A dissertation on

The Economics of Elderly Care

by

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Table of Content

List of Abbreviations

2SLS	Two-stage least squares
ADL	Activities of Daily living
ANOVA	Analysis of variance
BHPS	British Household Panel Survey
BUC	Blow-up and cluster
CG	Caregiver
CR	Care receiver
ECHP	European Community Household Panel
FE	Fixed-effects
GSOEP	German Socio-Economic Panel
HH	Household
HQ	Household questionnaire
HRCA	Hebrew Rehabilitation Center for the Aged
IPW	Invers probability weighting
IV	Instrumental Variables
LPM	Linear probability model
LTCI	Long-term care insurance
MANOVA	Multivariate Analysis of Variance
NBER	National Bureau of Economic Research
OLS	Ordinary Least Squares
OR	Odds ratio
PHI	Private health insurance
SEM	Structural equation model
SGB	Sozialgesetzbuch (Code of Social Law)

SHARE	Survey on Health, Ageing and Retirement in Europe
SHI	Statutory health insurance
SuppDI	Supplemental dental insurance
SuppHI	Supplemental health insurance
SWB	Subjective well-being

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1   General Introduction

Longer life expectancy and low fertility rates increase the share of elderly among the population of most industrialized and developing countries. This demographic change affects the economy and the society, and is most likely to proceed in the future. The global share of elderly (aged 60 years and above) is currently around 12 per cent and is estimated to double until 2050. Today, particularly industrialized countries are already facing the consequences of an aging society; developing countries are soon to follow as their older population is already growing at a faster rate (United Nations, 2013). Thus, demographic aging is one of the major global challenges of the 21st century.

One particularly great challenge comes with the rising number of fragile elderly people, for which many countries are currently unable to provide sufficient long-term care solutions. Finding such is difficult, as they need to account for economic, social, and ethical considerations - which can highly differ between countries. Despite a growing formal care sector, the majority of elderly care is still provided within the family (OECD, 2011). Therefore, both policy makers and families need to be aware of the implications associated with an aging population.

In Germany, for instance, public support promotes these informal care arrangements (§3 SGB XI) and endorses care receivers to remain in their domestic environment. Even though most families prefer such informal care arrangements, caregiving can have a large impact on the caregivers' lives. Policy makers need to measure and incorporate these outcomes in order to provide suitable aid for caring families and, thereby, ensuring a sustainable and dignified aging of the population.

This dissertation consists of three academic papers and contributes to the topic in several ways: the first paper reviews the recent literature on the effects of informal caregiving on the caregiver and, thereby, assesses the opportunity costs associated with informal care provision. A large body of academic literature has provided important insights to help understanding the social dynamics associated with caregiving. The paper reviews the literature from various fields – i.e., economics, gerontology, and psychology – and summaries the heterogeneous empirical work on the implications of caregiving on the caregiver's employment, health, and family. Further, the paper analyzes the used methodology and identifies certain risk groups, as well as arrangements that are particularly burdensome.

The second paper is an empirical analysis of data from the German Socio Economic Panel (GSOEP) that analyzes the effects of providing care on the subjective well-being of caregivers in Germany. The study considers not only the intensity of caregiving, but also the care duration. In contrast to most prior studies, the paper uses large population-based longitudinal data, accounts for unobserved heterogeneity, and estimates the relationship with different methodologies. The paper further values well-being losses monetarily, which allows a comparison to formal care alternatives.

The third paper provides new insights on individual selection behavior in the German market for supplemental health insurances. This is an increasingly popular way to insure against long-term care needs, a risk not fully covered despite a statutory long-term care insurance. Private insurance markets are fragile in the presence of asymmetric information and, therefore, might not be a sustainable solution to cover the increasing risks of an aging society. An innovative approach is developed to disentangle different selection behavior in a heterogeneous sample

and identify asymmetric information, exemplarily for the market of supplemental dental insurance, despite the lack of a significant coverage-risk correlation for the aggregated sample. These results yield important information to improve the efficiency on the German market for supplemental health insurances and, therefore, could be used to increase overall welfare. This thesis ends with a general summary of the results and concluding remarks.

2 Impacts of Informal Caregiving on Caregiver Employment, Health, and Family[1]

Abstract

As the aging population increases, the demand for informal caregiving is becoming an ever more important concern for researchers and policy-makers alike. To shed light on the implications of informal caregiving, this paper reviews current research on its impact on three areas of caregivers' lives: employment, health, and family. Because the literature is inherently interdisciplinary, the research designs, sampling procedures, and statistical methods used are heterogeneous. Nevertheless, we are still able to draw several important conclusions: first, despite the prevalence of informal caregiving and its primary association with lower levels of employment, the affected labor force is seemingly small. Second, such caregiving tends to lower the quality of the caregiver's psychological health, which also has a negative impact on physical health outcomes. Third, the implications for family life remain under investigated. The research findings also differ strongly among subgroups, although they do suggest that female, spousal, and intense caregivers tend to be the most affected by caregiving.

2.1 Introduction

Not only have increasing life expectancy and lower fertility rates increased the elderly dependency ratio in most industrialized countries (Bettio & Verashchagina, 2010), but a higher share of elderly, being associated with worse health, inherently implies a higher demand for care (Polder et al., 2002; Schwarzkopf et al., 2012). In most countries, a major share of such care is provided informally, meaning that it is not reflected in social statistics (Bettio & Verashchagina, 2010; Kemper et al., 2005). Yet even though informal caregivers work mostly without payment, care provision can still come at a certain cost: in particular, it is time-consuming, mentally stressful, and physically exhausting, which can negatively affect the caregiver's career and health. The main focus of this paper, therefore, is the effect of informal care provision in three different domains of the caregiver's life: employment, health, and family. In terms of the first, caregiving is often a full-time job, which reduces its compatibility with full-time employment. Hence, we examine the impact of caregiving on employment at both the extensive and intensive margin. As regards the second, caregiving can be a mentally and physically burdening task that negatively affects caregiver health. Because the body of literature on such effects is large, however, we review the research on psychological and physical health separately. For effects on the family, we concentrate on the literature that addresses caregivers' family dynamics and living arrangements, because caregiving is constantly present within the household and therefore affects the family's daily living.

Although committing to a caregiver role is an individual decision, the welfare support needed by elderly for whom no informal care is available is also a matter for policy-makers. Yet economic analyses point to a complex problem set; in

particular, different countries have selected different solutions, and it remains unclear whether it is formal or informal care expansion that would best meet rising demand. On the one hand, fostering informal care ties labor to households in which productivity may be lower than in the labor market. On the other, not only is the expansion of formal care support expensive and unpopular among care recipients, but theoretically, it remains unclear whether formal and informal care are actually substitutes. Formal care does, however, allow caregivers to better manage their domestic care arrangements and may reduce the need for placement in nursing homes.

This review, based on the most relevant literature identified in a web search on caregiving effects,[2] focuses on the outcomes of elderly caregiving on the caregiver from primarily an economic perspective. With a few noteworthy exceptions,[3] it includes only empirical work published in peer-reviewed journals between 2000 and 2013. However, because the effects of caregiving on health outcomes are also extensively analyzed in gerontology, psychology, and medicine, when assessing the health effects of caregiving, we refer to several meta-studies and literature reviews from these disciplines.

The paper is structured as follows: After providing an overview of the prevalence and measurement of informal care, as well as the institutional background, we focus on the impact of caregiving on the caregiver. From this discussion, we draw several conclusions, which are elaborated in the final section.

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[2] The literature was identified by using the following key works and their combinations in Google Scholar, Scopus, and Science Direct: "elderly care," "informal care," "aged care," "employment," "labor force participation," "work," "work hours," "wage," "health," "burden," "well-being," "family," and "relationship." We also screened the references for any important omissions.

[3] Because the research on implications for the family was sparse, we extended the time span for this topic to a few literature reviews published prior to 2000.

2.2 Background

Despite widespread agreement that family members are the backbone of a society's care supply[4], exact numbers on informal caregiving are unavailable because two vital elements for gauging them are lacking, an official definition of informal care and official statistics on household production. Nevertheless, a report funded by the European Commission (Triantafillou et al., 2010) does identify the following characteristics as typical of informal caregivers (see also Van den Berg et al., 2004; OECD, 2011): a close relationship with the care receiver, no professional training, no working contract, no equivalent pay, a wide range of care giving duties, no official hours (never really off duty), and no entitlement to social rights.

Prevalence of Informal Care

Policy-makers need to know the prevalence and value of informal work because changes in informal supply are linked to public welfare and influence the social security balance sheet. Although officials in countries that publicly support informal care (e.g., Germany) can gather data about care recipients from their long-term care insurance (LTCI)[5] provider, these data focus on care recipients (not caregivers) and exclude those who do not apply for benefits or fit none of the entitlement requirements. As a result, most information on the magnitude of informal care[6] is derived from surveys,[7] often in the form of interviews with representative subsamples. In 2011, the OECD released a report on long-term care

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[4] See Albertini et al. (2007) for a theoretical and empirical discussion of European family transfers.

[5] In 2011, 2.5 million people received benefits from the German LTCI, which equals about 3.1% of the population.

[6] Such research commonly employs one of two survey methods: (i) diary methods, considered the gold standard because they bring in the most accurate information about time use, and (ii) recall methods, which are more widely used because they are easier and cheaper to carry out (Van den Berg et al., 2004).

[7] For example, the 2001 UK census reported 5.2 million informal caregivers in England and Wales, while the 2000 General Household Survey identified 6.8 million for the entire UK (Heitmueller, 2007).

that examined the challenges for countries facing growth in care needs. With an almost 10% share of people over 80 by 2050, demand is estimated to be largest in OECD countries. However, the care regimes differ substantially between nations: for example, while only 8% of the population in Sweden reports being involved in informal caregiving (providing help with activities of daily living); the share in Italy is reportedly twice as high.

In a report for the European Commission, Bettio and Verashchagina (2010) use the Survey on Health, Ageing and Retirement in Europe (SHARE) to document the extent of informal care in the European Union. They report that in 2007, approximately 60% of the 20.7 million dependent elderly in the EU received informal or no care, thereby highlighting that "informal care givers—family and friends—remain the most important group of providers [in the EU]" (p. 77). Moreover, differences in the prevalence of informal care across Europe are large, with certain Eastern European countries relying nearly exclusively on informal care while countries like France and Belgium have a much larger share of formal care. For the United States, precise diary information from the American Time Use Survey suggests that in 2011–2012, 39.6 million people in the civilian (noninstitutional) U.S. population aged 15 and over engaged in elderly care provision (Bureau of Labor Statistics, 2013).

Institutional Differences

The variation in informal care among countries can be accounted for, at least to some extent, by differences in the availability of public support and possible alternatives, which determine the opportunity costs of becoming a caregiver. In most OECD countries, caregivers are entitled to leave work for a limited amount of time, but the absence granted from work varies and only some countries provide

paid leave. Even when paid leave is provided, however, it tends to be short, usually less than a month and rarely as long as the 12 months allowed in Belgium. The amount of such compensation also varies; Scandinavian countries, for example, offer between 40% and 100% of the caregiver's original wage. With regard to regulation of unpaid leave, countries can be grouped into two clusters (OECD, 2011): countries in one cluster, including Belgium, France, Spain, and Ireland, allow absence from work for several years; those in the other (which includes mostly English-speaking countries) only grants shorter leaves of up to three months. Yet even though such regulations exist, data from the 2004 European Establishment Survey on Working Time and Work-Life Balance shows that the use of these opportunities is still limited (OECD, 2011). That is, although care leave is available to roughly one third of employees in Europe, with lower shares for Canada and Japan, its use differs among sectors, being more common in the public sector and in large companies.

Another incentive used to promote care in the home to avoid hospitalization is financial transfers made either to the care receivers themselves or to the informal caregivers. Entitlement to such benefits, however, also differs across countries: in Scandinavia, for instance, caregivers receive a remuneration that can vary with care needs. However, even though the compensation in Sweden, for example, is fairly generous, the regulations for granting such compensation are very restrictive to minimize disincentives to work among certain low-wage earners. These disincentives are even greater for caregivers living in English-speaking countries where benefits are means tested. If the entitlement to benefits requires that caregivers earn below a certain threshold, it reduces the opportunity costs for dropping out of the labor force or reducing working hours. Providing cash benefits

directly to the care receiver, on the other hand, avoids many administrative issues because the care receivers decide how the money will be used. Such direct payments, which allow care receivers a very flexible use of money to meet their individual needs, are used by three quarters of OECD countries. However, this payment scheme, although intended to promote individual responsibility, carries other risks to family arrangements. For example, introducing such financial incentives into an altruistically motivated care relationship could promote monetary dependency by caregivers and thus decrease intrinsic motivation.

In Germany, instead of cash transfers, families can also receive benefits in kind. For instance, depending on the intensity of the care needs, families can get support from private formal care professionals who perform certain care tasks in the domestic environment. Such care support is often used when the care burden exceeds the informal caregiver's capability. When care needs become so intense that the household is unable to ensure appropriate accommodations, institutionalization may become unavoidable. In this case, some countries provide financial support by paying a certain share of the monthly expenses for the nursing home.

In general, however, public support—whether in cash or kind—affects families' willingness to provide informal care, a link than can move in either of two directions. On the one hand, formal care can complement informal care, especially when the informal caregiver is employed, while cash benefits allow the caregiver to reduce employment to provide sufficient care and keep income at an acceptable level. Formal support may also reduce the care burden to a compatible level, thereby enabling the employee to maintain the informal care arrangement. On the other

hand, when formal care substitutes for informal care, an increase in its supply decreases the time devoted to informal care.

Several empirical studies find evidence for such substitution effects (Clark et al., 2001; Van Houtven & Norton, 2004; Bolin et al., 2008a; Pickard 2012), which, even though mostly small, are characterized by a clear negative correlation between informal and form care alternatives in both the U.S. and Europe. Bonsang (2009), for example, finds a negative correlation between hours of low-skilled formal care (e.g., housework, shopping, and minor care tasks) and informal care, while high-skill tasks (e.g., nursing care) for severely impaired elderly parents complement informal care weakly. These results, which seem consistent among the nine European countries studied,[8] suggest that in severe care situations, a combination of informal and formal domestic care can avoid the need for nursing home placement.

Value of Informal Care

Because informal care is, by its very nature, not handled by the market, it has no price tag, making a proper comparison with formal care only possible to a certain extent. Nonetheless, several studies have tried to measure and valuate informal care monetarily using various methods to estimate an adequate price for care hours.[9] For the U.S., for example, Arno et al. (1999) investigate the prevalence of informal care and the amount of money needed to substitute all informal care with formal

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[8]   Austria, Belgium, Germany, Denmark, France, Italy, the Netherlands, Spain, and Sweden.

[9]   The three commonest methods for valuing the amount of informal care are (i) using the caregiver's opportunity to value the time that could be used to supply labor elsewhere, (ii) valuing the time provided according to possible market substitutes (e.g., nurses or unskilled workers), and (iii) using the caregivers' reported well-being and valuing the mean time spent on caregiving based on the rise in income necessary to keep caregiver well-being constant when providing one additional hour of care (Van den Berg & Ferrer-i Carbonell, 2007). The second method, often termed the "proxy good method," is the most widely used because of its ease of application (for further information, see Van den Berg et al., 2004, 2005, Van den Berg & Spauwen, 2006, Sousa-Poza et al., 2001).

alternatives. For their approximation, they use two data sets from the mid-1980s and assume constant caregiving ratios for the same cohorts until 1997. The hours of caring are taken from the National Family Caregiving Survey, which suggests an average of 17.9 hours per week. Setting the valuing wage at $8.18, the mean of the minimum and average wages of home health aides, they calculate the value of informal caregiving as $198 billion, which is equivalent to 18% of total U.S. health care expenditures at that time. A similar study on dementia caregiving, however, calculates a 1993 value of only $18 billion (Langa et al., 2001).

In a 2006 measure of the magnitude of informal care in Germany, Schneider (2006) estimates that 7% (4.8 million) of the over-16 German population are care providers, which corresponds to 4.9 billion hours of informal care. Substituting for this informal labor would require over 3 million full-time employees and, depending on wages, between €30 and €60 billion in salary. For Dutch caregivers, Van den Berg and Ferrer-i-Carbonell (2007) estimate the monetary compensation for one additional hour that would keep caregiver well-being constant. Based on the means of caring hours (49 hours per week) and income (€1,665 net household income per month), they identify adequate compensation as between €7 and €10 for each additional hour of care,[10] which is slightly lower than most Dutch market proxies.

2.3 Implications for Caregivers

Even though many care arrangements involve informal support, care provision is often a burden, so households must find an arrangement that takes into account several factors. First, care recipients usually prefer to stay in their own homes,

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[10] Price varies based on the family relationship between care recipient and caregiver, with family caregiving requiring higher monetary compensation.

which requires either family members able and willing to provide informal care or formal care support that is both accessible and affordable. In deciding between the two, potential caregivers must be aware that caregiving is a major responsibility that is time consuming and stressful. In addition, because the need for care occurs primarily at an older age, spouses are likely to be older themselves, which reduces their capabilities. Children, on the other hand, being more likely to be employed or have other obligations within their own household, face higher opportunity costs. Hence, choosing either arrangement always involves trade-offs for the caregiver.

In the following sections, we review the relevant literature with a focus on the implications for caregiver employment, health, and family, not only in terms of individual outcomes but also from a policy perspective. Undoubtedly, if dignified aging is to be ensured, the increased demand for caregiving must be met with a satisfactory supply, yet formal care is expensive and public money short. Fostering informal care arrangements, therefore, seems tempting because it saves direct costs in professional care services and can postpone expensive hospitalization. These savings, however, may be offset by such indirect costs as reduced employment, possible loss in human capital, and higher health care expenditures for caregivers.

2.3.1 Employment

When potential caregivers are of working age, the time used for informal care competes with that for paid work, meaning that the opportunity costs of informal care are often associated with paid employment[11] (Becker, 1965). We therefore examine the evidence of a link between informal care and employment decisions and strive to identify which characteristics of the care arrangement matter and to

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[11] For extensions with other time-allocation categories, see Gronan (1977); for a summary of all costs for adult caregivers, see Keating et al. (2014).

what extent informal care affects caregiver employment. In particular, caregiving is still too often seen as "women's work," meaning that recent political efforts to increase female labor force participation (e.g., European Commission, 2011) are likely to fail for women tied to a caregiver role. Conversely, there are rising concerns that increasing female labor force participation could reduce the willing supply of informal care. If a smaller supply of informal care does indeed imply a greater demand for formal care, then understanding the link between care and work is extremely important for forecasting future care needs.

Research into these issues has been greatly facilitated by the growing availability of longitudinal data and the development of more sophisticated statistical methods. In particular, these latter are greatly aiding the determination of causality, which although not taken into account by all the studies reviewed here (see table 2.1), is always an important consideration. From the causal perspective, any negative care-work association can be explained in two ways: first, care is time consuming, so combining it with regular employment is difficult; caregivers must reduce work hours or even quit their jobs to provide sufficient care to the individual in need. Second, because unemployed or part-time workers have more time, they are more likely to become caregivers. Not only are these two lines of causality equally plausible, they are not mutually exclusive and can even occur simultaneously (Michaud et al., 2010). However, several recent studies find little evidence for an endogenous caregiving decision and thus treat caregiving as exogenous, particularly when controlling for unobserved individual characteristics in panel data (see Bolin et al., 2008b; Ciani, 2012; Meng, 2012; Van Houtven et al., 2013; Nguyen & Connelly, 2014). The instruments used in such research, however, often measure the health of potential care receivers, which should exogenously

increase the demand for caregiving. These instruments are criticized on the grounds that a dummy variable or metric measurement of care hours is unable to sufficiently capture a heterogeneous care task. Hassink and Van den Berg (2011), for instance, argue that ignoring the fact that some care task are "time-bounded" while others can be shifted from one day to another can affect the exclusion restriction in the instrumented regressions and thus provide biased estimates. Doubts about the use of care needs as an instrument have already been raised by Heitmueller (2007). For his cross-sectional data, the IV estimates are almost 10 times larger than the OLS results, which are supposed to overestimate the effect of caregiving.

Work Status

Although a negative association between informal care and work is supported by the theory of opportunity costs and time allocation within households (see Becker, 1965, Pezzin et al., 1996), several studies refute the existence of such a link, reporting only a small or no correlation between the two. For example, Lilly et al.'s (2007) review of 34 articles on caregiving's effects on labor force participation published between 1986 and 2006 finds no convincing evidence that caregivers show generally lower levels of employment. One explanation for such a weak informal care-work relation is caregivers' low attachment to the labor force, which implies that they would be unlikely to increase their participation in paid employment even without the caregiving burden. Evidence for such selection is provided by several studies: Dautzenberg et al. (2000), for example, although they use an admittedly small sample, find that unemployed daughters who live close by are most likely to become caregivers. Carmichael et al. (2010) provide evidence that future caregivers,[12] although they share similarities with actual caregivers,

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[12] Individuals in year t-1 before they become actual caregivers.

differ significantly from those who have never taken on that role. For example, male (female) future caregivers have a 6% (5%) lower employment rate and are more likely to work in unskilled (noncareer track) occupations. In support of this notion, Michaud et al. (2010), using data from the British Household Panel Survey (BHPS), show that current employment reduces the probability of becoming a caregiver in the future. Results from Dutch data also suggest that employment in the previous year reduces the probability of caregiving by 2.4% (Moscarola, 2010). Berecki-Gisolf et al. (2008), however, can find no systematic difference between Australian female future caregivers in their 50s and their noncaregiver peers nor any significant effect of current employment on the likelihood of providing care.

Nevertheless, as Leigh (2010) emphasizes, selection may take place on unobserved characteristics, including personality traits and general labor force attachment, and can change the estimates greatly. Using panel data from Australia, he finds that accounting for individual fixed-effects reduces the strong negative coefficients for the link between caregiving and labor force participation from -20 to -28% to 4–6% (also see Heitmueller, 2007). Likewise, accounting for individual fixed-effects and ruling out endogeneity in a sample from the U.S. Health and Retirement Survey (HRS) results in no significant effect of being a caregiver on employment probability (Van Houtven et al., 2013). For Germany, Meng (2012), in an analysis of the effect of care hours in seven waves of the GSOEP, finds no reduction in labor force participation. However, although Viitanen's (2010) analysis of the European Community Household Panel (ECHP) initially identifies Germany as the only one among 13 European countries that has a significant caregiving-work relation, once the state dependency of labor force participation and individual fixed-effects are controlled for, this negative impact falls to only 0.3

percentage points. For Canada, Lilly et al. (2010) obtain only small, slightly significant effects for their male sample and conclude that the net effect of caregiving on employment is not significant.

Even though these effects remain small, however, the majority of studies do provide some evidence that caregivers are less likely to have a paid job (Carmichael & Charles, 2003; Bittman et al., 2007; Berecki-Gisolf et al., 2008; Bolin et al., 2008b; Carmichael et al., 2010; Lilly et al., 2010; Nguyen & Connelly, 2014). For example, Bolin et al. (2008b), using data from SHARE, identify a 10% increase in care hours associated with a 3.7% lower employment probability. In terms of comparability, the marginal effect from a random-effects probit in Kotsadam's (2011) analysis of ECHP data indicates that lower employment probability for caregivers varies between countries, with a 5% lower probability for the full European sample. An analysis of the same data, using a sample of men aged 40–64 and women aged 40–59, shows a significant but small effect on labor force participation, with a causal effect of 1% (2%) for northern (southern) countries in Europe (Ciani, 2012). However, a simultaneously estimated care-work equation for a Dutch subsample of the ECHP finds the caregiving probability to be 5.8% lower once the state dependency of employment is accounted for (Moscarola, 2010).

Spiess and Schneider (2003), on identifying an asymmetric response in which entering the caregiver role reduces labor force participation but leaving or reducing it results in no participation adjustment, attribute it to the fact that for the 45- to 59-year-old women sampled, the years to retirement are few. Wakabayashi and Donato (2005) identify a similar dynamic in their female sample—significantly reduced labor force participation on entering the caregiver role but no reentry after leaving it. This finding is supported by Van Houvten et al. (2013), who demonstrate a

significantly higher probability of being retired among caregiving women, while employment probabilities remain unaffected. Such an asymmetric response might be associated with depreciation of skills: in interviews, caregivers have reported being unable to reenter employment after a long duration of caring because their job specific knowledge was outdated (Carmichael et al., 2008).

Work Hours

The research results on the extensive margin remain rather small, possibly because of a flexible working environment that allows caregivers to adjust their work hours rather than leaving the labor force completely. There is strong evidence, however, that caregivers are more likely to work fewer hours than noncaregivers (Lilly et al., 2007), a finding supported by multiple recent findings of caregivers adjusting their work hours (e.g., Bittman et al., 2007; Berecki-Gisolf et al., 2008; Bolin et al., 2008b; Leigh, 2010; Kotsadam, 2011; Meng, 2012; Van Houtven et al., 2013). In Europe, for instance, Bolin et al. (2008b) find a working-caring-time elasticity for a SHARE sample of -0.26 when informal care is treated as exogenous. This rather inelastic response on working hours is echoed by Kotsadam (2011), who finds that caregivers have 2–3% lower working hours for a full European sample compared to noncaregivers. Meng (2012), however, identifies only a small effect for Germany: providing 10 hours more care per week is associated with a reduction of 48 (35) minutes for men (women) in weekly working time. Leigh (2010) obtains mixed results depending on the definition of caregiver. For instance, the effect of caregiving on work time is significant in a group of individuals that self-classify as caregivers but not in a group defined by whether or not they receive public care allowances. Similarly, in their analysis for Canada, Lilly et al. (2010) find that once they adjust for potential indirect effects from wage differences, primary caregiving

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has no negative effect on the log of weekly labor force hours, but when they increase the threshold of care duty to 15–20 hours per week, a negative link emerges.

Few recent studies find an overall strong link on working hours, but should be treated with caution. For instance, Bittman et al. (2007) observe that about 20% of full-time working women in Australia will give up full-time for part-time work after taking on care duties. However, this result is based upon simple correlation, which might overestimate the casual effect of care on employment.

That accounting for endogeneity not necessarily reduces the estimates was demonstrated by Van Houtven et al. (2013), who also obtain insignificant results for caregiving's effects on work hours when treating informal care as exogenous. In their 2SLS approach, only the work hour regressions pass the endogeneity test. However, in contrast to the exogenous fixed-effects results, the instrumented care supply yields significant and substantial negative effects on work hours: caregivers who provided at least 100 hours of care over the previous two years work three hours less a week than noncaregivers. Likewise, providing care reduces the working hours of middle aged women by 41% on average, even when individual heterogeneity and endogeneity is accounted for (Johnson & Lo Sasso, 2006). In line with Heitmueller (2007), the results suggest that exogenous caregiving underestimates the effect of caregiving on labor force participation. A finding difficult to explain, particularly in models accounting for individual fixed-effects.

Wages

The opportunity costs of caregiving not only relate to time spent in paid employment but may also affect wages. For example, potential caregivers earning higher wages face higher opportunity costs for one hour of informal care. In such a case, purchasing formal care substitutes is more attractive, implying a negative

correlation between time spent for informal care and wages. Caregiving might also interfere with work, leading to lower performance and fewer promotions and thus a wage penalty for caregivers. Empirical evidence on such wage effects also tends to be inconclusive, with some studies finding that caregivers earn lower wages (e.g., Carmichael & Charles, 2003; Wakabayashi & Donato, 2005; Bittman et al., 2007; Heitmueller & Inglis, 2007) but others identifying no or only very small effects (e.g., Bolin et al., 2008b; Lilly et al., 2010; Van Houtven et al., 2013). Carmichael and Charles (2003), for example, estimate that wages are 18% (9%) lower for male (female) caregivers who provide more than 10 hours of care per week. Likewise, Heitmueller and Inglis (2007), using English data to estimate the opportunity costs of caregiving in the form of wage reductions, find that caregivers earn about 6% less, with about half the reduction directly accounted for by care provision. The authors also show that this effect has increased over the years (1993–2002) and differs between genders, with women being more affected than men. Bittman et al. (2007) relate such wage effects not only to care intensity but also to care duration: whereas the income of Australian caregivers in their first two years is lower by about $10,000 annually, the difference to noncaregiver increases to $12,000 in the fourth year.

Because caregivers might expect future care demand to increase, Van Houtven et al. (2013) speculate that wage reductions might arise from caregivers selecting into jobs for which they are overqualified. However, these authors identify no overall negative effect on wages and only a small but significant wage reduction (3.1%) for women providing help with chores, the least intense care arrangement in their analysis. Similarly, using data from SHARE, Bolin et al. (2008b) find that caregiving does not generally reduce wages, a result supported by Lilly et al. (2010)

for Canada.

Overall, the empirical findings related to employment and wages, being sensitive to the specific care situations and caregiver subgroups, are often difficult to generalize. Most studies, for instance, take a distinct look at the caregiver's gender, relationship to the care recipient, and living arrangements. Large impacts on the caregivers' labor force participation are mostly observed among particular at-risk groups or subsamples (see, e.g., Nguyen & Connelly, 2014). Researchers also often address other characteristics that seem to influence the work-care relationship,[13] such as the tendency for older, white, or uneducated caregivers to suffer more in terms of career (Wakabayashi & Donato, 2005).

Gender Differences

The effect of caregiving on employment, work time, and wages often differs between men and women. For instance, Carmichael and Charles (2003) show that even though all caregivers face lower wages (cf. Heitmueller & Inglis, 2007), which reduces the likelihood of their working in a paid job (indirect effect), only women directly substitute their paid work with informal care work. The authors further report that women seem to have a weaker attachment to employment than their male counterparts.[14] In support of this latter, King and Pickard (2013) find that only women are affected by becoming a caregiver: employed women who begin to provide less than 10 hours of care per week have an even higher likelihood than noncaregivers of being employed one year later. On the other hand, they also observe a negative association between becoming an intense caregiver (over 10

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[13] For a list of other possible mediators suggested in pre-2006 studies, see Lilly et al. (2007).

[14] Carmichael and Charles (2003) note that they themselves define the direction of causality in this paper arbitrarily. In particular, they assume that care choices are made exogenously and do not consider opportunity costs, although they do not rule out the possible interaction between the mutual effects of care and employment.

hours per week) and future employment. The gender-based findings reported by Van Houtven et al. (2013), however, contradict these findings. In their examination of extensive effects, they show that only men providing personal care are 2.4% less likely to work, whereas women suffer a wage penalty and reduced working hours. Nguyen and Connelly (2014), in contrast, find no gender differences, whereas Meng (2012) identifies a slightly lower reduction in work hours for female caregivers in Germany.

Because women are more frequent caregivers, provide care at higher intensity, and experience higher social pressure to provide care (Carmichael & Charles, 2003), they are of particular research interest, leading some studies to focus only on female care provision (e.g., Johnson & Lo Sasso, 2006; Kotsadam, 2011; Casado-Marin et al., 2011). For instance Berecki-Gisolf et al. (2008), who find that middle-aged females are twice as likely as noncaregivers to reduce their labor force participation after becoming caregivers.

Importance of Residency and Intensity

In addition to certain caregiver characteristics, the way that caregiving is defined also appears crucial. Even though the overall effect of caregiving on employment seems to be small, most studies find a relevant association between caregiving and labor force participation/wages for at least some types of care arrangement. One important characteristic related to employment decisions within caring families is residency, which Heitmueller (2007) investigates by using cross-sectional and panel data. The different estimations indicate that both co-residential and intensive care have a significant impact on employment but extra-residential care does not. These findings are confirmed by Casado-Marin et al. (2011) using eight waves of a Spanish subsample from the ECHP to show that among middle-aged women, only

co-residing caregivers suffer negative effects on labor force participation. Similarly, Michaud et al. (2010), in an analysis that accounts for both time-invariant heterogeneity and a dynamic care- employment for which causality is plausible in both directions, reveal a statistically significant correlation between a co-residential caregiver subsample and future occupation, even though they identify no overall effect.

Caregiver residency also plays a crucial role in selection into caregiving. For example, Carmichael et al. (2010) use a discrete-time logit model to show a negative link between employment, as well as higher hourly earnings, and the probability of care provision, especially in a co-residential setting. Such marked effects on the caregiver's labor force participation are not surprising given that co-residing with the care receiver often reflects high care demands (see Heitmueller, 2007; Nguyen & Connelly, 2014). Hence, Lilly et al. (2007) conclude that cases of intense care are inherently related to lower labor force participation; the threshold for intense caregiving varies among studies, but points mostly to caregiving over 10 hours (King & Pickard, 2013) or 20 hours a week (Heitmueller, 2007; Lilly et al., 2010). In fact, Carmichael et al. (2008), in their analysis of the impact of caring responsibilities on employment, conclude that those who provide care for long hours over a longer period are far more likely to adjust their job participation or leave employment completely.

Additional differences are observable for primary and secondary caregivers, with only the former showing meaningful reductions in their labor force participation. For instance, Nguyen and Connelly (2014) find an approximately 12% lower probability for employment among Australian primary caregivers (see also, Lilly et al., 2010), a much stronger impact than for secondary caregivers. On

the other hand, Lee and Tang (2013), using HRS data to assess differences in types of caregiving tasks, find that the employment probability for women providing care personal care to their parents is significantly lower, whereas the coefficient for also running errands and helping with chores (in combination with personal care) shows no effect. This finding stands contrast to Van Houtven et al.'s (2013) observation that caring for chores does reduce female wages and increases the retirement probability, while personal care has no effect.

Quality of Work

Another factor that may be negatively affected by caregiving is work quality, and not necessarily just employment status and work hours. Reid et al. (2010), for example, show that 46.3% of employed caregivers feel that their work performance is affected and about 40% of caregivers say they miss work or have had to leave suddenly because of their care responsibilities. These effects could lead to fewer promotions and may partly explain why caregivers tend to earn less. For instance, a survey among Norwegian caregivers (Gautun & Hagen, 2010) suggests that caregiving often leads to late arrival or early departure from work (16%), the need to reschedule the work day (13%), and/or problems concentrating during work hours (10%). On the other hand, in terms of labor force participation, the survey also indicates that most caregivers try to combine work and care by using accumulated holidays (31%) and flexible working hours (15%), with only a few reducing their work hours. Nevertheless, although the above findings suggest a very complex interplay between caregiver, recipient, employer, and the institutional background, more recent quantitative research suggests that caregiving's impact leads to a broad spectrum of outcomes in the labor market. Ugreninov (2013), for instance, using Norwegian data, demonstrates that employees who combine full-

time work with caregiving are more likely to be absent from work because of sickness.

International Differences

Finally, it must be stressed that countries differ in the assistance they provide. For example, whereas many countries provide considerable support for those needing care and their families, in the United States, such aid tends to be limited. The effects of caregiving on labor force participation even differ noticeably within continental Europe. For instance, although Bolin et al. (2008b) find no significant effect on employment for their entire European sample, they identify a lower probability of employment for men from central Europe.[15]

Central European caregivers of both genders also work fewer hours than those in other areas. The estimates for Nordic caregivers, in contrast, are only significant for men. The highest wage gap among the regions is observed between female caregivers in southern Europe and their male counterparts.

These variations may stem from cultural and institutional differences, including differing degrees of governmental support for caregivers in the form of such entitlements as job leave and tax cuts or benefits like cash and in kind. Families formulate their care arrangements in light of such regulations, which must therefore be considered when assessing effects on labor force participation or health. For example, the negative link found by Spiess and Schneider (2003) between starting care provision and working hours in a European sample is only significant for northern countries, whereas increasing care hours reduces working hours only in the south.

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[15] The authors divide Europe into the following three areas: (1) Nordic (Sweden and Denmark); (2) Central (Germany, France, Netherlands, Austria, and Switzerland), and (3) Southern (Spain, Italy, and Greece).

Table 2.1: Studies on Informal Care and Employment

Author	Data	Controls	Key results
		Literature review or meta study	
Lilly et al. (2007)	Review of 34 articles (1986–2006)	–	Carers generally do not show lower levels of employment, but intense caregiving is related to lower working hours and lower levels of labor force participation
		Studies accounting for or ruling out endogeneity and/or account for unobserved heterogeneity	
Berecki-Gisolf et al. (2008)	N=9,837, Australian Longitudinal Study on Women's Health (2001 & 2004, L)	Selection in care, health of care receiver, caregiver demographics	Employment does not affect selection into caregiver role, but providing care is related to odds ratios up to 2.11 for reducing work hours or leaving employment
Bolin et al. (2008b)	N=3,769. Survey of Health, Ageing and Retirement in Europe (2004, C)	OLS, 2SLS, regional differences, caregiver demographics	Exogeneity of caregiving could not be rejected. Evidence for reduced employment probability, and working hours. Results vary between north and south Europe
Carmichael et al. (2010)	N=20,000, British Household Panel Survey (1991–2005,L)	Previous care provision, caregiver demographics, co-residential care	Occupation and earnings negatively affect the probability of demanding care provision
Casado-Marin et al. (2011)	Spanish female subsample of the European Community Household Panel (1994-2001, L) between 30-60. N= 28,260.	Ordered probit, IPW estimator against attrition, caregiver characteristics	Lower probabilities for employment were observed for women caring for someone at home and for those who care for more than one period

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Author	Data	Controls	Key results
Ciani (2012)	European Community Household Panel (1994-2001, L) with women between 40-59 and men 40-64 with about 300,000 observations	Endogeneity and individual effects, caregiver, and care receiver characteristics	Once individual fixed-effects are accounted for, the exogeneity assumption for informal care could not be rejected. Effects are small and differ between north and south Europe
Heitmueller (2007)	N=25,000, British Household Panel Survey (1991-2003, C & L)	Endogeneity, co- and extra-resident care, intensity, caregiver demographics	Endogeneity is important if the impact of care on employment decisions is not to be overestimated. Negative linkage is observed for co-residential and intensive care only
Heitmueller & Inglis (2007)	British Household Panel Survey (1993 & 2002), about 5,000 observations	Heckman procedure for selection, caregivers characteristics	Employed carers are expected to earn about 6% less than non-carers. The wage penalty is estimated to be 1.04 pounds/hour
Johnson & Lo Sasso (2006)	Household and Retirement Survey (1996-1998, L) about 2,500 women between 55-67	Instrumental variables, family and caregiver characteristics	Caregiving substantially reduces working hours; not accounting for individual heterogeneity might underestimate the effect
King & Pickard (2013)	N=17,123. English Longitudinal Study of Ageing (2002-2009, L) aged 50-64.	Logit, caregiver characteristics	Those providing more than 10 hours of care show lower levels of employment
Kotsadam (2011)	N=14,478, European Community Household Panel (1994–2001, L), females from 14 countries.	Random-/fixed-effects logit, probit, caregiver characteristics	Effects on working hours and employment probability vary within Europe and are larger in southern countries
Leigh (2010)	7 waves of the Household, Income and Labour Dynamics in Australia survey (2001–2007, L) with 8,000 to 10,000 observations	Pooled OLS and fixed-effects model	After accounting for individual characteristics, only small effects emerged for care and employment, while subjective well-being remained unaffected

Author	Data	Controls	Key results
Meng (2012)	N=14,873, German Socio-Economic Panel (2001-2007)	Endogeneity, fixed-effects, caregiver and care receiver characteristics	Labor force participation is not significantly reduced. Providing 10 hours more of care a week reduces working hours by less than 50 minutes
Michaud et al. (2010)	Females age 25 to 59 from the British Household Panel Study (2000 -2005, L) N=2,551	Co- and extra-resident care, endogeneity of care provision, partner, and partner's family, caregiver demographics	Small but significant effect of co-residential caregiving on future employment
Moscarola (2010)	N=9,656, Dutch women 25-55 from the European Community Household Panel Surveys (1995-2001, L)	Dynamic bivariate probit for simultaneous estimation with lagged care and work variables, caregiver characteristics	Employees are less likely (5.8%) to become caregivers and vice versa (2.4%).
Nguyen & Connelly (2014)	8 waves of the Household, Income and Labour Dynamics in Australia survey (2001-2008) with 7,845 observations between 25-64	Instrumental variable, multinomial logit, endogeneity, co- and extra-resident care, care intensity, caregiver demographics	Endogeneity of the caregiving decision was rejected and therefore the estimates were treated exogenous. Results suggest that caregiving reduces labor force participation by around 12% for men and women
Van Houtven et al. (2013)	Health and Retirement Study (1992-2008, L) with around 4,000 men and women.	Instrumental variable, fixed-effects, care tasks, caregiver characteristics.	Endogeneity was only found for the work hours equations and drastically increased the negative association. Exogenous estimates for employment probability and wages remained mostly not significant. Women were more likely to retire
Viitanen (2010)	European Community Household Panel (1994-2001, L) around 900,000 observations from 13 countries.	Unobserved heterogeneity, caregiver characteristics	Only in Germany do women providing care show a significant lower labor force participation

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Author	Data	Controls	Key results
		Other studies	
Bittman et al. (2007)	4 waves of the Household Income and Labour Dynamics in Australia with up to 7,500 observations	OLS, probit, caregiver characteristics, descriptive comparison	Caregivers show lower earnings and working hours, and starting caregiving is related to a higher probability of leaving the labor force
Carmichael & Charles (2003)	N=10,000, General Household Survey (1990, C)	Co- and extra-resident care, caregiver demographics	Men (-12.9%) suffer less than women (-27%) in terms of employment probability. However, both face lower wages
Carmichael et al. (2008)	N=272 respondents recruited among support groups & British Household Panel Survey (1991–2001, C)	Hours and years of caregiving, caregiver demographics	Longer hours and longer duration of care increase the likelihood of changing work hours or leaving employment completely
Dautzenberg et al. (2000)	N=581, Telephone survey (1994 & 1996, L)	Distance to and health of care recipient, siblings, and caregiver demographics	Unemployed daughters and daughters living nearby are more likely to become caregivers. Care and work hours are unrelated
Gautun & Hagen (2010)	Survey with 4,000 Norwegians between 45-65 (2006, C)	Descriptive univariate analysis	75% of caregivers experience problems combining work and caregiving, mostly in terms of irregular work hours and lack of participation in training and meetings
Lee & Tang (2013)	N=5,119, Health and Retirement Study (2004, C)	Spousal, parental, and grandchild care, demographics	Parental personal care was associated with a significantly lower OR (0.49) for women. No effect emerged for men
Lilly et al. (2010)	Statistics Canada's 2002, C, General Social Survey with 24,855 observations above 45	Probit, two-stage Heckman procedure to account for selection in the wage/work hours regression, caregiver demographics	The results suggest that it is mostly primary caregivers that show lower levels of labor force participation. Employed caregivers show neither lower working hours nor lower wages. Secondary caregivers seem unaffected

Author	Data	Controls	Key results
Pavalko & Henderson (2006)	N = 2,021, National Longitudinal Survey of Young Women (1995-2001, L)	Logit, caregiver characteristics, firm characteristics, work place benefits	Caregiving women with more flexible working contracts were more likely to remain in the labor force
Reid et al. (2010)	N=136, Employed caregivers from Victoria, British Columbia (1999–2000, C)	–	Caregiving might interfere with work in terms of quality, which is not measured through employment status or work hours
Spiess & Schneider (2003)	N=6,400 women aged 45 to 59, European Community Household Panel Surveys (1994 &1996, L)	Cross-national comparison, focus on changes to control for selection, caregiver demographics	Starting and increasing care lowers working hours, not vice versa. Results differ along a north-south gradient within Europe
Ugreninov (2013)	N =3,969 full-time worker from the Norwegian study of life course, ageing, and generation (2008, C)	Probit, caregiver characteristics, work-place characteristics.	Full-time caregivers have more absences for sickness and lower health than noncaregivers.
Wakabayashi & Donato (2005)	N=2,638, Female subsample form the National Survey of Family and Household (1987/88 & 1992-1994, L)	Enter, remain, and quit caregiver role. Social demographics	Substantial reduction in employment, work time, and earnings when becoming a caregiver. Ceasing to give care is not associated with any counteracting effect.

2SLS= Two-stage least squares, C = Cross-section, IPW = Invers probability weighting, L = Longitudinal, OR = Odds ratio

The authors ascribe these differences to the more flexible work environment and higher levels of formal support, which allow female caregivers to adjust to the care situation and find a better balance between employment and informal care. Using the same data, Kotsadam (2011) conduct separate analyses for three European areas—north, central, and south—which support the notion of a north-south gradient along which the effects of caregiving on female employment and work hours are generally smaller in the north than in the south (see also Ciani 2012). Different working environments, i.e. job options as flexible work hours, telecommuting, or compassionate care leave, affect labor force decisions even within a country: U.S. female caregiver with access to such arrangements are more likely to remain in the labor force (Pavalko & Henderson, 2006).

2.3.2 Health

Because informal care involves both psychological effort and a physical burden, some researchers distinguish between the psychological and physical health outcomes of caregiving, while others study both relations simultaneously (see table 2.2). The majority of studies focus on psychological outcomes, although they employ different, and frequently ambiguous, dependent variables. Some investigations, for example, measure the correlation between caregiving and depression symptoms, while others analyze the links with subjective well-being, burden, and other mental health measures. Informal caregiving and psychological health are related not only because the former is time-consuming and frequently difficult to combine with work and family life, but because caring for close family members in need may induce negative emotions linked to compassion and fear of loss. In addition, caregiving is a stressful task that can require great physical effort, particularly in special cases such as mentally impaired relatives who develop

behavioral problems and even aggressive habits. Hence, policy-makers must be concerned not only with the self-evident interests of the individuals but also the poor caregiver health that can result from the informal care burden. This latter implies higher health care expenditures, which must be taken into account when promoting or supporting informal care arrangements. Poor health can also decrease caregivers' capacity for care provision, leading to low quality care or a reduced informal care supply and increasing demands for formal care.

Psychological Health

Several meta-analyses that pay particular attention to the psychological implica-tions (e.g. Schulz et al., 1990, 1995; Pinquart & Sörensen, 2003a, 2003b, 2006; Savage & Bailey, 2004) indicate that the majority of studies find a negative association between caregiving and psychological measures. Schulz et al. (1990), for example, review 33 articles published between 1968 and 1990 in order to identify the psychiatric morbidity effects of caregiving. Most of the work reviewed assesses these psychological effects using multi-item scales that include questions about general well-being or happiness. The evidence overall suggests that caregivers tend to show an above-average level of psychiatric symptoms. In a subsequent review, Schulz et al. (1995) concentrate on 41 papers, published from 1989 to 1995, that focus on the well-being effects of caring for dementia patients, a form of care that places a high burden on the caregiver. Their general conclusion is that providing care for dementia patients leads to higher levels of depressive symptoms (see also Etters et al., 2008).

A more recent review by Pinquart and Sörensen (2003a), which covers 228 studies between 1966 and 2002, focuses on the psychological effects of elder care provision on the caregivers. These authors cluster the studies based on similar

characteristics related to outcome (caregiver burden or depression), sampling (probability or convenience samples), impairment (dementia, non-dementia, or mixed patients), and the relationship to the caregiver (spouse or adult children). They find overall evidence that behavioral problems (e.g., disruptive and aggressive behavior), physical and cognitive impairment, and the time spent on caregiving place a burden on the caregiver and increase symptoms of depression, with behavioral problems being particularly important when caring for demented care recipients. This finding is supported by Black and Almeida's (2004) review of associations between behavioral and psychological symptoms of dementia and the burden on caregivers. They find a strong link with caregiver burden but, based on the weak correlation with depression, suggest that the concept of burden might be too broad to identify clinically relevant caregiving outcomes.

Another review by Cooper et al. (2007), in contrast, finds that dementia care is associated with higher levels of caregiver anxiety. An overview by Savage and Bailey (2004) likewise examines the impact of caring on caregivers' mental health but clusters relevant papers according to different factors associated with caregiver burden. They find that the care relationship is an important factor for mental health outcomes, with closer relationships inducing more positive outcomes for the caregiver. They also find evidence that mental impairment among care recipients negatively affects caregivers' well-being, an effect enhanced by financial restrictions and lack of social support. The importance of such social support is emphasized by both Lim and Zebrack (2004), who discuss its relation to stress, and Chappell and Reid (2002), whose path analysis confirms that caregiver burden is a predictor for caregiver well-being and mediator of caregiving characteristics. The amount of care provision that is informal increases the probability of feeling

burdened and directly decreases well-being. Perceived social support and coping strategies reduce these downturns and increase caregiver well-being.

A small stream of literature even finds that being a caregiver can have positive impacts. For example, Cohen et al. (2002) observe that 73% of their Canadian sample could name at least one positive aspect of caregiving, including companionship, fulfilment, and enjoyment. Experiencing such care outcomes, however, was negatively related to depression, burden, and self-assessed health. Qualitative interviews by Ashworth and Baker (2000) also reveal direct positive effects: about 40% of the caregivers expressed satisfaction with care provision (see also Raschick & Ingersoll-Dayton, 2004).

Positive outcomes are, however, rare or at least dominated by negative effects. Yet it should be noted that negative impacts can suffer from an upward bias generated by failure to control for the so-called family effect (Bobinac et al., 2010): the influence of having a family member with bad health. This effect is one that many studies fail to consider, which raises the risk of bias in simple comparisons between caregivers and noncaregivers. To avoid such bias, studies should carefully distinguish between the family effect and the caregiving effect. Amirkhanyan and Wolf (2006), for instance, find that care provision in the household affects the well-being of the entire family and simply having a parent in need of care increases the likelihood of depression. Likewise, Bobinac et al. (2010), after proxying the caregiver effect by the number of care tasks and the family effect by the actual health of the care recipient, show that both factors affect the caregiver's well-being by a comparable magnitude. They also provide evidence that not accounting for the family effect leads to a 30% overestimation of the caregiving effect. One additional methodological shortcoming noted by Leigh (2010) is that most of the caregiving

research fails to account for omitted variable bias by ignoring important individual characteristics. In his study, the negative effect on life satisfaction becomes insignificant when individual fixed-effects are taken into account. Lawton et al. (2000) also find very little evidence that becoming a caregiver or caring over a long period worsens the caregiver's well-being.

The long-term impact of providing care to an ill or disabled parent (or parent-in-law) is a major focus of a study by Bookwala (2009), which draws on three waves of data collected over a 15-year period. Her research demonstrates that caregivers tend to suffer more over time, with well-being decreasing in the long term, which supports the so-called "wear-and-tear" concept when caregivers do not adapt to their role.[16] Hirst (2005), in contrast, finds that particularly intense caregiving—that is, providing more than 20 hours of care a week—is associated with the highest levels of distress when caregiving begins and after the caregiving spell has ended.

Bookwala (2009) also reveals that women experience a higher probability of depression after a certain time of caring, whereas men's depression levels decrease over the same amount of time. Female caregivers also generally report higher levels of depression, anxiety, and lower levels of well-being (Yee & Schulz, 2000), and the literature reviewed suggests almost exclusively stronger adverse effects for women than for men. Additional gender differences identified by Raschick and Ingersoll-Dayton (2004) using cross-sectional data include a tendency for women to be more burdened by the caregiving experience than men, to perceive more caregiving costs, and have lower levels of life satisfaction. Pinquart and Sörensen (2006), however, suggest that large gender differences can be partly

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[16] "Wear-and-tear" refers to an increasing psychological burden over time, while "adaption" assumes a coping ability that reduces the burden in the long run (Brickman & Campbell 1971).

explained by the fact that women tend to provide longer and more intense care. After accounting for the objective care burden in their meta-analysis of 229 studies, the remaining gender differences were small.

Raschick and Ingersoll-Dayton (2004) find that adult children receive higher emotional rewards than spouses, possibly because of qualitative differences in the care situation; that is, spouses face more intensive responsibilities than do adult children. These observations are echoed by Pinquart and Sörensen (2003a), who find that spouses who provide care are often more burdened than adult children who act as caregivers, possibly because spousal caregivers, being older, find the physical effort more onerous.

Physical Health

Studies on caregiving's impact on physical health are less widespread and have received less attention than studies on caregivers' psychological health. This literature does show, however, that physical health outcomes can be linked to informal caregiving through the following dynamics: (i) caregiving often requires physically demanding work over a long duration, which might cause musculoskeletal injuries and aggravation of arthritis and other chronic illnesses; (ii) caregivers tend to neglect a healthy lifestyle (e.g., diet and exercise); and (iii) caregiving increases stress and lowers psychological health, which is likely to manifest in such physical outcomes as hypertension and cardiovascular disease (Pinquart & Sörensen, 2007).

A meta-study by Vitaliano et al. (2003), which explores caregiving's impact on physical health in 23 samples, does indicate that caregivers have worse physical health than noncaregivers; however, their assessment of different health categories shows significant but moderate differences in self-reported health, medication use,

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antibodies, and stress hormones. Another meta-analysis of the informal care literature, by Pinquart and Sörensen (2007), focuses exclusively on articles on physical health written between 1986 and the spring of 2006. In particular, this review concentrates on the following care-affiliated factors that specifically impact caregivers' physical health: (i) mentally impaired care recipients and behavioral problems; (ii) characteristics of the care situation, such as care duration, co-residency, nonspousal care, and lower levels of informal care support; (iii) the caregiver characteristics of high age and lower socioeconomic status; and (iv) a high caregiving burden and symptoms of caregiver depression. Based on their review, the authors conclude that physical health losses among caregivers are more likely to be related to their mental health status than to physical overload. They base this conclusion on the lack of a significant correlation between a care recipient's physical impairment and the caregiver's physical health status. At the same time, however, they also find a high correlation between a care recipient's mental illness or a caregiver's depression and physical health (see also, Schulz et al., 1995). As Pinquart and Sörensen (2007) point out, the most severe physical impairments can be found among caregivers who are older, male, or in charge of dementia patients, a risk group slightly different from those identified in the psychological health research, in which women in particular perceive a higher cost of caring (Raschick & Ingersoll-Dayton, 2004).

The general association between informal care and worse health is demonstrated by Legg et al. (2013), who employ UK census data to reveal a significant negative association between care and health that becomes stronger with care hours provided (see also Ugreninov, 2013). Likewise, Mentzakis et al. (2009), using 14 waves of the British Household Panel Survey (BHPS) to explore the determinants of

caregiving, identify a significant correlation between worse health and the probability that the caregiver is providing residential care.

Dementia caregiving, in particular, is associated with a high burden and overall downturns in health, as demonstrated by Schoenmakers et al.'s (2010) meta-analysis of its impact, which supports most of Pinquart and Sörensen's (2007) observations. Nevertheless, although both reviews conclude that dementia caregiving is associated with lower physical health, they both admit to the following caveats: (i) the literature reviewed is very heterogeneous and therefore minimally comparable, (ii) most studies are cross-sectional and thus do not account for endogeneity, and (iii) research often omits important controls (e.g., preexisting illness).

One particularly strong predictor of an individual's own health is spousal health, which emerges prominently in all self-reported surveys, even in households where no care is needed (Satariano et al., 1984). At the same time, however, research results based on more objective measures like doctor visits and drug use remain ambiguous. In addition, although stressful caregiving may not overtly affect actual health status during the period of caring, it can be related to subsequent downturns in immune function. Such a lagged effect of caregiving is demonstrated by the sample of single mothers providing intergenerational care in which physical downturns like lower self-assessed health and high blood pressure occurred after a 2- to 4-year delay (Coe & Van Houtven, 2009). Similarly, in a study by Gräsel (2002), although caregivers experienced no health decrease over the caregiving period, after leaving the caregiver role, they experienced uplifts in health but nearly twice as many doctor visits, which the author interprets as a strengthened awareness of their own health, neglected while a caregiver.

In contrast to these mostly negative associations, other studies draw a more ambivalent picture. For example, Vlachantoni et al. (2012), in their review of caregiving's impact on health measures in Britain, underscore the ambiguous results on caregiver characteristics. In an analysis of the differences between cross-sectional and longitudinal studies, they also find that, depending on the sample and model used, cross-sectional analyses may find positive, negative, or no correlation. In particular, they highlight a study by O'Reilly et al. (2008), based on a sample from the Northern Ireland Census, which shows that caregiving is related both to poorer health *and* lower levels of physical impairment and mortality. Although this link between caregiving and lower mortality is supported elsewhere (Brown et al., 2003), Schulz and Beach (1999) demonstrate that mortality rates are higher among caregivers who report emotional strain than among noncaregivers. On the other hand, caregivers who do not report a high burden from their tasks seem to have the same mortality risk as the comparison group. O'Reilly et al. (2008) therefore conclude that previous literature underestimates the positive health outcomes associated with caregiving.

One possible explanation for this ambiguous outcome is that caregiving can induce a psychological uplift that may increase physical health by enhancing well-being (Ashworth & Baker, 2000). Another explanation may be self-selection out of the caregiver role when the severity of the physical impairment makes care impossible. In such cases, public support could provide different options for selecting out of the caregiver role when the adverse health effects become too severe or at least reduce the care intensity. Empirical evidence for this notion is provided by Dujardin et al. (2011), who show in a country comparison that a heavy care burden, although more prevalent in Britain than in Belgium, has a less adverse

health effect for British caregivers, probably because of the better public support. If researchers are to avoid biased results, therefore, they must additionally account for self-selection into caring. For example, although it seems rational to assume that when caregivers have free choice, only those with robust health are likely to become caregivers, Coe and Van Houtven (2009) find decreased self-rated health measures for both male and female care providers even after they account for self-selection.

Table 2.2: Studies on Informal Care and Health

Author	Data	Controls	Key results
Literature review or meta study			
Black & Almeida (2004)	Review of 30 cross-sectional (meta-analysis) and 12 longitudinal (1990-2001)	–	Behavioral and psychological symptoms of dementia correlate with caregiver burden, but only to a small degree with depression
Cooper et al. (2007)	Review of 32 studies (1988-2005)	–	One fourth of dementia caregivers reported clinically significant anxiety levels, higher than the noncaregiver controls. Coping, perceived burden, and physical health were the only clear associations found
Etters et al. (2008)	Review of literature (1996-2006)	–	The dementia caregiving burden leads to deterioration of caregiver health, which can result in early nursing home placement
Lim & Zebrack (2004)	Review of 19 studies (1987-2004)	–	Care receiver and caregiver characteristics, coping methods, and social support are predictors for caregiver quality of life measures
Pinquart & Sörensen (2003a)	Review of 228 studies(1966–2002)	–	Behavioral problems, physical and cognitive impairment, and care time increase depression, and spouses who provide care are often more burdened than adult children
Pinquart & Sörensen (2003b)	Review of 84 studies(1987-2002)	–	A comparison of caregivers with noncaregivers shows significantly lower mental health but only small differences in physical health. Dementia caregiving had stronger effects

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Author	Data	Controls	Key results
Pinquart & Sörensen (2006)	Meta-analysis of 229 studies (1983- 2005)	–	Differences between female and male carers were small. Women perceived greater adverse effects of care with regards to burden, depression, well-being, and physical health
Pinquart & Sörensen (2007)	Review of 176 articles (1982-2006)	–	Reasons for physical downturns can be found in psychological associations with care. Being older, male, or a dementia caregivers increases the risk for physical health problems
Savage & Bailey (2004)	Review of 26 studies (1979–2002)	–	Care recipient disabilities and residency influence the impact of caring on the caregiver.
Schoenmakers et al. (2010)	Review of 207 articles on dementia caregiver (1990-2009)	–	Caregiver characteristics are more important for the observed negative impact on health than for objective care needs.
Schulz et al. (1990)	Review of 33 articles (1978–1990)	–	Caregivers tend to have higher levels of psychiatric symptoms than the average population
Schulz et al. (1995)	Review of 41 articles (1989–1995)	–	Substantial evidence in the literature that dementia caregiving leads to higher levels of depression

Author	Data	Controls	Key results
Vlachantoni et al. (2012)	Review of 20 studies (1992-2012)	–	Caregiver characteristics are important; longitudinal designs tend to show less severe effects on health outcomes
Vitaliano et al. (2003)	Meta-analysis of studies 45, based on 23 samples of dementia caregivers (1987-1999)	–	Small but significant correlation with several health outcomes, including subjective self-assessed health and objective measures (e.g., biomarkers)
Yee & Schulz (2000)	Review of 30 reports (1985-1998)	–	Caregivers report higher psychiatric morbidity than noncaregivers. A gender comparison shows women are more affected than men.
Studies accounting for or ruling out endogeneity and/or account for unobserved heterogeneity			
Coe & Houtven (2009)	N=3316, subsamples of the Health and Retirement Survey (1992-2004, L)	Dynamic model, instrumental variables, random-and fixed-effects, family relationship, caregiver demographics	Negative impacts on physical health emerge with a 2-year delay
Amirkhanyan & Wolf (2006)	N=7,009, Health Retirement Study (1996,1998, 2000, L)	Family relations, care recipient ADL, caregiver demographics, random-effects	Generally, noncaregivers whose parents need money for transportation are more likely to show symptoms of depression than caregivers without disabled relatives.
Other studies			
Ashworth & Baker (2000)	N=23, Qualitative interviews with caregivers	–	About 40% of caregivers report positive outcomes of caregiving

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Author	Data	Controls	Key results
Bookwala (2009)	N=716, National Survey of Families and Households (1987/88, 1992/94, 2001/02, L)	Selection into caregiving, caregiver demographics	In contrast to female caregivers, males show a decline in depression symptoms over time. Experienced caregivers are significantly less happy in their marriages than recent caregivers
Chappell & Reid (2002)	N=243, telephone interviews in British Columbia, Canada , C)	SEM models, care recipient characteristics, caregiver demographics	Perceived social support (+), self-esteem (+), informal care hours (-), and burden (-) have a significant influence on caregivers' mental health
Cohen et al. (2002)	N=289, subsample from the Canadian Study of Health and Aging (1996, C)	Stepwise regression, caregiving relationship, residency, care receiver, caregiver age, and gender	73% of caregivers perceive at least one positive outcome of caregiving, which positively affects mental and physical health
Dujardin et al. (2011)	Census data from Britain (N=1,361,222) and Belgium (N=4,368,637)	Logit, caregiver characteristics, regional matching	Caregiving is more prevalent in Britain than in Belgium, but British caregiver have better health
Gräsel (2002)	N=681, caregivers, re-interviewed after 12 months	MANOVA	Terminating the caregiver role is associated with uplifts in health and frequency of doctor visits
Hirst (2005)	N=25,000, British Household Panel Survey (1991-2000, L)	Logit, care intensity, care duration, care location, and relationship	Starting or leaving intense caregiving is associated with high psychological distress
Lawton et al. (2000)	N=634, Volunteer female sample (1990–1994, C)	MANOVA, comparison of new and veteran caregivers	Only a small amount of evidence exists for a negative link between caregiving and subjective well-being
Legg et al. (2013)	N=44,465,833, UK Census (2001, C, including 5,451,902 caregivers)	Level of caregiving, caregiver demographics	Caregivers providing more than 20 hours care per week report lower levels of health

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Author	Data	Controls	Key results
Mentzakis et al. (2009)	N=84,000, British Household Panel Survey (1991-2004, L)	Estimates supply of care, lagged care, caregivers, household, and formal care controls	The extensive margin shows a negative significant correlation between health and the probability to provide care
O'Reilly et al. (2008)	N=974,450, Northern Ireland Census (2001, C)	Level of caregiving, caregiver demographics	Caregivers show lower levels of mortality than noncaregivers. The effect is especially large for female, older, and generally sick caregivers
Raschick & Ingersoll-Dayton (2004)	N=978, National Long-Term Care Survey(1999, C)	Two-step hierarchical regression, care recipient disabilities, relationship, caregiver gender	Women perceive more caregiving costs than men, and adult children receive higher emotional rewards than spouses
Schulz & Beach (1999)	N=819 aged 66-96 years for four US communities (1993-1998, L)	Caregiver baseline health with a 4-year follow-up, caregiver demographics	Perceiving a high burden from caregiving increases mortality risk

ADL = Activities of daily living, MANOVA = Multivariate analysis of the variance, SEM = Structural equation model

2.3.3 Family Implications

Caregiving competes with leisure time, which is usually spent with family members and helps maintain healthy family relationships. The time for leisure, however, is drastically shortened when caregiving lasts for hours or must be combined with a regular workday. Caring for co-residing elderly, in particular, not only influences a family's daily life but decreases the well-being of both caregivers and their family members (Amirkhanyan & Wolf, 2006). Yet the effect of caregiving on the entire family has received only marginal attention in the research. The few studies that do exist (see table 2.3) focus especially on informal caregiving's effect on married couples. For example, Bookwala (2009)[17] finds that among a sample of adult caregiving daughters and sons, experienced caregivers are significantly less happy in their marriages than those who have just assumed the caregiving role.[18] Likewise, former caregivers experience greater differences than recent caregivers, long-term caregivers experience more than noncaregivers, and, in terms of gender inequality, these effects are stronger for females in both groups. These findings are consistent with the already cited research showing that it takes time for the impacts of caregiving to manifest in any measurable magnitude and that downturns in overall life satisfaction come to include downturns in satisfaction with family life.

On the other hand, Litvin et al. (1995) argue that if care provision is exogenous, then the double burden perceived by married caregivers can be counterbalanced by spousal support in the caregiving process. In fact, Brody et al. (1995) do find that well-being among married caregivers is highest, while never-married caregivers are

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[17] For details, see Table 2.2.

[18] Bookwala (2009) observed three caregiver groups in three waves: T1 (1987–1988), T2 (1992–1994), and T3 (2001–2002). Caregivers in T1 were subjected to a baseline interview, "experienced caregivers" provided care in T2 and T3, but only "former caregivers" provided care in T2 and only "recent caregivers" in T3.

less likely to co-reside with parents than their married counterparts. Moreover, although married daughters do not differ significantly from separated and divorced female caregivers in terms of co-residency, there are directional differences: whereas most of the latter have moved back into their parents' home, the majority of married caregivers co-reside in their own dwelling. This pattern appears to be driven by the opportunity to provide better care, on the one hand, and by financial problems, on the other, particularly in the case of divorced daughters. In fact, Young and Grundy (2008), using data for England and Wales, find that the share of caregivers is higher among the never married than among married or formerly married men and women.

In an attempt to describe the decision-making process within the family, Pezzin and Schone (1999) develop a theoretical model in which parents and their children (in this case, only daughters) both agree to a Nash bargaining rule by which the household formation itself is endogenous.

Table 2.3: Studies on Informal Care and Family

Author	Data	Controls	Key results
Brody et al. (1995)	U.S. sample of 364 daughters sharing households with their elderly parents	ANOVA, linear regression, caregiver and care receiver characteristics.	Married daughters fared best in well-being, which may be related to higher income, social support, and more helpers in caregiving.
Litvin et al. (1995)	U.S. sample of 522 primary caregiving daughters	ANOVA	Even though the family can support caregivers, married women suffer most from competing demands of caregiving
Young & Grundy (2008)	N=110,464, UK Census data from the Office for National Statistics Longitudinal Study (1981-2001, L)	Logit, caregiver characteristics	Singles might be more likely to provide care because of financially limited access to formal care. Women showing lower attachment to the labor force after child birth were more likely to become caregivers
Pezzin & Schone (1999)	424 parent (60+)-daughter pairs from the Hebrew Rehabilitation Center for the Aged (HRCA) Survey of the Elderly and HRCA-NBER Child Survey (1986-87, C)	Maximum likelihood, parent and child characteristics	Children select into the caregiver and co-residing roles based on opportunity costs: employment and competing demands

ANOVA = Analysis of Variance

Both parents and daughters want to maximize their utility dependent on altruism, informal care, formal care, and leisure time and will only co-reside if both parties derive positive utility from this solution. Maximal family consumption depends on satisfaction of the parents' care needs by allowing the daughter to (i) provide informal care herself and trade off leisure or (ii) increase financial transfers for a formal care solution. Substitution between the two choices depends on the daughter's wage, with higher opportunity costs for care leading to a lower probability of providing informal care and therefore shared residency. The authors test their theoretical approach using a complete data set of 424 parent-daughter pairs from Israel. Their estimates show significantly negative coefficients for married daughter, daughter's age, and number of daughter's children. For married parents, the likelihood of co-residency is small but increases significantly with degree of parent impairment.

2.4 Conclusions

As an aging population increases the demand for caregiving, societies are being forced to develop strategies for providing a sufficient supply of care, a large share of which is informal. Hence, to formulate successful policies, policy-makers must be aware not only of the social implications of informal care's effects on the caregiver but of the economic consequences of changes within the care arrangements. Yet although the implications for the job market have become of major interest to researchers in recent years, the findings on informal caregiving's overall effect remain ambiguous. Whereas most studies report a negative link between care and employment, some relate a reduction in employment or work hours only to specific characteristics, with female co-residing caregivers being the most affected. The magnitude of these effects, however, appears rather small:

caregivers seem to have a lower attachment to the labor force even before they enter the caregiver role. Likewise, the probability of informal caregivers being employed is at most 5–10% lower than that for noncaregivers. Stronger effects could be obtained for very intense caregiving, which is provided primarily by females of working age, who are less likely to be fully employed and earn generally lower wages. Only high family income and strong social support enables families to freely choose an arrangement that is satisfying to all family members, so willingness to care remains a result of circumstances. Even with full employment, low wealth and no alternatives within the family increase the pressure to provide care (Carmichael et al., 2008).

For psychological health measures, the results are more homogeneous: the majority of studies find a negative impact of caregiving on mental health. That is, even though caregiving can create psychological uplifts, the negative consequences tend to dominate, particularly for female and spousal caregivers. Such negative outcomes not only affect the caregiver per se but also the caregiver's family. As regards physical health, there is less conclusive evidence for specific risk groups within the literature: the general negative association of caregiving and physical health outcomes is often related to psychological downturns.

The link between marital status and caregiving is twofold: first, married caregivers seem to cope best with the caregiving burden, possibly because of more social support and a better financial situation. Second, the generally accepted reality that too much stress can harm a relationship also holds for caregiving, in which a longer duration of care negatively affects marital satisfaction. Nevertheless, the empirical findings are sparse, so further research is needed.

It should also be noted that the three categories analyzed in this paper

(employment, health, and family) mutually affect each other. For example, occupation and marital status both affect health levels while poor health is linked to both unemployment *and* working overtime (Bell et al., 2012; Brown et al., 2012), but being married is associated with higher levels of both income (Antonovics & Town, 2004) and health (Helmert & Shea, 1998). As important, these effects are not only cumulative but may spill over into other domains and reinforce each other. For instance, combining full-time work and care can be related to lower health (Farfan-Potret et al., 2009) or a higher usage of antidepressants (Schmitz & Stroka, 2013). Likewise, downturns in psychological health generated by the caregiving burden could affect work performance and thus increase the risk of unemployment, which is itself a psychological stressor. Obviously, these linkages are complex and require sophisticated analysis if the different effects are to be isolated.

The majority of existing studies, however, are subject to methodological shortcomings, including nonrepresentative or small samples, limited use of control variables (Bobinac et al., 2010), and widespread use of cross-sectional analyses (Schulz et al., 1990). In particular, because decisions to provide care can be endogenous with the outcomes of interest (Coe & Van Houtven, 2009), not accounting for selection in and out of the caregiver role or simultaneous decision-making biases empirical findings. Nevertheless, with regard to employment, recent studies raise doubts about the endogeneity of its relationship with care (e.g., Bolin et al., 2008b; Ciani, 2012; Meng, 2012; Van Houtven et al., 2013; Nguyen & Connelly, 2014) or criticize the approach being used (Hassink & Van den Berg, 2011). Nor should analyses be restricted to the individual caregiver: if studies are to obtain conclusive evidence on the effects of caregiving, they must also

incorporate caregivers' families and formally supported alternatives (Amirkhanyan & Wolf, 2006).

Today, such alternatives to informal care are finding an increasing market and are, to some extent, available in all developed countries. With the right public policies, therefore, formal support can relieve caregivers (Bolin et al., 2008a) and help care receivers avoid hospitalization (Bonsang, 2009; Jiménez-Martín & Prieto, 2012). However, because caregiving arrangements are heterogeneous, flexible public support is needed that is adaptable to caregiver needs. Based on our analysis, we draw two conclusions related to achieving this goal: first, even though the individual outcomes on employment and health seem rather small, the literature suggests that the effects of caregiving are mostly negative. Such negative outcomes must therefore be considered part of the cost of informal care when defining the opportunity costs of formal care subsidies. Second, most studies reviewed find that the caregiver burden is higher for women than for men. One contributory factor may be that traditional gender roles place greater pressure on women to commit to the caregiver role, even though they face relatively higher caregiving costs, different expectations that contribute to the existing gender wage gap. As demand rises, it seems likely that, despite increasing female labor force participation and the softening of traditional gender roles, women will be more at risk of having to deal with a family member in need of care.

3 Informal Elderly Care and Caregivers' Subjective Well-being[19]

Abstract

Because of an ageing population and declining fertility rates, the topic of informal care for the elderly is gaining in importance. This paper uses panel data from the German Socio-Economic Panel (GSOEP) to analyze the effects of informal care provision on caregivers' subjective well-being. We also disentangle the effects of long-term care arrangements to provide insights into the ambiguous findings reported in the literature on long-term care effects on subjective well-being. Specifically, we show that the time spent caring has a non-linear effect, with subjective well-being declining in the first years of care provision but then increasing again, and that more care time is generally associated with lower levels of subjective well-being, albeit primarily in individuals born between 1920 and 1959. As regards the relation between well-being and caregiver co-residency, we find only a negative association, which supports either the "wear-and-tear" or "adaptation" models, depending on whether care time or residency is the subject of analysis. The amount of income needed to compensate a caregiver's loss in well-being amounts on average to approximately €7 per hour.

3.1 Introduction

Germany's ageing population has been the most important contributing factor to the steady rise in individuals needing care from the German Long-Term Care Insurance (LTCI), who now number about two and a half million. This demand for care, which has risen 4% in only 2 years (Federal Ministry of Health, 2009), will most probably continue to increase in the coming decades, with more than four million patients predicted to need long-term care by 2050 (Hackmann & Moog, 2008). At the same time, the supply of caregivers (CG) is declining for a number of reasons. First, with increasing female education and employment, female CGs (who have traditionally provided most of the care) are facing higher opportunity costs of informal care (Thome & Birkel, 2005). At the same time, the persistently low fertility rate in Germany is decreasing the number of potential CGs for older generations, meaning that the burden of intergenerational care is now distributed among fewer children, which increases the individual share. This latter effect is further reinforced by the children's mobility: today's families tend to be more geographically distributed than in the past (Röß, 2011), making daily care provision more difficult. In addition, women not only have fewer children than in the past, they also have them later in life, which, combined with children remaining longer in the parental home, often means that women are still burdened by their own children in their 50s, which makes caring for elderly parents more difficult. Finally, higher divorce rates have led to more single elderly households (Mager & Eisen, 2002), meaning no partner on whom individuals in need of care can rely.

This probable increase in demand accompanied by a decrease in supply has led policy makers to seriously reassess the role of formal versus informal care in Germany (Campbell et al., 2009), not least because formal care is considerably

more costly for the LTCI than informal care. In fact, to keep LTCI insurance premiums as low as possible the German Social Law stipulates that informal care must take priority over any other stationary care arrangements[20]. Hence, to promote domestic care solutions, policy makers have recently introduced new legislation that – in addition to the financial benefits already in place – provides further incentives for prolonged home treatment aimed at reducing the negative impact on CGs' careers[21].

Such informal care solutions are also usually preferred to formal care by most care receivers (CRs) and CGs (Schneekloth & Leven, 2003). Yet even if relatives provide informal care voluntarily, this duty constitutes a burden whose physical and psychological toll is empirically well documented (Schulz et al., 1990, 1995; Pinquart & Sörensen, 2003). For example, one strand of the (primarily medical) literature assesses how providing informal care affects the subjective well-being (SWB) of CGs (see, e.g., George & Gwyther, 1986; Yates et al., 1999; Yee & Schulz, 2000; Chappell & Reid, 2002; Bookwala, 2009), showing that, despite major differences in magnitude, caregiving is generally associated with a decline in well-being. Other empirical studies, in contrast, document positive psychological effects of caregiving (i.e., Kramer, 1997). These differing results are variously attributed to "wear-and-tear," the erosion of CGs' resources and well-being over time by the accumulation of caregiving demands, or to the long-term effects being driven by CGs' "adaptation" to their new situation, making the negative effects only short-lived (Brickman & Campbell,1971). Overall, however, the results from

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[20] See §3 of the German Social Law (Sozialgesetzbuch, SGB).
[21] LTCI benefits are regulated under SGB §36 -37; new legislation can be found in the German Care Time Law (Pflegezeitgesetz)

longitudinal studies on caregiving's long-term impact on well-being are inconsistent (Bookwala, 2009).

Such inconsistency is perhaps not surprising given that this literature, albeit extensive, is hampered by a number of methodological and design problems, including the (nearly exclusive) use of cross-sectional data, unrepresentative data sets, and unreliable statistical methods that report simple correlation coefficients. These latter fail to take into account the impact of other potential SWB determinants, while the regression analyses using cross-sectional data allow no conclusion of causality because of omitted and unobservable personal characteristics. Moreover, most studies rely on self-reports (of SWB and informal care), meaning that the association identified between informal care and SWB could in fact be driven by "third factors" like personality traits of neuroticism, hardiness, extroversion, or negative affectivity; and most analyze specific populations, making generalizations problematic.

Our paper, besides being, to our knowledge, the first representative analysis of the effects of informal care on CGs' well-being in Germany, contributes to this research stream by examining the relation between informal care and SWB in a way that remedies some of the above shortcomings. Most particularly, our use of a rich set of covariates in the regression analysis partially eliminates the impact of other SWB determinants that may potentially correlate with eldercare provision. Likewise, our use of 10 years of data from the GSOEP allows us to control for such unobservable individual characteristics as affectivity, thereby enabling more convincing conclusions about causality.

The paper is structured as follows: the next section reviews the pertinent literature on the effects of care on CGs' SWB. Section 3 then describes the data and methodology. Section 4 reports the results, and section 5 concludes the paper.

3.2   Prior Research[22]

Medical and gerontological research, which began addressing the effects of domestic caregiving on CGs in the late 1970s (George & Gwyther, 1986; Kramer, 1997), has generated a rich body of literature focused on such diverse outcome variables as CGs' SWB (George & Gwyther, 1986; Yates et al., 1999; Yee & Schulz, 2000; Chappell & Reid, 2002; Bookwala, 2009), employment (Heitmueller, 2010), and even marital relations (Bookwala, 2009). Given our research interest, we concentrate particularly on the literature that focuses on SWB.

Several meta-analyses give an overview of this literature with particular attention to its psychological implications. A study by Schulz et al. (1990), for example, reviews 33 articles from 1968 to 1990 in order to identify the psychiatric morbidity effects caused by caregiving. Most of the studies reviewed assess these psychological effects using multi-item scales that include questions about general well-being or happiness. Although the evidence overall suggests that CGs tend to show above-average psychiatric symptoms, the findings are far from conclusive because of major methodological shortcomings. In a subsequent review, Schulz and colleagues (1995) concentrate on 41 papers, published between 1990 and 1995, that focus on the well-being effects of caring for dementia patients – a form of care that places a high burden on CGs. Their general conclusion is that providing care for dementia patients leads to higher levels of depressive symptoms.

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[22] This section partly relies on an earlier version of Bauer and Sousa-Poza (2015)

A more recent review by Pinquart and Sörensen (2003a), which covers 228 studies between 1966 and 2002, focuses on the psychological effects of elderly caregiving on the CGs. These authors cluster the studies based on similar characteristics related to outcome (CG burden or depression), sampling (probability or convenience samples), impairment (dementia, non-dementia, or mixed patients), and relationship to the CG (spouse or adult children). They find overall evidence that behavioral problems (i.e., disruptive and aggressive behavior), physical and cognitive impairment, and the time spent on caregiving burdens the CG and increases symptoms of depression, with behavioral problems being particularly important when caring for demented CRs.[23] They also report that spouses who provide care are often more burdened than adult children who act as caregivers. Savage and Bailey (2004) likewise examine the impact of caring on CGs' mental health, but cluster relevant papers from primarily medical databases according to different factors associated with CGs' burden. They find that the care relationship is an important factor for mental health outcomes, with closer relationships inducing more positive outcomes for the CG. They also find evidence that mental impairment among CRs negatively affects CGs' well-being, an effect enhanced by financial restrictions and lack of social support.

To assess the impact of caregiving on general well-being, George and Gwyther (1986) apply four generic categories – physical health, mental health (which also contains a single-item measure of life satisfaction), social participation, and financial resources – to a sample of family members caring for memory-impaired

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[23] The relationship between adult children and their parents, however, is often shaped by conflicting norms and can thus be linked with a higher burden perception (Young & Kahana, 1989; Lye, 1996).

older adults. Specifically, these authors compare CGs' overall SWB to adjusted values from other population-based samples in order to calculate the difference in well-being between CGs and random community samples of non-CGs. Their final sample consists of 510 family CGs, who have a 20% lower level of self-reported life satisfaction than the control group. The authors conclude that the CGs' burden is driven primarily by their relatively lower levels of mental health and social participation.

More recent research focuses not only on the negative outcomes of caregiving but also increasingly on its positive effects, which tend to be perceived indirectly. That is, it is not the actual care task that (directly) triggers higher satisfaction but rather the feeling of having provided care and done something good (McDaid, 2001). For example, Ashworth and Baker (2000) ask 23 CGs aged between 14 and 85 in London about how they experience their care arrangement and what they think about respite care. They report that about 40% of the CGs interviewed expressed positive satisfaction with care provision. According to Chappell and Reid (2002), in their path analysis of 243 CGs identified by random-dialing in British Columbia, Canada, such experience may be influenced by social support and coping strategies, while the number of hours that informal care is provided increases the probability of being burdened and directly decreases CG well-being.

Amirkhanyan and Wolf (2006), using data from three waves of the Health Retirement Study (3,350 men and 3,659 women), further point to an age effect: older CGs seem to show lower symptoms of depression than younger CGs. Nevertheless, care provision affects the well-being of the entire family and having a parent in need of care increases the likelihood of depression. This effect, they argue, is one that many studies fail to consider, an omission that leads to a risk of

bias in simple comparisons between CGs and non-CGs, which cannot clearly differentiate whether well-being is derived from care provision care or influenced by having a family member with bad health.

Depression and impact on the family are also a major focus of Bookwala's (2009) study of the long-term impact of providing care to an ill or disabled parent (or parent-in-law), which draws on three waves of data collected over a 15-year period and a probability-based sample drawn from the National Survey of Families and Households (N = 716). Using well-being and marital quality as outcome indicators, this author finds some support for the wear-and-tear model, showing a decline in CGs' marital quality over time. In terms of depression symptoms, her research also shows different outcomes for men and women: women experience a higher probability of depression after a certain time of caring, whereas men's depression levels decrease over the same amount of time. Such gender differences are also illustrated by Raschick and Ingersoll-Dayton (2004), who use a cross-sectional subsample of 978 CGs from the 1999 National Long-Term Care Survey to compare the perceptions of men versus women. They report that women perceive more caregiving costs than men, tend be more burdened by caregiving experience, and show lower levels of life satisfaction. They also find that adult children receive higher emotional rewards than spouses, which may stem from the qualitative differences in the care situation; that is, spouses face more intensive responsibilities than do adult children.

This research overview, although it refers mostly to findings for the U.S. with only limited evidence for other countries, suggests several conclusions. First, in line with theoretical reasons to expect both a positive and a negative effect of caregiving on CGs' well-being, as well as differences in sampling strategy, duration of study,

and type of care experiences examined (Bookwala, 2009), the empirical evidence is mixed. Second, the majority of studies are subject to several methodological shortcomings, including non-representative samples, small sample sizes, limited use of control variables, and widespread use of cross-sectional analyses. According to Leigh (2010), for example, most of the caregiving research fails to account for omitted variable bias by ignoring important individual characteristic. His study, which uses 7 years of panel data from the Household, Income and Labour Dynamics in Australia survey (N = 10,000), controls for individual fixed effects and identifies no significant impact of caring on CG's well-being.

3.3 Methodological Issues and Data

Data

This analysis is based on the GSOEP[24], a survey administered by the German Institute for Economic Research, which provides a rich longitudinal data set. Begun in 1984, by 2010, the GSOEP incorporated 27 annual waves, had more than doubled its sample size over time, and covered 22,870 individuals (based on individual questionnaires). The GSOEP survey asks questions of all household members older than 16 years and also administers a household questionnaire (HQ) to heads of household on behalf of all household members (there were 16,099 households in 2010). Households are picked by regionally pooled multi-stage sampling, combined with a random walk selection. For detailed information about the survey, see Huber et al. (2011).

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[24] The data used in this paper was extracted using the Add-On package PanelWhiz for Stata.PanelWhiz (http://www.PanelWhiz.eu) was written by Dr. John P.Haisken-DeNew (john@PanelWhiz.eu). See Haisken-DeNew and Hahn (2006) for details.

Variables

Although the survey began as far back as 2001 to include a question on the hours spent on "care and support of persons in need of care", semantically, the question in German differs slightly from the English translation[25]. That is, the word "pflege" is more of a medical term than "care" and focuses primarily on nursing tasks. This same section also asks about the time spent on housework (washing, cleaning, and cooking), particularly child care, implying that these tasks are most probably not covered by the care variable. In addition, the questionnaire only includes this question for a typical weekday in each wave and only asks about time spent caring on a typical Saturday or Sunday every second year. Hence, creating the main independent variable of "care time" poses two main challenges.

First, an approximation is needed to estimate the time spent on caregiving on weekends in those waves that do not include this question. Although theoretically, we could simply use the workday values for weekends, this method proves unsatisfactory because time spent on care on the weekends differs significantly from that spent during workdays.[26] We therefore impute the values from past waves for which all three variables are available; for example, we use 2001 values for the weekends in 2002. Second, the values for our care time variable, which represents the time spent weekly on caring for a dependent person, range from 0 to 168 hours, meaning that some respondents reported spending every hour of the week caring for a dependent person. These numbers suggest that people interpret care not only as physical care tasks but also as supervision of their protégé. Given that earlier studies report higher hours of care time for people with mental health problems who

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[25] The German formulation being: "Versorgung und Betreuung von pflegebedürftigen Personen".

[26] Two-way t-tests show significantly higher means in every wave for weekend care time.

cannot be left unattended at any time (Ory et al., 1999), we do not exclude these observations from our estimation.

For our main measure of well-being,[27] we use responses to the question on overall life satisfaction, available in every wave, which participants rank on a 10-point scale from 0 (completely dissatisfied) to 10 (completely satisfied). If the pure effect of the informal care burden on CG's well-being is to be estimated, however, it is crucial that we control for all other variables that affect it; specifically, the main socioeconomic determinants of SWB (Diener et al., 1999; Blanchflower & Oswald, 2008), including age, health, income, education, marital status, employment, and children in the household. In addition, because our panel analysis must necessarily be based on waves 18 (2001) to 27 (2010), for which we have care time data, we also include wave dummies.

As regards CR characteristics, the information in the GSOEP is limited; that is, the data set includes information about a care recipient only if that recipient is living in the household covered by the GSOEP. All 27 waves[28] do, however, include data from a section of the HQ that explicitly poses questions on informal care situations, such as the type of care received and the relationship to the CG. Hence, to investigate the impact of residency, we add a dummy indicating whether or not a CR lives in the household, which allows us to measure the effect of "care time" separately from a CR's place of residence. Finally, to shed light on the "wear-and-tear" versus "adaptation" models, we investigate the long-term effects of providing

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[27] For a discussion of the problems in measuring well-being, see Peichl and Pestel (2012); Juster and Stafford (1991); Warr (1990).

[28] Because the design of the GSOEP does not provide a direct link between CG and CR information in the HQ, we assume that a CG who spends some time on care and has a CR in the household (who receives family care) devotes all care time reported to this relative. Such an approximation will only create a bias if an additional CR is not covered by the GSOEP sample. We are confident, however, that this approximation creates only minor noise in the data.

care by including a variable that measures the accumulated number of years that CGs have provided care, including also a squared term to capture possible non-linear effects.[29] The resulting descriptive statistics are outlined in the Appendix A Table A 1 to A 6.

Methods

Model I

In model I, we use a sample of 33,994 individuals to measure the overall impact of providing care on SWB. In a first step, we use a standard fixed-effects (FE) model in the expectation that unobservables will depend on individuals' emotional resilience and skills for coping with stress.[30] We thus treat our dependent SWB variable as a cardinal and estimate an FE model of the following form:

$$w_{it} = \beta c_{it} + \gamma X_{it} + \mu_i + \varepsilon_{it} \qquad for\ t=1,..,T\ \&\ i=1,..,N \qquad (1)$$

where w_{it} is the SWB of the CG, c_i the time spent on care, and X_i a vector of other control variables. ε_i is the error term, and μ_i is a fixed constant variable capturing the unobserved heterogeneity in the error term.

For a consistent and efficient application of the FE model, we need a metric dependent variable, but most well-being indicators are measured on an ordinal scale. Using a standard FE regression with an ordered dependent variable, however, might bias our results (Baetschmann et al., 2011), a non-metric variable issue that

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[29] The counting of years begins with the 2001 wave when this question is asked for the first time. We cannot know, however, how long beforehand respondents were caregivers. We therefore test for this bias using an additional sample beginning with the 2002 wave and simply looking at those who were not CGs in 2001.

[30] A Hausman test supports the link between individuals and the unobserved effect and rejects the consistency of a random-effects model.

several panel models have been developed to address (Das & Van Soest, 1999; Ferrer-i-Carbonell & Frijters, 2004). We therefore test for a possible bias from the ordinal nature of our dependent variable using the fixed effect ordered logit model proposed by Baetschmann et al. (2011), a so-called "blow-up and cluster" estimator (BUC) whose consistency fares well in comparison to the FE model and other estimators for ordered dependent variables. Riedl and Geishecker (2011), for example, find that in Monte Carlo simulations, the BUC estimator outperforms all other models, especially for the GSOEP well-being variable, which contains 11 categories.

Specifically, the BUC estimator blows up the sample with K–1 copies of every observation and then dichotomizes them at different thresholds so that a conditional maximum likelihood logit can be estimated on the entire "blown-up" sample. Because some individual observations contribute to several terms in the log-likelihood, standard errors are clustered at the individual level:

$$w_{it}^* = \beta t_{it} + \gamma X_{it} + \mu_i + \varepsilon_{it} \tag{2}$$

The estimation of the latent variable w^*_{it} is based on the independent variables and the two error terms (u_i, e_{it}). w^*_{it} is approximated by an ordered variable w_{it}, which follows the rule:

$$w_{it} = k \quad if \ \tau_k < w_{it}^* < \tau_{k+1} \tag{3}$$

Here, the thresholds must strictly increase, running from $-\infty$ for t_1 to $+\infty$ at t_{K+1}. In addition, because the literature reports gender differences associated with the effect

of caregiving on SWB, we run separate regressions for men and women.

Model II

An important control variable in this context is CG age because, besides the possibility of different perceptions among different age groups in providing informal care, caring can be physically demanding. Assisting recipients with mobility and personal hygiene, particularly, requires physical strength, which is very likely to differ among age groups. Model I, however, provides no differentiated perspective of ageing effects because time-demeaning age with an FE model in a 10-year panel data set subtracts most of the age effect. With longitudinal data, on the other hand, three separate time effects can be differentiated that could influence perceptions of caring: cohort, age, and period effects.

The first type, the cohort effect, refers to the influence of the conditions surrounding individuals born at the same time. For example, it is likely that, besides their actual age, those born before World War II experienced their environment differently at age 70 than will the baby-boomer generation at the same age. The age effect, in contrast, distinguishes the changing perceptions of people at different ages. For instance, 20-year-olds, being in the early stage of their lives, do not have the same values and experiences as 60-year-olds, a difference that we control for by using age and age-squared in the fixed-effects model. This effect of age on well-being is demonstrated in several studies, which also show that it tends to be U-shaped over the life course (Blanchflower & Oswald, 2008; Schilling, 2005). In Germany, this U-shaped relation between aging and well-being seems to apply particularly to those under 65, with a health-related decline in life satisfaction occurring at age 75+ that can be largely attributed to cohort effects (Gwozdz & Sousa-Poza, 2009; see also López Ulloa & Sousa-Poza, 2012). Although certain

dimensions of well-being decline, however, others may remain constant (Kunzmann et al., 2000).

The third type of effect, the period effect, occurs only in panel data and is hard to separate from the cohort effect. Nevertheless, there is no doubt that being 60 in 2001 differs from being 60 in 2010, not only because of the cohort or age effect but because general well-being can differ on account of macro events (e.g. recessions). We therefore control for period effects by using dummies for every wave. To account for all three effects, we run separate regressions for seven decades in which we also control for waves and age.

Model III

Our third model pays specific attention to Amirkhanyan and Wolf's (2006) contention that the impact on CG's well-being is influenced more strongly by the presence of a CR in the household than by the fact of providing them with care (also see Bobinac et al, 2010). To test this assumption, we create three dummy variables: (i) CGs who provide care to CRs living in the same household, (ii) individuals living in the same household as the CR who do not provide any care, and (iii) CGs who provide care to CRs that do not live in the same household. The reference category is composed of individuals who neither provide care nor have a CR in their household, a differentiation that should provide further insights into the care effects not captured by our care variable.

For this model, we run three estimations that build upon one another. The first, model IIIa, designed to identify the effect of the care arrangements and how the CGs' SWB differs from that of those unaffected by caregiving, contains only the three dummy variables that separate the sample into four groups. Model IIIb then controls for the actual amount of care time provided in order to assess the pure

impact of the domestic situation. Model IIIc simply adds in a quadratic function of "care" using the control variables mentioned above.

To gain additional insight into how the presence of a CR within a household effects the SWB of a household member, we observe caregiving households over a certain amount of time and compare the SWB of the members before and after a CR enters the household or a household member becomes a care recipient (see Clark et al., 2008a). More specifically, we identify the first year in which one of the household members is in need of care and then compare the impact on the SWB of a CR in the household to a baseline set 5 to 9 years before the event. We then add dummy variables for 3-4 years, 2 years, and 1 year before the event; the year of event; and 1–2 years, 3–4 years, 5–7 years, and 8 or more years of shared residency with the person in need of care. We run the FE regressions using 1,715 household members (8,111 observations) in an unbalanced panel in which the average person is observed for 4.7 years.

Model IV

Because perceptions of the care situation can be influenced by different relationships between CGs and CRs, we specifically analyze this relational aspect using the information reported by the head of household on the HQ about who provides care to whom. Although focusing specifically on CGs who provide care to a person living in the same household reduces the sample size to 1,452 individuals (with 4,947 observations), it does allow us to identify the family structure. We then create layers of generations within the household and two different categories of care arrangements: "intragenerational care", when people provide care within their own generation (e.g. spouses and siblings), and "intergenerational care", when individuals provide care to a member of an older

generation (e.g., parents or grandparents)[31].

Model V

The impact of caregiving on the provider's well-being allows us to assign a monetary value to informal care time using the method developed by van den Berg and Ferrer-i-Carbonell (2007), which calculates the amount of income needed to compensate an individual's loss of well-being from an increase in informal care time. This method can only be applied if income has a positive effect and care time a negative effect, which generally appears to be the case (Boyce et al., 2010; Easterlin et al., 2010; Clark et al., 2008b). To impute the diminishing marginal returns on well-being, we use the logarithmic values of net household income. The logarithmic function of weekly care hours serves a similar function for care: one additional hour of care has different effects on SWB whether it doubles the absolute care time or increases it by only 1% (e.g., changing it from 100 to 101 hours a week). It can also reduce the effect of high values (over-reporting), which could occur in the data.

   For the valuation, we create a subsample of all those who provide at least one hour of informal care a week (N = 5,094), which we then regress on SWB while controlling for all important demographics. We thereby obtain coefficients with which to calculate the impact ratio of income and care time on SWB:

$$\frac{\partial t}{\partial y} = -\frac{\partial w / \partial t}{\partial w / \partial y} \tag{4}$$

This equation, in which w represents the overall SWB and t the time spent on informal care, shows how a change in care time can be compensated by a change

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[31]   Because our focus is primarily on elderly CRs, we do not analyze the care provided by older CGs to younger CRs; most particularly, because providing care to a younger generation (as opposed to an older generation) can be expected to produce different perceptions, which would then have a different impact on CGs' well-being (see Sen & Yurtsever, 2007).

in income y.

As already mentioned, using a logarithmic function of care provides the change estimation in percent; however, because the percentage increase in one hour of care depends on the amount already provided, we need to look at different cut-off points. Specifically, we are interested in how a one-hour increase in care affects well-being and how much additional income can compensate the perceived loss. Here, as in van den Berg and Ferrer-i-Carbonell (2007), we focus on the means of both the income and care time variables to derive an average monetary value.

3.4   Results

Model I

Table 3.1 reports the results of the FE and BUC estimations for model I. The negative effect of informal care time on CGs' SWB is significant for both estimators and all modifications of the model. In the FE model (Ia), the coefficient is equal to -.0039; that is, an increase of 80 hours per week has approximately the same effect on SWB as becoming unemployed. The coefficient of the BUC (Ic) is slightly larger but much in tune with the FE results in all estimations, and neither the significance nor the sign of any coefficient differs between the FE and BUC. Given this similarity, the remaining discussion reports the results of the FE model only, which are more straightforward to interpret.

As Figure 3.1 shows, the accumulated years of providing care display a U-shaped pattern, the average length of care provision within the 10 years of observation is 2.78, with the first years of being a CG seeming to impose the largest burden. Because of the squared term's positive relation, the negative impact of caring is reduced to a minimum at about 3.5 years and has a nullified impact after

nearly 7 years[32].
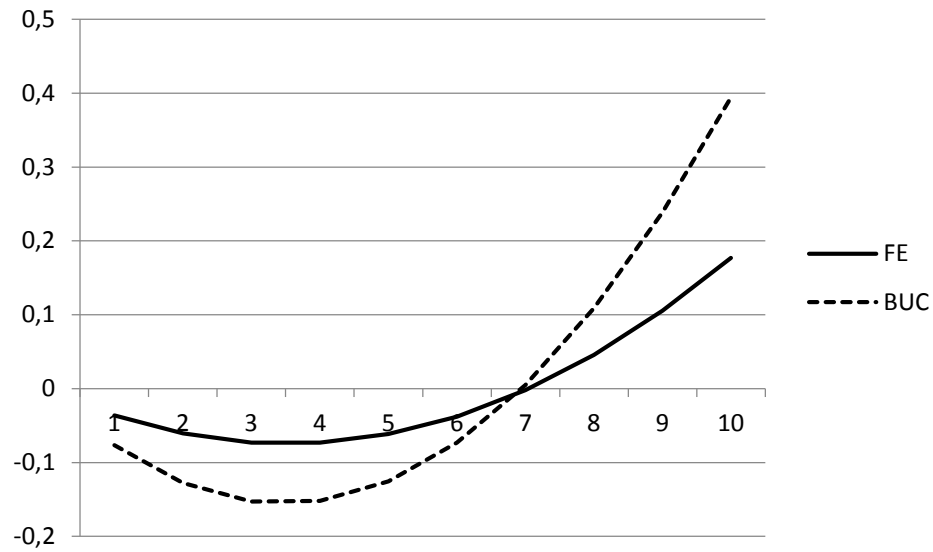
Figure 3.1: Impact of Years of Caregiving on Subjective Well-being

Figure 3.2 shows the results of a more flexible specification in which 10 dummy variables indicate how many years the CG has provided care within the observation time. Although the coefficients are negative in the first 3 years but positive in the last three, only two dummies are significant at the 5% level (years 3 and 9). The general picture is that wear-and-tear may dominate in the early years, but these negative effects are less pronounced in the long term. This finding lends support to the adaptation model, although larger samples would be needed to obtain conclusive evidence.

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[32] A comparison with a subsample from 2002–2010 using only CGs that began care provision in 2002 or later (not reported) shows a similar pattern.
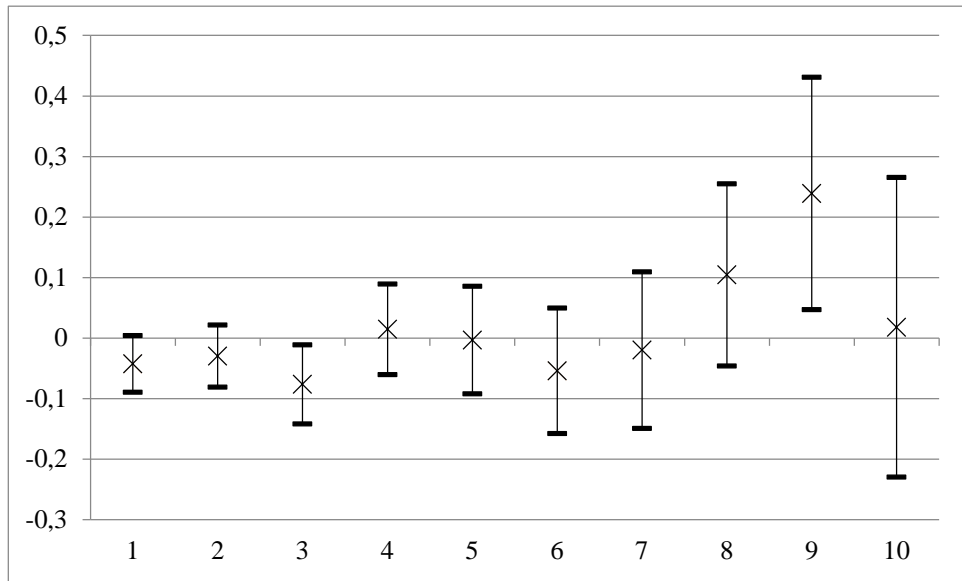
Figure 3.2: Dummies for Years of Being a Caregiver

Residency does indeed appear to have an important impact on CGs well-being, which declines by 0.1758 (FE) if a CR lives in the CG's home, a relatively strong effect, comparable to half the coefficient of the full employment variable. We observe few differences, however, for gender except that the long-term care coefficients are not significant in the male sample and men are less strongly affected by having a CR in the household. Care time itself shows only minor differences, with women suffering just .0002 more in their SWB if they provide one hour of care a week. However, when model Ib introduces the diminishing marginal impact of care time on CGs' SWB, the data confirm our hypothesis: the care coefficients become more negative ($\beta_{Model\ Ia}$ =-0.0039; $\beta_{Model\ Ib}$=-0.0085) but are diminished by the positive squared term (β=.0004) of increasing care hours. Nevertheless, the U-shaped pattern of the impact for long-term care remains, with negligible changes in the coefficients. Hence, overall, the results for model I suggest a negative impact of care and domestic care arrangements, whose relation to CG age is analyzed using model II.

<u>Model II</u>

Table 3.2 reports the results for seven estimations of the 10 birth decades. The N_{TOTAL} column shows the number of people born in that specific decade, while N_{CR} gives the number of CGs in these cohorts. For 1900 to 1919 (not shown), we obtain no significant results, driven primarily by the low number of observations: fewer than 400 people in the sample were born before 1919 and few provide care (n = 36). For the 1920s cohort, although the number of CGs is still low (n = 282), the impact of hours of care has the highest negative size among all decades (ß = -0.0106). The coefficient of age is 0.5853 and only marginally diminished by the negative squared term (-0.004), possibly as a result of the oft-cited U-shaped pattern of SWB over the life course. The 1930s and 1940s cohorts show similar patterns. The residency dummy is highly significant and negative, with a magnitude of about -0.25, but the care coefficients decrease in younger cohorts, with the -0.0083 impact of one additional hour for a 1930 CG declining to -0.0051 for those from the following decade. The 1950s cohort shows an even lower impact of care time (-0.0034) and no significance for shared residency. The corresponding coefficients for CGs born after 1960 are not significant, possibly because the share of CGs is much smaller, meaning that younger people provide care less frequently, and shared residency is less common among younger cohorts, so obtaining empirical evidence among younger CGs may require a larger sample. Overall, however, the table does show a pattern for the link between age and caregiving, which, as already pointed out, is a physically demanding task that requires physical strength. Specifically, our analysis shows larger declines in SWB for older cohorts resulting from care provision to and shared residency with the CR.

Table 3.1: Caregivers Overall Well-being

	Fixed-effects								BUC					
	Model Ia						Model Ib		Model Ic					
	overall		female		male		overall		overall		female		male	
Hours of care weekly	-.0039	***	-.0038	***	-.0035	***	-.0085	***	-.0045	***	-.0044	***	-.0040	*
Hours of care weekly²	-		-		-		.00004	***	-		-		-	
Time caring yearly	-.0418	***	-.0584	***	-.0180		-.0245	**	-.0896	***	-.1164	***	-.0475	
Time caring yearly²	.0060	***	.0077	***	.0034		.0042	***	.0129	***	.0160	***	.0078	
CR lives in the household	-.1763	***	-.2247	***	-.1324	***	-.1543	***	-.2406	***	-.2618	***	-.2324	**
R²(pseudo)	.1374		.1318		.1485		.1369		.0637				.0667	
Numbers of CG	5094		3055		2039		5094		5094		3055		2039	

Notes: Regressions include controls for age, household income, education, marital status, employment, health, children, and waves. Robust standard errors in parentheses. *p<.10, **p<.05, ***p<.01.

Table 3.2: Cohort Decades for Caregivers

Birth	Care		Age		Age²		CR in HH		N_{TOTAL}	N_{CG}
1920-1929	-.0106	***	.5853	***	-.0040	***	-.0980		1785	282
1930-1939	-.0083	***	.1201		-.0010	*	-.2544	***	3778	776
1940-1949	-.0051	***	.0265		,0002		-.2682	***	4845	1124
1950-1959	-.0034	**	-.0676		.0006		-.0889		5859	1288
1960-1969	.0006		-.0202		-.0001		-.1216		6551	830
1970-1979	-.0007		-.0466		.0006		-.1638		4728	382
1980-1989	-.0044		-.2614	***	.0047	***	.0312		4916	343

Notes: Regressions include controls for household income, education, marital status, employment, health, children, and waves. Robust standard errors in parentheses. *p<.10, **p<.05, ***p<.01

<u>Model III</u>

This model is designed to reveal the dynamics outlined by Amirkhanyan and Wolf (2006), who stress the shortcomings in many studies in which a comparison of CG to non-CG does not measure the pure impact of caring. Rather, they find more negative effects generated by the existence of a CR within the family than by care time. To account for this effect, we split the residency dummy into three separate dummies and report the results in Table 3.3. Model IIIa, which does not control for care time, shows the negative coefficients for all three dummy variables. The coefficient for those who provide care to a resident has the highest value (β=-0.3164), with a relatively large impact that corresponds to the effect of becoming unemployed. A comparison of the other two dummy variables confirms Amirkhanyan and Wolf's (2006) findings to some extent. Individuals with a CR living in the household suffer more in their well-being than those who provide care to a non-residential CR.

Model IIIb integrates the care time variables into the estimation. Not only does the magnitude of the coefficient show minor differences with model Ib, but we observe changes in our three dummy variables compared to model IIIa. Both βs for actual CG's (co-residential and non-residential) become smaller, while the dummy for non-CGs remains relatively constant. The coefficients for CGs with shared accommodation decrease by more than 40% from -0.3164 to -0.1893 and for non-shared CGs by as much as 60% (β_{IIIa} = -0.1015 to β_{IIIb} = -0.0373). These results suggest that approximately 16 hours of care by a CG assisting a CR outside the household has the same effect on SWB as having a CR in the household but not providing care time.

Nevertheless, these differences between CGs and non-CGs in a household affected by informal care are hard to interpret once care time is controlled for. One

possible explanation is that the time spent on caring strengthens the relationship between CR and CG, which makes the former feel more responsible and therefore more affected by the care situation of a close relative. Yet, even after care is controlled for in model IIIb, the non-resident CG still shows a negative ß, albeit with a low level of significance (10%), compared to non-CGs without a CR in their household. In fact, the coefficient is nearly the same size as the difference between CGs and non-CGs in a caring household, which could suggest that caring simply has a negative impact that is not captured by our care variable. At about .03, this effect is quite small and even becomes insignificant (for non-resident CGs) once we add in controls for the years of CG experience in model IIIc.

The additional baseline method also shows an overall negative impact of residency even after care time is controlled for (see figure 3.3): compared to the baseline, even one year before a CR is present in the household, there is a negative impact on the household member. This finding might be explained by some type of foreshadowing, by relatives already being in a bad state of health. This explanation is partly supported by our analysis of the time that household members spend on caring: whereas at the baseline, the subsample of 1,715 CGs provides an average of 0.4 hours of care weekly, one year before the event, this average care time rises to over 2 hours, and after the event, the mean is always above 13 hours a week.

In the first year with a CR in the household, the coefficient shows a high negative value (ß=-0.4660), and the size of the coefficients increases over the next 7 years. As we are using an unbalanced panel, the lack of significance in the 8+ year dummy is most probably related to the reduced sample size (N = 397). Nevertheless, this analysis indicates that the residency of a CR has a strong and persistent effect on the SWB of a household member, which suggests that, as no

adaptation seems to be taking place, wear-and-tear tends to dominate.
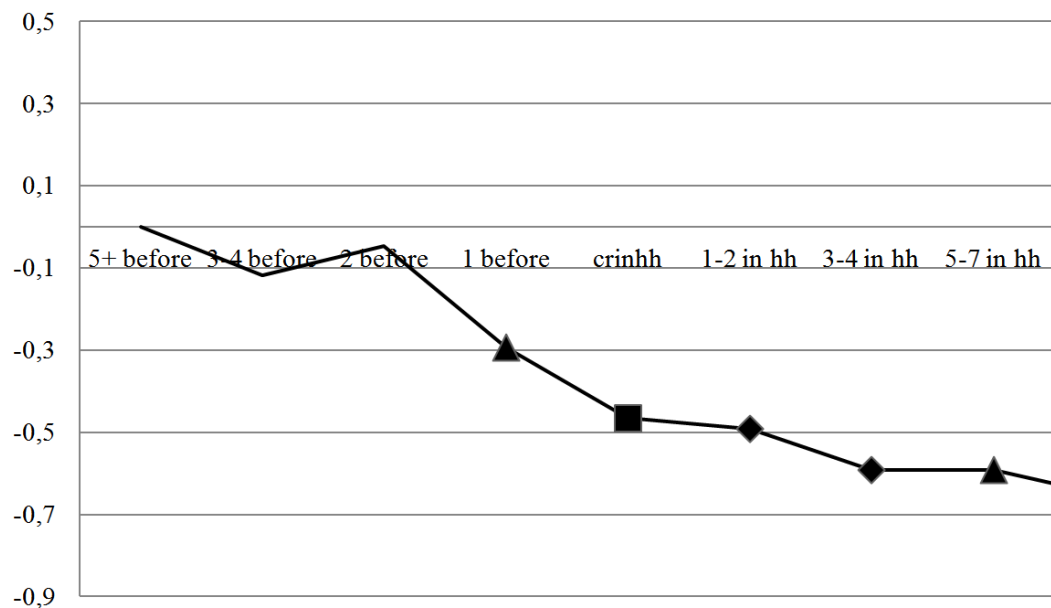
Level of significance: ▲ = 10%, ◆ = 5%, ■ = 1%

Figure 3.3: Baseline Analysis of a CR Resident in the Household

Model IV

Table 3.4 shows the different effects of care once the sample is split into inter-
and intragenerational CGs. Not only is the coefficient for intergenerational care
three times larger than that for intragenerational care, but the intergenerational CGs
are significantly younger (M^{age}_{inter} = 51) than their intragenerational counterparts
(M^{age}_{intra}= 66). Although this difference may be explainable by the higher
opportunity costs of caring among the young (and often working) CGs, it might
equally be associated with the oft-cited family conflicts that arise from
intergenerational care (Young & Kahana, 1989; Lye, 1996; Raschick & Ingersoll-
Dayton, 2004).

Table 3.3: The Importance of Residency

	Model IIIa		Model IIIb		Model IIIc	
Hours of care weekly	-		-.0079	***	-.0080	***
Hours of care weekly²	-		.00004	***	.00004	***
Time caring yearly	-		-		-.0113	
Time caring yearly²	-		-		.0029	
CG provides care to a resident	-. 3164	***	-.1893	***	-.1818	***
CG provides care to a non-resident	-. 1007	***	-.0373	*	-.0308	
CG does not provide care to a needy resident	-. 1630	***	-.1597	***	-.1585	***
R²	. 1394		.1382		1366	

Notes: Regressions include controls for age, household income, education, marital status, employment, health, children, and waves. Robust standard errors in parentheses. *p<.10, **p<.05, ***p<.01.

Table 3.4: Caregivers' Overall Well-being

	Intergenerational care					Intragenerational care					
	overall		female		male		overall		female		male
Hours of care weekly	-.0114	***	-.0115	***	-.0112	**	-.0035	**	-.0066	***	.0024
Time caring yearly	.0230		.0261		.0307		.0317		.1624		-.2316
Time caring yearly²	.0012		.0046		.0023		.0003		.00002		.0039
Observations	385		210		175		766		422		344
R²	.1526		.1568		.1218		.0443		.0025		.0058

Notes: Regressions include controls for age, household income, education, marital status, employment, health, children, and waves. Robust standard errors in parentheses. *p<.10, **p<.05, ***p<.01.

As regards explained variance, whereas using the same model explains approximately 15% of the variance for intergenerational care, for the intragenerational subsample, it explains less than 5%. This notable difference suggests that older CGs may be affected by something other than care and the control variables we select. In addition, the comparison between female and male CGs reveals certain differences in the family structure: in intergenerational care arrangements, both genders are more or less equally burdened by care, whereas for intragenerational CGs, we obtain significant results only for women. In neither estimation do we obtain any results related to the long-term effect, probably because of the small sample size.

Model V

The results of the monetary valuation using the van den Berg and Ferrer-i-Carbonell (2007) method are given in Table 3.5. Here, based on the coefficients, we estimate the increase in income needed to compensate CGs for one additional hour of care with particular attention to the values for the mean of weekly care time and household net income. Because the 5,094 CGs in the sample provide 14.5 hours of care on average, we define the cut-off point at 14 to 15 hours, which implies a 7% increase in the time spent caring. The mean income of CG households is €2,997 a month, a little lower than the average of the whole sample.

Table 3.5: Monetary Valuation

Additional hour of informal care	Change	FE	BUC
4-5	25%	27.60 €	26.66 €
9-10	11%	12.27 €	11.85 €
14-15	7%	7.89 €	7.62 €
19-20	5%	5.81 €	5.61 €
29-30	3%	3.81 €	3.68 €
39-40	2%	2.83 €	2.73 €
167-168	0.6%	0.66 €	0.64 €

Notes: N = 5,094, M_{care}= 14.5 , M_{income}= €2997; the controls are regular.

The bold numbers show how much money would be needed to compensate an average CG with an average income for one more hour of care, which is valued within the range of €7.62 to €7.89.

These results are in line with those of van den Berg and Ferrer-i-Carbonell (2007), who identify a monetary value of one additional hour (taken at the average) of between €7.21 and €9.06 for a sample of Dutch CGs in the 2000s. It is interesting to compare this value with the minimum hourly wages for care nurses, namely €7.50 for Eastern and €8.50 for Western Germany. A further comparison can be made with the benefits from the German LTCI, in which CRs are entitled to financial compensation if care is provided by a relative. As of 2012, a CR who needs 15 hours of care per week would be classified as care level 1 and be entitled to €235 a month[33]. If this compensation were paid to the informal CG, then, according to our calculations, the hourly compensation of approximately €3.62 would not be enough to hold the CG's well-being constant.

3.5 Conclusions

Despite the growing importance of informal care in Germany, few studies address the effects of such care on the caregivers themselves, and research that does exist for other countries is hampered by methodological problems, including reliance on often small and unrepresentative cross-sectional analyses. This paper therefore aims to provide new evidence for Germany on the effect care provision has on CGs' SWB while striving to overcome some of these methodological problems by exploiting the representative and longitudinal nature of the German Socio-Economic Panel. Our results contribute useful new evidence to the extant literature and confirm previous findings.

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[33] SGB XI § 37

First, and in line with much previous research, we observe a negative correlation between hours of care and CG's SWB (Schulz et al., 1995; Chappell & Reid, 2002; Pinquart & Sörensen, 2003). This effect is relatively large and comparable to becoming unemployed. Second, regarding long-term care, we find a pattern that cannot simply be attributed to one of the two existing theories, adaptation and wear-and-tear. Most particularly, by allowing the possibility of a non-linear relation between long-term care and SWB, we find some evidence for a U-shaped pattern: in the first years, care seems to decrease SWB, reaching a minimum at about year 3. However, although this observation is in line with the wear-and-tear model, we also observe an attenuating effect that supports the adaptation model: that is, SWB increases with each additional year of care provision. Hence, our evidence suggests that these two models need not be mutually exclusive. Rather, becoming a CG can be a slowly evolving process in which adaptation to the new role of CG is likely to take time. Changes in working time or professional care support, especially, need time to be organized and finally implemented.

Third, we show that this negative effect depends on birth cohorts, with negative effects being nearly exclusively observed for cohorts born between 1920 and 1959. This negative impact of care hours, however, also increases with higher age, an effect that could be related to the lower physical capability of older CGs. At the same time, older CGs also seem to be the most burdened by the presence of a CR in the household, which could be related to the additional loss of an active and mutually valuable partnership. Yet we find no evidence that this higher impact of caring can be explained by the family structure of the care arrangement; for example, by the prevalence of intragenerational care among older CGs.

Fourth, our results support previous studies' emphasis on the importance of CR

residency. In households that provide informal care over time, we observe no patterns of coping but rather see households with a CR as worse off over the long term compared to non-CG families. Although this observation adds some support to the wear-and-tear theory in terms of the capacity to adapt to domestic care arrangements, further research is needed to distinguish the effects of close distance to a suffering family member from a possible increase in housework that might burden the caregiving family.

Finally, to make our findings more tangible and comparable to the existing formal care reference values, we use the negative effect of caring to determine the additional hourly income needed in order to compensate CGs for one additional hour of care. In our sample, we identify a value between €7.62 and €7.89 per hour on average, which appears consistent with the results obtained in other countries. Hence, although the politically enforced priority that LTCI benefits be used to maintain a domestic care arrangement might be a less expensive and even a socially more desirable form of care, such informal care is likely to take place at the expense of CG's SWB. In fact, our valuation suggests that higher monetary benefits are needed if the negative effects of caring are to be compensated, especially given that the market for private care insurance is still surprisingly small (Meier, 1999; Brown & Finkelstein, 2007). With such negative outcomes for partners and offspring in cases of care dependency, it may be advisable to make these increasing risks of burdening the closest family members more public.

4 Heterogeneous Selection in the Market for Private Supplemental Dental Insurance: Evidence from Germany[34]

Abstract

This paper analyzes the German market for supplemental dental insurance (SuppDI) to identify individual selection behavior. The rather limited underwriting by German private health insurers makes the SuppDI market especially prone to selection effects, which can lead to inefficient insurance coverage. Although our OLS does not identify a significant correlation between SuppDI coverage and risk for acute treatments, we conjecture that this outcome may result from sample heterogeneity when adverse and advantageous selection occur simultaneously and offset each other. We therefore use an IV method to confirm the existence of advantageous selection in a distinct subsample. We find that individuals who purchase SuppDI because of high insurance affinity have significantly lower risk in terms of dental treatment. Our results thus suggest that even in the absence of a positive correlation between risk and insurance coverage, the German SuppDI market suffers from information asymmetry caused by multidimensional private information.

4.1 Introduction

As health care expenditures have risen, coverage by public health care systems like the German statutory health insurance (SHI) has been incrementally reduced (Simon, 2013). Therefore, markets for supplemental health insurance (SuppHI) that enables individuals to close these widening coverage gaps have been and are likely to continue growing in many OECD countries (OECD, 2004; Paolucci et al., 2007; Grabka, 2014). Within such a context, increasing copayments or benefit exclusions in public health care systems not only reduce the financial burden on public insurance schemes but can also strengthen personal responsibility for health and raise individual cost consciousness (OECD, 2004; Müller & Böhm, 2009). Individuals are also more able to voluntarily choose their preferred insurance coverage. When the insurance market suffers from information asymmetry, however, shifting coverage to voluntary private health insurance carries a risk of inefficiency. That is, if insurers are not able, or not allowed, to fully adjust premiums for individual risk type, selection effects lead to nonoptimal insurance coverage of the population.

To improve understanding of selection within voluntary private health insurance, this paper analyzes information asymmetry in the market for private supplemental dental insurance (SuppDI) in Germany, a particularly appropriate context given that the rather limited underwriting by German private health insurers makes the SuppDI market particularly prone to selection effects. In particular, it tests a basic prediction of the standard adverse selection model (i.e., Rothschild & Stiglitz, 1976), the existence of a positive correlation between insurance coverage and individual risk once all the policyholder characteristics used by insurers for pricing are controlled for (Cohen & Siegelman, 2010). Despite empirical support for this positive correlation in various voluntary private health insurance markets (e.g., Wolfe &

Goddeeris, 1991; Godfried et al., 2001), several recent studies find a nonsignificant or even negative relation (e.g., Fang et al., 2008; Schmitz, 2011). This negative association, often referred to as advantageous selection, can be explained by multidimensional private information; that is, individual possession of private information about characteristics correlated with both higher insurance coverage and lower risk. De Meza and Webb (2001) suggest in their theoretical model that highly risk averse individuals are more likely to purchase insurance coverage and invest more in precaution, thereby lowering risk.

The absence of a coverage-risk correlation, however, which is also observed in our analysis despite the limited underwriting of German health insurers, could be explained by two alternatives: either the market does not suffer from empirically important information asymmetry, which suggests an efficient solution, or the adverse and advantageous selection offset each other in the aggregate, which may lead to an inefficient market outcome (Finkelstein & McGarry, 2006). Because both these explanations have different welfare implications, it is important to investigate the underlying cause of this nonsignificant correlation. Hence, we apply an instrumental variable (IV) approach that allows us to disentangle different subgroups within a heterogeneous sample. By instrumenting SuppDI, we identify the presence of information asymmetry in the German SuppDI market that is not evident when the coverage-risk correlation is estimated using standard regression.

By identifying heterogeneous selection behavior in the insurance market using a method different to that of previous studies (e.g. Fang et al., 2008; Finkelstein & McGarry, 2006, Lange et al., 2015), we make a valuable contribution to the literature. To the best of our knowledge, we are the first to use an IV approach to disentangle adverse and advantageous selection in the same insurance pool. Moreover, we base

this approach on the assumption that, in line with de Meza and Webb (2001), individuals having many supplemental insurances are more likely to exert effort for prevention and purchase SuppDI because of an inner need for security. Thus, our IV results complement the scarce and mixed evidence on risk preferences as a potential source of advantageous selection.

The remainder of the paper proceeds as follows. Section 2 gives an overview of the German health insurance system with a special focus on SuppDI. Section 3 then summarizes the basic theoretical effects of information asymmetry in insurance markets and reviews the most relevant empirical studies on such asymmetry as it pertains to voluntary private health insurance. Section 4 describes the data and empirical model, and Section 5 reports the results of both the main analysis and several robustness checks. Section 6 concludes the paper.

4.2   Institutional Background and Private Supplemental Dental Insurance in Germany

In Germany, nearly 90% of the population is covered by SHI, while about 10% has substitutive private health insurance (PHI). SHI members contribute in the form of a payroll tax with a uniform rate since 2009. Dependent workers whose income is below the so-called compulsory threshold cannot opt out of SHI,[35] but employees with an income above the threshold, as well as civil servants and the self-employed, can opt for PHI, which substitutes for SHI entirely. PHI premiums are generally risk adjusted based on age and health status at the date of contract signing, with benefits subject to individual contractual agreement between the health insurer and the insured. SHI, in contrast, has a highly uniform standard benefit package for all funds (Simon, 2013), one that is quite comprehensive compared to those in other

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[35]   In the empirical analysis, we use data from 2011 when the threshold for compulsory health insurance was a pre-tax annual income of €49,500.

industrialized countries (Beske et al., 2005). Nevertheless, because German health care expenditure as a proportion of GDP is only exceeded by that of the United States and a few other countries (OECD, 2013), out-of-pocket expenses from copayments and standard benefit exclusions have recently been increasing in an attempt to lower this share (Müller & Böhm, 2009; Farbmacher & Winter, 2013).

Individuals enrolled in SHI are however permitted to buy supplemental private coverage directly from private health insurers (rather than through their employers), which is guaranteed renewable (Pauly et al., 1995). Generally, SuppHI offers two types of benefits: entitlement to higher quality treatment (e.g., private hospital rooms or treatment by a chief physician) and reduced financial risk associated with services not or only partly covered by SHI. In case of SuppDI, the main purpose is to reduce or close the coverage gaps in the SHI benefit package.[36] According to data from the GSOEP, a representative survey for the German population, the proportion of SHI enrollees having at least one supplemental insurance increased from 9.6% in 2000 to 21.6% in 2012 (see Figure 4.1), meaning that more than one out of five SHI members have some type of additional health insurance coverage (Grabka, 2014).

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[36] A minor purpose of SuppDI is to obtain higher quality by offering services such as professional tooth cleaning.
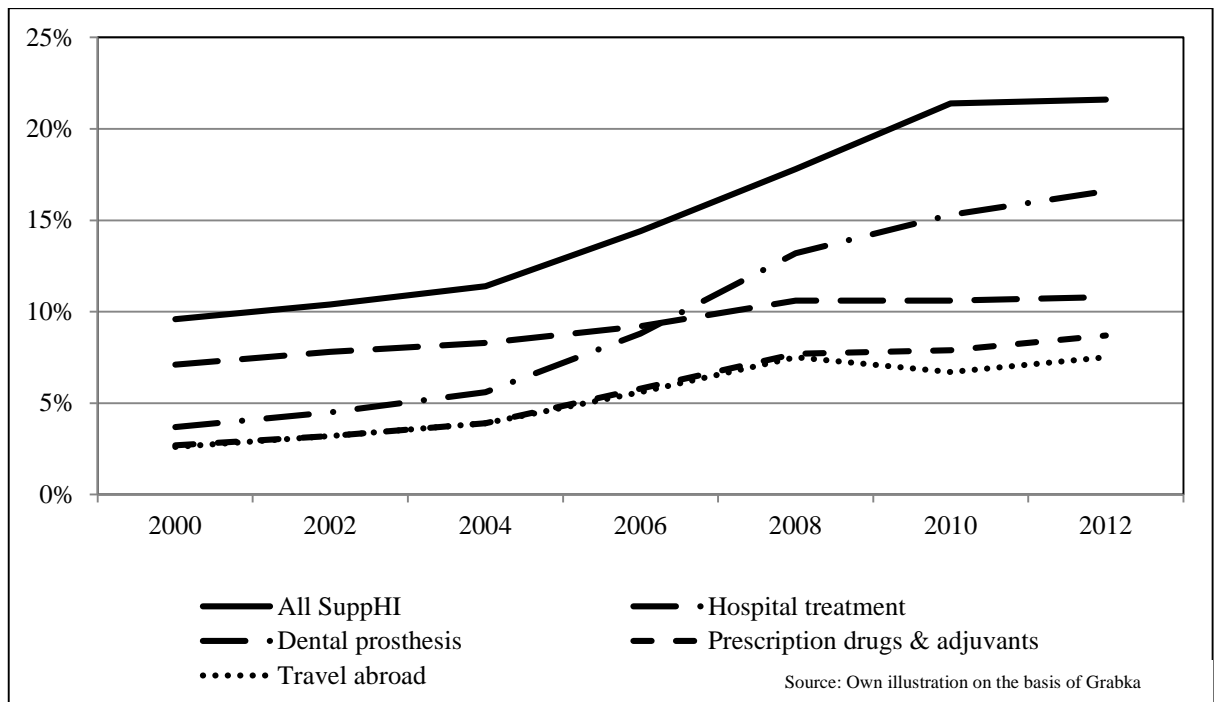
Figure 4.1: Share of SHI Enrollees with SuppHI, 2000–2012

Among the various supplemental insurances available to SHI enrollees, SuppDI is the most prevalent and has the highest recent growth rate, probably because of the considerable cuts in SHI dental benefits over the past 20 years (Simon, 2013). In particular, these benefits have been subject to two major reforms. The first, in 1997, excluded dental prostheses from the standard benefit package for a subgroup of insured, although this exclusion was reversed only two years later for political reasons.[37] The second was a 2004 reform that changed the 35%–50% coinsurance rate for dental prostheses to diagnosis-based fixed benefits covering 50%[38] of the cost of standard treatment for all but low-income SHI enrollees, who are eligible to receive

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[37] This reform, which was based on the law for contribution reduction (*Beitragsentlastungsgesetz*), only applied to those born after 1978. The fixed benefits for dental prostheses were introduced as part of the laws for SHI reorganization (*GKV-Neuordnungsgesetze*) but were replaced in 1999 by the principle of benefits in kind for dental prostheses.

[38] By law, the fixed benefits can rise by 20% (30%) if there is evidence that the insured performs regular prevention and can prove yearly dental check-ups during the last 5 (10) years before treatment.

the full cost of standard treatment.[39] Dental prostheses costs that exceed the fixed benefits, however, must be paid out of pocket (Klingenberger & Micheelis, 2005), subjecting SHI enrollees to an increased financial risk associated with dental care (Simon, 2013). In response, SHI enrollees have substantially stepped up their demand for SuppDI after the reform (Figure 4.1). Additionally, some funds started cooperating with private health insurers to offer SuppHI to their insured since 2005, possibly stimulating the demand for SuppDI policies (Grabka, 2014). According to the Association of German Private Healthcare Insurers (2006, 2013), the number of such policies rose nearly 75% between 2005 and 2012 to over 13 million, with 16.6% of statutorily insured individuals having a SuppDI in 2012 (see Figure 4.1). Hence, the proportion of SHI enrollees with SuppDI coverage tripled between 2004 and 2012.

The premiums for SuppDIs are generally risk adjusted based on individual age at date of contract signing[40] and sometimes based on a few questions about dental health for risk classification. Specifically, insurers may ask applicants about past dental prostheses or advised dental or orthodontic treatment and can also reject them based on risk-related responses. Nevertheless, the ex-ante premium differentiation for SuppDI is limited, which may lead to selection effects from information asymmetry. In addition, there is no consideration of past premium payment history, meaning that the information asymmetry from lack of ex-ante premium differentiation preserves over time.

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[39] According to Barmer GEK, in 2012, about 9% of SHI enrollees received diagnosis-based fixed benefits covering 100% of the cost of standard treatment (Rädel et al., 2014).

[40] Conditional on the chosen coverage, the premium for an individual signing a SuppDI contract at age 43 is between 5 and 47 euros per month (Finanztest, 2014).

4.3 Theoretical Effects of Information Asymmetry in Insurance Markets

In the standard insurance model with adverse selection (Rothschild & Stiglitz, 1976), individual private information is one-dimensional because the individuals differ only with respect to policyholder risk. In this setting, insurers can only offer separating contracts, which induce self-selection. Hence, in equilibrium, high-risk individuals choose policies with full (more) coverage at higher unitary premiums, whereas low-risk individuals choose policies with partial (less) coverage at lower unitary premiums. According to this model, in the context of mandatorily insured SHI enrollees, only high-risk individuals purchase SuppDI, meaning that low-risk individuals are rationed with respect to the first-best market outcome. The result is an inefficient market outcome in the separating equilibrium.

The basic empirical prediction of adverse selection models is that in market equilibrium, the amount of insurance coverage is positively correlated with the risk of loss (Chiappori et al., 2006). In testing this assumption, however, it is very important to control for all relevant characteristics used by insurers for risk-based rate setting (Cohen & Siegelman, 2010) so that the impact of residual private information can be assessed (Finkelstein & McGarry, 2006). Nevertheless, once all known observables are controlled for, a positive correlation between coverage and risk is only a necessary and not a sufficient condition for the presence of adverse selection, as such a positive correlation may also arise from moral hazard. In the latter case, individuals with higher coverage take fewer preventive measures, which in turn leads to a higher probability of loss (ex-ante moral hazard), or demand more health services following illness when such demand is not perfectly inelastic (ex-post moral hazard) (Cutler & Zeckhauser, 2000; Einav & Finkelstein, 2011).

The absence of such a positive correlation can be explained either by negligible information asymmetries or, more important, by the introduction of unobservable risk preference heterogeneity into the model. Hemenway (1990), who first applied the term "propitious selection" to this reversal of the standard adverse selection prediction, suggests that highly risk-averse individuals are more likely to buy insurance coverage and invest more in prevention so as to reduce their risk of loss. This mechanism can produce an advantageous selection leading to a negative correlation between actual risk and risk aversion. In line with this argument, de Meza and Webb (2001) develop a theoretical model that explicitly allows for multidimensional private information and assumes that individuals differ not only with respect to risk type but also to risk preferences. Based on this assumption, the authors show the existence of equilibria with advantageous selection in competitive insurance markets, which is crucially dependent on private information about characteristics that are positively correlated with insurance coverage and negatively correlated with individual risk. These characteristics, therefore, must not be used in insurers' premium calculations (Finkelstein & McGarry, 2006).

The evidence for such ex-ante hidden information in private SuppHI markets, however, is mixed. In an analysis somewhat similar to ours, Godfried et al. (2001) identify adverse selection among the effects of dental service exclusion from compulsory health insurance on the demand for SuppDI in the Netherlands. In doing so, they show that individuals with poorer dental health or more frequent past dentist visits (high risk) are more likely to purchase SuppDI than individuals with better dental health or fewer past visits (low risk). In contrast, Schmitz (2011), using GSOEP data, reports weak evidence for advantageous selection in the German supplemental hospital insurance market. He shows that males with higher risk

aversion are more likely to purchase this insurance but have fewer hospital stays within a 6-year post-purchase period than males with lower risk aversion. In another study, Augurzky and Tauchmann (2011) find no significant effect of excluding and then re-including dental prostheses in SHI coverage on SuppDI demand in Germany. They conclude that either individuals fail to make informed choices about the amount of dental insurance coverage needed or individual preferences are not subject to heterogeneity. However, their analysis, unlike ours, does not focus on information asymmetry.

Several recent studies do find evidence for the importance of multidimensional private information in different insurance markets (Cohen & Siegelman, 2010; Einav & Finkelstein, 2011). For example, Finkelstein and McGarry (2006), in a closely related analysis of the U.S. long-term care insurance (LTCI) market, show that once insurer assessment of policyholder risk type is controlled for, individuals with a higher subjective expectation of entering a nursing home are more likely to buy LTCI coverage. On the other hand, they find no evidence from the same data of a positive correlation between LTCI coverage and admission to a nursing home. They explain this puzzle by suggesting that risk-based (adverse) selection is offset by preference-based (advantageous) selection in the aggregate. Using two separate regressions based on the approach proposed by Chiappori and Salanié (2000), they show that wealthier and more cautious individuals are more likely to hold an LTCI policy but less likely to enter a nursing home. They thus conclude that an insurance market may suffer from inefficiencies due to information asymmetry even in the absence of a positive correlation between insurance coverage and risk occurrence.

Combining the ideas of Hemenway (1990) with the theoretical model of de Meza and Webb (2001) highlights risk aversion as an important potential source of

advantageous selection in voluntary health insurance markets. However, the empirical evidence on the role of risk preferences in SuppHI demand remains scarce and ambiguous (Kiil, 2012). Moreover, evidence for risk aversion as a significant determinant of insurance coverage is not a sufficient condition for risk aversion as a source of advantageous selection. For example, Fang et al. (2008) find evidence for advantageous selection in the U.S. market for Medigap (i.e. a supplement for Medicare). Furthermore, they add some covariates into a regression of Medigap coverage on expected health care expenditure and pricing variables to identify the sources of advantageous selection.[41] Adding only proxies for risk preferences into this regression barely changes the coefficient on health care expenditure risk even though risk tolerance significantly decreases the purchase of Medigap. One possible explanation is that risk tolerance is not necessarily linked to bad health, meaning that risk preferences are not a source of advantageous selection. This is in line with Cutler et al. (2008) who find no systematic relationship between risky behavior and expected claims for Medigap and acute health insurance. Instead, Fang et al. (2008) identify cognitive ability as an important selection source in the Medigap market.

Buchmueller et al. (2013), using a similar approach with risk as the dependent variable,[42] find a significantly negative correlation between having a duplicate private health insurance in Australia and the number of nights spent in hospital (risk) indicating advantageous selection in this market. Furthermore, they show that risk preferences turn the relation between insurance coverage and risk from negatively

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[41] In their study, variables that are correlated positively with coverage but negatively with risk change the magnitude of the risk coefficient and can thus be considered sources of advantageous selection.

[42] In contrast to Fang et al. (2008), Buchmueller et al. (2013), in studying advantageous selection sources, use a proxy for risk as the dependent variable and insurance coverage as the independent variable. However, their strategy of adding covariates into the regression to identify sources is similar to Fang et al. (2008).

significant to insignificant when proxies for risk preferences are added into the regression. They conclude, along with their additional finding that individuals with private health insurance are more likely to buy other types of insurance (e.g., life insurance), that risk aversion essentially influences the demand for private health insurance and modestly contributes to the observed advantageous selection in this market.

4.4   Data and Methodology

Our analysis is based on the Healthcare Monitor,[43] a representative survey of a cross-section of the German population administered since 2001 by the Bertelsmann Foundation.[44] Comprising 21 biannual waves, this survey includes such detailed health information as general health status, health insurance coverage, different types of SuppHI coverage (including SuppDI), socioeconomic characteristics, number of physician visits, and relationship between patients and physicians. For the present analysis, we rely exclusively on wave 19 (from 2011) because it contains very detailed information about dental status and dentist visits. For this wave, a total of 2,200 individuals aged 18 to 79 were contacted by mail, of whom over 80% responded, producing a sample of 1,781 individuals (GfK Health Care, 2011).

Table 4.1 lists the characteristics of all individuals by insurance status. According to column 1, which shows the share of PHI enrollees ($n = 285$), these individuals tend to be older, have higher incomes, and be more predominantly male than SHI enrollees (column 2). These findings are in line with the fact that switching from SHI to PHI requires an income above the compulsory threshold, which is far above the German average income. With regard to dental health, however, we observe no major

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[43]   The *Gesundheitsmonitor*.

[44]   Since 2011, the statutory health insurance fund Barmer GEK has been cooperating with the Bertelsmann Foundation on the Healthcare Monitor.

differences between the two groups. Given our focus on selection in the SuppDI market, however, we are particularly interested in differences between individuals with and without a SuppDI policy. Since the additional coverage offered by SuppDI is already included in most PHI plans, we exclude individuals with PHI and concentrate only on individuals with SHI, which reduces the final sample to 1,496. The comparison between SHI with (3) and without (4) SuppDI shows that, in line with most findings in the literature (e.g., Kiil, 2012), SuppDI enrollees are more likely to be married and have a higher income.

More important in our context, the comparison reveals that policyholders have significantly more dental implants and fillings, as well as more acute dental pain, and show generally worse dental health, with a lower share of individuals without any dental issues. Individuals with SuppDI also go to the dentist more often than the noninsured comparison group, which would suggest adverse selection were it not that the overall number of dentist visits also includes check-ups and aesthetic procedures. In fact, Table 4.1 confirms this latter observation: SuppDI policyholders tend to have more preventive dentist visits than individuals without SuppDI.

Table 4.1: Descriptive Statistics by Insurance

	PHI (1) All	SHI (2) All	SHI (3) SuppDI Yes	(4) No
Male	0.687	0.454	0.429	0.464
Age	54.567	49.495	50.324	49.153
Married	0.690	0.576	0.637	0.550***
Income	3.690	2.782	2.993	2.695***
A-level	0.657	0.462	0.446	0.468
Employment				
Full time	0.422	0.389	0.407	0.381
Part time	0.052	0.123	0.115	0.127
Hourly	0.022	0.059	0.061	0.059
Unemployed	0.455	0.358	0.373	0.352
Job training	0.049	0.071	0.044	0.082**
Household size	2.291	2.315	2.341	2.304
Self-rated health	3.201	3.135	3.130	3.137
Never a smoker	0.545	0.561	0.532	0.572
BMI	26.500	26.428	26.543	26.381
Activity	4.134	3.940	4.034	3.901
Diet				
Fruits	3.179	3.218	3.267	3.198
Vegetables	3.157	3.075	3.137	3.050**
Fast food	1.825	1.822	1.824	1.822
Sweets	2.347	2.411	2.419	2.408
Dentist visits per year	1.817	1.761	2.049	1.641***
Number of other SuppHIs	1.160	0.506	1.179	0.228***
Usual preventive dentist visits per year				
Seldom/only in pain	0.108	0.054	0.022	0.068***
Once in 2 years	0.082	0.032	0.020	0.036
Once	0.354	0.375	0.353	0.384
Twice	0.384	0.490	0.551	0.464***
Three times or more	0.071	0.049	0.054	0.048
Dental issues				
Periodontitis	0.146	0.178	0.159	0.185
Filling	0.623	0.674	0.728	0.651***
Prosthesis	0.384	0.419	0.441	0.409
Implant	0.198	0.105	0.127	0.096*
Braces	0.022	0.021	0.017	0.022
Grind teeth	0.056	0.065	0.076	0.060
Missing teeth	0.078	0.095	0.098	0.093
Toothache	0.011	0.015	0.025	0.011*
Chewing/jaw	0.007	0.022	0.025	0.021
Caries	0.071	0.074	0.061	0.079
No issues	0.123	0.115	0.088	0.126**
Observations	285	1,496	429	1,067

Notes: Sample size can vary slightly within each variable. Income is measured in €1,000 intervals from < €1,000 up to > €5,000 monthly net household income. Self-rated health: bad = 1 to excellent = 5. Activity: never = 1 to daily = 6. Diet: never/seldom = 1 to daily = 4. The level of significance for the statistical differences in a two-sided *t*-test between the two groups (see columns 3 and 4) is designated as follows: *p<.10; **p<.05; ***p<.01.

To estimate the relation between SuppDI coverage and risk, we must find an appropriate measure for the financial risk associated with dental treatments. Because the Health Monitor data are cross-sectional only and based on patient surveys, they include no information on specific type of dental care or resulting expenditure for dental treatments, meaning that we cannot fully measure individual risk. Rather, we proxy risk by the number of dentist visits. Simply comparing the numbers for SuppDI enrollees and non-enrollees, however, is inadequate for risk assessment because the former may simply be more likely to have annual check-ups. Hence, to improve our dependent variable's risk measuring ability, we adjust our model in two ways: transforming the count variable to disentangle acute treatment visits from preventive check-ups and adding in more covariates to further reduce the nonacute treatment bias.

As regards the first adjustment, Figure 4.2 shows the distribution of dentist visits for the whole sample of individuals with SHI. As is evident, many individuals go to the dentist only once or twice a year, which indicates actual treatment or simply following dentist recommendations of two dental check-ups per year.[45] We thus transform the dependent variable *DentVisits* into a dummy equal to 1 if an individual went to the dentist more than twice in the previous year, and 0 otherwise. This transformation of the count variable, also used by Godfried et al. (2001), should prevent incorrect measurement of preventive dentist visits as a proxy for risk. Because German insurers only cover two annual check-ups, we assume that three or more dentist visits a year clearly point to acute treatment.

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[45] SHI members have a financial incentive to go for regular dental check-ups because if they do so during the 5 or 10 years preceding treatment, they receive higher benefits for dental prostheses.
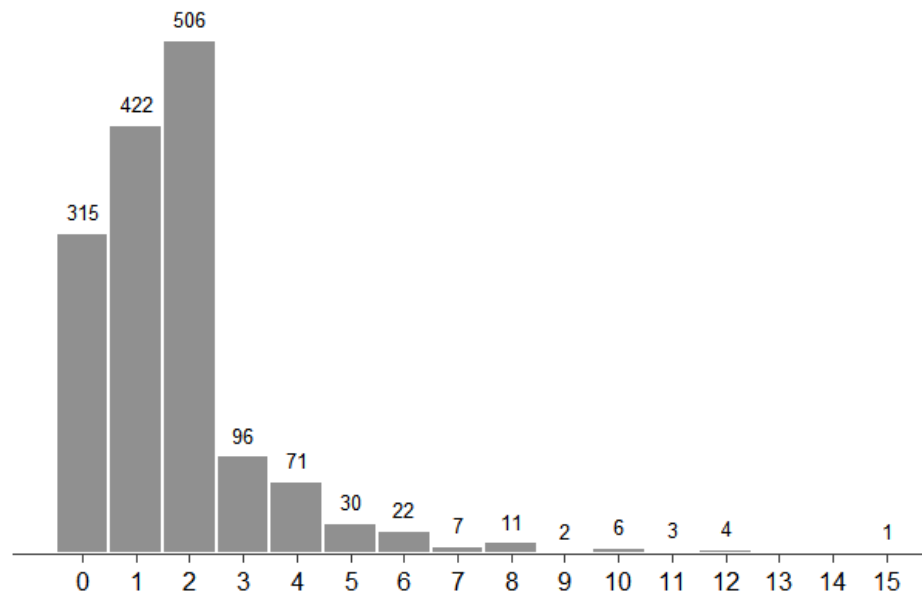
Figure 4.2: Number of Dentist Visits for all Individuals with SHI

The other covariates introduced into the model to further reduce the nonacute treatment bias are based on responses to individual survey items. One assesses the usual number of annual dentist visits for patients without any major dental issues.[46] We add dummies for this variable into the controls represented by vector C with the aim of capturing overly cautious individuals (i.e., those getting more than the recommended two annual check-ups). C also includes individuals' fear of the dentist, which might prompt them to skip annual check-ups or even avoid necessary treatments.[47]

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[46] Possible answers are three or more times a year," "about twice a year," "about once a year," "about once in two years," or "seldom, only in pain."

[47] Measured by a 6-item scale from "no fear" to "panic."

Drawing on the above, we estimate the relation between SuppDI coverage and risk by specifying the following linear probability model[48] (LPM):

$$P(DentVisits=1|DIns, X, C) = \alpha_0 + \alpha_1 DIns + \alpha_2 X + \alpha_3 C \qquad (1)$$

Here, the coefficient of interest, *DIns*, indicates insurance coverage (i.e., whether an individual has SuppDI (*DIns*=1) or not (*DIns*=0)), and X represents a vector of covariates to control for the risk classification in SuppDI policies. In line with the pricing of all German health insurers offering SuppDI, we use the insured's age[49] but also include whether or not the individual has dental prostheses or dental implants to reflect the more thorough risk classification used by some insurance companies. All these variables are included in nonparametric form, and results are robust against interaction between all characteristics. Because of space constraints, however, in Table 4.2, we use only the simplified version of the risk classification without interaction terms. It should also be noted that although insurers are allowed to reject applicants whose estimated risk is too high, the data do not allow us to control for rejected applications. Given that only a few insurance companies have explicit rejection rules (e.g., no contract finalization when tooth loss is greater than three), we expect this bias to be small. Moreover, rejections by German private health insurers because of bad dental health are rare (Finanztest, 2014).

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[48] Because the dependent variable is dichotomous, we also estimate a probit model whose results are given in Table 4.2.

[49] As the data are only cross-sectional, we cannot include characteristics related to time of contract finalization. As a proxy, we use current information from the survey. In fact, age at contract entry is decisive for risk classification; however, since the survey does not report this datum, we control for the age of the insured at time of survey. We assume this bias to be relatively small since the majority of policies were finalized after the 2004 health care reform.

Assuming that model (1) adequately measures risk, three observations are possible in the interdependence between SuppDI coverage and dentist visits, two related to a positive correlation of $\alpha_1 > 0$ in (1) and one to a negative link ($\alpha_1 < 0$). The first, in line with classical adverse selection, is that $\alpha_1 > 0$ results from residual ex-ante private information about the expected use of dental services. Under this condition, individuals with private information about their high risk type would be more likely to buy the supplemental coverage. The second possibility is that individuals with SuppDI coverage take fewer precautions (e.g., everyday dental care) and are thus either at higher risk (ex-ante moral hazard) or demand more dental services because of lower marginal costs (ex-post moral hazard). A negative link ($\alpha_1 < 0$), in contrast, would indicate advantageous selection in the German SuppDI market, possibly caused by a higher likelihood that cautious individuals will purchase SuppDI and engage in more preventative behaviors, leading to fewer dentist visits for acute treatments. Nevertheless, it should also be noted that, despite doubts about a strong impact of moral hazard in the field of dentistry, we cannot reject a possible bias in the analysis of selection behavior. Because moral hazard can only explain an upward bias that overestimates possible adverse selection, it brings into question the interpretation of a positive correlation. In the case of a negative correlation, on the other hand, moral hazard would cause the model to underestimate the magnitude of the coefficient. Hence, $\alpha_1 < 0$ indicates advantageous selection irrespective of the presence of moral hazard.

When equation (1) is estimated by a simple OLS regression, the coefficient α_1 shows the aggregate relation of all these possibly overlapping effects. A significant correlation thus only refers to the dominant population. If the sample is heterogeneous, some high-risk individuals may adversely select into SuppDI, while

others bring about advantageous selection by having characteristics that are positively correlated with buying SuppDI but negatively correlated with dentist visits for acute treatments. If selection in the sample is heterogeneous, these effects may offset each other so that an insignificant correlation might wrongly suggest the absence of information asymmetry. Because such an equilibrium could be inefficient (Finkelstein & McGarry, 2006), it is useful to distinguish these groups in order to derive a clearer picture of the different selection effects.

To test for a heterogeneous sample, we employ an IV method that allows us to identify a set of advantageous selectors while disentangling any possible overlap with adverse selection. The arrows in Figure 4.3 illustrate the interdependence of insurance coverage and risk: (i) designates the potential link resulting from adverse selection, (ii) indicates moral hazard, and (iii) represents our assumption that SuppDI policyholders differ not only in risk type but also in motivation for purchasing SuppDI. From the previous literature, we know that high-risk aversion may lead to simultaneous overcautiousness and purchase of health insurance; in other words, advantageous selection. In line with Buchmueller et al. (2013), we assume that this relation is not restricted to a specific risk and that cautious individuals generally have a higher affinity for buying insurance to reduce future risk. We then look at how many SuppHIs individuals have in addition to their SuppDI. Based on de Meza and Webb (2001), we argue that individuals holding many SuppHIs buy SuppDI because of their inner need for security (hereafter, insurance affinity) and are more likely to take precautions leading to lower risk.
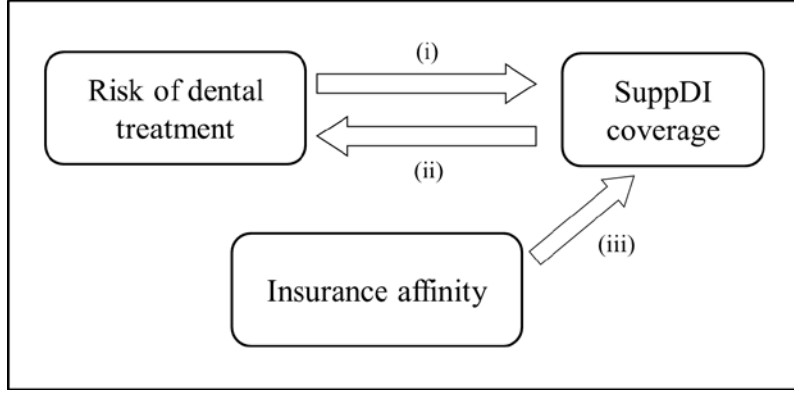
Figure 4.3: Relation between SuppDI Coverage and Individual Risk of Dental Treatment

As our instrument for having a SuppDI, we use the number of other SuppHIs enrolled in. We avoid misspecifying our instrument's functional form by creating the dummy variable "insurance affinity," which equals 1 if an individual has more than two SuppHIs in addition to SuppDI ("high insurance affinity") and 0 otherwise ("low insurance affinity"). In equation (2), we model the linear projection for *DIns* with the same covariates as in model (1) but add in the dichotomous instrument Z, which is excluded from the second stage:

$$P(DIns=1|Z, X, C) = \beta_0 + \beta_1 Z + \beta_2 X + \beta_3 C \tag{2}$$

SuppHIs will be a valid instrument (Z) for SuppDI as long as it satisfies two criteria: buying other SuppHIs must be a good predictor of purchasing a SuppDI and the correlation between dentist visits and having other SuppHIs must not be channeled through any other mechanism than that presented here. The first condition is shown to be met in our discussion of results; we find the second to be true for the following SuppHI components:

- additional daily hospital benefits;
- single or double hospital bed and treatment by chief physician;

- benefits for eyeglasses, drugs, and other medication;

- long-term care;

- alternative healing methods and naturopathy; and

- treatment by a private physician.

Admittedly, we doubt that worse dental health is likely to influence the decision to buy one of these insurance products. Moreover, dental care, being a very distinct field, may not be influenced by other health issues that increase the likelihood of buying supplemental hospital insurance. Nevertheless, if an individual's general health correlates negatively with overall insurance coverage and positively with dental health, any potential bias is likely to be positive.

This relation, however, is in no way straightforward. Rather, we are interested in identifying those who buy SuppDI because of their relatively high insurance affinity, a sample we explicitly assume to be heterogeneous in selection behavior. Yet the IV results, because they show only a local average selection for a specific subpopulation (the effect for so-called compliers), are not representative of the whole sample (Imbens & Angrist, 1994). Hence, for the results derived using our instrument, in contrast to those based on local average treatment effects, we claim no direct causality. Rather, we assert that individuals buying SuppDI because of high insurance affinity are better risks because of their preventive behavior, which is not necessarily observable.

4.5 Results

4.5.1 Evidence for heterogeneous selection

Table 4.2 shows the effects of the LPM (column 1) representing the aggregated correlation between risk and insurance coverage. In this model, the coefficient of SuppDI is not significantly different from zero. Hence, in the aggregate, we find no

evidence of information asymmetry. Moreover, although the covariates indicate that the dummies for dental implants and prostheses are significant and positive, age seems not to affect the number of dentist visits. Nevertheless, individuals reporting many preventive dentist visits are more likely to go to the dentist more than twice. One obvious explanation is the common practice of arranging further appointments if any need for acute treatments is noted during the regular check-up. Fear of the dentist, in contrast, seems to have only a minor impact. Estimating the aggregated coverage-risk correlation using a probit model (column 5) confirms these results. Such a nonsignificant risk-coverage relation in this market may, as already discussed, be attributable to one of two possible explanations: (i) the information asymmetry is empirically negligible or (ii) the risk- and preference-based selection offset each other in the aggregate (Finkelstein & McGarry 2006).[50]

We report the results of our tests for this heterogeneous selection in Table 4.2. Column 2 shows the results for our 2SLS estimations, while column 3 reports the first stage results, whose F-statistic of 220 indicates that the instrument is sufficiently strong and Z a good predictor for SuppDI in the model. We also obtain a mildly significant negative impact of having a SuppDI policy on dentist visits for acute treatments. This negative correlation points to the existence of multidimensional private information and advantageous selection within a subgroup of the sample, although we again cannot rule out a possible upward bias from moral hazard. The reduced form (column 4), which directly estimates the effect of the instrument on the dependent variable, also yields significant negative results, suggesting that the

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[50] Another explanation may be that private health insurers often include an elimination period in the SuppDI contracts during which they do not pay for any dental treatment. Unfortunately, the Healthcare Monitor does not include information about the date of contract signing. Nevertheless, we expect any possible bias to be small because the elimination period is usually only eight months (Finanztest, 2014).

Interpretation of our IV results in column 2 is valid: those having more than two additional health insurances tend to be low risk.[51]

Additionally, using an endogeneity test for robust standard errors, we are also able to reject the hypothesis that the SuppDI coefficient does not differ from OLS at a 5% significance level (Wooldridge, 1995). This rejection supports our assumption that the identified sample of advantageous selectors differs significantly from the aggregate with respect to risk. It is also worth noting that the 2SLS model (column 2) explains less variation in the dependent variable because we are now targeting only a specific subgroup. The results of the additionally estimated IV probit model (column 6) support the findings from the LPM (column 2).

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[51] The estimations reported in columns 3 and 4 of Table 4.2 are comparable to Finkelstein and McGarry's (2006) two separate regressions to identify advantageous selection.

Table 4.2: Aggregated and Instrumented Selection into Insurance

	(1) OLS	(2) 2SLS	(3) First stage	(4) Reduced form	(5) Probit	(6) IV probit
SuppDI	0.0321	-0.1056*			0.1392	-0.5075*
	(0.021)	(0.059)			(0.089)	(0.284)
Insurance affinity			0.6082***	-0.0642*		
			(0.041)	(0.036)		
Underwriting						
Dental prosthetics	0.0746***	0.0757***	-0.0018	0.0759***	0.3255***	0.3165***
	(0.021)	(0.021)	(0.026)	(0.021)	(0.089)	(0.088)
Dental implants	0.0723**	0.0794**	0.0194	0.0774**	0.2778**	0.3003**
	(0.035)	(0.036)	(0.040)	(0.035)	(0.125)	(0.124)
Age 20-24	0.0224	0.0235	-0.0353	0.0273	0.1139	0.1244
	(0.051)	(0.052)	(0.064)	(0.051)	(0.325)	(0.320)
Age 25-29	0.0454	0.0558	0.0537	0.0502	0.2645	0.3069
	(0.055)	(0.055)	(0.067)	(0.054)	(0.319)	(0.311)
Age 30-34	0.0295	0.0467	0.1105	0.0350	0.1733	0.2481
	(0.052)	(0.054)	(0.069)	(0.052)	(0.307)	(0.305)
Age 35-39	0.0708	0.0885*	0.0944	0.0785	0.3709	0.4427
	(0.052)	(0.053)	(0.066)	(0.052)	(0.295)	(0.290)
Age 40-44	0.0429	0.0623	0.1208*	0.0495	0.2607	0.3446
	(0.050)	(0.052)	(0.064)	(0.050)	(0.290)	(0.288)
Age 45-49	0.0097	0.0283	0.1202*	0.0156	0.1176	0.2002
	(0.049)	(0.051)	(0.063)	(0.050)	(0.293)	(0.291)
Age 50-54	0.0558	0.0708	0.1011	0.0601	0.2918	0.3565
	(0.052)	(0.053)	(0.067)	(0.052)	(0.292)	(0.288)
Age 55-59	0.0552	0.0687	0.0955	0.0586	0.3056	0.3604
	(0.052)	(0.052)	(0.064)	(0.052)	(0.288)	(0.284)
Age 60-64	0.0679	0.0819	0.0996	0.0714	0.3529	0.4085
	(0.058)	(0.059)	(0.069)	(0.058)	(0.304)	(0.300)
Age 65-69	0.0758	0.0878	0.0944	0.0778	0.3783	0.4226
	(0.054)	(0.055)	(0.066)	(0.054)	(0.290)	(0.285)
Age 70-79	0.0524	0.0685	0.1256**	0.0553	0.2888	0.3547
	(0.049)	(0.051)	(0.062)	(0.049)	(0.280)	(0.278)
Preventive visits						
Once in 2 years	0.0709	0.0850	0.1066	0.0738	0.3892	0.4343
	(0.061)	(0.064)	(0.071)	(0.062)	(0.316)	(0.315)
Once a year	0.0103	0.0304	0.1309***	0.0166	0.0857	0.1705
	(0.036)	(0.037)	(0.043)	(0.036)	(0.221)	(0.215)
Twice a year	0.0839**	0.1123***	0.1766***	0.0937**	0.4271**	0.5369**
	(0.037)	(0.039)	(0.043)	(0.037)	(0.217)	(0.210)
3+ a year	0.5942***	0.6207***	0.1387**	0.6060***	1.8687***	1.9099***
	(0.062)	(0.063)	(0.066)	(0.062)	(0.260)	(0.249)
Fear of dentist						
Very much	-0.0886	-0.0789	0.0760	-0.0869	-0.3322	-0.2733
	(0.070)	(0.070)	(0.074)	(0.070)	(0.290)	(0.283)
Rather more	-0.0985	-0.0868	0.0875	-0.0961	-0.4131	-0.3450
	(0.065)	(0.067)	(0.073)	(0.066)	(0.266)	(0.262)
Rather little	-0.0911	-0.0850	0.0570	-0.0910	-0.3710	-0.3264
	(0.065)	(0.066)	(0.070)	(0.065)	(0.254)	(0.250)
Very little	-0.0247	-0.0040	0.1629**	-0.0212	-0.1089	-0.0084
	(0.068)	(0.069)	(0.073)	(0.068)	(0.262)	(0.258)
None	-0.0967	-0.0927	0.0451	-0.0975	-0.3977	-0.3586
	(0.064)	(0.065)	(0.069)	(0.064)	(0.251)	(0.245)
Constant	0.0783	0.0707	-0.0564	0.0766	-1.5292***	-1.5022***
	(0.075)	(0.075)	(0.078)	(0.075)	(0.376)	(0.367)
Observations	1474	1474	1474	1474	1474	1474
Adj. R²	0.134	0.107	0.100	0.134		

Notes: The dependent variable in column 3 equals 1 for individuals having a SuppDI; otherwise, the dependent variable equals 1 for individuals who had two or more dentist visits in the previous year. Instrument: more than two additional SuppHI = 1. Omitted reference categories: age = age< 20; preventive dentist visits = seldom/only in pain; fear of dentist = panic. Robust standard errors in parentheses. *p<.10, **p<.05, ***p<.01.

4.5.2 Robustness Checks

We test the robustness of our results using additional survey data not observable by the insurance company. Table 4.3 reports the share of individuals without any dental problems and the self-rated health for four separate subgroups, with the differences in means reported within the first and last two columns. The first row shows that the share of individuals without SuppDI coverage (12.6%) who are not suffering from any dental problems is significantly higher than the respective share of SuppDI policyholders (8.9%), indicating that in the aggregate, SuppDI policyholders are higher risk than individuals without SuppDI coverage. It should also be noted that this result cannot be interpreted as information asymmetry because we do not control for insurance company risk classification. It does, however, imply that the negative correlation is unlikely to be caused by these companies' successful engagement in active risk selection.[52] This minor importance of active risk selection on the part of German private health insurers is also supported by the fact that the commissions of insurance agents with respect to SuppDI is based on volume rather than profit. Thus, these agents are not incentivized to select and reveal information about individual risk types to their companies (Cummins & Doherty, 2006).

Table 4.3: Differences by Insurance and Subgroup

Variable	(1) No SuppDI	(2) SuppDI	(3) ≤2 other SuppHIs	(4) >2 other SuppHIs
No dental issues	12.6%	8.9%**	7.2%	18.0%***
Self-rated health	3.14	3.13	3,10	3,30*
Observations	1,067	429	365	64

Notes: Measurements: no dental issues (1 = yes); self-related health from bad (1) to excellent (5). The level of significance for the statistical differences in means is designated as follows: *p<.10; **p<.05; ***p<.01.

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[52] Active risk selection means that insurers take measures to attract low-risk individuals and prevent high-risk individuals from enrolling (Nuscheler & Knaus, 2005).

Even more relevant, column 4 shows that 18.0% of SuppDI policyholders with more than two other SuppHIs have no dental issues versus only 7.2% of SuppDI policyholders with fewer additional SuppHIs. This significantly lower result is consistent with our earlier estimations showing that multidimensional private information leads to preference-based selection by some individuals. It should also be noted, however, that the group with more than two other types of insurance does not consist only of compliers. Hence, these differences must be interpreted with caution. Nevertheless, individuals with high insurance affinity do seem to have better dental health, an observation supported by the fact that their mean of self-rated overall health is slightly higher than that of the comparison group (for additional intergroup differences, see Appendix B Table B 1).

In general, the differences between these two groups show that SuppDI policyholders with a high insurance affinity have a higher income and are better educated than SuppDI policyholders with lower insurance affinity. Moreover, as shown in Table B1, including variables on smoking behavior, physical activity,[53] and diet as further proxies for risk preferences suggests that SuppDI policyholders with a high insurance affinity are more risk-averse than SuppDI policyholders with a lower insurance affinity. On the other hand, those with higher insurance affinity also seem to consume more fast food, which is usually a health risk but possibly explainable by their younger age. Admittedly, however, the differences between both groups with respect to the potential sources of advantageous selection are mostly not statistically significant, which is at least partly attributable to the small sample size.

Table 4.4 reports the regression results for three models containing an increasing set of additional covariates. In column 2, the coefficient of the instrumented SuppDI

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[53] Physical activities include sports, hiking, and gardening.

(-0.1345) becomes slightly more negative than in Table 4.2 (-0.1056) once socioeconomic controls are added into the basic model. Whereas the results for most of the added covariates in column 2 are insignificant, overall self-assessed health shows a significant negative relation to the dependent variable, indicating that healthier individuals are generally lower risk with respect to dental treatments. This link might contribute to the increased negative coefficient of SuppDI when sick individuals purchase more insurance coverage and are a worse dental risk.

When health is not controlled for, this link affects the second stage error term, violating the exclusion restriction and producing an upwardly biased estimate. Therefore, even though we cannot directly test for this bias, we split the sample by health status and re-estimate the model. The results, shown in Appendix B Table B 2, suggest that instrumenting SuppDI does not work when individual health is bad: the coefficient shows a positive but insignificant correlation between coverage and risk. Moreover, although the SuppDI coefficient is negative and highly significant in the upper health distribution (from good to excellent), the impact of self-assessed health appears small and the coefficient decouples in the lower health distribution (from bad to less good). These findings support the hypothesis that cases of very bad health in combination with full insurance coverage can upwardly bias our 2SLS results and hamper our identification strategy. Nevertheless, not only are such cases rare, but we obtain a significant negative effect even without controlling for overall self-assessed health.

Table 4.4: Aggregated and Instrumented Selection with Additional Controls

	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS	(5) OLS	(6) 2SLS
SuppDI	0.0264	-0.1345**	0.0275	-0.1172**	0.0252	-0.1171**
	(0.022)	(0.058)	(0.022)	(0.059)	(0.022)	(0.057)
Demographic controls						
Male	0.0088	0.0039	0.0161	0.0114	0.0184	0.0137
	(0.021)	(0.021)	(0.023)	(0.023)	(0.023)	(0.023)
Part time work	0.0495	0.0419	0.0493	0.0414	0.0480	0.0403
	(0.035)	(0.036)	(0.036)	(0.036)	(0.035)	(0.036)
Hourly based work	0.0367	0.0391	0.0159	0.0178	0.0214	0.0239
	(0.046)	(0.046)	(0.044)	(0.044)	(0.044)	(0.044)
Unemployed	-0.0303	-0.0247	-0.0343	-0.0291	-0.0337	-0.0286
	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)
Trainee position	-0.0013	-0.0038	0.0009	-0.0029	0.0066	0.0026
	(0.051)	(0.051)	(0.054)	(0.053)	(0.055)	(0.054)
A-level	0.0068	0.0003	0.0058	0.0015	0.0037	-0.0003
	(0.019)	(0.019)	(0.020)	(0.020)	(0.020)	(0.020)
Married	0.0176	0.0317	0.0163	0.0285	0.0169	0.0283
	(0.028)	(0.029)	(0.028)	(0.029)	(0.028)	(0.028)
Widowed	0.0668	0.0835	0.0615	0.0783	0.0735	0.0898
	(0.054)	(0.056)	(0.055)	(0.056)	(0.054)	(0.055)
Divorced	-0.0065	0.0100	-0.0098	0.0045	-0.0053	0.0085
	(0.038)	(0.038)	(0.040)	(0.040)	(0.040)	(0.040)
Income	0.0151	0.0262**	0.0140	0.0234**	0.0147	0.0239**
	(0.010)	(0.011)	(0.010)	(0.011)	(0.010)	(0.011)
HH size	-0.0143	-0.0193*	-0.0126	-0.0164	-0.0121	-0.0156
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Self-rated health	-0.0341**	-0.0349**	-0.0379**	-0.0384***	-0.0301**	-0.0306**
	(0.014)	(0.014)	(0.015)	(0.015)	(0.015)	(0.015)
Risk measures						
Care about health			-0.0073	-0.0095	-0.0079	-0.0099
			(0.014)	(0.014)	(0.014)	(0.014)
Never smoker			-0.0021	-0.0063	-0.0005	-0.0040
			(0.021)	(0.021)	(0.021)	(0.021)
BMI			-0.0040*	-0.0039*	-0.0043**	-0.0041*
			(0.002)	(0.002)	(0.002)	(0.002)
Physical activity			-0.0117*	-0.0112*	-0.0121*	-0.0116*
			(0.006)	(0.006)	(0.006)	(0.006)
Consumption						
Fruits			0.0040	0.0035	0.0055	0.0052
			(0.013)	(0.013)	(0.013)	(0.013)
Vegetables			0.0104	0.0132	0.0089	0.0113
			(0.016)	(0.016)	(0.016)	(0.016)
Fast food			-0.0111	-0.0099	-0.0142	-0.0123
			(0.017)	(0.017)	(0.016)	(0.017)
Sweets			0.0158	0.0161	0.0099	0.0095
			(0.013)	(0.013)	(0.013)	(0.013)
Dental issues						
Periodontitis					0.0784***	0.0706**
					(0.029)	(0.029)
Filling					0.0318	0.0381*
					(0.022)	(0.022)
Braces					-0.0196	-0.0260
					(0.056)	(0.057)
Grind teeth					0.0561	0.0625
					(0.040)	(0.040)
Missing teeth					0.0334	0.0373
					(0.036)	(0.036)
Toothache					0.1406	0.1707*
					(0.094)	(0.094)
Chewing/jaw					0.1357*	0.1356*
					(0.080)	(0.075)

Continued on next page

Table 4.4 (continued)

	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS	(5) OLS	(6) 2SLS
Caries					0.0467	0.0429
					(0.043)	(0.043)
Constant	0.2057**	0.1967**	0.3121**	0.3004**	0.2724**	0.2565*
	(0.097)	(0.097)	(0.137)	(0.137)	(0.139)	(0.138)
Fear dummies	Yes	Yes	Yes	Yes	Yes	Yes
Underwriting	Yes	Yes	Yes	Yes	Yes	Yes
Preventive visits	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1448	1448	1382	1382	1382	1382
Adj. R²	0.136	0.100	0.141	0.111	0.157	0.128

Notes : The dependent variable equals 1 for individuals who had two or more dentist visits in the previous year. Income is measured in €1,000 intervals from < €1,000 up to > €5,000 monthly net household income. Self-rated health: bad=1 to excellent=5. Care about health: not at all = 1 to very strongly = 5. Activity: never = 1 to daily = 6. Diet: never/seldom = 1 to daily = 4. Omitted reference categories: full time employment, marital status = single. Robust standard errors in parentheses. *p<.10, **p<.05, ***p<.01.

In columns 3 and 4 of Table 4.4, we include additional proxies for possible risk tolerance, including BMI, physical activity, and diet. The observed decrease in magnitude of the SuppDI coefficient suggests that we are capturing some of the linkage between insurance affinity and risk. Adding further information about current dental health into columns 5 and 6 slightly reduces the coefficient size; however, in column 5, the coefficient remains positive and insignificant, while in column 6 (the 2SLS results), the correlation remains significantly negative.

4.6 Conclusions

In this paper, we analyze information asymmetry in the German SuppDI market using a representative sample from the Healthcare Monitor patient survey. Our results provide no evidence that individuals with SuppDI visit the dentist for acute treatments more frequently than individuals without SuppDI, meaning that like many other recent studies on SuppHI in other countries, we find no support in the aggregate for the positive coverage-risk correlation predicted by classic adverse selection models. Although this lack of evidence could be attributed to information asymmetry not being empirically important in this market, we suggest it could be better explained by multiple forms of private information offsetting each other. We therefore apply an IV

method to disentangle any overlap between adverse and advantageous selection. Using possession of a SuppHI in addition to a SuppDI as our instrument, we show that SuppDI policyholders with a high insurance affinity go to the dentist for acute treatments significantly less frequently than those without SuppDI coverage, which supports the multiple information offset assumption. These results remain robust even after we control for a comprehensive set of covariates, which suggests that demographic characteristics alone, even when used for a more thorough underwriting, are insufficient to account for such selection behavior.

Nevertheless, even though these results are consistent with our findings that SuppDI policyholders with a high insurance affinity have better dental health than other SuppDI policyholders, we are unable to fully identify the causal mechanics by controlling for further covariates. That is, because the survey items gather only dichotomous information on dental health (e.g. "Do you have a least one dental filling?"), we cannot control for the intensive margin of dental health (i.e., whether an individual has 1 or 10 dental fillings), which might explain the remaining information asymmetry in our model and provide a possible cause for the remaining lower dental risk of the instrumented SuppDI policyholders.

Our findings do, however, provide solid evidence of information asymmetry in the German SuppDI market, an imbalance disguised by heterogeneous selection behavior. We thus argue that more than one type of individual is buying insurance coverage: on the one hand, individuals with private information about their own high risk lead to adverse selection; on the other, low risk individuals who purchase because of higher risk aversion lead to advantageous selection. Although these different selection effects can offset each other in the aggregate, they lead to a market equilibrium that is unlikely to be efficient compared to the first-best solution of

symmetric information (de Meza & Webb, 2001; Finkelstein & McGarry, 2006). Further research is thus needed that extends our insights about heterogeneous selection and tests our findings using longitudinal data with better risk measures. Such investigation might reveal the causal channels for the negative coverage-risk correlation and yield robust results for practical application.

In the meantime, the selection effects identified here might be gainfully used by the German SuppDI market for a more thorough underwriting, which could decrease inefficiencies from information asymmetry. In particular, given the lack of perfect competition between insurance companies, private health insurers in the German SuppDI market might profit not only from more thorough premium differentiation but from selecting individuals with a high insurance affinity.[54]

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[54] Under the opposite assumption of perfect competition in the insurance market (cf. the model proposed by Rothschild & Stiglitz, 1976), health insurers can earn no positive profits.

5 General Conclusions

This thesis contains three academic articles that differ in scope and methodology, but jointly contribute to improve the understanding of population aging and particularly elderly care. The first paper reviews the large body of literature on the effects of caregiving on the caregiver's life domains, namely: employment, health, and family. Even though the relationship with employment has become a great focus in recent years, the empirical findings are far from conclusive. This can be partly related to methodological difficulties to convincingly estimate a causal relationship of caregiving on employment. However, researchers have found a mostly negative but relatively small correlation in most population based samples – if even significant on a statistical level. Concerning health, the results are less equivocal. Despite the fact that most contributions are from non-economic fields, the association between caregiving and health is found to be generally negative. However, a small stream of literature also highlights possible channels for positive outcomes of caregiving: care duty can lead to strengthened familial relationships and psychological rewards from feelings of mastery or achievement. Implications on the family arrangements are less studied, where the relationship can have two pathways: first, married caregivers can often rely on support of their partner and face less financial burden. Second, care situations are associated with lower marital satisfaction and tend to strengthen traditional gender roles. Generally, it can be concluded that the implications of caregiving are complex and interdependent, which makes an overall valuation difficult. However, more research is needed to draw a clearer picture of the effects of caregiving and to obtain reliable knowledge, which can be used for policy implications.

The second paper is an empirical analysis and focuses on the effects of caregiving on the caregiver's well-being. As already mentioned in the literature review, population-based evidence for psychological stress of caregiving is scarce and this study is, to the candidate's best knowledge, the first to assess the effects of caregiving on subjective well-being in Germany. Additionally, the use of panel data allows to account for unobserved heterogeneity in the data, getting close to a causal interpretation of the results. The estimates from the German Socio-Economic Panel suggest a mainly negative link between caregiving and subjective well-being. This appears to be true for higher intensity with diminishing marginal burden for extremely long care hours. For the care duration, the results support neither of the classical theories – i.e., adaption or wear-and-tear. In fact, results suggest care burden to be U-shaped with the years of caregiving, meaning that in the first years the caregiving burden becomes more sever before a process of adaption sets in. Splitting the regressions by birth years shows that older generations are particularly burdened, as no significant link could be obtained for caregivers born after the 1950s. However, a more detailed analysis of the family structure finds the coefficients for intergenerational caregivers (e.g., parental care) to indicate a higher burden per hour, if compared to intragenerational caregivers (e.g., spousal care). An economic valuation of caregiving burden yields the opportunity cost of one hour of caregiving to be around seven Euros. As the estimations are based on data from 2001 to 2010, the valuation yields hourly costs close to the minimum wage in the formal care sector at that time.

Public policies were designed as reaction to demographic change and, thereby, try to address the downturns associated with informal caregiving. Financial support and new regulations should ease the burden for families facing a care situation. A care

recipient in need creates a substantial risk to the family, as loss of income and formal care costs may overburden the family's budget. Even though Germany had implemented a compulsory long-term care insurance in 1994, a financial risk remains existent due to the design of the system. To reduce the remaining financial risk caused by the capped benefits, private companies offer additional coverage through supplemental health insurances. Even though shifting health care coverage to the private sector may reduce the financial pressure on the public budget, such solutions create an additional risk of market inefficiency that do not provide an optimal equilibrium.

Therefore, the third paper analyzes a market for supplemental health insurance and yields new insights on selection behavior. As data on long-term care insurance was unavailable, the empirical analysis is based on data from the market for supplemental dental insurance. However, both markets are characterized by great similarities – i.e., the scarce underwriting and the coverage of out-of-pocket expenses – making the results likely to be transferable. By using an innovative instrumental variables approach, the paper reveals selection behavior in heterogeneous group of people. The empirical approach isolates a subset of highly insurance-affine people that buy insurance coverage because of their inner need for security; results show that such individuals lead to a negative coverage-risk correlation. This advantageous selection is, however, not evident when measuring the overall link between coverage and risk as it is counterbalanced by other dynamics - i.e. advers selection or moral hazard. These results raise the concern of an inefficient market solution for private supplemental health insurances and underline the risks of increasing individual responsibility by shifting more and more health care coverage to the private sector. However, this paper not only yields new insights on the German market for

supplemental dental insurance, but also introduces a new method that allows to test for market asymmetries and selection behavior within a heterogeneous sample.

To sum up, population aging is a great challenge and the growing demand for caregiving requires an efficient use of the limited resources available. Even though the well-being of the elderly should be a primary objective for policy makers, it would be shortsighted not to also consider possible outcomes for the informal caregivers. This thesis highlights some important aspects, which may help to design more holistic policies that account for all stakeholders involved and, thereby, improve the way a country masters its demographic transition.

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Appendix A

Table A 1: Descriptive statistics - Model I

Variable	Mean	Std. Dev.	Min	Max
Subjective well-being	6.97119	1.768399	0	10
Care time weekly	1.11235	6.919154	0	168
Years of caring	.2107114	.9249506	0	10
CR in the HH	.0249679	.1560277	0	1
Age	48.07661	17.51999	16	100
Male	.4794583	.4995792	0	1
Health status	3.378018	.9573898	1	5
Net household income	2991.553	2126.816	0	99999
High education	.3824814	.4859945	0	1
Married & together	.6045294	.4889528	0	1
Married & separated	.0171154	.1297019	0	1
Divorced	.0716932	.25798	0	1
Widowed	.0657355	.2478198	0	1
Fully employed	.3899549	.4877411	0	1
Part-time employed	.1041031	.305395	0	1
Otherwise employed	.1230816	.3285317	0	1
Child below 16 in HH	.2906149	.4540473	0	1
Observations	19004			

Table A 2: Descriptive statistics – Model II

Variable	Cohort	Mean	Standard Deviation	Min	Max
Subjective well-being	00s	5.625	236	0	10
	10s	6.321	224	0	10
	20's	6.857	1.934	0	10
	30s	6.946	1.803	0	10
	40s	6.978	1.788	0	10
	50s	6.777	1.832	0	10
	60s	6.932	1.731	0	10
	70s	7.097	1.649	0	10
	80s	7.271	1.628	0	10
	90s	7.521	1.581	1	10
Regular care time weekly by caregivers	00s	30	.	30	30
	10s	19.85	15.21	1	70
	20s	20.82	22.35	1	168
	30s	18.24	23.38	1	168
	40s	14.53	20.17	1	168
	50s	11.91	16.03	1	168
	60s	14.70	24.15	1	168
	70s	14.23	24.60	1	168
	80s	1.26	16.96	1	168
	90s	9.38	10.16	1	56
Share of caregivers in the sample	00s	.0113	.1066	0	1
	10s	.0579	.2337	0	1
	20s	.0804	.2720	0	1
	30s	.0993	.2991	0	1
	40s	.1163	.3205	0	1
	50s	.1086	.3112	0	1
	60s	.0562	.230a	0	1
	70s	.0336	.1802	0	1
	80s	.0298	.1701	0	1
	90s	.0310	.1736	0	1
Share of male caregivers	00s	.	0	0	
	10s	.5057	.5028	0	1
	20s	.5452	.4982	0	1
	30s	.4413	.4966	0	1
	40s	.4070	.4913	0	1
	50s	.3363	.4725	0	1
	60s	.3116	.4632	0	1
	70s	.3129	.4639	0	1
	80s	.4767	.4998	0	1
	90s	.6595	.4789	0	1

Table A 3: Descriptive statistics – Model III

Variable	Mean	Standard Deviation	Min	Max
Caregiver with care receiver in the household	.0197	.1391	0	1
Noncaregiver with care receiver in the household	.0052	.0720	0	1
Caregiver with no care receiver in the household	.0557	.2295	0	1

Other variables similar to descriptive statistics of Model I

Table A 4: Descriptive statistics – Model IV: Intergenerational care

Variable	Mean	Std. Dev.	Min	Max
Subjective well-being	6.7023	1.9520	0	10
Care time weekly	17.0984	20.5277	1	168
Years of caring	3.1612	2.2352	1	10
Age	50.9876	13.7514	17	85
Male	.4488	.4975	0	1
Health status	3.2527	.9727	1	5
Net household income	3261.509	1799.145	345	12000
High education	.4441	.4970	0	1
Married & together	.6279	.4835	0	1
Married & separated	.0155	.1235	0	1
Divorced	.0542	.2266	0	1
Widowed	.0348	.1835	0	1
Fully employed	.3155	.4648	0	1
Part-time employed	.1201	.3252	0	1
Otherwise employed	.1356	.3425	0	1
Child below 16 in HH	.1100	.3131	0	1
Observations	1290			

Table A 5: Descriptive statistics – Model IV: Intragenerational care

Variable	Mean	Std. Dev.	Min	Max
Subjective well-being	6.0844	2.0159	0	10
Care time weekly	25.0482	28.3214	1	168
Years of caring	3.0694	2.1837	1	10
Age	66.1464	13.2283	17	99
Male	.4563	.4981	0	1
Health status	2.8103	.9645	1	5
Net household income	2321.903	1252.448	329	12000
High education	.5640	.4959	0	1
Married & together	.8369	.3694	0	1
Married & separated	.0108	.1034	0	1
Divorced	.0428	.2025	0	1
Widowed	.0669	.2500	0	1
Fully employed	.1085	.3111	0	1
Part-time employed	.0482	.2143	0	1
Otherwise employed	.1064	.3085	0	1
Child below 16 in HH	.0470	.2116	0	1
Observations	2404			

Table A 6: Descriptive statistics – Model V

Variable	Mean	Std. Dev.	Min	Max
Subjective well-being	6.6831	1.8595	0	10
Care time weekly	14.7262	20.8170	1	168
Years of caring	2.7895	2.0328	1	10
CR in the HH	.2614	.4394	0	1
Age	54.3340	14.7092	17	99
Male	.3854	.4867	0	1
Health status	3.177	.9290	1	5
Net household income	2996.876	2015.153	0	55000
High education	.4027	.4904	0	1
Married & together	.7374	.4400	0	1
Married & separated	.0142	.1183	0	1
Divorced	.0683	.2523	0	1
Widowed	.0569	.2317	0	1
Fully employed	.2950	.4560	0	1
Part-time employed	.1319	.3384	0	1
Otherwise employed	.1208	.3260	0	1
Child below 16 in HH	.1891	.3916	0	1
Observations	14352			

Appendix B

Table B 1: SuppDI Policyholders: Low versus High Insurance Affinity

Characteristics	Low insurance affinity	High insurance affinity
	(1)	(2)
Male	0,435	0,393
Age	51,418	44,098***
Married	0,648	0,574
Income	2,960	3,180
A-level	0,438	0,492
Employment		
Full time	0,392	0,492
Part time	0,121	0,082
Hourly	0,066	0,033
Unemployed	0,378	0,344
Job training	0,043	0,049
Household size	2,346	2,311
Self-rated health	3,101	3,295*
Never smoker	0,524	0,574
BMI	26,427	27,202
Activity	3,983	4,328
Diet		
Fruits	3,271	3,246
Vegetables	3,135	3,148
Fast food	1,801	1,951*
Sweets	2,415	2,443
Dentist visits per year	2,081	1,869
Number of other SuppHIs	0.726	3.754***
Usual preventive dentist visits per year		
Seldom/only in pain	0,023	0,016
Once in 2 years	0,023	0,000
Once	0,363	0,295
Twice	0,539	0,623
Three times or more	0,052	0,066
Dental issues		
Periodontitis	0,167	0,115
Filling	0,720	0,770
Prosthesis	0,441	0,443
Implant	0,124	0,148
Braces	0,017	0,016
Grind teeth	0,075	0,082
Missing teeth	0,098	0,098
Toothache	0,023	0,033
Chewing/jaw	0,026	0,016
Caries	0,061	0,066
No issues	0,072	0,180***
Observations	365	64

Notes: Sample size can slightly vary within each variable. Income is measured in €1,000 intervals from < €1,000 up to > €5,000 monthly net household income. Self-rated health: bad = 1 to excellent = 5. Activity: never = 1 to daily = 6. Diet: never/seldom = 1 to daily = 4. The level of significance for the statistical differences in a two-sided *t*-test between the two groups is designated as follows: *p<.10; **p<.05; ***p<.01.

Table B 2: Individual Health Status: Good versus Bad

	Good Health		Bad Health	
	(1)	(2)	(3)	(4)
	OLS	2SLS	OLS	2SLS
SuppDI	0.0263	-0.1567***	0.0009	0.2482
	(0.024)	(0.057)	(0.055)	(0.375)
Self-rated health	-0.0307*	-0.0325*	-0.3764***	-0.3545***
	(0.018)	(0.019)	(0.107)	(0.107)
Constant	0.2650**	0.2570**	0.5161*	0.3381
	(0.119)	(0.119)	(0.262)	(0.376)
Fear dummies	Yes	Yes	Yes	Yes
Underwriting	Yes	Yes	Yes	Yes
Demographic controls	Yes	Yes	Yes	Yes
N	1,166	1,166	282	282
Adj. R²	0.109	0.059	0.254	0.185

Notes: The dependent variable equals 1 for individuals who had two or more dentist visits in the previous year. Good health includes good, very good, and excellent health; bad health includes less good and bad health. The variable self-rated health contains the corresponding within-group variation. Robust standard errors in parentheses. *p<.10, **p<.05, ***p<.01.

Curriculum Vitae

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September – October 2013	Academic visitor at the Davis School of Gerontology, University of Southern California
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Conferences & Presentations

2012	Doctoral seminar at the Oxford Institute of Population Ageing, UK
	ISQOLS Conference in Venice, Italy
2013	XVI Applied Economics Meeting in Granada, Spain
	ESPE Conference 2013 Aarhus, Denmark
	Institute seminar at the Center for Population and Development Studies, Harvard University, US
2014	Doctoral seminar in Empirical Economics Hohenheim, Germany
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Summer Schools & Workshops

August 2011	ZHSF-Methodenseminar Summer school in econometrics at GESIS Cologne, Germany
October 2011	5th International Research Workshop "Methods for PhD" in Flensburg, Germany
June 2012	GSE Summer School Barcelona: Panel Data Linear Analysis by Badi H. Baltagi; Quantitative Methods for Public Policy Evaluation by Stephan Litschig & Gabrielle Fack, Spain
May 2013	FZID Spring School in Quantitative Methods 2013: Panel Data Analysis by Jörg Breitung and Bayesian Methods by Gael Martin at the Hohenheim University, Germany
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Publications

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Bauer, Jan Michael, Cords, Dario, Sellung, Rachelle & Sousa-Poza, Alfonso (2015), Effects of Different Life Events on Life Satisfaction in the Russian Longitudinal Monitoring Survey, *Economics Letters*, forthcoming

Working Papers

Bauer, Jan Michael (2014), Informal elderly care and caregivers' subjective well-being

Bauer, Jan Michael, Schiller, Jörg & Schreckenberger, Christopher (2015), Heterogeneous Selection in Market for Private Supplementary Dental Insurance - Evidence from Germany. Submitted to the *Journal of Health Economics*

Bauer, Jan, Levin, Victoria, Munoz Boudet, Ana Maria, Nie, Peng & Sousa-Poza, Alfonso (2014), Subjective well-being and ageing in Europe and Central Asia

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Signature

Declaration of Authorship

Declaration in lieu of oath in accordance with § 8 paragraph 2 of the regulations for the degree "Doctor of Economics" at the University of Hohenheim.

1. I, Jan Michael Bauer, declare that this thesis on "The Economics of Elderly Care" and the work presented in it is my own and has been generated by me as the result of my own original research.

2. I have the approval of my co-authors to use the joint work in this dissertation and they endorse my individual contribution to the respective article.

3. I have used no sources or auxiliary means other than the ones acknowledged in this dissertation. I also have not used the illegal support of a third party, such as the help of a professional dissertation agency or consultancy. Where I have quoted from the work of others, the source is always given.

4. I affirm that the digital version submitted to the Faculty of Business, Economics and Social Sciences is identical to the hard copy.

5. I am aware of the meaning of this affirmation and the legal consequences of false or incomplete statements.

I hereby confirm the correctness of this declaration. I affirm in lieu of oath that I told the absolute truth and have not omitted any information.

_____   _____
Place, Date   Signature