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Selection Behavior in the Market for Private Complementary Long-term Care Insurance in Germany*

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ABSTRACT

In this paper, we analyze selection effects in the German market for private complementary long-term care insurance contracts (CompLTCI) within a static and dynamic framework. Using data on more than 98,000 individuals from a German insurance company, we provide evidence that advantageous selection is dominating in this market, with respect to both the decision to buy a CompLTCI policy and the decision about the extent of CompLTCI coverage. We identify occupational status, residential location and the holding of further supplementary health insurance policies as unused observables contributing to selection effects in this market. Our results suggest that non-linearities in the relationship of potential sources of selection to insurance coverage and risk should be considered. A panel data analysis shows that an increase in health insurance payouts is positively correlated with the uptake of CompLTCI, while a decrease in those costs is positively associated with the lapse of CompLTCI. In addition, we find that people in financial distress and of lower socioeconomic status are more likely to let their CompLTCI policies lapse.

Keywords: Asymmetric information; advantageous selection; adverse selection; long-term care insurance

JEL Classification: D82, G22

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1. INTRODUCTION

The aging of the population in virtually all industrialized countries has become a great burden for financing long-term care (LTC) (OECD/European Commission 2013). Public LTC coverage, such as basic mandatory long-term care insurance (LTCI) in Germany, however, does not cover the full costs of care, leading to a risk of high out-of-pocket payments for individuals in need of LTC. The private insurance market offers complementary LTCI (CompLTCI) to close this coverage gap in basic LTCI. However, similar to the limited size of the private LTCI market in the U.S (Brown and Finkelstein 2009), the number of CompLTCI policies in Germany was only approximately 3.3 m in 2015 (Association of German private healthcare insurers 2016b), i.e., only approximately 4% of enrollees in German basic LTCI hold CompLTCI.

The purpose of this paper is to analyze the German CompLTCI market to identify imperfections and related selection effects, as these may lead to market inefficiencies and contribute to the limited demand for private LTCI. This market is appropriate for analyzing selection effects because premiums for CompLTCI in Germany are risk-adjusted on the date of contract signing based on a small number of characteristics, i.e., age and gender. Ex-ante private information of individuals may lead to adverse (e.g., Rothschild and Stiglitz 1976) and advantageous selection (de Meza and Webb 2001). Those selection effects – and the related market inefficiencies – may arise not only from unobservable private information but also from the existence of unused observables, i.e., informative observable characteristics that are correlated with both insurance coverage and risk but are not used in pricing (e.g., Finkelstein and Poterba 2014). Our first research question relates to the existence of those selection effects due to private information in the aggregate. For this purpose, we analyze the correlation between

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1 This demographic change is expected to double or even triple LTC expenditures across OECD countries by 2050 (Colombo et al. 2011).
2 Brown and Finkelstein (2009) summarize several demand-side and supply-side factors that may limit the market for private LTCI.
CompLTCI and the risk of LTC needs in a static framework. Here, we differentiate between the decision to buy CompLTCI and, if insured, the decision about the amount of CompLTCI coverage to purchase. By examining potential unused observables in a manner similar to Finkelstein and Poterba (2014), we seek to answer a second research question related to the drivers of selection effects in this market. Based on previous findings (e.g., Browne and Zhou-Richter 2014; Fang, Keane, and Silverman 2008; Finkelstein and McGarry 2006), our hypothesis is that asymmetrically used information about preferences for insurance coverage and aspects of socioeconomic status, such as education or income, contribute to selection effects in this market. In addition to selection effects based on ex-ante private information, an ex-post selection may arise from insufficient front-loading in a situation with long-term contracts and one-sided commitment (e.g., Hendel and Lizzeri 2003). This may contribute to the limited demand for LTCI policies, as in the U.S. (Browne 2006). Hence, by examining the lapse and uptake behavior in a dynamic framework, our third research question is what characterizes the in- and outflow of the insured collective over time. This may provide important insights into the stability of the risk pool of CompLTCI enrollees. Note that the focus of this paper is on selection effects rather than information asymmetry because the latter is not a necessary condition for such an ex-post selection (Hendel and Lizzeri 2003).

By using a large dataset from a German private health insurance company and analyzing selection behavior in both a static and dynamic context, we extend previous empirical studies that rely on survey data to test for asymmetric information and selection effects in LTCI markets (e.g., Finkelstein and McGarry 2006; Finkelstein, McGarry, and Sufi 2005; Browne and Zhou-Richter 2014). Moreover, we contribute to the literature on unused observables (e.g., Finkelstein and Poterba 2014) in insurance markets and the sources of selection effects, especially of advantageous selection. Our empirical results provide evidence of asymmetric information in the German CompLTCI market and indicate that advantageous selection is the dominating selection
effect. We find that occupational status, residential location, and the holding of further supplementary health insurance are unused observables contributing to selection effects in this market. Another contribution our paper makes to the literature is that our results suggest that the effect of characteristics on insurance coverage and risk may be heterogeneous. By analyzing LTCI uptake and lapse behavior, we show that the decision to hold and retain CompLTCI is affected by a change in health insurance payouts. In addition, individuals with lower socioeconomic status and financial problems are more likely to drop CompLTCI coverage.

The remainder of this paper proceeds as follows. Section 2 provides an overview of the German market for LTCI. Section 3 summarizes the theoretical background and related empirical literature on selection effects in insurance markets. Section 4 describes the data and the empirical models used for analyzing selection effects in this market. Section 5 reports and discusses the results of our empirical analysis, and Section 6 concludes the paper.

2. PRIVATE COMPLEMENTARY LONG-TERM CARE INSURANCE IN GERMANY

In Germany, approximately 88% of the population is covered by statutory health insurance (SHI), while approximately 12% have substitutive private health insurance (PHI) (Federal Ministry of Health 2015). Since 1995, all citizens have been required to be insured by the statutory LTCI. A basic principle of the German LTCI scheme is that LTCI follows health insurance (Schulz 2010). Thus, statutory LTCI can be divided into two forms: First, SHI members are usually insured by social LTCI. Second, PHI enrollees are insured by the mandatory private LTCI, which is the focus of our paper. Premiums for the basic private LTCI are risk-adjusted at the date of contract signing based on the individual’s age and state of health (Association of German private healthcare insurers 2016a). By law, the type and scope of benefits of the mandatory private LTCI are equivalent to those in the social LTCI (§ 23 Social Code Book XI). Insured persons are entitled
to claim benefits for LTC if independent experts confirm their need for LTC in a review. The need for LTC is legally defined and requires that the insured need help in the long-term, i.e., for at least six months (§ 14 Social Code Book XI). If it is determined that the insured are eligible for LTC, the experts assign them to one of three possible care levels.\(^3\) People in a higher care level receive more benefits. In the basic private LTCI, enrollees can choose between cash benefits for informal home care, reimbursement of part of the LTC costs for formal care or combinations of both. Since 2013, people with a considerably limited ability to cope with daily activities (for instance, due to dementia) but who are not assigned to one of the care levels may also obtain these types of benefits at a lower level than the lowest care level. However, statutory LTCI only partly covers the costs of LTC (Association of German private healthcare insurers 2016a). Hence, out-of-pocket payments for LTC benefits in Germany are substantial.\(^4\) More than one third of all LTC costs in 2013 were financed by out-of-pocket payments (Rothgang et al. 2015).\(^5\)

Enrollees in the mandatory private LTCI are permitted to purchase private CompLTCI coverage directly from private health insurers to reduce the coverage gaps of basic LTCI. Generally, the PHI market, including the market for CompLTCI, can be regarded as oligopolistic (Hofmann and Browne 2013). In 2015, the total number of CompLTCI policies was approximately 3.3 m, compared to only approximately 0.8 m in 2005 (Association of German private healthcare insurers 2016c).\(^6\) While the number of CompLTCI policies is increasing, the demand is still rather low. Among CompLTCI policyholders, most individuals have a CompLTCI with daily cash benefits (Association of German private healthcare insurers 2016b); these policies

\(^3\) Due to reform of the German LTCI scheme, the number of care levels changed from three to five in 2017.

\(^4\) For instance, out-of-pocket payments for people, who are in need of LTC in a nursing home and who are assigned to the highest care level, are, on average, as high as 1,800 EUR per month, i.e. more than 50% of the total average LTC costs for inpatient LTC care (Association of German private healthcare insurers 2015).

\(^5\) See Schulz (2010) for more detailed information on the German LTC system.

\(^6\) Since 2013, private health insurers may additionally offer government-funded CompLTCI policies. In 2015, nearly 0.7m (i.e. about 21%) of CompLTCI policies were government-funded (Association of German private healthcare insurers 2016b). In our paper, however, we will focus on non-funded policies.
are the focus of this paper. The cash benefits depend on the recipient’s care level, the chosen tariff and the type of LTC, but they do not depend on the actual costs of LTC. In line with basic LTCI, CompLTCI policyholders only receive benefits from the CompLTCI if an individual is assigned to a care level. If LTC is indeed needed, the daily cash benefits are freely available to the beneficiaries.

At the date of contract signing, CompLTCI premiums are generally risk-based on the individual’s gender as well as the age. The rather limited underwriting and hence a limited premium differentiation may lead to selection effects concerning both the uptake and extent of CompLTCI. Contracts are guaranteed renewable (Pauly, Kunreuther, and Hirth 1995). As insurers are committed to the contract terms and enrollees may opt out of their contracts, there is one-sided commitment. As policyholders’ health status deteriorates over time, CompLTCI policies are front-loaded in order to cover higher expected LTC costs in older age (Hendel and Lizzeri 2003). The front-loading ensures that premiums are independent of individual changes in health status for the entire contract duration. Hence, policyholders are completely insured against the individual reclassification risk. However, the participating nature of CompLTCI contracts, where policyholders participate in the risk pool’s performance, leads to a collective reclassification risk. When actual LTC expenditures exceed calculated (expected) costs, insurers have the right to adjust premiums for all policyholders of the risk pool (Hofmann and Browne 2013; Nell and Rosenbrock 2008). The lack of consumer commitment and higher incentives for low-risk enrollees to drop CompLTCI coverage may increase the collective reclassification risk, due to a worsening of the risk pool over time (Brown and Finkelstein 2009; Hofmann and Browne 2013). In extreme cases, this worsening of the risk pool may endanger the protection against the

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7 Since the introduction of unisex tariffs in December 2012, private health insurers have been prohibited from using gender as a criterion for determining premiums. Moreover, insurers may reject applicants based on their health status or need for LTC at the date of contract signing.
individual reclassification risk (Finkelstein, McGarry, and Sufi 2005; Nell and Rosenbrock 2008). Overall, the rather limited ex-ante premium differentiation for CompLTCI, as well as the lack of consumer commitment, may lead to market inefficiencies due to selection effects.

3. THEORETICAL BACKGROUND AND RELATED LITERATURE

Our paper is closely related to two strands of literature. First, we rely on and contribute to the literature on adverse and advantageous selection based on ex-ante private information. In classic models of asymmetric information in insurance markets (e.g., Rothschild and Stiglitz 1976), individuals have only private information about their risk of loss, i.e., private information is one-dimensional. In a separating equilibrium, high-risk individuals choose policies with higher coverage compared to low-risk individuals. According to the model of Rothschild and Stiglitz (1976), in the context of CompLTCI in Germany, people with a high risk of needing LTC are more likely to buy CompLTCI or choose higher coverage compared with low-risk individuals. The basic empirical prediction of adverse selection models in a market equilibrium is the so-called “positive correlation hypothesis”, i.e., there is a positive correlation between the individual’s risk of loss and the amount of insurance coverage selected conditional on all individual characteristics used by insurers for pricing. This prediction seems to be quite robust if the insurance market is perfectly competitive (Chiappori et al. 2006). Several studies have found a positive coverage-risk correlation in different insurance markets, such as the annuity insurance or health insurance markets (for a review, see Cohen and Siegelman 2010). In a closely related paper, Browne and Zhou-Richter (2014) find a positive coverage-risk correlation in the German private LTCI market using data from the German Socio-Economic Panel. This is consistent with Oster et al. (2010), who provide evidence for adverse selection in the United States’ LTCI market.
when individuals have increased private information on their risk (obtained through genetic testing) with respect to carrying Huntington’s disease.

It should be noted that finding a positive correlation is not a sufficient condition for the existence of adverse selection, as such a correlation may also arise from the presence of moral hazard, i.e., reverse causality may be present (e.g., Chiappori et al. 2006; Dionne 2013). In the latter case, individuals with a high level of insurance coverage have fewer incentives to put effort into prevention, leading to higher risks compared to individuals with lower insurance coverage (ex ante moral hazard); they may also use more benefits due to decreased marginal costs (ex post moral hazard). Cohen and Siegelman (2010) and Dionne (2013) discuss several approaches to disentangling different information problems, such as the causality test of Dionne, Michaud, and Dahchour (2013), which uses dynamic data to separate moral hazard from adverse selection.

While the prediction of a positive coverage-risk correlation is quite robust in a competitive insurance market, the positive coverage-risk correlation may be of any sign under asymmetric information in an imperfectly competitive market (Chiappori and Salanié 2013). This may be explained by unobservable heterogeneity in preferences for insurance, in addition to heterogeneity in risk (Cutler et al. 2008). Hemenway (1990) and de Meza and Webb (2001) suggest that a reversal of the positive correlation prediction can be explained by individuals who are more likely to purchase insurance coverage and who simultaneously put more effort into prevention to decrease their risk of loss. Such a mechanism leads to an “advantageous selection” for insurance companies, as insurance coverage is more likely to be chosen by low-risk types. Although, in the theoretical model of de Meza and Webb (2001)⁸, risk aversion is a source of advantageous selection, essentially any private information that individuals have about a characteristic with a positive association with insurance coverage but a negative association with

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⁸ de Meza and Webb (2001) base their theoretical model on a competitive insurance market. However, administrative costs in processing claims play a crucial role in the existence of the equilibrium.
the risk of loss can be considered a driver of advantageous selection (Fang, Keane, and Silverman 2008). Some empirical evidence suggests that multidimensional private information and the resulting selection effects are important in different insurance markets, such as in LTCI markets (Cutler, Finkelstein, and McGarry 2008). Finkelstein and McGarry (2006) find that people with private information about their own high risk are more likely to hold LTCI in the U.S. LTCI market. However, this adverse selection is offset by advantageous selection, which explains the absence of a positive correlation between insurance coverage and admission to a nursing home. Their findings suggest that wealth and risk preferences are sources of advantageous selection in this market. Using survey data, Browne and Zhou-Richter (2014) also find that while adverse selection is predominant in the German private LTC market, both selection effects are present in the same insurance market. They identify the preference for insurance, as measured by the number of additional complementary health insurances, as a source of advantageous selection in the German private LTC market.9 Fang et al. (2008) provide evidence that cognitive ability and socioeconomic characteristics (e.g., income and education) are sources of advantageous selection in the U.S. Medigap insurance market.

In another closely related paper, Finkelstein and Poterba (2014) suggest that the identification of observable characteristics that are not used by insurance companies for pricing but correlate with insurance coverage and the risk of loss (i.e., unused observables) indicates that the insurance market suffers from asymmetrically used information. They provide evidence of asymmetric information in the U.K. annuity market by identifying residential location (proxied by the individual’s postcode) as an unused observable during the period of their study; they find that the socioeconomic status of an individual’s residential location is correlated with insurance demand and with the individual’s risk of loss. As shown by Kesternich and Schumacher (2014),

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9 Browne and Zhou-Richter (2014) consider this individual characteristic to be related to risk aversion.
unused observables may exist in an equilibrium in an imperfectly competitive insurance market with costly market entry.\(^{10}\)

The second strand of literature addresses selection effects and dynamic market inefficiencies due to one-sided commitment that may arise for risk-averse individuals who want to insure against the individual reclassification risk (e.g., Pauly, Kunreuther, and Hirth 1995) in long-term contracts. In a situation with one-sided commitment (i.e., a lack of commitment from only the insured), low-risk types learning about their risk over time may have an incentive to drop their long-term contracts (Hendel and Lizzeri 2003). Consistent with their predictions, Hendel and Lizzeri (2003) find that front-loading reduces incentives to lapse and that more front-loading helps to retain a better risk pool by decreasing the probability of lapsing in the life insurance market. In line with these findings, there is some evidence in the German health insurance market that low-risk individuals are more likely to drop their basic PHI coverage (Hofmann and Browne 2013) or supplementary hospital insurance coverage (Lange, Schiller, and Steinorth 2017). Similarly, with respect to LTCI, Finkelstein, McGarry, and Sufi (2005) and Browne (2006) find that people in the U.S. market with a lower LTC risk are less likely to retain LTCI policies over time. Such an ex-post selection may lead to a worsening of the risk pool and therefore higher premiums for LTCI (Brown and Finkelstein 2009). Dynamic market inefficiencies resulting from an incomplete lock-in of low-risk types (due to insufficient front-loading) may be one factor explaining the limited size of the U.S. LTCI market (Browne 2006; Finkelstein, McGarry, and Sufi 2005). It should be noted that this type of selection may be based on the symmetric learning of both insurance companies and consumers, as shown in the model of Hendel and Lizzeri (2003). Konetzka and Luo (2011), however, find little evidence for a worsening of the risk pool due to policy lapse in the U.S. LTCI market and conclude that other

\(^{10}\) Kesternich and Schumacher (2014) also discuss further explanations for the existence of unused observables.
drivers, such as a decrease in assets, play a more important role in lapse behavior compared with improved health status.

In this paper, we contribute to the literature on asymmetric information and selection effects as well as lapse behavior in LTCI markets. While prior literature is mostly based on survey data, our paper uses insurer data. In addition, we test for selection effects in a static framework and test selection behavior in a dynamic framework. While, for instance, Browne and Zhou-Richter (2014) also analyze the German private LTCI market with a similar research focus, they use survey data with information on private LTCI coverage only from 1992, i.e., before the implementation of mandatory basic LTC coverage in Germany. Not only has the German market grown substantially since then, as shown in the previous section, we also examine lapse and uptake behavior over time. In contrast to their findings, we show that advantageous selection is dominating the German LTCI market. Moreover, we extend the literature by focusing our analysis on unused observables, such as the individual’s occupation, in the German CompLTCI market. Another contribution we make to the literature is that we consider the heterogeneous effects of characteristics on the risk of loss and insurance coverage when testing for sources of selection.

4. DATA AND METHODS

4.1 Data and Specification of Variables

In our paper, we use data from a German private health insurance company that sells insurance policies throughout Germany, but is regionally focused on one federal state.\footnote{It should be noted that, theoretically, people might buy CompLTCI policies from more than one insurance company. While this could be an obstacle to analyzing asymmetric information with data from one insurance company (Chiappori and Salanié (2013)), we argue that it is very unlikely that individuals will purchase CompLTCI policies from different insurers, as they would suffer from higher transaction costs if they were to buy CompLTCI policies from more than one insurer without benefitting. It would only make sense for the insured to purchase...} Our data include
information on health insurance and LTCI policies concluded between 1960 and 2014. We observe claims for each policy between 2006 and 2014. In our analysis, we restrict our sample in three ways. First, we exclude SHI enrollees because we only have information about their LTC risk if they hold a CompLTCI policy from this private health insurance company. Thus, we do not have a control group among SHI enrollees with respect to LTC risk. Second, we exclude civil servants to avoid any complexity arising from differences between civil servants and individuals not employed as civil servants.\footnote{Civil servants in Germany receive subsidies for their health care and LTC costs from their employer. In addition, civil servants have a strong incentive to enroll in the PHI, which covers their remaining health care costs (Hofmann and Browne 2013). Moreover, civil servants enrolled in the substitutive PHI have to be insured in the basic mandatory private LTCI (Association of German private healthcare insurers 2016a). However, coverage in the basic LTCI is lower for civil servants compared to other enrollees.} Third, similar to Browne and Zhou-Richter (2014), we only include individuals aged 40 years and older in 2006, i.e., the first year of observing insurance payouts, as the risk of needing LTC substantially increases with age. Hence, our final sample consists of 98,305 individuals. Table A.1 in the Appendix summarizes, by data source, all variables that we use in our analysis.

As a measure of risk of loss in our empirical models, we use several proxies. First, we use a dichotomous variable that indicates 1 if there was any insurance claim for the mandatory LTCI between 2006 and 2014, and 0 otherwise ($LTCprob$). This measure neglects the intensity of the individual impairment but allows for a clear identification of LTCI needs. Using this dichotomous proxy for risk allows us to exclude any ex post moral hazard effects that may arise from the choice of the type and scope of LTC services. As a second measure of the insured’s risk, we use the natural logarithm of the total cost of payouts from the mandatory LTCI ($lnLTCcost$). Note that we can only observe the annual amount of LTC payouts, and hence, we have no additional insurance from another insurer if they wanted to purchase coverage that exceeds the maximum daily allowance from one insurance company. However, the maximum daily allowance for CompLTCI must not be exceeded by the daily allowance of all CompLTCI policies, including those bought from other insurers. Moreover, we only find about 1\% of the CompLTCI policies providing the maximum possible coverage in our sample. Hence, we conclude that outside options seem to be a minor issue.
information about the insured’s care level. As some of the insured may only receive relatively low payouts from the mandatory LTCI, for instance for care aids, even though they do not need LTC in legal terms, we only consider enrollees as in need of LTC if their payouts exceed the minimum amount of cash benefits for LTC. Here, we take into account that the insured are only eligible for LTC benefits if they need care for at least six months. For instance, we classified people as care-dependent if their LTC payouts in 2006 exceeded 1,230 EUR, which equals six monthly payouts of cash benefits at the lowest care level.\textsuperscript{13} In the panel data analysis, we use a dummy variable that indicates 1 if there was any claim for health insurance benefits (\textit{HCprob}), and we use the natural logarithm of total payouts from health insurance (\textit{lnHCcost}) as a proxy for risk. As the latter variables only consider claims that were submitted to the insurer, we have to take into account that health insurance policies differ with respect to deductibles. To make policyholders comparable with respect to their health insurance benefits, we follow Cohen (2005) and consider only claims for health insurance benefits exceeding the highest possible deductible in these policies (i.e., 1,680 EUR).

We measure LTCI coverage in a first step with the dichotomous variable \textit{CompLTCI}, which indicates 1 if an individual holds any type of relevant CompLTCI and 0 otherwise. To measure CompLTCI coverage more precisely, we also use the natural logarithm of the sum of the monthly premiums that individuals pay for their CompLTCI policies (\textit{lnCompLTCIp}). When using this variable as a proxy for insurance coverage, we restrict our sample to CompLTCI policyholders, as non-policyholders do not pay any premiums for CompLTCI.

To control for the risk adjustment made by the insurance company, we include gender and age as covariates in our models.\textsuperscript{14} When analyzing only the sample of CompLTCI

\textsuperscript{13}To take into account that people may begin to need LTC at the end of a year, we also checked that the received LTC payouts exceed six monthly cash benefits over two successive years.

\textsuperscript{14}We include gender because most of the CompLTCI policies in our dataset were signed before the introduction of the unisex tariffs in December 2012.
policyholders, we also control for the year of contract conclusion. We interact all pricing characteristics to ensure, for instance, that every individual with the same age and gender is placed in the same risk class. Including these variables adjusts the coverage-risk correlation for all observable factors used by the insurer to set the individual premium.\textsuperscript{15} To check the extent to which these characteristics can predict the premiums for CompLTCI, we regress the premium for CompLTCI on these characteristics as well as the type of CompLTCI policy. In this regression, we interact the pricing characteristics. The type of CompLTCI policy considers the generosity with respect to benefits at the different care levels. We find an adjusted $R^2$ of 0.9545. In our empirical models, however, it is not feasible to consider each type of CompLTCI policy. As much variation in the premiums can be explained without even considering the year in which the contract was signed ($adj. R^2 = 0.8221$), our proxies for the characteristics used to determine the CompLTCI premiums are good predictors for placing individuals in different risk classes.

When analyzing the sources of selection, we consider several observable characteristics of the insured that are not used by the insurer to set LTCI prices. Here, we analyze the preference for insurance proxied by the holding of additional health insurance policies, in line with Browne and Zhou-Richter (2014). Specifically, we consider daily sickness benefits insurance and hospital daily benefits insurance because PHI enrollees can purchase both types of insurance policies as supplements to their health insurance coverage.\textsuperscript{16} In addition to data of the insurance company, we include further information to our dataset in two ways to test for unused observables. First, the insurance data contain information on occupational status for more than 80% of our sample.\textsuperscript{17}

\textsuperscript{15} Note that there is no discount for buying several policies from the same insurance company or for choosing higher benefits in the CompLTCI policies.

\textsuperscript{16} While sickness benefits insurance policies protect PHI enrollees against the loss of income due to the inability to work caused by sickness, PHI enrollees holding hospital daily benefits insurance receive daily cash benefits for each day in the hospital.

\textsuperscript{17} As some occupations of the insured in our dataset cannot be assigned an ISEI value, the number of individuals with an ISEI-08 value differs from the number of individuals for whom we have information about occupation.
We use the International Socio-Economic Index of Occupational Status (ISEI) introduced by Ganzeboom et al. (1992) and assign to each individual an index value corresponding to socioeconomic status. The index values used in this paper are based on ISEI-08\(^\text{18}\) (Ganzeboom and Treiman 2010) and consider the income and education of an individual. Second, following Finkelstein and Poterba (2014), we are able to merge information from the German Census of 2011 and the Eurostat database with the residential location of the insured measured by the first three digits of the insured’s postcode. The German Census of 2011 includes detailed data on socioeconomic characteristics for more than 400 rural and urban districts.\(^\text{19}\) We use these district-level data to assign data on education, employment status, GDP per capita and marital status to each individual.\(^\text{20}\) In addition, we include information on the age pattern (dependency ratio) in the residential locations where the individuals live.

4.2 Econometric Approach in a Static Setting

For the identification of selection effects based on the individual’s private information in a static framework, we rely, in our empirical model, on the idea of the bivariate probit model by Chiappori and Salanić (2000); this model has been applied in several previous studies (see Cohen and Siegelman, 2010 for a review). In a first step, we will assess the coverage-risk correlation to obtain the overall difference in LTC risk between people holding a CompLTCI and people without additional LTCI coverage by estimating the following two-equation model:

\(^{18}\text{ISEI-08 is based on the 2008 revision of the International Standard Classification of Occupations (ISCO), i.e. ISCO-08.}\)

\(^{19}\text{These districts in Germany correspond to the units of the Nomenclature of Territorial Units for Statistics (NUTS) level 3.}\)

\(^{20}\text{In most cases, the first three digits of the postcode can be attributed to more than one district. Therefore, we use the mean values of the socioeconomic variables for each residential location.}\)
\[ R_i = \alpha_1 + \alpha_2 X_i + \varepsilon_i \]  
\[ C_i = \beta_1 + \beta_2 X_i + \vartheta_i \]  

In this model, we regress both the individual’s risk of receiving benefits from the compulsory (basic) LTCI \((R_i)\) and the CompLTCI coverage \((C_i)\) on a vector of the individual’s characteristics \((X_i)\) that are observable to the German CompLTCI insurers and used for determining the premium for CompLTCI. After regressing both equations, we use the residuals \((\varepsilon_i & \vartheta_i)\) and check their independence by analyzing the correlation coefficient \(\rho(\varepsilon_i, \vartheta_i)\). Identifying a correlation between the residuals that is significantly different from zero, i.e., \(\rho(\varepsilon_i, \vartheta_i) \neq 0\), indicates that \(R_i\) and \(C_i\) are correlated. This finding points to the existence of asymmetric information in the aggregate. Based on previous findings and the rather limited underwriting in the German CompLTCI market, we hypothesize that the German CompLTCI market suffers from asymmetric information, leading to adverse and/or advantageous selection.

To identify potential sources for selection, we follow the approach of Finkelstein and Poterba (2014). Their test for unused observables is based on the two regressions in equations (1) and (2):

\[ R_i = \delta_1 + \delta_2 U_i + \delta_3 X_i + \varphi_i \]  
\[ C_i = \theta_1 + \theta_2 U_i + \theta_3 X_i + \omega_i \]  

The interpretation of the equations generally follows equations (1) and (2). We separately regress the \(R_i\) and the \(C_i\) on the same model that includes an intercept \((\delta_1 & \theta_1)\), the characteristics used for pricing of the CompLTCI policies, and the error term \((\varphi_i & \omega_i)\). We also include information about the insured that was not used for calculating the premiums but is available to the insurer \((U_i)\). These unused observables can be on the individual level or on a
more aggregated level (such as residential location). Looking at $\delta_2$ & $\theta_2$ allows us to identify characteristics that can drive selection into CompLTCI. A variable that correlates positively with risk ($\delta_2 > 0$) but also significantly increases the uptake of CompLTCI ($\theta_2 > 0$) can be interpreted as a driver of adverse selection. Conversely, if a variable correlates positively with the uptake of CompLTCI ($\theta_2 > 0$) but negatively with risk ($\delta_2 < 0$), then we interpret this variable as a driver of advantageous selection. In line with previous studies (e.g., Browne and Zhou-Richter 2014), another property of a driver of adverse (advantageous) selection is a substantial change in the coverage-risk correlation represented by $\rho (\varepsilon_i, \theta_i)$ in a negative (positive) direction, i.e., $\rho (\phi_i, \omega_i) < \rho (\varepsilon_i, \theta_i)$ ($\rho (\phi_i, \omega_i) > \rho (\varepsilon_i, \theta_i)$).

4.3 Econometric Approach in a Dynamic Setting

In addition to cross-sectional information, the data set provides longitudinal annual costs for each contract with information about the lapse of CompLTCI between 2008 and 2014 and about the uptake of CompLTCI over the whole observation period (i.e., since 1960). We exploit this information to investigate dynamic selection into and out of CompLTCI over our observation period. In a first step, we base our analysis on a pooled regression model similar to equation (4). Here, rather than merely compare individuals with and without CompLTCI, we focus on people changing their CompLTCI status.

For further longitudinal analysis, in a second step, we use variations in the annual health care costs associated with the year an individual takes up or lapses CompLTCI. In this event study, we assign distinct dummy variables to the years before and after the event. This analysis provides a dynamic understanding of the relationship between the individual’s health status and the decision-making concerning CompLTCI. Therefore, we model the annual health care costs and claim occurrence in health insurance as:
\[ H_{it} = \beta' X_{it} + \sum_{j=-5}^{5} \gamma_j L_{j, it} + u_t + \epsilon_{it}, \quad j = -5, -4, \ldots, 4, 5 \] (5)

where \( H_{it} \) represents the health of individual \( i \) at time \( t \) measured as the natural logarithm of the annual health care cost (\( \ln \text{HCcost} \)) or as a dummy variable indicating the occurrence of at least one claim during the specific year (\( \text{HCprob} \)). \( X_i \) represents information about the insured that is used for calculating the premiums. By including dummies for year fixed effects with \( u_t \), we control for unobserved but constant heterogeneity among different years. The \( L_{it} \) dummies indicate the years before and after the take up or lapse in year 0. Given the nine years of observation, leads and lags of more than five years are rarely observed. Therefore, we include those observations in the five-year dummies.

As individuals can only lapse (buy) CompLTCI if they previously had (did not have) such insurance, we restrict our sample in the following way. For the lapse analysis, we only include individuals who had CompLTCI in the year 2008, as we only observe lapses after 2007. For the uptake analysis, we include people who did not hold CompLTCI in 2006. Thereby, we make our sample comparable in such a way that all individuals in the sample have the opportunity to experience such an event. As reference for the year dummies, we exclude the group of individuals for whom we do not observe a change in CompLTCI status.

5. RESULTS

5.1 Descriptive Statistics

Table I provides summary statistics for the whole sample and by CompLTCI status. Within the sample, 19% of individuals own a CompLTCI. A simple comparison of the means of people who do and do not have CompLTCI suggests that the groups do not differ in their probabilities of claiming LTC benefits and in their average LTC costs; this lack of difference may be at least
partly due to the relatively small number of LTC beneficiaries \((n = 923)\). However, if we only consider health care costs that exceed the highest deductible, the probability of submitting a claim and the total cost of health insurance payouts is higher, on average, for CompLTCI policyholders.\(^{21}\) In addition, CompLTCI policyholders are more likely to hold daily sickness benefits insurance and hospital daily benefits insurance. With respect to demographics, the average CompLTCI enrollee is more likely to be male and older. Data from the additional sources show that individuals with CompLTCI have a slightly higher ISEI-08 score, i.e., a higher socioeconomic status, and they live in areas with higher socioeconomic status as measured by the proportion of individuals with a higher education entrance qualification, the employment rate, and the GDP per capita in an individual’s region.

\(^{21}\) Considering all claims for health insurance, we also find that CompLTCI policyholders have a higher probability of making claims and higher amounts of health insurance benefits (not presented in Table 1).


### TABLE I

Summary Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
<th>CompLTCI (mean)</th>
</tr>
</thead>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>0.096</td>
<td>0</td>
<td>1</td>
<td>0.009</td>
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<td>0</td>
<td>12.262</td>
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<td>0.394</td>
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<td>0</td>
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<td>98</td>
<td>58.056</td>
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<td>ISEI-08</td>
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<td>88.960</td>
<td>55.620</td>
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<td>14,922.50</td>
<td>86,837.50</td>
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<td>47.000</td>
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<td>98,085</td>
<td>27.398</td>
<td>5.328</td>
<td>21.000</td>
<td>42.800</td>
<td>27.428</td>
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</table>

**Notes:**
- The aggregated data for the variables `educ_sec`, `employ`, `dependency ratio` and `single` are measured as the respective percentage share. The GDP per capita is measured in EUR. More information about the variables can be found in Table A.1 in the Appendix.
5.2 Results of the Static Analysis

5.2.1 Existence of asymmetric information

Table II reports the estimated correlation coefficient of the residuals $\rho (\varepsilon_i, \eta_i)$ of equations (1) and (2). Column (1) shows that $\rho (\varepsilon_i, \eta_i)$ is negative and significant when equations (1) and (2) are estimated with a bivariate probit model. As shown in column (2) and (3), this result is confirmed when we estimate equations (1) and (2) with a probit model and a linear probability model (LPM) separately for the whole sample. These results point to a significantly negative correlation between the probability of buying a CompLTCI policy and the risk of needing LTC care. Thus, low-risk individuals are more likely to purchase a CompLTCI policy. When considering only the sample of CompLTCI policyholders, column (4) shows that the correlation between the extent of CompLTCI coverage ($\text{lnCompLTCIp}$) and the extent of payouts from the mandatory LTCI ($\text{lnLTCcost}$) is also significantly negative, i.e., low-risk individuals choose higher CompLTCI coverage than high-risk individuals. These results support our hypothesis that individuals have private information that leads to selection effects in the German CompLTCI market, regarding both the decision to buy a CompLTCI policy and the extent of CompLTCI coverage selected. The negative correlation between insurance coverage and risk indicates that advantageous selection is dominating, which may be explained by multidimensional private information. Following Chiappori and Salanié (2013), this suggests that, similar to the German PHI market (Hofmann and Browne 2013), the German CompLTCI market is not perfectly competitive, i.e., the insurer has some market power.
TABLE II
Correlation between CompLTCI Coverage and Risk

<table>
<thead>
<tr>
<th></th>
<th>(1) Full Sample</th>
<th>(2) Full Sample</th>
<th>(3) CompLTCI Holders</th>
<th>(4) CompLTCI Holders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biprob compLTCI</td>
<td>-0.0624***</td>
<td>-0.0063**</td>
<td>-0.0155***</td>
<td>-0.0325***</td>
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<tr>
<td>Probit compLTCI</td>
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<tr>
<td>LPM prob - compLTCI</td>
<td></td>
<td>-0.0155***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OLS lnLTCcost - lnCompLTCI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Correlation coefficient of residuals $\rho (\varepsilon_i, \vartheta_i)$

| Observations | 98,305 | 98,305 | 98,305 | 18,908 |

Notes: The residuals are derived from equations (1) and (2). In column (1), the correlation coefficient is based on a bivariate probit model. The coefficient in column (2) represents the correlation between predicted Pearson residuals. *p<0.1, **p<0.05, ***p<0.01.

5.2.2 Unused Observables

After analyzing the existence and the dominant type of selection effects in the German CompLTCI market, we focus on the association of observable characteristics of individuals that are not currently used for pricing CompLTCI with the proxies for LTC risk and with CompLTCI coverage. Table III illustrates the regression results of adding potential drivers of selection to our model in equations (1) and (2), considering the full sample. We find a significant and positive correlation of socioeconomic status (as measured by the ISEI-08 value) with CompLTCI coverage, but we find a significant and negative correlation with the risk of loss. Similarly, individuals from regions with a high proportion of people with higher education entrance qualification and with a higher employment rate are more likely to purchase CompLTCI but less likely to claim LTC benefits. The relationships of these socioeconomic characteristics with our dependent variables remain robust after adding all covariates simultaneously in columns (4) and (5) as well as in (9) and (10). Moreover, the correlation between CompLTCI coverage and the risk of loss declines from negatively significant ($\rho (\varepsilon_i, \vartheta_i) = -0.0504; p = 0.090$) to

Note: The correlation coefficient of the residuals based on a bivariate probit model without controlling for potential divers of selection is slightly different from that in Table II. We used here the same sample $n = 71,358$ for the models with and without socioeconomic characteristics to make the correlation between the residuals comparable.
insignificant ($ρ (φ_i, ω_i) = 0.0388; p = 0.195$) after including these socioeconomic variables in the model simultaneously (not reported in Table III). These findings suggest that both occupational status and the residential location of an individual are unused observables. Related information about socioeconomic status on an individual level and on a district level contributes to advantageous selection in the German CompLTCI market. This is consistent with previous studies that have also found socioeconomic characteristics, such as education and wealth, to be sources of advantageous selection (e.g., Fang, Keane, and Silverman 2008; Finkelstein and McGarry 2006).

The results of our proxies for preference for insurance are mixed. Holding daily sickness benefits insurance is correlated negatively with the risk of loss and positively with insurance coverage. Moreover, the coverage-risk correlation is, while still significant, lower after controlling for this characteristic (column (3)). However, the negative correlation of holding this type of insurance with risk of loss becomes insignificant after controlling for all covariates simultaneously (column (4)).\(^{23}\) As this type of insurance compensates individuals for the loss of earnings, it is relevant only for employed people. Therefore, we also analyzed the relationship of holding daily sickness benefits insurance with our dependent variables only for people aged 65 and younger, and we still found a positive correlation with CompLTCI coverage and a negative correlation with the risk of loss. This finding is consistent with Browne and Zhou-Richter (2014), who find the preference for insurance to be a source of advantageous selection.

In contrast, holding hospital daily benefits insurance can be regarded as a driver of adverse selection because it is positively correlated with both CompLTCI coverage and the probability of claiming LTC benefits when risk is measured by the probability of needing LTC.

\(^{23}\) This is at least partly due to the reduced sample. Adding all potential sources of selection except the ISEI-08 value to the model, the correlation between holding daily sickness benefits insurance and the risk of loss is still significantly negative.
This is consistent with Lange et al. (2017), who find that people in Germany with supplementary hospital insurance coverage are more likely to suffer from sickness in the future. One possible explanation for these mixed results with respect to supplementary health insurance is that some people have private information about their risk of suffering from diseases that are likely to require treatment in a hospital. This would lead to a higher probability of purchasing hospital daily benefits insurance and CompLTCI. On the other hand, people buying daily sickness benefits insurance may be relatively highly risk averse, leading to a higher demand for this type of supplementary health insurance and CompLTCI but a lower LTC risk due to cautious health behavior. Another explanation could be that some people have private information about their risk of becoming sick and suffering from income loss due to a resulting inability to work, but this situation is not linked to a higher risk of needing LTC. Nevertheless, we suggest that the holding of supplementary health insurance is another unused observable.

Table IV depicts the results for sources of selection for the subsample of CompLTCI policyholders. Here, we find that the ISEI-08 value and holding supplementary health insurance coverage are positively correlated with the extent of CompLTCI coverage. Additionally, the employment rate of an individual’s district is positively correlated with the amount of CompLTCI coverage, even though this relationship becomes insignificant after controlling for all potential sources of selection simultaneously (column (5)). Individuals who live in areas with a high share of single adults purchase less CompLTCI coverage. While some variables, such as educational attainment and the share of single adults in an individual’s region, are significantly negatively correlated with the risk of needing LTC, these relationships are weak and even insignificant in the full model, as shown in column (4). The holding of hospital daily benefits insurance is positively correlated with the probability of receiving LTC payouts. Hence, among CompLTCI
policyholders, only the holding of this supplementary health insurance can be identified as a source of adverse selection when all covariates are simultaneously considered.\textsuperscript{24}

The results in Tables III and IV suggest that most potential sources of selection consistently affect the decision to buy a CompLTCI policy and the amount of CompLTCI coverage. However, only one variable (\textit{dhosp_ins}) can be identified as a consistent source of either adverse or advantageous selection for the full sample, on the one hand, and the restricted sample of CompLTCI policyholders, on the other hand. This finding indicates that unused observables may contribute to selection effects concerning the decision to purchase a CompLTCI, but not concerning the decision to choose the amount of CompLTCI coverage among the CompLTCI policyholders.

\textsuperscript{24} The relationships of all observable characteristics with our risk proxy remain robust when risk is measured with the natural logarithm of LTC payouts (\textit{InLTCost}).
### TABLE III
Sources of Selection (Full sample)

<table>
<thead>
<tr>
<th></th>
<th>(1) Adding potential sources separately</th>
<th>(2) Adding all potential sources simultaneously</th>
<th>(3) Adding potential sources separately</th>
<th>(4) Adding all potential sources simultaneously</th>
<th>(5) Adding potential sources separately</th>
<th>(6) Adding all potential sources simultaneously</th>
<th>(7) Adding potential sources separately</th>
<th>(8) Adding all potential sources simultaneously</th>
<th>(9) Adding potential sources separately</th>
<th>(10) Adding all potential sources simultaneously</th>
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</tr>
<tr>
<td>ISEI-08</td>
<td>-0.0028*** 0.0014*** -0.0459</td>
<td>-0.0023** 0.0012***</td>
<td>-0.0004*** 0.0010*** -0.0110***</td>
<td>-0.0003*** 0.0008***</td>
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<tr>
<td></td>
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<td>(0.001) (0.000)</td>
<td>(0.000) (0.000) (p = 0.003)</td>
<td>(0.000) (0.000)</td>
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</tr>
<tr>
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<td>(0.001) (0.001) (p = 0.001)</td>
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<td>gdp per 10000</td>
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<tr>
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<td>(0.031) (0.010) (p = 0.000)</td>
<td>(0.045) (0.014)</td>
<td>(0.007) (0.010) (p = 0.000)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correlation between residuals $\rho(\varphi, \psi)$</td>
<td>-0.0480 (p=0.114)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** The number of observations slightly differs due to missing values. The coefficients in columns (1)-(5) are based on a bivariate probit model. Robust standard errors for each coefficient and p-value for the correlation coefficient of the residuals in parentheses, respectively. When aggregated characteristics are included into the model, standard errors are clustered at a district level. *p<.10, **p<.05, ***p<.01.
In a next step, we divide all non-binary variables into quintiles to examine potential non-linear effects of individuals’ characteristics on our outcome variables. This enables us to obtain a clearer picture of whether the association of the covariates with our outcome variables is heterogeneous. As shown in Table V, the correlation of the characteristics that we identify as sources of advantageous selection (i.e., the ISEI-08 value as well as the educational attainment and the employment rate of an individual’s region) with CompLTCI is consistently lower in the first quintile (reference group) compared to higher quintiles (column (2)). However, these correlations do not increase linearly. For instance, consistent with similar findings of McCall et
al. (1998) regarding the association of income and LTCI, the pattern of the correlation of the ISEI-08 value with CompLTCI is U-shaped, with its strongest association in the third quintile. Thus, the demand for CompLTCI increases up to the third quintile of the ISEI-08 distribution and, while still significantly higher than the first quintile, decreases afterwards. The identification of these characteristics as sources of selection is mainly driven by the highest quintiles, as the negative correlation with the risk of loss is only significant in those quintiles. Moreover, while we could not identify the GDP per capita in an individual’s district as a source of selection in our previous analysis (see Table III), we find that individuals living in regions with a GDP per capita in the highest quintile are lower risks and significantly more likely to hold CompLTCI than individuals in the lowest quintile. This indicates that individuals living in relatively wealthy regions contribute to advantageous selection.
TABLE V
Heterogeneous Effects of Potential Sources of Selection on CompLTCI and Risk

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>(1) LTCprob</th>
<th>(2) CompLTCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISEI-08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second Quintile</td>
<td>-0.0031</td>
<td>0.4111***</td>
</tr>
<tr>
<td></td>
<td>(0.057)</td>
<td>(0.018)</td>
</tr>
<tr>
<td>Third Quintile</td>
<td>-0.0761</td>
<td>0.3126***</td>
</tr>
<tr>
<td></td>
<td>(0.061)</td>
<td>(0.018)</td>
</tr>
<tr>
<td>Fourth Quintile</td>
<td>-0.0649</td>
<td>0.2584***</td>
</tr>
<tr>
<td></td>
<td>(0.060)</td>
<td>(0.018)</td>
</tr>
<tr>
<td>Fifth Quintile</td>
<td>-0.1562***</td>
<td>0.0686***</td>
</tr>
<tr>
<td></td>
<td>(0.059)</td>
<td>(0.018)</td>
</tr>
<tr>
<td>educ_sec</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second Quintile</td>
<td>0.0035</td>
<td>0.2039***</td>
</tr>
<tr>
<td></td>
<td>(0.043)</td>
<td>(0.034)</td>
</tr>
<tr>
<td>Third Quintile</td>
<td>-0.0952**</td>
<td>0.2275***</td>
</tr>
<tr>
<td></td>
<td>(0.046)</td>
<td>(0.035)</td>
</tr>
<tr>
<td>Fourth Quintile</td>
<td>-0.0444</td>
<td>0.1124***</td>
</tr>
<tr>
<td></td>
<td>(0.043)</td>
<td>(0.038)</td>
</tr>
<tr>
<td>Fifth Quintile</td>
<td>-0.1119**</td>
<td>0.2676***</td>
</tr>
<tr>
<td></td>
<td>(0.044)</td>
<td>(0.030)</td>
</tr>
<tr>
<td>employ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second Quintile</td>
<td>-0.0155</td>
<td>0.1345***</td>
</tr>
<tr>
<td></td>
<td>(0.041)</td>
<td>(0.042)</td>
</tr>
<tr>
<td>Third Quintile</td>
<td>-0.0130</td>
<td>0.2096***</td>
</tr>
<tr>
<td></td>
<td>(0.043)</td>
<td>(0.038)</td>
</tr>
<tr>
<td>Fourth Quintile</td>
<td>-0.1086***</td>
<td>0.3345***</td>
</tr>
<tr>
<td></td>
<td>(0.041)</td>
<td>(0.033)</td>
</tr>
<tr>
<td>Fifth Quintile</td>
<td>-0.1238***</td>
<td>0.3475***</td>
</tr>
<tr>
<td></td>
<td>(0.041)</td>
<td>(0.033)</td>
</tr>
<tr>
<td>gdp per 10000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second Quintile</td>
<td>-0.0484</td>
<td>0.1682***</td>
</tr>
<tr>
<td></td>
<td>(0.043)</td>
<td>(0.043)</td>
</tr>
<tr>
<td>Third Quintile</td>
<td>-0.0046</td>
<td>0.0932**</td>
</tr>
<tr>
<td></td>
<td>(0.043)</td>
<td>(0.045)</td>
</tr>
<tr>
<td>Fourth Quintile</td>
<td>0.0084</td>
<td>0.2201***</td>
</tr>
<tr>
<td></td>
<td>(0.040)</td>
<td>(0.043)</td>
</tr>
<tr>
<td>Fifth Quintile</td>
<td>-0.0899**</td>
<td>0.1995***</td>
</tr>
<tr>
<td></td>
<td>(0.041)</td>
<td>(0.042)</td>
</tr>
<tr>
<td>dependency ratio</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second Quintile</td>
<td>0.0429</td>
<td>0.0186</td>
</tr>
<tr>
<td></td>
<td>(0.045)</td>
<td>(0.048)</td>
</tr>
<tr>
<td>Third Quintile</td>
<td>0.0551</td>
<td>0.0614</td>
</tr>
<tr>
<td></td>
<td>(0.041)</td>
<td>(0.040)</td>
</tr>
<tr>
<td>Fourth Quintile</td>
<td>0.0858*</td>
<td>0.0146</td>
</tr>
<tr>
<td></td>
<td>(0.045)</td>
<td>(0.038)</td>
</tr>
<tr>
<td>Fifth Quintile</td>
<td>0.0170</td>
<td>-0.0154</td>
</tr>
<tr>
<td></td>
<td>(0.042)</td>
<td>(0.039)</td>
</tr>
<tr>
<td>single</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second Quintile</td>
<td>-0.0063</td>
<td>0.1144***</td>
</tr>
<tr>
<td></td>
<td>(0.041)</td>
<td>(0.034)</td>
</tr>
<tr>
<td>Third Quintile</td>
<td>-0.0638</td>
<td>0.0701*</td>
</tr>
<tr>
<td></td>
<td>(0.042)</td>
<td>(0.039)</td>
</tr>
<tr>
<td>Fourth Quintile</td>
<td>-0.0959**</td>
<td>-0.0509</td>
</tr>
<tr>
<td></td>
<td>(0.046)</td>
<td>(0.047)</td>
</tr>
<tr>
<td>Fifth Quintile</td>
<td>-0.0877**</td>
<td>-0.0161</td>
</tr>
<tr>
<td></td>
<td>(0.042)</td>
<td>(0.040)</td>
</tr>
</tbody>
</table>

Notes: The number of observations slightly differs due to missing values. Robust standard errors for each coefficient in parentheses. When aggregated characteristics are included into the model, standard errors are clustered at a district level. Omitted reference categories: First quintiles of the independent variables. *p<.10, **p<.05, ***p<.01.
It should be noted that one potential issue could be that the unused observables and the related characteristics are not necessarily exogenous.\textsuperscript{25} We argue, however, that endogeneity is unlikely to be an issue with respect to using residential location and occupational status as unused observables. The characteristics based on residential location are measured on an aggregated regional level. We argue that they are less likely to suffer from the issue of reverse causality or an omitted variable bias based on unobserved individual characteristics. Similarly, the insurance company collects information about the individual’s occupation only once, at the time of the individual’s first health insurance enrollment. This information is not frequently updated. Hence, occupational changes as a consequence of LTC-related health shocks seem to be less likely.

5.3 Results of the Dynamic Analysis

Our finding of the negative coverage-risk correlation, which indicates advantageous selection as the dominating selection effect, is based on a static perspective on the sample. In this section, we turn to a dynamic analysis of how the sample of CompLTCI policyholders changes over time. Here, we consider the lapse as well as the uptake of CompLTCI policies. Table VI reports the results of a pooled regression of these outcome variables on health care costs and on several other characteristics. Considering columns (1) and (2), we find that CompLTCI policyholders with higher health insurance payouts are less likely to let their CompLTCI policies lapse. Consistent with previous findings (e.g., Finkelstein, McGarry, and Sufi 2005), this points to an ex-post selection predicted by Hendel and Lizzeri (2003) even though CompLTCI policies are front-loaded. Moreover, individuals with higher socioeconomic status, as measured by the ISEI-value, are also less likely to let their policies lapse. Consistent with Konetzka and Luo (2011), this

\textsuperscript{25} Dionne, La Haye, and Bergerès (2015), for instance, use several instruments to take account for possible endogeneity in testing for the presence of asymmetric information.
suggests that people with lower socioeconomic status are more likely to suffer from financial problems, which increases the probability that they will let their policies lapse. This is supported by the strong positive correlation of having an “emergency treatments only” tariff (designed for non-paying customers in financial distress) with a lapse in CompLTCI. As shown in columns (3) and (4) of Table VI, our findings similarly suggest an adverse selection with respect to the uptake of CompLTCI, as individuals with higher health care costs are more likely to purchase CompLTCI. Consistent with the findings of our static analysis, our results show that individuals with a higher socioeconomic status (as measured with the ISEI-08 value and the employment rate of an individual’s district) and individuals who have supplementary health insurance coverage are more likely to buy CompLTCI.

PHI enrollees who are not able to pay their regular health insurance premiums over several months are assigned to an “emergency treatments only” tariff, which covers only the costs of acute sickness and pain, as well as pregnancy and maternity. In 2014, about 0.1m PHI enrollees held this tariff (Association of German private healthcare insurers 2016b).
**TABLE VI**

Pooled Regression for Lapse and Uptake of CompLTCI

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>LTCI_lapse</th>
<th>CompLTCI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td><strong>Independent variables</strong></td>
<td>Adding covariates separately</td>
<td>Adding covariates simultaneously</td>
</tr>
<tr>
<td>lnHCcost</td>
<td>-0.0060***</td>
<td>-0.0022***</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>ISEI-08</td>
<td>-0.0006***</td>
<td>-0.0003***</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>educ</td>
<td>-0.0002</td>
<td>0.0002</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>employ</td>
<td>-0.0014**</td>
<td>-0.0001</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>gdp per 10000</td>
<td>-0.0018*</td>
<td>-0.0009</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>dependency ratio</td>
<td>0.0007**</td>
<td>0.0008</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>single</td>
<td>-0.0001</td>
<td>0.0006</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>dsick_ins</td>
<td>-0.0103**</td>
<td>-0.0075</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.005)</td>
</tr>
<tr>
<td>dhosp_ins</td>
<td>-0.0013</td>
<td>-0.0019</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>tariff_non-payer</td>
<td>0.8709***</td>
<td>0.8521***</td>
</tr>
<tr>
<td></td>
<td>(0.022)</td>
<td>(0.024)</td>
</tr>
<tr>
<td>Pricing Characteristics</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.0597</td>
<td>-0.3621***</td>
</tr>
<tr>
<td></td>
<td>(0.217)</td>
<td>(0.067)</td>
</tr>
<tr>
<td><strong>Observations</strong></td>
<td>8,321</td>
<td>66,408</td>
</tr>
</tbody>
</table>

*Notes*: The number of observations slightly differs due to missing values. Robust standard errors for each coefficient in parentheses. When aggregated characteristics are included into the model, standard errors are clustered at a district level. *p<.10, **p<.05, ***p<.01.

Figure I illustrates the health insurance benefits held by individuals in the periods before and after two events: lapse and uptake of CompLTCI. The marginal effects on health insurance benefits before and after these events are reported in Table A.2. Considering, first, the lapse behavior of CompLTCI policyholders (graphs on the left), we find that the probability and amount of health insurance payouts for people in financial distress (red line) decline until the CompLTCI policy lapses. After the lapse, health insurance payouts remain at a low level. One obvious reason for this finding is that people with financial problems are more likely to drop CompLTCI coverage, and this tariff provides only basic coverage, such as for the costs of acute treatment and severe pain. The probability of claiming health insurance benefits– as well as the amounts of health insurance payouts – of individuals without financial distress (blue line) are
both at a higher level, but they are still consistently below the average of CompLTCI enrollees who did not let their policies lapse. Similar to the trend for people in financial distress, the probability of claiming insurance benefits, as well as the amount of health insurance benefits, decrease around the year of the lapse. If health insurance payouts mainly reflect the individual’s health status, which is positively correlated with LTC costs in the future, this result may point to ex-post selection, which would be consistent with previous studies (e.g., Finkelstein, McGarry, and Sufi 2005; Hofmann and Browne 2013); i.e., people with better health and lower LTC risks are more likely to let their CompLTCI lapse. However, as shown in Figure 1, the health care costs of policyholders without financial problems rise again some years after the lapse in insurance, and costs actually return to their pre-lapse level. While we cannot exclude the possibility that the decreased health insurance payouts around the year of lapse reflect an improvement in health, we suggest that it is more likely that individuals’ financial problems explain these findings. Individuals with a deductible as part of their health insurance policy may omit medical treatments to reduce health care expenses, which will lower health insurance payouts for a short time period. Moreover, as shown in Table VI and Figure 1 (red lines), people of lower socioeconomic status and/or with financial problems are more likely to drop CompLTCI.

The uptake behavior shown in the graphs on the right indicates that both the probability and the amount of health insurance payouts of CompLTCI enrollees are lower than the average of non-enrollees before the uptake, but starting in the year of the uptake, both also increase to a level above the average of non-policyholders. This may indicate that people with increasing health care costs become more aware of LTC risk or anticipate an increased risk of needing LTC. If health care and LTC costs are positively correlated, this finding would be consistent with adverse selection and hence a deterioration of the risk pool of CompLTCI policyholders over time.
Average Marginal Effects of Lapse and Uptake of CompLTCI policies on the Probability of Claiming Health Insurance Benefits and the Amount of Health Insurance Payouts.

Note: The horizontal line on each graph represents the outcome variable of the reference group, i.e., people who did not lapse in the graphs on the left and people without a CompLTCI in the graphs on the right. The vertical bars on each point refer to the 95% confidence interval.

5.4 The Issue of Moral Hazard

The finding of our static analysis – i.e., that advantageous selection is the dominating selection effect – holds true regardless of the existence of moral hazard, as the latter would imply a positive coverage-risk correlation. Nevertheless, it is of interest to determine the extent to which any selection effect is biased by moral hazard effects. In a first step, we theoretically argue that moral hazard should be of minor importance in the context of the German market for CompLTCI. In addition, we provide empirical evidence that moral hazard is unlikely to bias our results.
From a theoretical perspective, our first argument is that ex-ante moral hazard plays a small role in the LTCI context (similar to the context of health insurance markets) because any behavior leading to ex-ante moral hazard negatively affects the individual’s own health (Cutler and Zeckhauser 2000). Second, ex-post moral hazard effects in the German LTCI market are less likely to be a problem due to the condition that LTC benefits depend on individuals being assigned to a care level by independent experts. Ex-post moral hazard in the German CompLTCI market could result from LTC beneficiaries choosing between different LTC services, such as between receiving LTC at home from a mobile nursing service or receiving more expensive care at a nursing home. Several surveys show that individuals in Germany prefer to receive LTC at home instead of going to a nursing home (MLP 2014; Deutsche Gesellschaft für Qualität 2015; R+V Versicherung 2013). Moreover, as shown by Grabowski and Gruber (2007), the demand for nursing home care is relatively price inelastic. In addition, when we measure risk by the probability of needing LTC, ex-post moral hazard should not be an issue.

To empirically test for moral hazard, we estimate an instrumental variable model for a regional subsample. The identification of potential moral hazard requires that we exclude the possibility of selection into insurance, which can be estimated using exogenous variation in the uptake of insurance. The instrument in question must predict CompLTCI uptake and be uncorrelated with LTC risk. As an instrument, we rely on the regional density of local banks in the area, as such banks serve as insurance agencies. Close proximity to an insurance agency reduces the costs of uptake and increases the probability of interacting with an insurance agent. The agency density in a region is, however, only exogenous to LTC risk if agents are not able to anticipate future risk development and select themselves into low-risk environments. We argue that this is not the case for two reasons: First, we only rely on local banks that are unlikely to locate themselves in certain areas based on local LTC risks. Second, little is known about the determinants of LTC risk beyond individual age and gender, both of which we use as controls in
the instrumental variable regression. We therefore account for any possible confounding relationship between the agency density and age and gender distribution.

Table VII shows the estimation results. The LPM displayed in column (1) shows a negative correlation between CompLTCI and the probability of LTC needs. This result again indicates the presence of advantageous selection in the LTCI market, which does overshadow potential moral hazard when CompLTCI is endogenous in the regression. For the regional subsample, we observe a similar relationship for the linear probability model, which suggests that the subsample does not systematically differ from the full sample. The first-stage regression shows that our instrument is sufficiently predictive of insurance uptake, with an F-statistic above the commonly accepted threshold of 10 (Greene 2012; Stock, Wright, and Yogo 2002). However, neither the reduced form regression nor the 2SLS estimation shows a significant effect on LTC risk. This supports our previous argument that the CompLTCI market is unlikely to suffer from moral hazard and our selection estimates are unlikely to be upwardly biased by the presence of moral hazard.

Table VII
IV-approach with Distribution Density as an Instrument for Testing for Moral Hazard

<table>
<thead>
<tr>
<th></th>
<th>(1) Full Sample</th>
<th>(2)</th>
<th>(3) Regional Sample</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LPM</td>
<td>LPM</td>
<td>Reduced Form LPM</td>
<td>First Stage LPM</td>
<td>2SLS</td>
</tr>
<tr>
<td>Dependent variable</td>
<td>LTCprob</td>
<td>LTCprob</td>
<td>LTCprob</td>
<td>CompLTCI</td>
<td>LTCprob</td>
</tr>
<tr>
<td>Independent variable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CompLTCI</td>
<td>-0.0038***</td>
<td>-0.0048***</td>
<td></td>
<td>0.0134</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.001)</td>
<td></td>
<td>(0.041)</td>
<td></td>
</tr>
<tr>
<td>distribution_dens</td>
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<tr>
<td></td>
<td>0.0001</td>
<td>0.0128***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.003)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Stage F-statistic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16.294</td>
</tr>
<tr>
<td>Observations</td>
<td>98,305</td>
<td>38,537</td>
<td>38,537</td>
<td>38,537</td>
<td>38,537</td>
</tr>
</tbody>
</table>

Notes: Robust standard errors in parentheses. In the regression of the reduced form, the first stage as well as the 2SLS (columns (3)-(5)), standard errors are clustered at the district level because the agency density is measured on a regional level. *p<0.1, **p<0.05, ***p<0.01.
6. CONCLUSIONS

In this paper, we analyze selection effects in the German market for CompLTCI using data from an insurance company. In a static framework, we provide evidence that individuals with a CompLTCI are lower-risk types than non-enrollees and that CompLTCI policyholders with more insurance coverage are lower risks compared to enrollees with less coverage. These results indicate that people in this market have private information, which leads to advantageous selection as the dominating selection effect – concerning both the decision to buy a policy and the extent of insurance coverage chosen. This is in contrast to the results of Browne and Zhou-Richter (2014), who find adverse selection to be dominating in the German market for LTCI. Given the design of the German LTCI system, these findings are unlikely to be biased by moral hazard, and we provide additional empirical evidence of this conclusion. An equilibrium involving advantageous selection, which arises from multidimensional private information and offsets adverse selection effects, may also suffer from market inefficiencies (e.g., Fang, Keane, and Silverman 2008; Finkelstein and McGarry 2006).

Testing for sources of selection, we identify the occupation, the residential location and the preference for insurance coverage as unused observables. While both occupation and residential location include information about socioeconomic status that contributes to advantageous selection, our results – with respect to holding supplementary health insurance as a source of either adverse or advantageous selection – are mixed. We argue that these tests are unlikely to suffer from endogeneity when we test aggregated information based on the residential location and information based on the occupation. The inconsistency – with respect to the sources of selection for the full and the restricted sample of CompLTCI policyholders – suggest that unused observables, which contribute to selection effects concerning the decision to buy CompLTCI, do not necessarily contribute to selection effects concerning the chosen amount of CompLTCI coverage. Moreover, our results indicate that non-linear effects of certain
characteristics on insurance coverage and the risk of loss should be considered when analyzing sources of selection.

Based on our results of the static analysis, we conclude that the German CompLTCI market is not perfectly competitive. First, following Chiappori and Salanié (2013), in a perfectly competitive market with asymmetric information, only a positive coverage-risk correlation would be predicted. Second, the significant relationships for several potential unused observables suggest that German CompLTCI insurers do not use all observable characteristics of individuals when classifying individuals into risk classes, even though these characteristics are correlated both with insurance demand and with the risk of loss in this market. Following Kesternich and Schumacher (2014), one explanation for the existence of the identified unused observables might be that the existing insurance companies offering CompLTCI in Germany cannot profitably use the unused observables to discriminate between different risk types. Nevertheless, we argue that the selection effects identified here might be gainfully used by insurance companies in the German LTCI market should they want to pursue a more targeted distribution of products.

It should be noted that our finding of advantageous selection in the static framework can be regarded as a snapshot of the risk pool at a given point in time. By examining the change in the risk pool over time in a dynamic framework, we find that individuals with increased health insurance payouts are more likely to buy a CompLTCI and that people with decreased health care costs are more likely to let their CompLTCI policy lapse. People who learn about their low LTC risk over time based on their current health care status and decide to drop CompLTCI coverage might explain this result if health insurance payouts are positively correlated with future LTC risk. In this case, our results suggest that the market suffers not only from adverse selection over time but also from ex-post selection arising from a lack of consumer commitment. The latter would be in line with findings for the U.S. LTCI market (Finkelstein, McGarry, and Sufi 2005) and the German PHI market (Hofmann and Browne 2013) and would lead to dynamic market
inefficiencies. However, our results also show that health insurance payouts rise again a short time after lapse. One possible explanation for this finding from a behavioral perspective could be that the declined insurance payouts reflect a short-term improvement in health and that this provides individuals with a salient reference point for their expectations about their future health and LTC risks. Accordingly, people may make their decisions to retain CompLTCI based on these factors. While we cannot exclude this explanation, we suggest, in line with Konetzka and Luo (2011), that it is more likely that lapses are driven by financial problems. People with financial problems and a deductible in their health insurance contracts may simply decide to forego or delay medical treatment over a short period to reduce their out-of-pocket expenses on health care. This could also explain the declined health insurance payouts. In addition, these people may decide to drop CompLTCI to eliminate premium payments. This alternative explanation is supported by our finding that lapses are positively associated with financial distress and low socioeconomic status. Moreover, considering our results that people of higher socioeconomic status are less likely to need LTC, the selection of people based on their socioeconomic status may counteract any possible worsening of the risk pool.

Overall, our findings provide solid evidence of the existence of market imperfections and selection effects in the German CompLTCI market, which may lead to inefficiencies with respect to insurance coverage for LTC risks. Note that we do not claim that our data are representative of all PHI companies in Germany. Future research could extend our insights into selection behavior in LTC markets by differentiating between different types of LTC. Furthermore, information about health care and LTC costs, as well the lapse of LTCI policies over a longer period, might provide more insights into the issue of ex-post selection. In addition, future studies could extend our analysis by focusing on CompLTCI tariffs that are subsidized by the state (“Pflege-Bahr”) and that were introduced in 2013. As insurance companies in this market cannot charge risk-adjusted premiums at the time of contract-signing or reject applicants who have no
need for LTC, the market for these policies is prone to adverse selection (Jacobs and Rothgang 2013; Ehing 2015).
## APPENDIX

### TABLE A.1
Specification of Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Explanation</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Risk</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LTCprob</td>
<td>1 = one or more insurance claims in the mandatory LTCI, 0 = otherwise</td>
<td>Insurance company</td>
</tr>
<tr>
<td>lnLTCcost</td>
<td>Natural log of the insurance payouts in the mandatory LTCI + 1</td>
<td>Insurance company</td>
</tr>
<tr>
<td>HCprob</td>
<td>1 = one or more insurance claims in health insurance above the highest possible deductible, 0 = otherwise</td>
<td>Insurance company</td>
</tr>
<tr>
<td>lnHCcost</td>
<td>Natural log of the insurance payouts in health insurance above the highest possible deductible + 1</td>
<td>Insurance company</td>
</tr>
<tr>
<td><strong>Coverage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CompLTCI</td>
<td>1 = holding of a CompLTCI, 0 = otherwise</td>
<td>Insurance company</td>
</tr>
<tr>
<td>lnCompLTCIp</td>
<td>Natural log of the monthly premium for CompLTCI tariffs + 1 (without rate module for increasing the benefits over time)</td>
<td>Insurance company</td>
</tr>
<tr>
<td><strong>Pricing characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>male</td>
<td>1 = man, 0 = woman</td>
<td>Insurance company</td>
</tr>
<tr>
<td>age</td>
<td>Age in years</td>
<td>Insurance company</td>
</tr>
<tr>
<td>year</td>
<td>Year of signing the insurance contract</td>
<td>Insurance company</td>
</tr>
<tr>
<td><strong>Unused observables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>dsick_ins</td>
<td>1 = holding of a daily sickness benefits insurance, 0 = otherwise</td>
<td>Insurance company</td>
</tr>
<tr>
<td>dhosp_ins</td>
<td>1 = holding of a hospital daily benefits insurance, 0 = otherwise</td>
<td>Assignment based on Ganzeboom and Treiman (2010)</td>
</tr>
<tr>
<td>ISEI-08</td>
<td>Socioeconomic status score based on ISEI-08</td>
<td>German Census 2011</td>
</tr>
<tr>
<td>educ_sec</td>
<td>Proportion of individuals (aged 15 years and older) with the general / subject-restricted higher education entrance qualification per district (in %)</td>
<td>German Census 2011</td>
</tr>
<tr>
<td>employ</td>
<td>Employment rate (of individuals aged 15-64 years) per district in %</td>
<td>German Census 2011</td>
</tr>
<tr>
<td>gdp per capita</td>
<td>Average gross domestic product (GDP) per inhabitant by district between 2006 and 2013 (in EUR)</td>
<td>Eurostat</td>
</tr>
<tr>
<td>dependency ratio</td>
<td>Dependency ratio, i.e. the ratio of individuals aged under 18 years or 65 years and older to individuals aged 18-64 years per district (in %)</td>
<td>German Census 2011</td>
</tr>
<tr>
<td>single</td>
<td>Proportion of single adults (19 years and over) per district (in %)</td>
<td>German Census 2011</td>
</tr>
<tr>
<td><strong>Further information of the insurance company</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LTCI_lapse</td>
<td>1 = lapse of CompLTCI policies, 0 = otherwise</td>
<td>Insurance company</td>
</tr>
<tr>
<td>distribution_dens</td>
<td>Proportion of distributors of CompLTCI policies per 10,000 inhabitants</td>
<td>Insurance company</td>
</tr>
<tr>
<td>tariff_non-payer</td>
<td>1 = holding of a “emergency treatments only” tariff for non-paying customers in financial distress, 0 = otherwise</td>
<td>Insurance company</td>
</tr>
</tbody>
</table>

*Notes: This educational degree in Germany is, for instance, the so-called “Abitur” which is comparable to A-level in the U.K.*
<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>(1) HCprob</th>
<th>(2) Lapse Behavior</th>
<th>(3) lnHCcost</th>
<th>(4) HCprob</th>
<th>(5) Uptake Behavior</th>
<th>(6) lnHCcost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customers without financial distress</td>
<td>Customers in financial distress</td>
<td>Customers without financial distress</td>
<td>Customers in financial distress</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Before the event</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;=5 years</td>
<td>0.5048***</td>
<td>0.4195***</td>
<td>3.8195***</td>
<td>3.2143***</td>
<td>0.3165***</td>
<td>2.3945***</td>
</tr>
<tr>
<td></td>
<td>(0.035)</td>
<td>(0.040)</td>
<td>(0.268)</td>
<td>(0.299)</td>
<td>(0.007)</td>
<td>(0.053)</td>
</tr>
<tr>
<td>-4 years</td>
<td>0.4147***</td>
<td>0.3366***</td>
<td>3.1182***</td>
<td>2.5523***</td>
<td>0.3066***</td>
<td>2.3016***</td>
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<tr>
<td></td>
<td>(0.030)</td>
<td>(0.034)</td>
<td>(0.224)</td>
<td>(0.248)</td>
<td>(0.007)</td>
<td>(0.055)</td>
</tr>
<tr>
<td>-3 years</td>
<td>0.4099***</td>
<td>0.3112***</td>
<td>3.0861***</td>
<td>2.6028***</td>
<td>0.2999***</td>
<td>2.2190***</td>
</tr>
<tr>
<td></td>
<td>(0.027)</td>
<td>(0.029)</td>
<td>(0.207)</td>
<td>(0.217)</td>
<td>(0.006)</td>
<td>(0.047)</td>
</tr>
<tr>
<td>-2 years</td>
<td>0.3704***</td>
<td>0.2901***</td>
<td>2.8163***</td>
<td>2.2444***</td>
<td>0.2957***</td>
<td>2.2040***</td>
</tr>
<tr>
<td></td>
<td>(0.027)</td>
<td>(0.029)</td>
<td>(0.206)</td>
<td>(0.215)</td>
<td>(0.006)</td>
<td>(0.044)</td>
</tr>
<tr>
<td>-1 years</td>
<td>0.4311***</td>
<td>0.2301***</td>
<td>3.2322***</td>
<td>1.7481***</td>
<td>0.3029***</td>
<td>2.2386***</td>
</tr>
<tr>
<td></td>
<td>(0.028)</td>
<td>(0.027)</td>
<td>(0.218)</td>
<td>(0.200)</td>
<td>(0.005)</td>
<td>(0.039)</td>
</tr>
<tr>
<td>0</td>
<td>0.3790***</td>
<td>0.1163***</td>
<td>2.7921***</td>
<td>0.9148***</td>
<td>0.3516***</td>
<td>2.6098***</td>
</tr>
<tr>
<td></td>
<td>(0.028)</td>
<td>(0.020)</td>
<td>(0.210)</td>
<td>(0.153)</td>
<td>(0.005)</td>
<td>(0.036)</td>
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<tr>
<td>After the event</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ 1 year</td>
<td>0.3454***</td>
<td>0.1195***</td>
<td>2.6618***</td>
<td>0.9771***</td>
<td>0.3654***</td>
<td>2.7058***</td>
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<tr>
<td></td>
<td>(0.029)</td>
<td>(0.024)</td>
<td>(0.232)</td>
<td>(0.183)</td>
<td>(0.005)</td>
<td>(0.038)</td>
</tr>
<tr>
<td>+ 2 year</td>
<td>0.2904***</td>
<td>0.0726***</td>
<td>2.2708***</td>
<td>0.6320***</td>
<td>0.3712***</td>
<td>2.7390***</td>
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<tr>
<td></td>
<td>(0.032)</td>
<td>(0.020)</td>
<td>(0.256)</td>
<td>(0.175)</td>
<td>(0.005)</td>
<td>(0.040)</td>
</tr>
<tr>
<td>+ 3 year</td>
<td>0.3978***</td>
<td>0.0611***</td>
<td>3.1058***</td>
<td>0.5021***</td>
<td>0.3910***</td>
<td>2.9133***</td>
</tr>
<tr>
<td></td>
<td>(0.036)</td>
<td>(0.019)</td>
<td>(0.297)</td>
<td>(0.150)</td>
<td>(0.006)</td>
<td>(0.045)</td>
</tr>
<tr>
<td>+ 4 year</td>
<td>0.4396***</td>
<td>0.1106***</td>
<td>3.4251***</td>
<td>0.8750***</td>
<td>0.3959***</td>
<td>2.9514***</td>
</tr>
<tr>
<td></td>
<td>(0.042)</td>
<td>(0.031)</td>
<td>(0.344)</td>
<td>(0.251)</td>
<td>(0.006)</td>
<td>(0.047)</td>
</tr>
<tr>
<td>+ 5 year</td>
<td>0.4389***</td>
<td>0.0963***</td>
<td>3.4286***</td>
<td>0.7940***</td>
<td>0.4126***</td>
<td>3.1066***</td>
</tr>
<tr>
<td></td>
<td>(0.062)</td>
<td>(0.039)</td>
<td>(0.506)</td>
<td>(0.340)</td>
<td>(0.005)</td>
<td>(0.043)</td>
</tr>
<tr>
<td>Pricing Characteristics</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>127,008</td>
<td>790,119</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** Standard errors clustered on the level of the individual in parentheses. *p<.10, **p<.05, ***p<.01.
REFERENCES


https://www.pkv.de/service/broschueren/verbraucher/private-pflegepflichtversicherung/.


