al. (1985), and the family bargaining approach formulated by Pezzin and Schone (1999).

The social interaction model formulated by Becker (1974) leads to the result that the household head's utility function is sufficient to describe the preferences of all family members. As his maximization behavior takes all relevant changes in commodity prices and family members' incomes into account, the family's common utility function

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<sup>4</sup>Care level 0: Minor help, no care allowance from care insurance.

Care level I: Help in two ADL once a day for at least 90 minutes, help needed in IADL several times a week.

Care level II: Help in ADL three times a day for at least three hours, help needed in IADL several times a week.

Care level III: Help round-the-clock, help needed in IADL several times a week.

is solely represented by that of the head of household. I am convinced that this framework, contrary to the other two approaches, is the most appropriate one to describe caregiving within a household for the following reasons:

The decision to live together is the first indicator of altruism when the care recipient is not a spouse of the carer. If a person within a household is in need of care, other household members will certainly have to react to this person's needs (Pezzin and Schone, 1999; Ettner, 1995) even if a future bequest might not be high enough to compensate for foregone earnings and costs of care. Together with Becker's theory of the division of labor in families (Becker, 1991) it is, therefore, reasonable to assume that the household maximizes a common utility function. Another argument for this assumption is provided by data collected by Schneekloth and Engels (2006) which shows that the preferences of moving into a nursing home are quite similar between the carer and care giver's generation. In 2006, more than 80 % of SOEP respondents would either turn to the spouse/partner, mother or daughter for help in the case of long-term care needs. Reasons for this might be social norms or a feeling of general reciprocity. The probability of moving into a nursing home then depends on the burden the carer has to bear if the health status of the care recipient deteriorates. This will become more likely if the impaired becomes cognitively unaware. I, therefore, assume that the family bargaining process has already taken place in the past and that the employment decision depends on the health status of the disabled person and hence, care is provided according to their needs.<sup>5</sup> This probability is even increased when the person in need is a spouse, partner, or the carer's disabled child.

The family budget constraint in Becker's model has been criticized by Altonji et al. (1992, 1997) and Hayashi (1995). However, the findings of the aforementioned authors do not contradict altruism if one extends its notion to affection. In addition, the greatest part of the care recipient's income consists of various government transfers and does, therefore, not necessarily influence the carer's time allocation decision between work time, care time and leisure. An argument confirming this point of view for

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<sup>5</sup>Bargaining can of course continue over the mixture of informal and formal care. This question is, however, beyond the scope of this paper.

Germany is the so called “Hilfe zur Pflege” after SGB §§ 61 et sqq in combination with the principle of subsidiarity in SGB XII § 2 which makes family members of handicapped individuals liable to recourse. As I assume here that caregiving is not explicitly paid for within the household<sup>6</sup> and by keeping in mind that formal care is expensive and may exceed the disabled person’s assets when they are impaired for quite a long time, this argument is justified (Schneider et al., 2001). Therefore, the caregiver will take the income of all other household members into account when making his labor supply decision. However, the income of the care recipient is only considered in paying for all costs that occur through their needs.

### 3.2 Theoretical expectations

A neoclassical time allocation model with rational utility-maximizing individuals who are altruistic is used to derive comparative statics. In the context of this paper, the groups in Becker’s social interaction model consist of two members of the same household. One of its members is an altruistic “head” in the sense of providing care hours to another household member who is disabled. The carer’s utility function is then sufficient to determine the optimal level of time allocation (Becker, 1974). All decisions in this model are, therefore, taken by the carer alone. The care recipient is passive in this process. The carer allocates his time between paid employment, caregiving, and leisure to maximize his utility which is subject to a budget and a time constraint. The utility function reads as

$$U = u(c_c) + v(T - h_w - h_c) + x(y, h_c, h_0, g, c_c, c_r) \quad (1)$$

where  $u$ ,  $v$ ,  $x$  and are concave functions with strictly positive first partial derivatives and negative second partial derivatives. Following Johnson and Lo Sasso (2000),  $u$  is the utility derived from consumption for the carer  $c_c$ ,  $v$  is the level of utility received from leisure where  $T$  is the total amount of time available to the carer and  $h_w$  and  $h_c$  are the number of hours which are spent in paid employment or for care, respectively.

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<sup>6</sup>A question concerning the payment of informal carers is only included in the SOEP since 2004.

$x$  is the utility which the carer receives from the well-being of his care recipient. It increases with the disabled person's health  $y$ , informal care  $h_c$  and formal care  $h_0$ , the amount of care allowance  $g$ , and the consumption of himself  $c_r$  and his carer  $c_c$ . It is assumed that the utility function is separable in its three components which implies that leisure is a normal commodity and, therefore, rising if income rises.

The maximization of function (1) is subject to the budget constraint in (2) and the time constraint in (3)

$$c \leq wh_w + A \quad (2)$$

$$T \geq h_w + h_c \quad (3)$$

where  $w$  is the wage rate earned in the carer's job and  $I$  is other household income which comprises net labor income from other household members as well as the household's non-labor income but not labor income of the individual under consideration. I assume further that all resources for consumption are utilized which makes (2) a binding constraint. However, (3) is not binding, hence, defining a positive amount of leisure.<sup>7</sup>

The carer allocates his time in a way that the marginal utility of consumption times the wage rate  $u/w$  equals the marginal utility of leisure  $v$  as well as the marginal utility of caregiving  $x$ . Due to the assumptions made above, an effect that increases the marginal utility of labor increases the time spent in paid employment and decreases the amount of both, care and leisure. Shocks in exogenous variables will, therefore, change the allocation of time for all activities to restore the equilibrium.<sup>8</sup>

Comparative statics show: if the *household's income* rises, the number of hours worked decreases while caregiving intensifies to maintain the equilibrium. In addition, the decrease in hours of work exceeds the rise in the amount of caregiving and time devoted to leisure rises as well. All other exogenous effects show an ambiguous effect

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<sup>7</sup>As the reaction of amount of work and amount of caregiving on exogenous shocks is tested here, I assume that at least some work and care is done which makes a case study for comparative statics superfluous.

<sup>8</sup>The comparative static results can be found in the Appendix.



in the comparative statics equations: If, on the one hand, caregiving and the disabled person's health are substitutes the hours devoted to paid employment will increase with the *care recipient's health*. On the other hand, the effect remains undetermined if caregiving and health are complements. Therefore, additional hours of care are more effective when the disabled person is in better health. It seems reasonable to assume that carers will spend less time caring if there are *other sources of help* available to take over some of the caregiving tasks and, therefore, they would be substitutes. However, both types of care could well be complements when the health status of the disabled individual becomes worse. The amount of *care allowance* that the care recipient receives from the mandatory public care insurance rises with the classification in care levels which is equal to an increase in the disability of the care recipient. It might be plausible to assume that the hours devoted to paid employment will increase more if formal care can be purchased in the market. However, it can well be the case that the disabled person even has to be institutionalized due to his worse health status. Thus, Social Security care transfers and caregiving would be substitutes in this case. However, if caregiving and the amount of care allowance received by the care recipient are complements, the carer might be forced to spend more time caring and even less working as the disabled individual remains in the household but is in need of intensified care. I do not discuss the effect of a c.p. higher *care recipient's income* on time transfer as I cannot reliably identify it. I, however, believe that it is more plausible to assume that more formal care can be purchased in the market to disburden the care giver who would then increase his time spent on paid employment than to assume a strategic bequest motive mechanism.

In general, four 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. Secondly, if the opportunity costs of care are low for a single person within the household, care increases the value of household production. This scenario is more likely when the

household has a high income in general so that the salary of the carer is not needed to maintain the standard of living of the household as a whole. Thirdly, if the opportunity costs of formal care are higher than the potential carer's loss in earnings, the employment spell is terminated or the hours of work are reduced. As a last remark, Schneider et al. (2001) refer to SGB XI §§ 1 and 37. These paragraphs rule that the responsible care insurance fund pays the pension contributions for a carer who does not work for more than thirty hours per week in the labor market. Therefore, this transfer increases the non-working income of the carer 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.

## 4 Data set and descriptive statistics

This paper uses SOEP data which is a representative longitudinal micro-data set covering a wide range of socioeconomic 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 was extended by about 2,200 families from East Germany. In 2007, about 22,000 individuals in 11,000 households participated in the data set.

In contrast to Schneider et al. (2001), I am employing the waves from the years 2001 to 2007 to take advantage of the newly included variables on caregiving. Moreover, I am able to connect the characteristics of the co-residing carer and care recipient. All respondents who care for someone who lives outside their own household, have to be dropped from the sample (3,263 observations / 5.26 %) because I have no information on their care recipient's characteristics. In addition, the sample contains rich data on employment status, income, education, and other individual characteristics. The sample contains about 58,777 observations consisting of 14,119 individuals<sup>9</sup> living in

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<sup>9</sup>Self-employed individuals are not included into the data set as the quality of responses on income

9,374 households. I will look at women and men separately as their labor supply and care behavior is different which can already be seen in Table 1 and 2. Schupp and Künemund (2004) say that men are occupied with care to an extent that almost equals that of women. Nevertheless, 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, 2003*b*). However, Dwyer and Coward (1991) show that men usually provide help in instrumental activities of daily living (IADLs) which are easier to arrange around the work schedule while women are helping with activities of daily living (ADLs) which are ranked to be more time consuming. In this data set, 30,290 women and 28,487 men between 36 and 64 years are included as the frequency of caregiving in this sample clearly increases after reaching the age of 35 (Figure 1).

## 4.1 The characteristics of potential carers

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

Overall, 62.44 % of women and 76.99 % of men are in paid employment. 2.33 % of women and 1.58 % of men state that they give some time assistance to a disabled individual while the mean care hours are 33.86 and 21.62, respectively. Among female caregivers, 48.15 % are still working while 51.48 % are not employed. This difference is somewhat larger for male caregivers: 56.92 % are in paid employment while 43.78 % are not working.

Compared to the whole sex-specific samples, carers tend to be older. The difference between men and women mainly results from the earlier retirement age of women.<sup>10</sup> However, it is not possible to tell whether the termination of work spells at these ages is related to caregiving. The marital status variables have the expected results. Among those who are without a partner, men are more likely to provide care compared to

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is less reliable.

<sup>10</sup>The actual retirement age of men is 60.90 in West Germany and 59.70 in East Germany, the one for women is 61.40 in the West and 58.90 in the East of Germany (Deutschland in Zahlen 2007).

Table 1: Labor force participation and care provision of women

Women	All	Workers	Care givers		
			All	Workers	Non-workers
All	100	62.44	2.33	48.15	51.84
Care hours <sup>a</sup>	0.79	0.5	33.86	27.84	39.46
Age					
Ages 36 – 55	75.06	66.15	36.26	85.88	47.81
Ages 56 - 65	24.94	13.45	33.85	14.12	52.19
Marital status					
Married	74.05	71.8	86.26	85.59	86.89
Divorced	14.83	16.76	5.52	6.47	4.64
Single	6.65	8.15	5.95	6.76	5.19
Widowed	4.47	3.29	2.27	1.18	3.28
Household size <sup>a</sup>	2.89	2.91	3.37	3.52	3.23
Household income (€/month) <sup>o</sup>	2,809	3,040	3,020	3,433	2,637
Number of children					
Younger than 7	8.45	6.68	5.24	5	5.46
Ages 7 -16	31.82	34.25	26.35	31.76	21.31
Years of education <sup>o</sup>	11.78	12.14	11.5	11.91	11.12
Health status					
Very good	5.9	6.77	3.12	3.82	2.46
Good - Satisfying	76.75	80.04	74.64	80.59	69.12
Poor	14.42	11.5	17.14	14.41	19.67
Very poor	2.92	1.39	5.1	1.18	8.74
<b>Characteristics of care recipients</b>					
Age					
Ages 1 - 55	0.95	0.86	36.26	42.94	30.05
Ages 56 – 79	0.67	0.47	26.35	22.65	29.78
Ages 80 and older	2.35	1.84	16.43	15	17.76
Needs help with ...					
... errands out of the house	2.35	1.84	91.5	92.06	90.98
... household chores and preparing meals	2.16	1.88	86.12	85.88	86.34
... minor tasks of daily help	1.87	1.36	75.78	70.88	80.33
... major tasks of daily help	0.91	0.61	37.11	31.76	42.08
Care level - Zero: Person in need of help	0.83	0.73	29.46	34.12	25.14
Care level - One	0.86	0.64	34.99	33.82	36.07
Care level - Two	0.57	0.45	22.95	23.53	22.4
Care level - Three	0.31	0.16	12.61	8.53	16.39
Other sources of help	0.33	0.31	12.18	15.59	9.02
<b>Observations</b>	30,290	18,916	706	340	366

Source: GSOEP subsample of men of the waves 2001 to 2007 (unweighted).

<sup>a</sup>These values are mean values for the respective samples, not percentages.

Table 2: Labor force participation and care provision of men

Men	All	Workers	Care givers		
			All	Workers	Non-workers
All	100	76.99	1.58	56.22	43.78
Care hours <sup>a</sup>	0.34	0.18	21.62	15.29	29.75
Age					
Ages 36 – 55	74.25	83.96	59.56	78.66	35.03
Ages 56 - 65	25.75	16.04	40.44	21.34	64.97
Marital status					
Married	76.31	77.64	80.67	77.87	84.26
Divorced	12.15	11.19	7.56	10.28	4.06
Single	10.27	10.39	9.78	10.28	9.14
Widowed	1.27	0.78	2	1.58	2.54
Household size <sup>a</sup>	2.94	3.07	3.2	3.48	2.85
Household income (€/month) <sup>o</sup>	2,879	3,137	2,812	3,225	2,281
Number of children					
Younger than 7	11.25	13.19	4	5.14	2.54
Ages 7 -16	32	36.85	26.44	40.32	8.63
Years of education <sup>o</sup>	12.12	12.4	11.41	11.82	10.88
Health status					
Very good	5.96	6.83	5.33	7.51	2.54
Good - Satisfying	77.72	82.01	72.23	76.68	66.5
Poor	13.24	9.87	16.89	13.04	21.83
Very poor	3.08	1.3	5.56	2.77	9.14
<b>Characteristics of care recipient</b>					
Age					
Ages 0 - 55	1.07	1.02	42	50.59	30.96
Ages 56 – 79	0.52	0.27	24.89	13.44	39.59
Ages 80 and older	0.46	0.36	15.33	15.81	14.72
Needs help with ...					
... errands out of the house	2.33	1.9	94.67	94.47	94.92
... household chores and preparing meals	2.09	1.72	86	86.96	84.77
... minor tasks of daily help	1.73	1.45	75.11	79.05	70.05
... major tasks of daily help	0.86	0.74	38.89	39.92	37.56
Care level - Zero: Person in need of help	0.77	0.61	26	24.11	28.43
Care level - One	0.8	0.63	31.11	30.43	31.98
Care level - Two	0.6	0.53	28.22	30.83	24.87
Care level - Three	0.31	0.27	14.44	14.62	14.21
Other sources of help	0.5	0.41	24	25.3	22.34
<b>Observations</b>	28,487	21,933	450	253	197

Source: GSOEP subsample of men of the waves 2001 to 2007 (unweighted).

<sup>a</sup>These values are mean values for the respective samples, not percentages.

women. In addition to caring for their children, women might mostly be caring for their husbands because women tend to be younger when they get married and they are often in better health than men of the same age. The higher proportion of single men caring for somebody else might be an indicator that other sources of care are not available. Households are larger in general if a care recipient lives within the household. The existence of young children in a household may indicate an endogeneity problem as staying at home rather than working in the labor market before caregiving is started might as well determine the amount of time assistance that is provided to the care recipient (Heitmueller, 2007). Carers experience their health status to be lower, in particular if they are not working. While this can again indicate the existence of an endogeneity problem, it could also result from a high physical or psychological caregiving burden (Fast et al., 1999). Households with individuals who do not work but care for a disabled individual have about 200 to 600 euros less per month compared to the whole samples of women and men, respectively. Thus, caregiving seems to be a cost burden to the household at least if the care recipient lives in the same household as the carer.

## 4.2 Characteristics of care recipients

The care recipients of men who provide care and do not work are mainly between 56 and 79 years old. Women are, beyond that category, more occupied with those in the oldest old category. 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 carers than in the one of working female caregivers. The same picture evolves when we look at the distribution of care recipients among the four German care level types. Working women care for 34.12 % of individuals who do not get any support from the long-term care insurance yet. However, this amount decreases to 25.14 % for non-working women. These frequencies change places for care recipient's ranked in care levels one to three. Getting support in care provision seems to promote female caregivers employment, though. The higher availability of other sources of help for men compared to the women's sample could explain the more balanced picture

between workers and non-workers.

## **5 Empirical model**

### **5.1 Dependent and independent variables**

The dependent variable in the labor supply regression equation is a binary indicator of labor force participation which equals 1 if the individual is working in the labor market and 0 otherwise. It has to be interpreted as the latent propensity to work in the labor market. GMM-fixed-effects and panel logit fixed-effects are used to estimate the effects on this binary measure. In addition, a linear measure of actual hours worked is regressed on the exogenous variables with the same GMM-fixed-effects and a linear panel fixed-effects model.

As individual characteristics, the marital status and the health status are included into the regression equations. In addition, the household size and the number of children are added. The latter is divided into those children which are younger than seven years old and into those aged seven to sixteen. The logarithmized household income does not include the labor market earnings of the respective observation but the earnings of other household members as well as the overall non-labor income. In addition, two care variables are added. These are the amount of hours somebody provides care, and the amount of care allowance the care recipient receives.

### **5.2 Unobserved heterogeneity, endogeneity bias, and panel attrition**

An advantage of the panel structure is that unobserved heterogeneity can be taken into account. Topics concerning labor supply have to bear in mind that the motivation to work or keep working might have a great influence on the probability of employment. However, this paper has to deal with an additional unobserved effect: The amount of labor supplied will be affected by a feeling of responsibility and a feeling of generalized reciprocity of the carer to the impaired individual. This feeling becomes even more

influential the closer the relationship is which is likely to be influenced by upbringing and social norms. Neglecting heterogeneity, therefore, leads to omitted variable bias and the idiosyncratic error is correlated with some of the exogenous regressors as its values are not completely random anymore. As I am dealing with a panel data set consisting of six data waves, it is important to conduct tests for selection bias due to panel attrition. As caregiving can be very stressful, some individuals might refuse to answer the SOEP questionnaires. However, tests after Verbeek and Nijman (1992) and Wooldridge (1995) for the different samples do not show significant drop outs for caregiving reasons.<sup>11</sup>

Like in the analyses of Ettner (1995, 1996); Stern (1995) (U.S.), Heitmueller (2007) (Great Britain) and Bolin et al. (2008) (11 European countries), the endogeneity bias has to be solved here. Individuals could be reluctant to provide a high amount of care hours if they are 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 carer is higher than the price of care services (Ettner, 1996). This assumption is as well consistent with the theoretical model: As the carer's utility function also depends on the disabled person's utility, (s)he weights caregiving against other time consuming activities. In addition, labor supply can be reduced if caregiving is started or its burden becomes higher. Therefore, causality could lead in both directions. The variable which indicates if a disabled individual is present in the household is not expected to be endogenous as the presence in the household cannot be chosen by other household members. Because caregiving and labor supply are supposed to be negatively correlated, neglecting the endogeneity problem might lead to overstating the impact of care on labor supply (Ettner, 1996).

I use efficient GMM estimation with fixed effects for instrumenting the endogenous regressor in both labor supply specifications. Good instruments should be correlated with the endogenous number of care hours and should be uncorrelated with the error of the labor supply regression equation at the same time. A natural set of instruments are the characteristics of the impaired individual which are likely to have a direct

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<sup>11</sup>The results are available from the author on request.



Table 3: Test statistics for GMM estimation

	Women		Men	
	Labor force participation	Work hours	Labor force participation	Work hours
Hours of care per week	0.00 (0.91)	-0.03 (0.46)	0.00 (0.83)	-0.07 (0.39)
F-test on weakness of instruments	31.82 (0.00)	31.82 (0.00)	17.46 (0.00)	17.46 (0.00)
Overidentification test	2.42 (0.66)	1.44 (0.84)	3.49 (0.48)	2.23 (0.69)
Test on exogeneity	2.58 (0.11)	0.48 (0.49)	0.39 (0.53)	0.08 (0.78)

p-values in parentheses

effect on the amount of hours they are cared for but only an indirect one on labor supply. Therefore, the dummy which indicates if a care recipient lives in the household is used as an instrument next to the four categories of ADL and IADL in which the impaired individual needs help. 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 should be larger than 10 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 overidentification test confirms that the exclusion restrictions are indeed valid so that the instruments are no significant predictors of labor supply. It has to be kept in mind, though, 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 instruments represent exogenous health shocks and, therefore, cannot be influenced by the carer, reversed causality can be ruled out here and both requirements are fulfilled. As can be seen in Table 3, regardless of being male or female, hours of care per week does not have a significant influence on labor supply for both GMM labor supply specifications, respectively. In the final step, I will

test for endogeneity of the endogenous regressor when using efficient GMM estimation. 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 the panel logit fixed-effects results for the effect on the binary labor supply measure and the linear panel fixed-effects results for the effect on actual hours worked, without instrumental variable estimation in addition to the GMM fixed-effects results in the next section.

An explanation for the infrequency of an endogeneity problem in this analysis and the previous literature may result from the time horizon of care decisions. It could well be the case that most individuals decide long before care is needed for a relative how much care they are willing to provide under different scenarios. Affection in the case of partners and children, and childhood in connection to a feeling of generalized reciprocity to parents are likely to induce long-term decisions that are quite inelastic.

## 6 Results - Determinants of labor supply

Expectations on the reaction of labor supply on some exogenous variables have already been derived in section 3.2. Table 4 and 5 present the empirical results.

The focus of this paper is to determine if care responsibilities within SOEP households have a significant effect on the carer's labor force participation. As the characteristics of the care recipient are expected to have an indirect effect on labor supply, the hours an individual is occupied with caregiving is the variable of the most interest. Regardless of using instrumental variable estimation, the effect of care hours on labor supply is not significant for the probability of leaving the labor market for both sexes. However, caring eight hours more per week decreases the work hours by 35 minutes per week for women and by 44 minutes for men in the regression equations without controlling for endogeneity. The impact on work hours is, therefore, economically small.

The amount of Social Security support through care allowance has a very small

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 (0.001)	-0.002 (0.002)	-0.028 (0.038)	-0.059*** (0.022)
Household size	0.043*** (0.006)	0.150*** (0.029)	1.621*** (0.215)	1.623*** (0.244)
Child(ren) younger than 7	-0.105*** (0.012)	-0.207*** (0.041)	-3.196*** (0.317)	-3.193*** (0.347)
Child(ren) aged 7 to 16	-0.019*** (0.006)	-0.050** (0.024)	-1.288*** (0.189)	-1.292*** (0.211)
Divorced and separated	0.013 (0.019)	0.048 (0.048)	0.829 (0.623)	0.820 (0.681)
Single	0.051 (0.039)	0.050 (0.128)	3.336** (1.324)	3.333** (1.460)
Widow(er)	-0.037 (0.032)	-0.087 (0.119)	-1.241 (1.108)	-1.416 (1.284)
Very poor health	-0.054*** (0.018)	-0.125*** (0.051)	-1.526** (0.596)	-1.536** (0.605)
Poor health	-0.004 (0.012)	-0.009 (0.034)	0.049 (0.385)	0.040 (0.390)
Fair health	0.011 (0.010)	0.035 (0.035)	0.323 (0.329)	0.314 (0.325)
Good health	0.008 (0.009)	0.026 (0.031)	0.285 (0.297)	0.281 (0.292)
Monthly net household income in euro	-0.000*** (0.000)	-0.000*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)
Care allowance	0.000 (0.000)	0.000 (0.000)	0.002 (0.002)	0.003* (0.002)
Constant				20.478*** (0.716)
Observations	29,050	7,859	29,050	30,290

Standard errors in parentheses: \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ 

Own calculations. SOEP, waves 2001 - 2007.

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 (0.002)	-0.003 (0.003)	-0.070 (0.081)	-0.074*** (0.025)
Household size	0.083*** (0.006)	0.164*** (0.050)	3.642*** (0.253)	3.647*** (0.278)
Child(ren) younger than 7	-0.035*** (0.007)	-0.079** (0.037)	-1.663*** (0.303)	-1.667*** (0.313)
Child(ren) aged 7 to 16	-0.027*** (0.005)	-0.061*** (0.025)	-1.226*** (0.222)	-1.230*** (0.236)
Divorced and separated	0.018 (0.014)	0.083 (0.051)	0.235 (0.662)	0.232 (0.732)
Single	0.067*** (0.022)	0.143** (0.064)	2.093** (1.047)	2.091* (1.108)
Widow(er)	-0.023 (0.049)	0.070 (0.116)	-0.851 (1.876)	-0.854 (2.305)
Very poor health	-0.096*** (0.017)	-0.160*** (0.068)	-3.696*** (0.750)	-3.704*** (0.768)
Poor health	-0.050*** (0.010)	-0.131*** (0.051)	-1.670*** (0.476)	-1.676*** (0.494)
Fair health	-0.013 (0.008)	-0.044 (0.028)	-0.247 (0.394)	-0.249 (0.400)
Good health	-0.010 (0.007)	-0.027 (0.026)	-0.238 (0.355)	-0.240 (0.357)
Monthly net household income in euro	-0.000*** (0.000)	-0.000*** (0.000)	-0.007*** (0.000)	-0.007*** (0.000)
Care allowance	0.000*** (0.000)	0.001*** (0.000)	0.009*** (0.002)	0.009*** (0.002)
Constant				32.817*** (0.776)
Observations	27,314	5,773	27,314	28,487

Standard errors in parentheses: \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ 

Own calculations. SOEP, waves 2001 - 2007.

but significantly positive influence on the decision of labor supply for men. That this effect is not economically important is also obvious if one looks at the overview of care insurance services (Federal Ministry of Health (ed.), 2008). The care allowance that a care recipient receives over different care levels only ranges from 215 euros to 675 euros per month. As many authors have emphasized in their research, forgone employment opportunities and earnings, less social contact, and emotional and physical well-being costs make care very expensive to the carer (Carmichael and Charles, 1998, 2003*a,b*; Fast et al., 1999). The amount of financial resources like care allowance, payments for help to the carer, and the prospect of a possible bequest might be too low to compensate these costs and, therefore, economically strong reactions cannot be expected.

The household size has a positive effect on women's labor supply and an even larger one for men. Children younger than seven have a significantly negative effect on the labor force participation of women (more than 3 hours per week) and men (more than 1 hour per week). For women, also children aged between seven and sixteen years have a negative effect on work hours and employment probability although it is lower than the one for younger children. In the case of women, only the actual working time is affected by being single (more than 3 hours per week). However, being single increases the probability of employment (14.3 percentage points) and the hours of work for men (2 hours per week). Other marital status variables are not significant. Only a very bad health status has a significantly negative influence on the labor supply of women. Similarly for men, being in poor health decreases the probability of being in paid employment compared to a man in very good health. If the income of other individuals in the household rises or if the household's transfer income rises, the effect on labor supply is negative as expected from comparative static results.

Overall, the effects on the binary labor supply measure are mitigated by using GMM estimation techniques. The regression results for actual work hours only differ with respect to the hours of care variable.

## 7 Conclusion

Most of the theoretical expectations that I derived in Section 3 could not be confirmed in the empirical results. One reason for this might stem from the small within-variances in the sample. I only found care effects which are economically small. The amount of care hours had a significantly negative effect, reducing the hours of work of men by 44 minutes if eight hours of care are additionally provided per week. The negative effect for women was by a little bit smaller, namely 35 minutes per week. The care allowance that a disabled individual in a household might receive has an economically negligible influence on the labor supply of the carer.

Like other international studies on this topic, the results with the latest waves of the SOEP are economically small. However, I found significantly negative effects of care on actual work hours without using GMM estimation, which was possible as exogeneity of the endogenous regressor care hours could not be rejected. The test on exogeneity is also insignificant in the article of Bolin et al. (2008) who use a European data set for individuals aged 50 and over. However, they only find significantly negative effects for the binary choice of labor supply for men and women. As far as actual work hours are concerned, they do not estimate a significant influence of care hours. My study also differs compared to the results of Ettner (1995), Ettner (1996) and Stern (1995), who only estimate significant negative effects after controlling for endogeneity. However, 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. Unfortunately, my results cannot explain which services have contributed to this cost reduction due to data limitations. Nevertheless, it seems quite 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 work hours are.

My results, therefore, illustrate that the compatibility of care and employment is less of a problem, at least when the demand for care is still low. However, the

probability to work is decreasing when caregiving tasks become heavier and more time consuming. In addition, representative surveys like the ones of Schneekloth and Engels (2006) and questions in the SOEP have shown that most people want to stay at home if care becomes necessary and that this also implies that most carers try to fulfill this wish as long as possible. The services of the public care insurance should, therefore, react to this reality and enforce those services that support the flexible time schedule of informal carers at least for those individuals who care for a relatively high number of hours per week. Unfortunately, I am not able to test for care hour thresholds with SOEP data as the number of affected observations becomes even smaller. Offers like day care or substitutional care when the carer is on holiday have to be extended and supplemented to include the job of a carer as a reason for using those services as well. The flexibility of part-time care institutions is very important in this respect. This should be complemented with more flexible work arrangements for those employees who have to look after a disabled individual. The amendment of the care insurance regime between 1999 and 2008 by the German Pflege-Weiterentwicklungsgesetz which came into force on the 1st of July 2008, introduces a “care time” for employees. After this bill, they can get up to six months of unpaid leave with a guarantee on a similar position in their firm. A reduction in working hours is also an option here. It is also possible to take up to ten days off in emergencies. The Pflege-Weiterentwicklungsgesetz systematically includes impaired individuals that do not suffer from physical but psychic illnesses of dementia now as well. The reform of the monetary aspects of the care insurance includes higher rates in the German care allowance as well as an increase in mandatory care insurance contributions by 0.25 percentage points to 1.95 % of employees’ monthly gross earnings. The provision of information to carers, a reform of formal care services, and better case management is also implemented into the new law to support carer and care recipient (Federal Law Gazette (ed.) 2008).

To build an understanding of the needs of the care recipient which go beyond the medical ones and to support the carer in organizing work and care commitments, further research is necessary in Germany. First of all, appropriate databases have to be sampled to ensure that a sufficient number of families, which have a care recipient

among themselves, are observed. Descriptive statistics on the usage of care services already exist through the representative studies of Infratest Sozialforschung. Nevertheless, little is known about the concrete organization of day to day care in an informal setting and about the interaction of social or family networks. It is also important to look at subgroups in the population to understand differences in using care insurance services by income. The combination of work and care is likely to be even more difficult for those individuals and their families which only have a low income to their disposal.

The media has recently emphasized social aspects of care. The dignity of care recipients in formal and institutional care is the focus of this discussion. The economic burden to the carer in particular, is not perceived as a major problem yet. However, the financing of the pay-as-you-go system in the care insurance can only be secured if the public realizes that the carer has to be provided with flexible but reliable sources of help for combining care and work commitments.



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# Appendix

## Formula Appendix for Section 3.2 - Comparative static results -

The derivatives of the utility maximization problem in section 3.2 as well as the derivative of the comparative static results are calculated in this section. The analysis follows the example of Johnson and Lo Sasso (2000) and is also used by Sloan et al. (1997). For mathematical details see Chiang and Wainwright (2005). The utility function is

$$U = u(c_c) + v(T - h_w - h_c) + x(y, h_c, h_0, g, c_c, c_r) \quad (1)$$

which is maximized by the carer under the two equations

$$c \leq wh_w + A \quad (2)$$

$$T \geq h_w + h_c \quad (3)$$

An additional assumption is that

$$h_w, h_c > 0 \quad (4)$$

as the effect of exogenous variables on labour supply and informal caregiving is to be considered here. A prerequisite is, of course, that both events exist. As the budget constraint is binding due to the utilization of all available resources while the time constraint is not because I assume that the carer enjoys at least some leisure, derivations have to be done by Kuhn-Tucker conditions.

$$Z = u(c_c) + v(T - h_w - h_c) + x(y, h_c, h_0, g, c_c, c_r) + \lambda_1(c - wh_w - A) + \lambda_2(T - h_w - h_c) \quad (5)$$

$$\begin{aligned} Z_c &= u' + x' + \lambda_1 \leq 0 & c &\geq 0 & cZ_c &= 0 \\ Z_{h_w} &= -v' - w\lambda_1 - \lambda_2 \leq 0 & h_w &\geq 0 & h_wZ_{h_w} &= 0 \\ Z_{h_c} &= -v' + x' - \lambda_2 \leq 0 & h_c &\geq 0 & h_cZ_{h_c} &= 0 \\ Z_{\lambda_1} &= c - wh_w - A \geq 0 & \lambda_1 &\geq 0 & \lambda_1Z_{\lambda_1} &= 0 \\ Z_{\lambda_2} &= T - h_w - h_c \geq 0 & \lambda_2 &\geq 0 & \lambda_2Z_{\lambda_2} &= 0 \end{aligned} \quad (6)$$

are the Kuhn-Tucker first-order conditions. According to these equations, the marginal utility of work is equal to the marginal utility of leisure which is then again equal to the marginal utility of care. As  $c, h_w, h_c$  are larger than zero and

$$\lambda_1 \neq 0, \lambda_2 = 0 \quad (7)$$

due to the two constraints, the resulting implicit functions are

$$\begin{aligned} F^1 : \quad Z_{\lambda_1} &= c - wh_w - A = 0 \\ F^2 : \quad Z_c &= u' + x' + \lambda_1 = 0 \\ F^3 : \quad Z_{h_w} &= -v' - w\lambda_1 = 0 \\ F^4 : \quad Z_{h_c} &= -v' + x' = 0 \end{aligned} \quad (8)$$

$Z_{\lambda_2}$  is not relevant for the comparative static analysis. First of all it has to be confirmed that the bordered Hessian is less than zero. After deriving the implicit functions with respect to the variables which are chosen by the carer I get

$$\begin{aligned} |\bar{H}| &= \begin{vmatrix} 0 & 1 & -w & 0 \\ 1 & u'' + x_{55} & 0 & x_{52} \\ -w & 0 & v'' & v'' \\ 0 & x_{25} & v'' & v'' + x_{22} \end{vmatrix} \\ &= -v''x_{22} + 2wv''x_{25} + w^2x_{52}x_{25} - w^2u''(v'' + x_{22}) \end{aligned} \quad (9)$$

which is indeed less than zero for reasonable values of the variables. Next, the first-order equation system is reduced to three equations by eliminating  $\lambda_1$ . From equation  $F^2$  it follows that

$$\lambda_1 = -u' - x' \quad (10)$$

The system then reduces to

$$\begin{aligned} c - wh_w - a &= 0 \\ -v' + wu' + wx_5 &= 0 \\ -v' + x_2 &= 0 \end{aligned} \quad (11)$$

To receive the effect of a change in an exogenous variable on labour supply and care-giving, the inverse matrix of H is needed which I calculate using the adjoint matrix

$$H^{-1} = \frac{1}{|H|} \begin{vmatrix} v'lx_{22} & vx_{25} & -v'lx_{25} \\ w(v'l + x_{22}) & v'l + x_{22} & -v'l - wx_{25} \\ -wv'l & -v'l & v'l \end{vmatrix} \quad (12)$$

Therefore, the comparative static results are

$$\frac{\delta h_w}{\delta I} = -\frac{1}{|H|}w(v'' + x_{22}) < 0 \quad (13) \quad \frac{\delta h_c}{\delta I} = \frac{1}{|H|}wv'' > 0 \quad (14)$$

$$\frac{\delta h_w}{\delta y} = \frac{1}{|H|}[(v'' + x_{22})x_{51} - (v'' + wx_{25})x_{21}] \quad (15) \quad \frac{\delta h_c}{\delta y} = \frac{1}{|H|}[-v''x_{51} + v''x_{21}] \quad (16)$$

$$\frac{\delta h_w}{\delta h_0} = \frac{1}{|H|}[(v'' + x_{22})x_{53} - (v'' + wx_{25})x_{23}] \quad (17) \quad \frac{\delta h_c}{\delta h_0} = \frac{1}{|H|}[v''(x_{23} - x_{53})] \quad (18)$$

$$\frac{\delta h_w}{\delta g} = \frac{1}{|H|}[(v'' + x_{22})x_{54} - (v'' + wx_{25})x_{24}] \quad (19) \quad \frac{\delta h_c}{\delta g} = \frac{1}{|H|}[v''(x_{24} - x_{54})] \quad (20)$$

$$\frac{\delta h_w}{\delta c_r} = \frac{1}{|H|}[(v'' + x_{22})x_{56} - (v'' + wx_{25})x_{26}] \quad (21) \quad \frac{\delta h_c}{\delta c_r} = \frac{1}{|H|}[v''(x_{26} - x_{56})] \quad (22)$$



Table 6: Means and standard deviations, pooled sample

Variable	Women		Men	
	Mean	Std. Dev.	Mean	Std. Dev.
Labour force participation	0.62	0.48	0.77	0.42
Actual working hours	19.34	17.98	33.31	19.68
Care recipient in household	0.03	0.16	0.02	0.16
Care hours	0.79	7.51	0.34	4.19
Age	48.58	8.40	48.70	8.46
Household size	2.89	1.25	2.94	1.30
<b>Number of children</b>				
Younger than 7	0.10	0.35	0.14	0.41
Ages 7 to 16	0.47	0.79	0.48	0.81
Household income in euro	2,146.52	1,465.93	1,326.31	1,060.53
<b>Health status</b>				
Very good	0.06	0.24	0.06	0.24
Good	0.41	0.49	0.42	0.49
Fair	0.36	0.48	0.36	0.48
Poor	0.14	0.35	0.13	0.34
Very poor	0.03	0.17	0.03	0.17
Years in education	11.78	2.46	12.12	2.65
<b>Marital status</b>				
Married	0.74	0.44	0.76	0.43
Single	0.15	0.36	0.12	0.33
Divorced	0.07	0.25	0.10	0.30
Widowed	0.04	0.21	0.01	0.11
<b>Number of observations</b>	30,290		28,487	
<b>Characteristics of care recipient</b>				
Other care available	0.02	0.14	0.02	0.14
Sex	97.96	14.09	97.97	14.06
Age	1.05	8.27	1.03	8.18
Married	0.01	0.08	0.01	0.08
<b>Care level and help needed with</b>				
...getting around outside the house	0.02	0.15	0.02	0.15
...household chores, preparing meals	0.02	0.15	0.02	0.14
...washing dressing etc.	0.02	0.14	0.02	0.13
...getting into and out of bed etc.	0.01	0.10	0.01	0.09
Care level 0	0.01	0.09	0.01	0.09
Care level I	0.01	0.09	0.01	0.09
Care level II	0.01	0.08	0.01	0.08
Care level III	0.00	0.06	0.00	0.06
<b>Care allowance</b>	6.16	64.22	6.22	58.93
<b>Number of observations</b>	779		707	

Own calculations. SOEP, waves 2001 - 2007.