Competition on selection and market access regulation in health insurance: evidence from Germany

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Abstract

In this project I study the interaction between two competing systems in the German health insurance market that offer horizontally differentiated insurance plans. The pool of consumers for which these companies compete is limited by regulatory access restrictions. Pricing and quality in both systems is regulated by the government, but to a different degree. While the companies in the so-called statutory insurance system are fully restricted in their pricing and face a regulatory lower-bound on quality, the competing private insurance sector is free to set any quality, and its prices are regulated only to the extent that they have to follow annuity-like contracts. The empirical question then arises to what extent selection of "good risks" dominates the interaction of these systems. Furthermore, what does this selection imply about the welfare effects of choice regulation by the government. To fix ideas and the institutional details, I first suggest a conceptual framework for the analysis of this market. For the empirical work, I then use a survey panel dataset from Germany for years 2005-2009. The data allows me to study the extent of selection between the two insurance systems, analyze the pricing rule of the private insurers and estimate demand for the private insurance plans. I do not find compelling evidence of substantial selection between the two systems and I argue that this is due to the annuity nature of the private insurance pricing interacted with the eligibility restriction. Demand estimates for the private insurance clearly indicate the presence of heterogeneous preferences for insurance plans that are not immediately related to the expected healthcare expenditure risk. Finally, the demand estimates allow me to quantify the *ceteris paribus* losses in consumer surplus from the access restriction.

1 Introduction

Health insurance is one of the key determinants of individual welfare in the developed world. Medical practice has reached unprecedented ability to prevent, diagnose and treat diseases. The cost of the procedures, however, has increased as dramatically. Thus, advanced treatments usually cannot be paid for out-of-pocket by an average household. Therefore, hedging the healthcare expenditure risks through an efficient health insurance system has been on the public agenda in almost any developed country. A part of this agenda have been the questions of how applicable the idea of competitive efficiency is to insurance markets. The ubiquitous feature of health insurance that makes the analysis of interaction between different insurance providers relatively complex is that the insurers' costs depend on who their customers are and how they behave. In other words, competition in health insurance could be based on mere selection of "good risks" rather than improvement of quality or efficiency. Since this nature of insurance markets may impose substantial welfare costs on the system, many governments attempt to intervene into the selection process to increase the efficiency of the system through regulation.

In this paper I study a regulatory intervention that allows for the existence of private health insurance companies and a significant degree of competition in the system. In particular, I use the institutional setting of the German health insurance market to analyze the extent of selection between two competing health insurance systems and how it interacts with the regulatory restrictions on market access. As Einav, Finkelstein, Levin (2010) note, competition among health insurance providers has been a relatively understudied topic. They argue that one of the reasons for the greater attention that has been given to consumer behavior rather than competition in the literature may be the lack of suitable datasets that would cover information on several insurance providers. This point is also raised in Dafny, Darnove, Limbrock, Scott Morton (2011). In the US system the scarcity of suitable data may be driven by the predominantly employer-provided insurance for working age employees that creates local monopoly markets (from the end consumer's point of view) and obfuscate any competition among providers that may be taking place before employers decide on their preferred contractor. In many European countries, at the same time, the health insurance system is dominated by governmental provision and regulation. I argue that the German institutional setting used in this paper offers a fairly unique environment to study the competitive health insurance landscape and regulation.

In Germany, where the market for health insurance is characterized by two parallel systems of statutory (henceforth SHI) and private insurance providers (henceforth PHI), the government regulates the market by restricting the movement of individuals across these systems. Specifically, only the self-employed, the civil servants and those employees with an income above a certain threshold are allowed the choice of private insurance. This regulatory instrument is believed to help the market overcome adverse selection spirals and market failures as well as provide comprehensive and affordable health insurance coverage to all residents. The SHI is comprised of more than 100 health funds that are independent corporations under public law and insure about 89% of the population. The individuals in this system may be either insured by mandate or voluntarily. Those that fall under the mandate are primarily employees with income below the regulatory threshold. The premiums for all statutory insured are based solely on their gross annual income. The premiums are calculated as a percentage of income and there is a cap on the maximum contribution. The SHI system has a very limited degree of cost-sharing.[1]

The employees whose income is above the mandate threshold are allowed to opt out of the statutory system and switch to one of about 40 independent private insurance providers. After a switch, the individual can only go back to the SHI if annual income drops below the threshold mandate and the individual is still younger than 55. While the statutory system charges a fixed risk-independent premium to the individuals with high incomes, the private providers are allowed to price discriminate using demographic characteristics and pre-existing medical conditions. The private insurers are also allowed to offer an array of deductibles. The quality of the private plans varies; however, the generally accepted wisdom is that private plans dominate statutory insurance plans in terms of their coverage and services.[2] The private insurance is usually thought of as providing more freedom in the choice of both inpatient and outpatient care, providing shorter wait time for outpatient appointments, paying for more expensive specialists and one/two-bed rooms in hospital, as well as covering more dental procedures. An important detail in the system is that statutory funds cover children and spouses that are out of the labor force for free, while the private providers do not.

In this paper I use the regulatory details of the German system to disentangle the selection and causality channels in the relationship between the type of insurance and the level of healthcare service utilization. I find no convincing evidence of either selection or causal changes in healthcare consumption in the private system. I then use the information on the individual's monthly premiums in the private health

[1] Strictly speaking, there is a 10 EUR co-payment per 3 months if the individual goes to a physician. Furthermore, there is a 5-10 EUR co-payment for pharmaceuticals and some daily co-payments for inpatient stays. At the same time, though, the employer in Germany continues paying the income and there also exist so-called "sick money" so that the individual faces practically no income shocks during sickness.

[2] Given the competitive environment of the private health insurance market, the private insurers have started offering lower quality cheap tariff versions recently, so this wisdom is not exactly true anymore.

insurance system to analyze the factors that affect the composition of prices, in the setting where the health insurance companies are allowed to price on observable characteristics, both demographic and directly health-related. This analysis subsequently allows me to estimate demand for private insurance and identify choice preferences in the setting of horizontally differentiated insurance products. I find that preferences for convenience, income levels, and political beliefs play a role in determining individual income for insurance beyond price elasticity. Finally, utilizing the finding of no net selection between the two insurance systems, I estimate counterfactual welfare losses from access restrictions and find sizable effects on individual welfare. Consequently, the paper is structured as follows. Section 2 provides a brief review of related literature. Section 3 discusses a stylized framework of the German health insurance market and the expected nature of selection and its interaction with access regulation. Section 4 describes the data used in this study and provides empirical evidence about the nature of selection. Section 5 analyzes the demand for private health insurance, including the examination of the private insurers' pricing and welfare implications of the access restrictions given the nature of selection between the systems and demand for the PHI. Section 7 briefly concludes.

2 Related literature

The current paper is related to several strands of literature. First, it naturally relates to the topics of asymmetric information, choice, and heterogeneous preferences in the demand for health insurance. Einav, Finkelstein, Levin (2010) offer a survey of the literature on asymmetric information that strives to detect market failures due to adverse selection and moral hazard and estimate its empirical welfare effects. McGuire (2011) provides a comprehensive survey of the health insurance demand and choice literature. The overarching topic of the role of heterogeneous preferences in the demand for health insurance is also thoroughly discussed in Cutler, Finkelstein, McGarry (2008). Their paper points out that in practice low risk individuals do not necessarily buy less insurance coverage, as would be predicted by the seminal work of Rothschild and Stiglitz (1976). They argue that individuals' preferences, such as for example the degree of risk aversion, may reverse the relationship between the risk type and the level of coverage. Geruso (2012) explores the theme of heterogeneous preferences further and finds that older individuals enroll in more comprehensive plans than younger individuals with the same expected healthcare expenditure risk.

Second, the current paper complements the growing literature on the nature of competition in health insurance markets. This literature studies whether imperfect competition, rents and market power may be a significant cause of welfare losses in this market beyond the losses attributed to asymmetric information. As noted in Einav, Finkelstein, Levin (2010), the topic of competition and market frictions in the health insurance market has received substantially less attention in the health insurance literature than the issues of asymmetric information. Dafny, Dranove, Limbrock, Scott Morton (2011) argue that the lesser focus on the competition may at least partially be the outcome of data quality and data scarcity on non-Medicare health insurance markets. Dafny (2010) uses a unique dataset on the health insurance purchases by large US employers and finds that more profitable firms pay more for similar health insurance plans than less profitable firms, which implies rent extraction and imperfect competition on the group-insurance market in the US.

Lustig (2011) studies the interaction of adverse selection and imperfect competition on the Medicare+C HMOs market. The paper focuses on the competition within the private HMO providers, rather than on the selection and competition between the HMOs and the traditional Medicare plan. Lustig uses variation in the number of firms operating on different markets to recover insurer's costs and consumer demand for different types of plans. These findings allow him to separately estimate the magnitude of welfare losses due to adverse selection and imperfect competition. The paper concludes that the welfare losses from imperfect competition are potentially greater than from adverse selection alone. Starc (2012) explores a similar theme in the context of the Medigap market. Her study finds that the inefficiencies of the Medigap market may be related to costly search and large marketing expenses by imperfectly competitive firms. In the current paper, I use a different institutional setting to examine a related issue of direct competition between insurance companies of "public" insurance system and private providers. This is similar in spirit to the question of competition between Medicare and Medicare Advantage plans, with the key difference being that in my setting the private insurers are paid directly by the consumers and are allowed to price-discriminate according to health risks and pre-existing conditions as well as to reject coverage. Furthermore, in Germany the government regulates which groups of consumers are allowed to opt out of the public system and thus constraints the market where the competition between the systems is possible.

Finally, given the institutional environment used in the study, this paper is closely related to the literature that analyzes the German health insurance system. This literature has naturally touched upon the questions studied in this paper. Nuscheler and Knaus (2003) address the issue of risk selection among different sickness funds that offer health insurance within the German statutory system, finding that the observed differences in the risk pools of different sickness funds are mostly due to the consumers' switching costs and that the sickness funds themselves don't practice any significant cherry-picking of consumers. Using an RD design similar to the one applied in the current paper, Hullegie and Klein (2010) estimate that holding a private insurance policy decreases the number of doctoral visits, doesn't affect the number of hospital stays and improves self-assessed health. Schmitz (2011) uses a self-reported measure of risk aversion to show some evidence of advantageous selection in the supplementary coverage market. He finds that more risk-averse men buy supplementary coverage more often, but use it less. Similar to Hullegie and Klein (2010), Schmitz (2012) takes another look at the effect of insurance coverage on the utilization of healthcare. The paper argues that two factors affect individuals' choice of the health insurance contract in Germany - health status and risk aversion, where the latter and parts of the former are individual's private information. The paper doesn't consider any specific preferences for the types of healthcare services (valuation of quality) that individuals may have as a reason for their choice of one or the other insurance. It finds that individuals demand less healthcare services when they face a deductible and more healthcare services when they have more coverage.

Grunow and Nuscheler (2010) addresses the issue of selection patterns between the private and statutory systems in Germany. Their paper argues that the private insurers are unable to select good risks at the enrollment stage, but manage to dump high-risk individuals back to the public system later. This could seem surprising for two reasons. First, given that the private insurers can price on health and pre-existing conditions and that they can reject the contract, it is surprising that they wouldn't be able to reject the unwanted high risk clients, unless there is a very high degree of asymmetric information. Second, given the regulatory constraint on switching back into the public system, it is surprising that private insurers can easily get rid of bad risks. In the current paper, I briefly re-examine the question of selection between the two systems and in addition analyze demand for private insurance and how it is affected by the regulatory choice constraints practiced in the German system.

3 Conceptual framework

3.1 Stylized model of the market

Consider the following stylized model of the German two-tier health insurance market.

Suppose we have a set of consumers that can be characterized by type θ_i. Assume that every individual is of a different type and that there is some distribution of these types in the population $\theta_i \sim F(\theta)$. The types here refer not only to the expected healthcare utilization costs, but also to risk preferences and, importantly, to the individual preferences for premium services in healthcare consumption. This assumption goes in line with the recent literature that has identified and measured the effects of preferences on health insurance choices. For example, Geruso (2012) finds residual health insurance preferences related to age. The literature has also found preference heterogeneity in other insurance markets, for example in annuities (Einav, Finkelstein, Schrimpf, 2010) and long-term-care insurance (Finkelstein and McGarry, 2006). These studies predominantly analyze how different preferences affect the extent of coverage that individuals choose to buy. In other words, the analyzed insurance contracts lie on a vertically differentiated product spectrum, and individuals agree on the ordering of contract valuation, but not on its level. A preference for more *convenience* rather than coverage in health insurance that is introduced in this paper, has not, to the best of my knowledge, received much explicit attention in the previous literature.[3] Introducing this preference allows for a horizontal differentiation of insurance contracts, since the degree of coverage is interacted with differential convenience, which may be valued differently by individuals.

Given the vector of consumer types, both individual expected medical expenditure risk and preferences can be parsimoniously summarized in a static utility framework. Specifically, suppose that individual's utility from any of the insurance plans offered on the market takes the following form[4]:

$$U_{ij} = u_{ij}(\theta_i) - p_{ij}(\theta_i)$$

Here, individual i gets some value $u_{ij}(\theta_i)$ from enrolling into an insurance plan j. This valuation depends on the individual's type θ_i and the type of the chosen insurance plan. The difference in the valuation between the the plans comes from heterogeneous preferences for the level of services, benefits, and cost-sharing. The individual has to pay price p_{ij} for the chosen insurance plan. Unlike in many

[3] The closest to the concept of the horizontally differentiated plans is the comparison between the HMO and PPO policies that has been studied in the literature.

[4] We may instead start with a dynamic life-cycle model of insurance choices, where individuals choose their preferred insurance coverage in every period given heterogeneity in preferences and uncertainty about the expected healthcare expenditure. However, given the institutional nature of choice, I view it as appropriate to approximate the dynamic model with a static framework. Under the current regulation, individuals basically have one-in-a-lifetime decision (if any) of which insurance plan to enroll into, since individuals that opt into the PHI system are restricted in the ability to switch back to the SHI. In that case, the expected continuation value in the Bellman equation of choosing the PHI folds into a constant. Further, for the individuals in SHI that eventually want to switch to the PHI, any waiting is suboptimal, given the annuity nature of the PHI. Thus, a static framework, where the valuations refer to life-time utility from being in one or the other system, seems to be an appropriate approximation to the choice problem at hand.

standard consumer goods markets, the price for the insurance contract is allowed to depend on the individual's type. The individual chooses insurance product j, so as to maximize utility.[5]

Now consider the supply side of the market. The stylized description of the health insurance market in our setting involves two firms P [PHI] and S [SHI].[6] The firms sell health insurance products that are horizontally differentiated. While the common perception is that the private insurer provides higher quality products, at the same time it also offers different cost-sharing arrangements.[7] Therefore, the consumer ranking of the products may disagree depending on individual preferences. Assume that both firms have no administrative cost, so that their only cost are the expenses caused by consumers' healthcare utilization. In this setting, the cost that each firm experiences for covering consumer i with characteristics θ_i depends on the consumer's characteristics and the quality of contract that the consumer chose. Let us denote the incurred expenditures for a given healthcare service and a given contract quality with $e_{Pi}(\theta_i)$ for an individual with policy P and $e_{Si}(\theta_i)$ for an individual with policy S. Since firm P reimburses more to providers, its initial expenditures for the same consumer and for the same service are always higher than those of firm S. That is, $e_{Pi}(\theta_i) > e_{Si}(\theta_i)\ \forall i$.

However, the actual cost for firms P and S to cover an individual i in a given time period, depend on the cost-sharing arrangements of the individual's contract. The cost-sharing arrangements both decrease the cost for the firms by directly passing a part of the cost to the consumer and may decrease the cost indirectly if the individual consumes less services due to cost-sharing. Since firm P tends to have both more cost-sharing and higher provider reimbursement, the net difference between the cost of coverage for a given individual i between the two firms is ambiguous. That is,

$$c_{Pi}(\theta_i) \gtreqless c_{Si}(\theta_i)\ \forall i$$

[5] Here I am abstracting from a number of institutional details of this choice. Thus, for instance, the concept of price for the contract in the static framework is not simple. First, in reality individuals pay monthly insurance premiums and these premiums change annually both on the SHI and the PHI contracts. The SHI prices usually rise because of the changes in regulation and any changes in income. The PHI prices may change due to higher costs of service, demographic, or regulatory changes. Further, PHI prices depend on the individual's entry age, since the contract is structured as an annuity. The static framework provides the closest approximation if the prices $P_{ij}(\theta_i)$ are viewed as life-time expected prices the individual faces for his or her insurance choices. Since the regulatory constraints are such that the choice of insurance can be approximated as one-in-a-lifetime decision, the interpretation of the valuations and prices as life-time variables appears appropriate. In the empirical work, however, I will have to resort to monthly premiums and valuations, since the data provides only short snapshots of the individual's experiences with their insurance choices.

[6] A natural concern here is of course that both the PHI and the SHI systems actually consist of many separate firms. Since I do not have data on the choices of specific PHI providers, these choices cannot be accounted for empirically and therefore are also abstracted from in the conceptual discussion. Therefore, one could think of the presented choices as being at the top level of a nested choice problem.

[7] Even for PHI contracts with zero deductible and zero co-insurance, the PHI feature of reimbursing individuals with 1 or 2 monthly premium payments for no-claims years, encourages the PHI-insured to not submit small claims and thus have a de facto deductible.

Although the comparison of costs between the two insurance providers is ambiguous, each firm knows its terms of contract with individuals and thus has some information about its expected costs on which it could base its pricing strategies. These pricing strategies are constrained by the government's regulation. The prices that both firm offer have to depend on their expected cost of coverage. This cost depends on the quality of coverage that the firm provides. To emphasize this relationship, I include the quality variables q_s and q_p into the cost functions.

The quality of firm S is strongly regulated and thus firm S does not make choices of quality. Furthermore, I suppose that firm S has to set its price to the average costs that it faces given its customer base weighted by income profiles in the population ω_i. That is, the price that individual i faces for policy S can be expressed as:

$$p_{Si} = \omega_i \int\limits_{\{\theta | buy\, S\}} c_S(\theta, q_s) d\theta$$

I assume that firm P gets to set the price after it observed the regulated price and quality of firm S. That is, firm P can respond strategically to the price set by firm S. In particular, if firm P competes with firm S on selection, then it would set its prices so as to attract the most profitable consumers. Further, firm P can price-discriminate on the observable part of consumers' characteristics, which makes the strategic response to the price of firm S easier to execute. Since the price that firm P offers to consumer i has to depend on expected costs, given the observable characteristics of the consumer, the price will be a function of expected costs and the price offered by firm S:[8]

$$p_{Pi} = f(c_{Pi}(\theta_i^{observable}, q_P), p_S)$$

In the equilibrium of this game, under the assumption that firm S sets its quality to the minimal regulatory constraint, the key choice variable is the quality provided by firm P. This quality (which refers to the combination of benefits and cost-sharing) determines the relative prices and sorting of consumers across the two systems. The next section discusses the possible implications of different pricing strategies in the two systems on the directions of risk sorting.

[8]I discuss the actual pricing technique of the private insurance providers in more detail in section 5.1

3.2 Selection between the insurance providers and eligibility mandate

Given the differences in pricing methods, different types of individuals may be considered "good" or "bad" risks for PHI vs. SHI and we would expect these differences to impact selection patterns. Specifically, for the employees above the income threshold, the SHI charges a fixed premium. Thus, the "good risks" for the SHI are simply those individuals whose healthcare utilization expenditures in this year are lower than what they pay into the system. Let us call these individuals "net payers" and the individuals that spend more on their healthcare than they pay, "net receivers."[9] Then, I can define selection in this market for the purpose of this paper as follows. There is adverse selection into the PHI if the individuals that opt out for the PHI would have been predominantly "net payers" in the SHI system. There is advantageous selection into the PHI if the individuals that opt out for the PHI would have been "net receivers" in the SHI system. And finally there is no selection if the switchers are a random mix of risks. Especially in the case of the adverse selection, we would be tempted to claim that the PHI competes with the SHI purely on selection rather than on efficiency or better quality. In this case, competition may appear to be harmful; while in the case of advantageous selection, competition would appear to be welfare-improving.

Before looking for any evidence of selection going one way or the other in the data, it is useful to explore whether we would intuitively predict any natural direction for selection. For this, it is essential to closer understand the pricing scheme of the PHI and which kinds of individuals it would have an incentive to select. The PHI premium is calculated as an annuity on the expected life-time healthcare costs. The theoretical idea is to have fixed life-long monthly payments for the individual, while the insurance company absorbs any risk on the variation in the healthcare costs above the predicted levels. Because of the annuity structure, the monthly premium payments are usually higher than the claims in the younger age and the difference between them is held (invested) by the insurance company and then used to pay for the higher expenses in the old age. That is, the very stylized calculation of the premium is to take the PDV of the expected lifetime healthcare spending and divide them equally across all expected life months.

This calculation faces two problems that do not allow the insurance companies to actually maintain the monthly premium fixed over the individual's lifetime. First, the society is aging and so the assumptions about life expectancy at the entry age will be underestimating the number of years the insurance will

[9] An alternative definition would be to consider life-time payments into the system versus lifetime healthcare expenditures and classify the individuals according to this criterion. Given that the SHI providers need to balance their annual budgets, the annual classification of risks appear more natural.

likely have to cover. This is especially critical, since the additional years of life in the old age are probably going to be the most expensive years in terms of the medical spending. Second, the prediction of the expected claims in the older age is based on the current expenditures of the company's customers at this age. That is, to predict how much spending a current 30-year male will have when he is 50, the company looks at the realized average spending of current 50-year old males in the same or similar insurance plan. Given the fairly steep growth in the medical expenditures, this premium calculation severely underestimates the actual expected costs for our 30-year old. To cope with these two issues, the insurer has to annually adjust up the premiums for the existing contracts.[10]

With this pricing mechanism in place, let us consider which individuals constitute "good risks" for the PHI and how these compare to the "net payer" and the "net receiver" classification in the SHI as suggested above. The PHI uses average costs by age and gender in a given plan as the basis for the calculation of the premiums for a new consumer. The insurer can also add individual-specific risk adjustment payments or exclude pre-existing conditions from coverage. A "good risk" for a specific PHI plan is then someone, whose healthcare expenses over lifetime are lower than the average expenditures that the insurer uses to calculate the premium. It follows that in the pool of employees above the income eligibility threshold in a given year, the PHI would try to select individuals that are expected to have healthcare utilization below the average utilization in that PHI plan.

At the same time, however, given the annuity system of the PHI, younger individuals should find it relatively more attractive to join the PHI system than older individuals. Thus, if PHI observes all its applicants at a relatively young age,[11] it may be hard for the insurer to predict how the healthcare utilization of a specific individual will relate to the average in the plan. That is, in this setting the level of informational uncertainty is so high that it may prevent the insurer from successfully executing any meaningful selection of good risks. In other words, the very nature of the PHI pricing scheme and the additional regulation that essentially prohibits the PHI to terminate existing contracts, dampens the extent of targeted selection.

Furthermore, even if PHI could select and if we viewed both systems as charging fixed monthly premiums over the life-time of the individual (and this would have been true absent the growth in healthcare

[10] This discussion of the pricing methodology is provided to the best of my knowledge and is based on external information about the operations of the PHI providers and the regulatory provisions for the industry; actual pricing strategies of individual insurance companies may be different. Specifically, the discussion provided here relies heavily on Kalkulationsverordnung KaIV version 2009 and Schneider(2002) presentation at the 27th International Congress of Actuaries

[11] Furthermore, note that for the employees, the PHI applicants are at the same time going to be high-earners, implying that these individuals are less likely to have any significant chronic conditions or disabilities

costs that in principle affects both systems), the classification of "good" and "bad" risks across the systems would be different due to the different base used for premium calculations. That is, someone, who is a "net payer" in the SHI system, may be a "bad risk" for the PHI system, if this individual's healthcare costs are higher than the average for his/her age and gender in the PHI. Similarly, someone, who is a "net receiver" in the SHI, may still be profitable for an expensive tariff in the PHI. Thus, the nature of selection between the two competing systems as defined in the beginning of this section appears to be ambiguous a priori.

At the same time, understanding if and what kind of selection occurs at the intersection of the systems is policy-relevant in light of the regulatory restrictions on the access to the PHI. Suppose that despite the theoretical ambiguity, we were to find empirically that there is adverse selection from the SHI to the PHI. Then, the access restriction policy in place would be ensuring that no Akerlof (1970) style unraveling can occur in the SHI structure, since the majority of individuals under this insurance coverage are in the non-selected risk pool.[12] The welfare-improving case of the access restriction would be significantly weaker, if advantageous selection were occurring. Lastly, consider the case of no selection. Suppose we believed that the reason for selection not occurring were indeed the pricing nature of the PHI, which induces individuals to switch to the PHI at as young age as possible. In that case, removing high-income eligibility threshold would allow individuals to apply for the PHI when they are even younger (assuming that most employees need some time to get to the high-earner status). This would make selection even harder for the PHI insurers, since they will face even less information about the applicant's expected risks. In this scenario, the current presence of the access restriction would again appear *ceteris paribus* welfare-decreasing.[13] To shed some light on the issue, the next section considers whether healthcare utilization data reveals any distinct selection patterns between the insurance systems.

[12]Granted, unraveling could well occur within the SHI system, since we must not forget that SHI is actually comprised of more than 100 companies that do have some minimal leeway in the manipulation of their risk pool. In fact, Bauhoff (2010) finds that SHI firms try to select customers on the basis of their geographic location. However, the argument here relates to the risk pool in the SHI system as a whole.

[13]It is important to note that this logic assumes no substantial changes in the pricing policies or contract space. A full welfare analysis would require predictions about the changes in the behavior of firms in response to any regulatory access changes.

4 Empirical evidence on the nature of selection

4.1 Data and descriptive statistics

Throughout the empirical analysis, I use data from years 2005-2009 of the German household survey panel SOEP. The survey offers a collection of self-reported answers for a sizable representative sample of the German population.[14] In the 2008 cross-section, the survey recorded observations on 18,703 individuals. The questions in the survey cover rich demographic information, a multitude of life perception issues, healthcare related information, as well as the intensity of social security services utilization. Among other things, the survey offers information on the type of health insurance coverage. As expected, most individuals report being insured in the SHI system. The number of individuals that were eligible for the PHI (excluding dependents) is 2,393 (13%) in the 2008 cross-section. 1,352 (56%) of these reported SHI enrollment and 1,041 (44%) were enrolled in the PHI. The survey further offers information on the self-reported insurance premiums and deductibles for the PHI insured, some information on other types of insurance policies in the household (e.g. life insurance), indicators of existing chronic diagnosis, BMI, self-reported information on the number of outpatient visits and hospital stays, as well as self-reported level of riskiness in different settings.

Table 9 summarizes the means of the key observed variables for all full-time employees and for all PHI-eligible full-time employees for years 2005-2009. The latter group is then split into those that reported SHI and those that reported PHI enrollment. The covariate means are compared for these two groups with a two-tailed t-test. We see that among all full-time employees, whose average monthly pre-tax income amounts to about 3000 EUR, only 8% of individuals report PHI enrollment. This share jumps dramatically to 35% among PHI-eligible employees. Given that PHI eligibility for employees is determined through income, it is not surprising that the PHI-eligible group reports much higher average income of about 5,800 EUR. This average is even higher for those employees that actually choose to enroll into the PHI - 6,150 EUR. Besides income, the main differences between the PHI-eligible and the all-employees groups are in covariates that we would expect to be highly correlated with income. Specifically, the PHI-eligible pool is older and more male. Perhaps unexpectedly, the PHI enrollees do not seem to be on average substantially different from the PHI-eligible SHI-enrollees, neither in demographic, nor in healthcare-related outcomes. In the next section I use econometric analysis to provide more detailed comparisons of these two groups.

[14] For for information on the SOEP panel please see http://panel.gsoep.de/

4.2 Empirical evidence on the nature of selection between the SHI and the PHI systems

The goal of this Section is to identify the patterns of any distinct sorting of individuals across the two insurance systems. As discussed in Section 3, ex ante the nature of net selection into the PHI system appears to be ambiguous. The ambiguity is especially stark if we believe that individuals choosing among the two horizontally differentiated insurance systems may have preferences for either one of the systems that are orthogonal to their expected healthcare expenditures (see Geruso (2012) for a recent discussion on the role of taste in health plan choices). The key challenge for the empirical identification of selection between the systems is the need to disentangle the ex ante selection into the PHI system, from ex post causal effects of PHI enrollment. To address the identification challenge, the main analysis of this Section relies on the instrumental variables approach within a fuzzy regression discontinuity design. Specifically, I employ the income-based eligibility to choose the health insurance system as an instrument for the individual's enrollment into the PHI. This allows me to identify the causal effect of the PHI enrollment and separate it from selection. In addition to the regression discontinuity analysis, I also discuss non-parametric evidence on the probability of chronic diagnosis by different types of insurance, as well as the development of covariates of the SHI-insured above and below the PHI-eligibility threshold.

For the analysis of selection in this Section, I construct a data extract from the 2005-2009 SOEP waves. This extract consists of the individuals reporting to be working full-time, either as employees or self-employed. I thus exclude students, retirees and workers that are entitled to the civil servant medical benefits. I further trim the sample to include individuals whose monthly income is reported to be between 400 EUR and 50,589 EUR and exclude individuals that are younger than 25 or older than 65. The latter again allows me to ensure that there are no students and retirees in the sample, since students are often insured with their parents or student insurance, while retirees are locked into their respective insurance choices and no sorting can be taking place among them. The final sample includes 31,112 individual-year observations on about 6,000 individuals. The median monthly pre-tax income in the remaining sample is about 2,600 EUR/month. 90% of the sample lies in the monthly pre-tax income interval between 1,200 EUR and 7,000 EUR. About 14% of the individuals in each year report having a full private insurance coverage. Half of these are employees and the other half are self-employed. The income of the PHI-insured is about one standard deviation higher than the average income in the sample.

The final sample provides me with the information on the individual's basic demographic characteristics, such as age and gender, and the level of monthly income that the individual reports. I then observe whether the individual reported being in the PHI or the SHI system. System choices are very stable across years, so it is suitable to think about these choices using the static utility framework, which is employed in the next Section. At the same time this stability implies that any analysis of selection between the systems refers to the steady-state composition of the risks in the systems only, since the observations on switchers in their first year of switching are very scarce. I further observe several risk and taste-related characteristics of the individuals, such as the self-reported risk aversion, health status and satisfaction, sports affinity, healthy eating habits, smoking, body-mass index, disability and chronic diseases. Finally, I observe indicators of self-reported individual healthcare utilization, such as the number of physician office visits in the past three months and the number of hospital stays in the past year. Table 9 provides detailed summary statistics of the sample along different data cuts. Table 10 compares the covariate means within a 500 EUR bandwidth around the PHI eligibility cutoff. The samples on different sides of the cutoff appear to be similar on the covariates.

Correlation between healthcare utilization and PHI enrollment

To summarize the *prima facie* evidence on the relationship between the insurance system and the healthcare utilization, I use the following linear specification for the expected healthcare utilization outcomes as a function of the type of insurance.

$$E[Y^{outcome}|X,\, PHI] = \alpha PHI + \beta X$$

The outcome variables include the number of inpatient and outpatient visits, both unconditional and conditional on having at least one visit, as well as the probability of having at least one visit. The parsimonious set of control covariates includes age, gender and income. I allow for a different intercept and a different slope for the self-employed individuals. Table 1 reports the OLS results for the regressions on the PHI-eligible sample. We observe that older individuals utilize more healthcare services, while women are more likely to visit a physician. Having PHI decreases the likelihood of a physician visit for the self-employed, while the effect on the outpatient behavior of the employees is negative, but not statistically significant different from zero. The connection between insurance status and inpatient stays of the employees is more precise than for outpatient visits. Specifically, it appears that employees are likely to have 0.27 fewer stays in the hospital per year, conditional on having at least one stay, if they have PHI insurance.

The association between the PHI enrollment and the utilization of healthcare observed in the linear specification warrants further analysis, as the choice of the PHI by an individual may be correlated with the unobserved characteristics that also determine the level of healthcare utilization. In particular, the OLS coefficients contain a mixed effect of selection into the PHI and the causal effect of the PHI on the individual's healthcare utilization. Even though the equation conditions on the key determinants of healthcare consumption such as age and gender, there may be taste characteristics of individuals that both induce the choice of the PHI and lesser or more significant healthcare utilization. For instance, if an individual likes to go to a physician a lot (for instance, for preventive care), then this individual may choose to buy PHI that provides better experience in the healthcare system and go to a physician more because of this idiosyncratic taste, even if conditional on age, gender, and income one would not predict higher utilization. This would be an example of selection.[15] At the same time, the PHI provides different cost-sharing mechanisms than the SHI and thus we would expect less moral hazard in the PHI system.

Therefore, in order to more accurately characterize the nature of selection between the SHI and the PHI systems, I need to disentangle the causal effects of having the PHI on the level of healthcare utilization from the ex ante selection. Before proceeding with the causality analysis, it is important to emphasize that the causal or "moral hazard" and selection effects in this setting themselves include a multitude of potentially countervailing forces. Specifically, the selection effects here are a combination of any strategic customer screening by the PHI firms and individual preferences that lead different individuals to apply for and accept PHI contracts. The causal effect of the PHI may include the classical moral hazard argument, according to which the higher degree of cost-sharing should decrease the demand for healthcare. At the same time, PHI causality could also include the physician-induced demand argument, whereby the physicians, whose remuneration is substantially higher under the PHI, induce more demand from patients. A countervailing causal force would exist if PHI-insured are treated better and thus need less healthcare service. Lastly, if PHI patients face shorter waiting times and more convenient service, they could be inclined to more utilization of healthcare. The available data does not allow me to disentangle any of these forces separately; therefore, it is useful to keep in mind

[15] In particular this would be close to the idea of selection on moral hazard - a topic discussed in detail in Einav, Finkelstein, Ryan, Schrimpf, Cullen (2012)

that my empirical findings of selection and causality will necessarily reflect the net of all these different influence channels.

Regression discontinuity analysis of the PHI's causal effect on healthcare utilization

To identify the causal effects of the PHI and subsequently separate them from selection, I need an instrumental variable that would be highly predictive of whether an individual has a PHI or not, but at the same time not related to the unobserved characteristics that may influence both the individual's utilization of healthcare and the choice of PHI conditional on the observed covariates. I exploit the regulatory break in PHI eligibility as an instrument for PHI enrollment. In the German system, the access to the choice between the SHI and the PHI for employees is restricted by the government. Only employees whose income crosses an annually set eligibility threshold may choose to opt out of the SHI system into the PHI. If the income eligibility boundary is binding, we would expect that there is a discontinuity in the probability of enrolling into the PHI at the income eligibility cutoff. In other words,

$$Pr(PHI_i = 1) = \begin{cases} g_1(income_i) & \text{if } income_i \geq cutoff \\ g_2(income_i) & \text{if } income_i < cutoff \end{cases}, \text{ where } g_1(\cdot) \neq g_2(\cdot)$$

This setting corresponds to a fuzzy regression discontinuity design, where I use the discontinuity in the probability of treatment as the instrument for the treatment status.[16] The discontinuity design is fuzzy, since the crossing of the eligibility threshold only gives the individual a choice to take up the PHI treatment, rather than imposing a switch to the PHI. The key identifying assumption in this setting is that individuals cannot precisely manipulate on which side of the cutoff they are, to gain the treatment. Given that income is likely reported with measurement errors (especially with rounding) and that employers tend to set rounded wages or use the insurance income cutoff as a wage benchmark, any statistical evidence of no manipulation should be interpreted with care. Nevertheless, histogram analysis of the density of observations at different levels of income suggests no evidence of heaping at the cutoff. Naturally, this still does not preclude the possibility of manipulation cases at the threshold. Given the employer's awareness of the threshold, it seems plausible, however, that employers would offer salaries that are right at the eligibility threshold or sizably lower. In this case,

[16]The fuzzy RD discussion here follows Angrist and Pischke (2009)

individuals are unlikely to have sufficient bargaining power to negotiate their wages up in the latter case, but at the same time it is also unlikely that individuals would choose their employment based on the PHI eligibility in the former case.

I start with the estimation of the first stage regression that should confirm that there is a strong relationship between the instrument and the endogenous decision to enroll in the PHI. I use different levels of polynomial controls that are allowed to differ above and below the cutoff and I center the income running variable at the cutoff. The latter makes the interpretation of results easier and allows me to combine observations from different years that had different cutoff levels.

$$E[PHI|income] = \gamma_1 + \gamma_2 Above\,cutoff + \beta f(income - cutoff) + \delta f(income - cutoff) \times Above\,cutoff$$

Both the graphical representation of the probability of the PHI-enrollment as a function of income in Figure 4 and the regression coefficients in Table 2 confirm that PHI-eligibility induces individuals to take up the treatment after they cross the eligibility cutoff. As Figure 4 shows, there appears to be no relationship between the income cutoff and the PHI enrollment probability for the self-employed, for whom the income mandate doesn't apply. The simpler versions of the first stage regression without cutoff-centering yield similar results. The results remain quite consistent across different polynomial specifications. [17]

Having established the presence of the first-stage relationship, I proceed with the analysis of the reduced form specifications. As Angrist and Pischke (2009) point out, the analysis in this fuzzy regression discontinuity setting depends on whether we can document a discontinuity in the outcome variable at the cutoff conditional on the non-linearities of the forcing variable. Graphical representation of the reduced form in Figure 5 shows no evidence of a discontinuity between the health utilization outcomes at the income PHI-eligibility cutoff. The econometric reduced form specification centers the income variable at the cutoff and allows for different polynomials before and after the cutoff.

$$E[Y^{outcome}|X] = \alpha_1 + \alpha_2 Above\,cutoff + \beta f(income - cutoff) + \delta f(income - cutoff) \times Above\,cutoff$$

[17] Considering the potential measurement error in income, local results around the cutoff may be misleading, since the observations around the cutoff may have been misclassified. Note that the graphical evidence suggests that there are a number of observations very close to the cutoff that have a fairly high probability of PHI enrollment, even if their income is reported to be below the eligibility level. The first reason for such observations may be a measurement error in income that leads me to misclassify the individual's eligibility. Secondly, the German health insurance regulation allows individuals that opted out to the PHI at some point and then their income dropped below the current eligibility threshold, to sign a waiver for the re-entry of the SHI.

Table 3 summarizes the reduced form coefficients. The estimates are imprecise, but broadly confirm the intuition from the graphical evidence that there is no stark jump in the average utilization of the healthcare services below and above the PHI-eligibility cutoff. This suggests that there is no strong evidence of net causal effect of the PHI. While this may appear surprising in light of the cost-sharing arrangements in the PHI, one should keep in mind that this result does not imply that cost-sharing arrangements in the PHI do not have any effect on the consumption of care. The concept of moral hazard differences between the two insurance systems again consists of several potentially countervailing forces. First, we would expect cost-sharing arrangements to decrease the demand for care. At the same time, however, better and faster service towards the PHI-insured may have the opposite effect. Lastly, the high remuneration of physicians by the PHI providers may create incentives for more physician-induced demand for care that would again countervail the decrease due to cost-sharing.

Table 4 summarizes the results of the first stage and the reduced form specifications in the 2SLS regression. Given the imprecision of the reduced form results, the 2SLS coefficients are also imprecise. In the OLS regressions at the beginning of this section, we saw that the only significant difference in the utilization of healthcare by the PHI-insured appears to occur in the frequency of stays at an inpatient facility conditional on having any stay in a given year. Since the 2SLS coefficients are not precise estimates, I cannot subtract them from the (also imprecise) OLS results to get the magnitude of the net selection between the PHI and the SHI systems. However, I can use the information from the confidence intervals of these two specifications to calculate the range of possible selection levels that I cannot reject at 5% confidence levels. Consider, for example, the total number of outpatient visits in three months as the outcome variable. The OLS results suggest that the effect of the PHI on this number lies between [-0.33, 0.07]. The 2SLS coefficient for the same outcome variable has a confidence interval of [-1.36, 0.0009]. Then, the data would suggest that we cannot reject that the causal effect of the PHI is to induce 1.36 fewer outpatient visits. If this causal effect were true, then to get the combined effect of causality and selection to be at least -0.33, we would need that individuals with on average one *more* outpatient visit get selected into the PHI. This would imply advantageous selection. If we consider the other side of the confidence interval that suggests zero causal effect of the PHI on physician visits, we would conclude that individuals with on average 0.33 fewer physician visits switch to the PHI. That is the highest level of adverse selection would be 0.33 outpatient visits per quarter. The econometric analysis also cannot reject that both the causal and the selection effects of the PHI on healthcare utilization are zero.

Additional evidence on selection between the PHI and the SHI

The "zero" effects appear to be supported by two additional pieces of evidence. First, Figure 1 shows no evidence of any difference in the probability of having a chronic diagnosis at different levels of income for individuals in different insurance systems. If one believes that these diagnosis cannot be strongly related to which kind of insurance the individual has (and this is plausible, since the level of SHI coverage is very high), then these graphs would suggest that PHI companies do not manage to differentially select individuals that will not have chronic/expensive illnesses. The only evidence of selection appears to happen on the diabetes-diagnosis. We observe that the probability of having a diabetes diagnosis is consistently lower for the PHI-insured with income above the eligibility threshold. These differences could be related to the nature of PHI pricing, as discussed in Section 3, whereby PHI companies observe the individuals at a fairly early age and thus may be unable to predict and screen on most of the diagnosis, except for diabetes.

Figures 2 and 3 provide further evidence for the no-selection hypothesis. These figures plot the development of a number of covariates, which may plausibly not contain a causal effect of the PHI, for the SHI-insured across the income eligibility threshold. The covariates include the average age, the fractions of older and younger individuals, the average BMI, health-related risk aversion, the affinity to smoking, to healthy eating, sports and the fraction of disabled. If PHI disproportionately selects individuals with certain levels of these covariates, we would expect to see a jump in the level of the covariates for those that stay in the SHI insurance. To detrend the development of the variables from the relationship with income, I plot the residuals from the regression of the covariates on income using the sample to the left of the cutoff and calculating out-of-sample residuals to the right of the cutoff. Again, these graphs suggest no evidence of a discontinuous net selection at the income eligibility threshold. As discussed in Section 3, finding no evidence of selection would imply that at least within some income bandwidth, the PHI eligibility threshold does not serve the purpose of maintaining the SHI risk portfolio. This conclusion renders the welfare analysis of the next section relevant for the policy discussion about the necessity or the level of such market access regulation.

5 Demand for PHI and welfare effects of the market access regulation

5.1 Premium payments for SHI and PHI

The key ingredient in the individual's choice between the statutory and the private systems is the relative price that the individual faces on both markets. Since I can only observe the prices for the PHI system if the individual chose to enroll into the PHI and reported the monthly premiums, I have to simulate the PHI premiums for all the SHI-enrollees. Together with the calculation of the SHI premiums, I can then derive hypothetical incremental difference between the premiums. Since the calculation of the counterfactual SHI price is straightforward, as it is set by law, I start with the discussion of the PHI prices.

To simulate the private insurance pricing for the individuals that chose to stay with the SHI, I use the prices reported by the individuals that did choose PHI and project these prices on the observable characteristics of these individuals. I consider five years of the data, years 2005-2009, where PHI pricing feasibly followed the same broad principles.[18] The sample for five years of the PHI prices has a total of 8,429 individual-year observations on about 1,500 individuals. The data includes observations on the monthly premium paid into the PHI, the number of people covered under this policy, whether the individual was self-employed or a civil servant, age, gender, BMI, number of outpatient visits in the past three months of the survey year, number of inpatient visits, whether the individual is a smoker, whether the individual experienced prolonged work disability, and indicators for diabetes, asthma, cardiac conditions, cancer, stroke, migraine, high blood pressure, depression, dementia, other illnesses, whether no serious diagnosis has been made.

Private health insurance companies use annuity pricing formulas that include information on the individual's age, gender, and health to arrive at the monthly premium payments for each individual. In theory these premiums correspond to the average monthly payment required to cover expected life-time medical expenses, given the levels of morbidity and mortality and should remain stable over time. In practice, however, the payments have to be continuously re-adjusted to rising medical costs and

[18] Although using several years of the panel gives me the advantage of having a larger sample size, there is also a disadvantage in using these years. In the period between 2007 and 2009, there was a short regulatory change that required the individuals to cross the income eligibility threshold three years in a row before they were eligible to switch to the PHI. However, if anything, this feature would lead me to underestimate the demand for the PHI and thus provides a more conservative specification.

increasing life expectancy. Given the details of the pricing system, individuals that have been in the PHI for longer and are older usually get higher annual premium increases than younger individuals. Since I do not observe the individual PHI entry age, I use an unrestricted linear specification to approximate the expected conditional price that individuals would face for a given age, gender and health status.

The general econometric specification is as follows:

$$E[P_i^{PHI}|\theta_i] = \alpha_0 + \alpha_1 \cdot female_i + \alpha_2 \cdot age_i + \beta \cdot healthcare\, indicators_i + \gamma \cdot employment\, type\, fixed\, effects_i$$

where the P^{PHI} refers to the reported prices in EUR for the years 2005-2009, $female$ equals one if the observation is for a woman, age has age in years, $healthcare\, indicators$ refer to different controls for chronic conditions or healthcare utilization. Employment fixed effects capture the differences in the premiums that self-employed, civil servants and full-time employees pay. These effects are included in up to third-level interactions to account for potentially differential prices for, for instance, full and part-time employees. Table 5 summarizes the key coefficients for different specifications.

The regression implies that a 40-year old male that is a full-time employee would pay on about 400 EUR a month for his private health insurance. Reformulating the regression in percentage terms by doing a log-transformation of the price variable, we get that each additional year increases the premium by about 2%. It is clear that the pricing is also sensitive to the individual's gender. It appears that women have both a different level and a different age slope in the PHI pricing. This is not surprising, since reported costs for women in the PHI system indeed have different levels in different age groups. Single individuals pay less for their insurance, which is natural, since they on average pay for fewer policies. The positive coefficient on income most probably captures the fact that individuals with higher income choose more comprehensive, and thus more expensive, coverage. The linear approximation of the PHI pricing rules accounts for a substantial amount of variation in the prices, with R^2 equal to 0.42 in the log-specification with diagnosis-specific controls.

Using this approximation of the average PHI prices, I calculate the counterfactual PHI premiums for the PHI-eligible individuals that had chosen SHI in the years 2005-2009. This counterfactual calculation is based on non-trivial assumptions. The first assumption is that conditional on the same demographics, individuals that didn't change to the PHI would have changed at the same age and would have chosen a similar PHI plan as the individuals that did change. Second, conditional on the same demographics, individuals that didn't switch would have been in a similar health condition at the time of the switch. In short, I assume that individuals that didn't switch to the PHI would have faced the same pricing rules as the individuals that did switch. Given the discussion in Sections 3 and 4 that points out to the fact that even though PHI firms are allowed to price-discriminate on the observables at the time of enrollment, their ability to actually distinguish healthcare expenditure risks of individuals of the same age and gender (where these individuals are mostly middle-aged high earners) may be limited. In that sense, the assumption that individuals would have faced the same prices at the time of the application is less stringent.

The left panel of Figure 6 compares the densities of predicted and observed prices for individuals that reported prices. The right panel compares the reported PHI-premiums with out-of-sample predictions for the currently SHI-insured. The lower part of the panel provides the same comparison for the full-time employees only. The densities in Figure 7 show the difference between the observed prices for PHI-insured and the predicted prices for the PHI-eligible SHI-insured. These plots indicate that the pricing regression performs well in predicting the total in-sample premium levels, while it performs substantially worse in the predictions for the employees only. Further, densities indicate that PHI-eligible employees chose policies with higher monthly premiums than the self-employed. This is not surprising, since unlike the self-employed that are PHI-eligible at any income level, the PHI-eligible employees are high earners that could be expected to choose more expensive plans.

In the next step, I apply the rules for SHI-premium calculations from respective years to get imputed SHI-premiums for both the SHI and the PHI-insured. These premiums then allow me to calculate the hypothetical price difference that the PHI-eligible individuals face. The predicted SHI premiums and the distribution of premium differences is illustrated in Figure 8. Note that the SHI premiums have two different levels. The lower level corresponds to the premiums paid by the employees, for whom the employer pays about half of the premium, while the upper level are the monthly premiums paid by the self-employed. The right panel of the figure plots imputed premium differences between the PHI and the SHI for employees.[19] For the majority of individuals, PHI appears to be more expensive than

[19]Note that this calculation faces a certain data-interpretation problem. In the German system, the employees can apply their employer's health insurance subsidy to their private insurance coverage. However, in the survey, when the employees are asked about their PHI premiums, the question does not specify whether the respondents should specify the monthly premium after or before the employer's subsidy. To remain conservative, I assume that the individuals reported the post-subsidy premium that they actually pay. Therefore, when calculating the predicted differences in the SHI and PHI premiums, I also apply the post-subsidy levels of the SHI premiums. If the assumption about the data is wrong and individuals reported the full premium rather than the post-subsidy premium, then I would be dramatically overestimating the PHI prices and thus underestimating the probability that the individuals switch to the PHI and the implied welfare effects.

the SHI. At the same time, it appears that there is no much difference in the predicted premiums for those that actually chose PHI and those that decided not to opt out of the SHI, which would suggest non-pricing preferences to be important for the demand decisions.

5.2 Individual demand for PHI

To formulate a simple model of demand for the private insurance, I go back to the consumer utility characterization introduced in Section 3. This utility characterization assumes that individual's utility from insurance is the difference between the individual's willingness to pay and the premium that the individual faces. That is, the utility can be characterized by the following:

$$U_{ij} = u_j(\theta_i) - p_j(\theta_i) \tag{1}$$

This representation of the individual's utility is readily mapped into a standard discrete choice framework.[20] In this framework, we would like to specify the observed and the unobserved (to the econometrician) portions of utility. That is, we want to decompose utility into the representative utility V_{ij} that is the observable part of utility and the unobservable part ϵ_{ij}. The unobservable part is defined as a residual in such a way that $U_{ij} = V_{ij} + \epsilon_{ij}$. Comparing this to Equation 1, we see that the unobserved part of utility will be the unobserved part of the willingness to pay $u_j(\theta_i)$ and the representative utility will include the observed part of the willingness to pay as well as prices.

As in the standard discrete choice, I assume that the observed part of utility is a function of the alternative's attributes Z_{ij} that may vary by the decision maker, but at least vary by the alternative, as well as some attributes of the decision maker X_i that are the same across the alternatives. Then, the observed part of utility can be approximated linearly as:

$$V_{ij} = \beta X_i + \gamma Z_{ij}$$

Specifically, suppose each individual can be characterized by a set of attributes X_i that doesn't change depending on the choice of insurance, but does affect individual's preference for one or the other choice. In out setting X_i consists primarily of demographic factors, such as age, gender, employee or

[20] In the formulation of the discrete choice model I closely follow the treatment in Train (2003).

self-employment status, income, sport affinity, smoking, BMI, and the degree of risk aversion.[21] The observed choice-varying attributes in our setting only include the different prices that individuals face for different insurance choices, i.e. $Z_{ij} \equiv p_{ij}$.

I explicitly include the alternative-specific fixed effect into the utility model. This constant captures the average choice-specific valuation of the unobserved portions of utility and thus automatically normalizes the mean of the unobserved utility ϵ_{ij} to zero. The final utility model then takes the following form:

$$U_{iPHI} = \beta_{PHI} X_i + \gamma p_{iPHI} + \xi_{PHI} + \epsilon_{iPHI}$$

$$U_{iSHI} = \beta_{SHI} X_i + \gamma p_{iSHI} + \xi_{SHI} + \epsilon_{iSHI}$$

The individual is assumed to choose the alternative that maximizes utility. The probability that an individual i chooses PHI over SHI is then given by

$$\begin{aligned}
&Pr(U_{iPHI} > U_{iSHI}) = \\
&\quad = Pr(\beta_{PHI} X_i + \gamma p_{iPHI} + \xi_{PHI} + \epsilon_{iPHI} > \beta_{SHI} X_i + \gamma p_{iSHI} + \xi_{SHI} + \epsilon_{iSHI}) = \\
&\quad = Pr(\epsilon_{iSHI} - \epsilon_{iPHI} < \gamma p_{iPHI} - \gamma p_{iSHI} + \xi_{PHI} - \xi_{SHI} + \beta_{PHI} X_i - \beta_{SHI} X_i)
\end{aligned}$$

Since utility is ordinal, the coefficients in this model are identified only up to a constant, so I normalize ξ_{SHI} and β_{SHI} to be zero. Then we get:

$$\begin{aligned}
&Pr(i\, choose\, PHI) = \\
&\quad = Pr(\epsilon_{iSHI} - \epsilon_{iPHI} < \gamma p_{iPHI} - \gamma p_{iSHI} + \xi + \beta X_i)
\end{aligned}$$

That is, under the assumption of separability of valuation and price, demand for PHI depends on the difference in the valuation of the products and the corresponding difference in price as well as the density function F of the difference in the error terms $F(\epsilon_{iSHI} - \epsilon_{iPHI}) \equiv F(\tilde{\epsilon_i})$. In other words:

[21] Arguably factors such as sport affinity, smoking and BMI may be endogenous to the insurance choice. For example, private insurance may work on encouraging the insured to quit smoking or loose weight. However, I abstract from this possibility for now and assume that individuals don't explicitly and differentially change their traits because of different insurance choices.

$$Pr(i\,choose\,PHI) = $$
$$= \int I(\tilde{\epsilon_i} < \gamma p_{iPHI} - \gamma p_{iSHI} + \xi + \beta X_i) dF(\tilde{\epsilon_i})$$

Assuming extreme value Type 1 distribution on the error terms, which implies that $F(\tilde{\epsilon_i})$ is logistic, we get a standard logit[22] closed-form representation:

$$Pr(i\,choose\,PHI) = \frac{e^{\beta X_i + \gamma p_{iPHI} + \xi}}{e^{\beta X_i + \gamma p_{iPHI} + \xi} + e^{\gamma p_{iSHI}}}$$

which is equivalent to:

$$\frac{(e^{\beta X_i + \gamma p_{iPHI} + \xi})e^{-\gamma p_{iSHI}}}{(e^{\beta X_i + \gamma p_{iPHI} + \xi} + e^{\gamma p_{iSHI}})e^{-\gamma p_{iSHI}}} = \frac{e^{\beta X_i + \gamma(p_{iPHI} - p_{iSHI}) + \xi}}{1 + e^{\beta X_i + \gamma(p_{iPHI} - p_{iSHI}) + \xi}}$$

The latter can be readily used to formulate and estimate the standard logit maximum likelihood. Table 6 reports the marginal effects from the logit estimates as well as linear-probability model comparison for different specifications of the representative utility. The sample in this estimation is restricted to non-civil servant, full-time employed individuals that report having voluntary SHI insurance or PHI insurance. In other words, to those individuals, who appear to have a clear choice between the PHI and the SHI systems. To better understand the differences in demand across different quantiles of the income distribution, I also present the preferred demand specification (columns (3) and (4) of the full-sample specification) for three separate income brackets in Table 7.

All specifications suggest that demand for the PHI is downward-sloping in price. Conditional on prices, there is some taste-heterogeneity in the preferences for the insurance system. Thus, older, self-employed, higher-income, and healthy-eating affine individuals as well as smokers are more likely to get the private health insurance conditional on the prices. At the same time, there appears to be no heterogeneity of tastes based on gender, BMI and risk aversion. Individuals with disability are less likely to enroll into the PHI - this may be a reflection of both tastes (e.g. aversion towards deductibles) as well as rejections by the PHI companies. Interesting taste heterogeneity is captured by

[22] Note that in the binary choice situation that we are analyzing, the Independence of Irrelevant Alternative property that makes logit model unattractive for differentiated goods analysis is not applicable. However, the inability of logit to capture the correlation in unobserved parts of utility over time is a fairly significant drawback for the choice of insurance and thus using a less restrictive model would be a useful extension of the paper. Furthermore, an extension to a more flexible mixed logit specifications would also help to capture preference heterogeneity more accurately.

the indicators for whether individuals employ household help and whether they have strong center-left political views. Supposing that individuals with household help highly value convenience, the strong effect of this coefficient would confirm the presence of convenience preferences in the choice of the horizontally differentiated insurance plans. The elasticity of demand towards the price differential conditional on the demographics appears to increase with income levels. At the same time the residual impact of the "convenience" preferences, which are proxied by whether or not the individual employs household help, fades at higher income levels. In the next Section, I use demand estimates to predict counterfactual PHI demand for individuals with income below the income eligibility threshold.

5.3 Counterfactual welfare effects of the access restriction

In order to quantify the welfare effects of the income eligibility threshold on the individual utility, I need to make predictions about the counterfactual utility levels. The demand estimation in Section 5.2 provides me with an approximation for the "observed" or the representative part of utility for the PHI relative to the SHI as a function of observable covariates. In the demand estimation, I can normalize the observable utility for the SHI to zero, using the relative price for the PHI rather than absolute. Consequently, the utility for the PHI just gives the additional representative utility relative to the SHI. Therefore, I can use the demand regression coefficients to construct empirical difference in the representative utility:

$$\hat{V}_{iPHI-SHI} = \hat{\beta}_{PHI-SHI} X_i + \hat{\gamma} p_{iPHI-SHI} + \hat{\xi}_{PHI-SHI}$$

The change in the expected consumer surplus from the scenario with the PHI choice available versus without the choice is then found using the standard consumer surplus formulation in the logit framework (Train 2003):

$$\triangle E(CS_i) = \frac{1}{\hat{\gamma}}[ln(1 + e^{\hat{V}_{iPHI-SHI}})]$$

Since the coefficient on price gives the marginal value of money, dividing the consumer surplus equation by this coefficient allows me to interpret the utility difference in monetary terms. The histograms in Figure 9 show the spread and levels of the representative utility calculations for the PHI-eligible sample of employees on which the demand estimation was done. The "observable" portion of the willingness to pay for the PHI across almost all models lies between -400 EUR and +400 EUR per capita. Across all models less than 50% of the distribution lies in the positive region. That is, more than half of the individuals in the sample would have higher representative utility from the SHI coverage. This, however, does not take into account the expectation of the unobserved part of the random utility model.

A closer analysis of the imputed utilities reveals that the demand model underpredicts the probability of enrolling into the PHI for all levels of income above the eligibility threshold if based on the representative utility alone. To see the underprediction pattern, I compare the non-parametric representation of the enrollment probability as a function of income for the observed and predicted PHI enrollment. It is apparent from Figure 10 that the observed enrollment probabilities just conditional on income are about 5 percentage points higher than the model's representative utility predictions. The predicted enrollment was set to one if the predicted PHI representative utility is positive and to zero if it is negative.

The within sample underprediction pattern implies that the out-of-sample enrollment will most likely be underestimated even if the error term expectation is included in the calculation. Before incorporating the expectation of the unobserved utility component, I use the four demand models specified in Table 7 to predict the representative utility and the implied PHI enrollment probabilities for the employees that are below the income eligibility threshold and thus are currently not eligible for the PHI. Figure 11 compares the enrollment predictions derived from different demand models of the representative utility. Model 3 is my preferred specification for the demand function, as it can explain the highest amount of variation in the data on which the model is estimated and consequently provides the tightest out-of-sample forecast. Nevertheless, I provide welfare estimates using all four models, even though Models 2 and 4 should be interpreted with care due to very low statistical precision.

To calculate the partial equilibrium welfare impact of the PHI eligibility restriction, I compare the expected consumer surplus with and without the PHI option for the currently ineligible population. The welfare calculations in Table 8 provide the implied surplus loss per capita as well as the implied total surplus loss for the population, where the latter is computed using sample weights for the survey. The calculations imply that removing the PHI access restriction completely would create monthly gains in surplus per capita of 4-39 EUR for currently ineligible individuals. Looking at the counterfactual policy of moving the threshold by 500 EUR rather than completely removing it, gives us a better idea of surplus gains for the group of individuals that are actually likely to choose PHI. Specifically, over this population the per capita monthly surplus gains are on the order of 15-60 EUR. This scenario also implies a gain of 75-200 mn EUR for the population, calculated using sample survey weights.

Figure 12 plots the differences in the expected consumer surplus gains that is predicted for different income levels. As expected, lower income is correlated with low to none surplus gains from the extra choice. Figure 13 shows how changes in the expected consumer surplus develop over different levels of policy changes. In accordance with the observation of decreasing gains in the previous Figure, we see that welfare gains flatten out the farther away we move the restrictive income threshold. At the same time the calculations far out of sample should be interpreted with caution. Individuals with substantially lower income levels may be systematically different in their preferences from the high earners, in which case the extrapolation of preferences out of sample cannot be too informative. To emphasize the focus on the observations with income levels closer to the current income threshold, the welfare function Figures provide a more detailed picture of the predictions within 1000 EUR bandwidth of the threshold, where the predictions of different demand models are also much more congruent.

It is important to note here that these welfare impact calculations are only partial equilibrium results, since I keep the pricing in both systems fixed and only introduce the counterfactual changes in the access restriction policy. Furthermore, these welfare calculations consider only the impact on the individuals and do not take into account any effects on the insurance providers. Ideally, with a richer model and richer data, one could conduct a full welfare analysis that would take into account the changes in the composition of enrollees in both the PHI and the SHI with a policy change, how that would impact prices and how those would in turn impact choices. Note that prices in the SHI could change with a change in the composition of enrollees even if there is little adverse or advantageous selection into the PHI as I seem to observe in Section 4. This is due to the fact that SHI covers a lot of enrollees at the bottom of the income distribution and individuals without any income, so any movements outside of the SHI could result in price adjustments. To reiterate, for the welfare calculations in Table 8, I assume that the only piece of the system changing is the eligibility threshold. Under this assumption, restricting access to the PHI system appears to create a sizable welfare loss for individuals below the eligibility threshold.

6 Conclusion

In this paper I have analyzed the role of taste preferences, risk selection, and access regulation for the market of two competing systems within the institutional setting of two-tier German health insurance. I find clear evidence for the presence of taste preferences in the demand for private health insurance, which offers more convenience and higher service quality, but also higher levels of cost-sharing. Since it appears plausible that the identified taste heterogeneity is not directly related to expected healthcare expenditures, this finding confirms that there is room for horizontal differentiation of health insurance products that is valuable for consumers. Since the German government prohibits access to private insurance for employees with income below a set threshold, I have also addressed the natural question about the welfare implications of this regulatory policy. Indeed, I find that this regulation is binding and creates a substantial *ceteris paribus* consumer welfare loss. The relevance of these welfare calculations depends critically on the nature of selection between the two insurance systems. In my analysis of selection, I find no strong evidence of adverse risk sorting from the SHI to the PHI. While this finding may appear surprising, I argue that the annuity nature of the PHI premiums and the regulatory policy of life-time health insurance contracts could explain the limited degree of screening possibilities in the system. A more precise analysis of selection is critical for the policy implications, however, since if there were adverse selection into the PHI system, the regulatory access restriction would play an important role in the maintenance of a sustainable risk pool in the SHI system that would weigh against individual welfare losses from the regulation. Accounting for the general equilibrium supply-side and risk-pool implications of the regulatory interventions in this market could provide a fruitful ground for further research.

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Tables and Figures

Table 2: First stage regressions: relationship between PHI eligibility and PHI enrollment

	(1) OLS PHI	(2) OLS PHI	(3) OLS PHI	(4) OLS PHI	(5) OLS PHI
Above cutoff	0.246^{***}	0.175^{***}	0.121^{***}	0.0825^{***}	0.0821^{***}
	(0.0152)	(0.0176)	(0.0203)	(0.0227)	(0.0227)
Cutoff deviation	0.0000195^{***}	0.0000839^{***}	0.000147^{***}	0.000256^{***}	0.000256^{***}
	(0.00000221)	(0.00000972)	(0.0000246)	(0.0000476)	(0.0000476)
Cutoff deviation x above cutoff	0.0000129^{*}	-0.0000264	-0.0000502	-0.000130^{*}	-0.000128^{*}
	(0.00000579)	(0.0000139)	(0.0000296)	(0.0000534)	(0.0000533)
Cutoff deviation squared		$2.03\text{e-}08^{***}$	$6.74\text{e-}08^{***}$	0.000000206^{***}	0.000000205^{***}
		(2.60e-09)	(1.47e-08)	(4.72e-08)	(4.72e-08)
Cutoff deviation squared x above cutoff		$-2.20\text{e-}08^{***}$	$-7.59\text{e-}08^{***}$	-0.000000222^{***}	-0.000000221^{***}
		(2.63e-09)	(1.47e-08)	(4.71e-08)	(4.71e-08)
Cutoff deviation cubed			$9.68\text{e-}12^{***}$	$7.28\text{e-}11^{***}$	$7.27\text{e-}11^{***}$
			(2.72e-12)	(1.88e-11)	(1.88e-11)
Cutoff deviation cubed x above cutoff			$-9.47\text{e-}12^{***}$	$-7.19\text{e-}11^{***}$	$-7.18\text{e-}11^{***}$
			(2.72e-12)	(1.88e-11)	(1.88e-11)
Cutoff deviation fourth				$9.41\text{e-}15^{***}$	$9.44\text{e-}15^{***}$
				(2.60e-15)	(2.60e-15)
Cutoff deviation fourth x above cutoff				$-9.42\text{e-}15^{***}$	$-9.45\text{e-}15^{***}$
				(2.60e-15)	(2.60e-15)
Age					-0.000566^{*}
					(0.000246)
Female					0.0119^{*}
					(0.00501)
Health satisfaction					0.00349^{**}
					(0.00109)
Constant	0.0472^{***}	0.0865^{***}	0.107^{***}	0.127^{***}	0.125^{***}
	(0.00448)	(0.00858)	(0.0126)	(0.0162)	(0.0215)
Observations	26828	26828	26828	26828	26788

Individual-clustered standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The table provides several specifications of the first stage regression. The sample includes all individuals in 2005-2009 that are full-time employees, except for civil servants. The goal of the specifications is to determine whether crossing the PHI eligibility threshold increases the probability of taking-up a PHI policy. The specifications control for several polynomial trends of the explanatory variable - income expressed as deviations from the cutoff value - since the effect of crossing the threshold has to be observed beyond any non-linear relationship between the PHI choice and income. Adding higher-order polynomials dampens the effect of the threshold. The last specification also controls for the key demographics which, however, do not affect the level of change in the treatment probability at the cutoff. Crossing the threshold clearly increases the probability of enrollment into the PHI, but the treatment is not deterministic, which suggests a fuzzy regression discontinuity design. Standard errors are clustered at the individual level.

Table 1: Healthcare utilization and insurance type

	(1) OLS Physician visits	(2) OLS P(Phys visit>=1)	(3) OLS Physician visits	(4) OLS Hospital stays	(5) OLS P(Hosp stay>=1)	(6) OLS Hospital stays
PHI	-0.131	-0.0339	-0.0553	-0.0237*	-0.00395	-0.268***
	[-0.330,0.0692]	[-0.0693,0.00141]	[-0.324,0.214]	[-0.0470,-0.000403]	[-0.0202,0.0123]	[-0.427,-0.110]
Age	0.0239***	0.00421***	0.0215***	0.00260***	0.00185***	0.00367
	[0.0155,0.0323]	[0.00274,0.00568]	[0.00924,0.0339]	[0.00162,0.00358]	[0.00117,0.00254]	[-0.00181,0.00915]
Female	0.398***	0.114***	0.133	0.00237	0.00420	-0.0168
	[0.205,0.591]	[0.0818,0.147]	[-0.132,0.398]	[-0.0184,0.0231]	[-0.00996,0.0184]	[-0.189,0.155]
log Income	-0.0474	-0.00636	-0.0528	0.00400	0.00460	-0.00696
	[-0.172,0.0770]	[-0.0303,0.0176]	[-0.246,0.140]	[-0.00972,0.0177]	[-0.00547,0.0147]	[-0.106,0.0923]
Self-employment	-0.176	-0.0848***	0.108	-0.0138	0.000290	-0.183*
	[-0.423,0.0711]	[-0.123,-0.0463]	[-0.255,0.472]	[-0.0403,0.0128]	[-0.0174,0.0180]	[-0.341,-0.0237]
Self-employed x PHI	-0.227	-0.0564*	-0.131	0.00783	-0.0106	0.293**
	[-0.533,0.0792]	[-0.109,-0.00362]	[-0.590,0.328]	[-0.0241,0.0398]	[-0.0334,0.0122]	[0.0846,0.501]
Constant	1.003	0.465***	2.252**	-0.0552	-0.0538	1.264**
	[-0.0209,2.027]	[0.260,0.669]	[0.666,3.839]	[-0.170,0.0598]	[-0.137,0.0298]	[0.336,2.192]
Observations	9485	9485	5353	9472	9472	641

95% confidence intervals in brackets
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The table provides descriptive statistics for the relationship between the utilization of healthcare and demographic factors as well as the insurance policy. The sample includes all working non-civil servant individuals in 2005-2009 that would have been eligible to buy the private insurance. That is, the sample includes the self-employed and the employees with income above the regulatory threshold. Six outcome variables are: 1) the total reported number of outpatient visits in the three months before the survey date; 2) the probability of reporting any outpatient visit in this time period; 3) the number of outpatient visits conditional on having had at least one; 4-6) the same for inpatient visits within a year from the survey date. Note that the utilization information only includes the number of visits (so no cost information is available) and it is self-reported by the survey respondents. Since the coefficients on the insurance type are not precise, 95% confidence interval is reported for an easier interpretation of the possible effects. The regressions allow for a different slope and a different intercept for the self-employed individuals. Standard errors are clustered at the individual level.

Table 3: Reduced form regressions: relationship between healthcare utilization and PHI eligibility

	(1) OLS Physician visits	(2) OLS P(Physician visit>=1)	(3) OLS Physician visits	(4) OLS Hospital stays	(5) OLS P(Hospital stay>=1)	(6) OLS Hospital stays
Above cutoff	-0.120	-0.0104	-0.132	0.00213	0.00178	-0.00556
	[-0.276,0.0352]	[-0.0371,0.0164]	[-0.339,0.0747]	[-0.0176,0.0219]	[-0.0110,0.0146]	[-0.177,0.166]
Cutoff deviation	0.0000649*	0.0000246***	-0.0000101	-0.00000586	-0.00000400	-0.00000830
	[0.00000343,0.000126]	[0.0000139,0.0000353]	[-0.0000920,0.0000718]	[-0.0000135,0.00000177]	[-0.00000907,0.00000108]	[-0.0000636,0.0000470]
Cutoff deviation x cutoff	-0.000104**	-0.0000327***	-0.0000202	0.00000284	0.00000178	0.00000688
	[-0.000173,-0.0000355]	[-0.0000454,-0.0000200]	[-0.000112,0.0000718]	[-0.00000566,0.0000113]	[-0.00000384,0.00000740]	[-0.0000768,0.0000906]
Age	0.0256***	0.00381***	0.0233***	0.00285***	0.00207***	0.00222
	[0.0208,0.0303]	[0.00306,0.00457]	[0.0172,0.0295]	[0.00226,0.00345]	[0.00169,0.00245]	[-0.00171,0.00614]
Female	0.676***	0.161***	0.320***	0.00945	0.00938*	-0.0335
	[0.573,0.779]	[0.145,0.177]	[0.192,0.448]	[-0.00311,0.0220]	[0.00154,0.0172]	[-0.129,0.0624]
Constant	0.623***	0.435***	1.849***	-0.0384**	-0.0239*	1.195***
	[0.398,0.848]	[0.396,0.473]	[1.553,2.144]	[-0.0666,-0.0101]	[-0.0424,-0.00537]	[0.983,1.408]
Observations	26828	26828	16504	26780	26780	1955
R^2	0.019	0.029	0.007	0.004	0.006	0.001

95% confidence intervals in brackets
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The table provides linear specifications for the reduced form relationship between the utilization of healthcare and the eligibility for the PHI. The sample includes all individuals in 2005-2009 that are full-time employees, except for civil servants. The goal of the specification is to quantify any discontinuity in the outcome variable at the eligibility threshold beyond possible non-linearities in the model. The linear specification is reported here; however, higher order polynomials produce a similar results. In no specification is there statistically significant evidence of a discontinuity at the threshold. The six outcome variables are: 1) the total reported number of outpatient visits in the three months before the survey date; 2) the probability of reporting any outpatient visit in this time period; 3) the number of outpatient visits conditional on having had at least one; 4-6) the same for inpatient visits within a year from the survey date. Note that the utilization information only includes the number of visits (so no cost information is available) and it is self-reported by the survey respondents. Since the coefficients on the PHI eligibility indicator are not precise, 95% confidence interval is reported for an easier interpretation of the possible effects. Standard errors are clustered at the individual level.

Table 4: Instrumental variable specification for the fuzzy Regression Discontinuity design

	(1) IV Physician visits	(2) IV P(Physician visit>=1)	(3) IV Physician visits	(4) IV Hospital stays	(5) IV P(Hospital stay>=1)	(6) IV Hospital stays
PHI	-0.679	-0.104	-0.600	0.0139	0.0105	-0.00738
	[-1.359,0.000939]	[-0.225,0.0165]	[-1.551,0.351]	[-0.0713,0.0992]	[-0.0452,0.0661]	[-0.823,0.808]
Cutoff deviation x PHI	-0.000158**	-0.0000514***	-0.0000223	0.00000438	0.00000271	0.0000105
	[-0.000271,-0.0000446]	[-0.0000759,-0.0000270]	[-0.000165,0.000120]	[-0.00000882,0.0000176]	[-0.00000595,0.0000114]	[-0.000119,0.000140]
Female	0.688***	0.164***	0.327***	0.00916	0.00918*	-0.0335
	[0.584,0.792]	[0.147,0.180]	[0.197,0.456]	[-0.00359,0.0219]	[0.00127,0.0171]	[-0.135,0. 0681]
Age	0.0248***	0.00363***	0.0230***	0.00287***	0.00208***	0.00223
	[0.0200,0.0296]	[0.00286,0.00440]	[0.0169,0.0292]	[0.00227,0.00347]	[0.00170,0.00247]	[-0.00173,0.00619]
Cutoff deviation	0.0000807*	0.0000272***	0.00000365	-0.00000620	-0.00000424	-0.00000815
	[0.00000756,0.000154]	[0.0000145,0.0000400]	[-0.0000954,0.000103]	[-0.0000153,0.00000287]	[-0.0000103,0.00000180]	[-0.0000744,0.0000581]
Constant	0.685***	0.447***	1.890***	-0.0397*	-0.0249*	1.195***
	[0.433,0.937]	[0.404,0.490]	[1.561,2.220]	[-0.0714,-0.00804]	[-0.0457,-0.00408]	[0.965,1.425]
Observations	26828	26828	16504	26780	26780	1955

95% confidence intervals in brackets
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The table provides instrumental variables specifications for the relationship between the utilization of healthcare and the PHI. The PHI enrollment and the enrollment interacted with the running variable are instrumented by PHI eligibility and PHI eligibility interacted with the running variable. The sample includes all individuals in 2005-2009 that are full-time employees, except for civil servants. The goal of the specification is to quantify the causal effect of the PHI on healthcare utilization (i.e. a compounded moral hazard effect). A linear specification is reported here; however, higher order polynomials produce similar results or do not properly invert. In no specification is there a statistically significant strong causal effect of the PHI on utilization. The six outcome variables are: 1) the total reported number of outpatient visits in the three months before the survey date; 2) the probability of reporting any outpatient visit in this time period; 3) the number of outpatient visits conditional on having had at least one; 4-6) the same for inpatient visits within a year from the survey date. Note that the utilization information only includes the number of visits (so no cost information is available) and it is self-reported by the survey respondents. Since the coefficients on the PHI enrollment indicator are not precise, 95% confidence interval is reported for an easier interpretation of the possible effects. Standard errors are clustered at the individual level.

Table 5: Linear approximation to PHI pricing

	(1) OLS PHI premium	(2) OLS PHI premium	(3) OLS PHI premium	(4) OLS PHI premium	(5) OLS Log PHI Premium
Age	4.581***	7.026***	6.267***	6.187***	0.0222***
	(0.661)	(0.299)	(0.286)	(0.306)	(0.00133)
Female	-21.53	129.1***	147.3***	174.7***	0.626***
	(27.00)	(19.94)	(16.96)	(14.98)	(0.0930)
Age x female	-0.0803	-2.100***	-2.469***	-2.993***	-0.0102***
	(0.530)	(0.412)	(0.342)	(0.304)	(0.00181)
Self-employed		117.9***	122.6***	123.0***	0.406***
		(11.67)	(12.24)	(12.76)	(0.0375)
Full-time work		230.4***	157.3***	162.2***	0.477***
		(7.871)	(7.841)	(8.667)	(0.0253)
Single		-31.75***	-30.74***	-30.37***	-0.0788***
		(3.573)	(3.320)	(4.024)	(0.0112)
Log income			67.64***	65.66***	0.195***
			(5.211)	(4.997)	(0.0124)
Diabetes				43.59***	0.106***
				(8.520)	(0.0244)
Asthma				10.88	0.0364
				(9.712)	(0.0287)
Cardiac				35.32**	0.0995***
				(11.33)	(0.0258)
Cancer				1.655	-0.0139
				(13.37)	(0.0342)
Stroke				-2.880	-0.0532
				(26.45)	(0.0825)
Migraine				-18.82*	-0.0349
				(8.052)	(0.0232)
High Blood Pressure				-7.880	-0.0382*
				(6.682)	(0.0171)
Depression				-24.83***	-0.0707*
				(6.754)	(0.0313)
Other diagnosis				19.05***	0.0542**
				(5.072)	(0.0152)
Obese				15.11**	0.0300
				(5.491)	(0.0186)
Disability				-14.91	-0.0383
				(9.397)	(0.0269)
Constant	139.7***	-80.28***	-553.0***	-539.4***	2.886***
	(31.93)	(14.37)	(35.38)	(35.77)	(0.115)
Observations	8502	8488	7579	6264	6311
R^2	0.066	0.299	0.366	0.378	0.402

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The table provides coefficients from a linear regression of the observed monthly PHI premiums (in EUR) on the characteristics of the individuals. The sample includes all PHI-insured in years 2005-2009 who reported the premiums they pay for PHI coverage. The sample includes civil servants and the self-employed, in order to increase the sample size and precision of the estimates. To account for differential pricing schemes for the different labor market groups, the regression controls for being self-employed, fully employed or a civil servant. The indicators are also included as interaction terms, up to the third order interaction, so as to allow for, e.g. spouses of civil servants that are self-employed to have a different rate than self-employed without civil service subsidy. The regression also includes year-specific controls that are omitted in the report. Women are allowed to have a different intercept and a different age-related slope in the pricing function. Column (4) explicitly adds reports of specific diagnosis to test whether prices get adjusted for different risk levels. Column (5) provides a log specification.

Table 8: Counterfactual consumer surplus changes

	Model 1	Model 2	Model 3	Model 4
Counterfactual 1: open access to PHI				
Change in consumer surplus within sample, mn EUR	0.6	0.2	0.4	0.06
Average change in CS per capita, EUR	39	13	28	4
Change in consumer surplus weighted by sample weights, mn EUR	2,100	730	1,600	240
Counterfactual 2: threshold decreased by 500 EUR				
Percentage of individuals affected by movement (out of 14,335 obs)	9%	9%	9%	9%
Change in consumer surplus within sample, mn EUR	0.08	0.04	0.06	0.02
Average change in CS per capita, EUR	60	34	48	15
Change in consumer surplus weighted by sample weights, mn EUR	278	155	228	74
Counterfactual 3: threshold decreased by 1000 EUR				
Percentage of individuals affected by movement (out of 14,335)	24%	24%	24%	24%
Change in consumer surplus within sample, mn EUR	0.2	0.1	0.15	0.04
Average change in CS per capita, EUR	56	28	43	11
Change in consumer surplus weighted by sample weights, mn EUR	737	366	598	157

The table summarizes calculations for the counterfactual changes in consumer welfare from changes in the enrollment eligibility *ceteris paribus.* Four columns refer to four demand models that were estimated using the same specification on different income subsamples. (See demand estimation tables). The key differences across the models comes from differential predictions of how many individuals currently below the eligibility threshold would be willing to switch to the PHI if they were given the opportunity, which in turn come from different representative utility predictions. In each counterfactual calculation the first row reports the fraction of individuals that would want to switch as a percent of all individuals that would have become eligible. The switchers are calculated by counting all individuals that have positive predicted utility from the PHI. The second row divides the total sum of the predicted positive utilities by the number of switchers. The third row weights all positive utilities by the sample weights for the respective individuals and adds these up. All calculations use observations only on full-time employees with income below the current PHI eligibility threshold.

Table 6: Demand for private health insurance

	(1) OLS	(2) Logit MFX	(3) OLS	(4) Logit MFX	(5) OLS	(6) Logit MFX	(7) OLS	(8) Logit MFX
Premium difference PHI-SHI	-0.000832***	-0.000880***	-0.00128***	-0.00148***	-0.000788***	-0.000854***		
	(0.0000510)	(0.0000613)	(0.000147)	(0.000179)	(0.0000594)	(0.0000718)		
Age			0.00191	0.00187			-0.00433**	-0.00477**
			(0.00182)	(0.00202)			(0.00159)	(0.00176)
Female (d)			0.143	0.171			-0.0808	-0.0842
			(0.149)	(0.168)			(0.147)	(0.155)
Age x female			-0.00439	-0.00520			-0.000333	-0.000442
			(0.00318)	(0.00361)			(0.00317)	(0.00353)
Self-employed (d)			0.0233	0.0215			0.245***	0.260***
			(0.0360)	(0.0402)			(0.0247)	(0.0268)
Premium difference PHI-SHI x self-employment			0.000995***	0.00120***				
			(0.000170)	(0.000203)				
Log income			0.0870***	0.0944***			0.109***	0.119***
			(0.0245)	(0.0281)			(0.0221)	(0.0251)
Single (d)			0.0869***	0.0974***			0.108***	0.119***
			(0.0256)	(0.0288)			(0.0256)	(0.0283)
Risk averse in health (d)			-0.0435	-0.0492	-0.0382	-0.0422	-0.0430	-0.0470
			(0.0288)	(0.0327)	(0.0292)	(0.0325)	(0.0296)	(0.0328)
Healthy eating (d)			0.0267	0.0319	0.0191	0.0216	0.0259	0.0287
			(0.0198)	(0.0227)	(0.0198)	(0.0222)	(0.0202)	(0.0225)
Life Insurance (d)			0.0369	0.0434	0.0332	0.0368	0.0361	0.0405
			(0.0205)	(0.0232)	(0.0207)	(0.0229)	(0.0210)	(0.0233)
Employ household help (d)			0.164***	0.188***	0.185***	0.202***	0.166***	0.182***
			(0.0260)	(0.0297)	(0.0257)	(0.0283)	(0.0263)	(0.0288)
Center-left politics (d)			-0.0738**	-0.0885**	-0.0747**	-0.0854**	-0.0767**	-0.0868**
			(0.0277)	(0.0320)	(0.0283)	(0.0319)	(0.0283)	(0.0317)
Higher education (d)			0.0333	0.0381	0.0471*	0.0529*	0.0397	0.0450
			(0.0238)	(0.0270)	(0.0233)	(0.0260)	(0.0241)	(0.0268)
Smoker (d)			0.0354	0.0399	0.0408	0.0454	0.0368	0.0402
			(0.0259)	(0.0295)	(0.0260)	(0.0290)	(0.0263)	(0.0293)
Constant	0.453***		-0.409*		0.364***		-0.486*	
	(0.0123)		(0.206)		(0.0351)		(0.193)	
Observations	8129	8129	5701	5701	5701	5701	5701	5701
R^2	0.083		0.133		0.111		0.106	

Marginal effects; Individual-level clustered standard errors in parentheses
(d) for discrete change of dummy variable from 0 to 1
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The table provides several specifications for PHI demand. For all specifications the sample includes full-time employees with income above the PHI eligibility threshold and the self-employed in years 2005-2009. The dependent variable in all specifications is the indicator for PHI enrollment that is equal to one if the individual reported having a PHI coverage. All specifications are reported both as a linear probability and a logit model. The logit specifications report marginal effects rather than coefficients. The premium difference between the PHI and the SHI has been constructed according to the discussion in the paper. For the individuals that were enrolled into the PHI the reported prices are used; for the individuals that were enrolled in the SHI the prices are imputed using the PHI pricing regression. Since prices are partially constructed using the characteristics of the individual, specifications (3)-(8) provide variations on the exclusion and inclusion of the pricing variable. In specifications (3) and (4) both the constructed price and all observed characteristics of the individual are included. Specifications (5) and (6) include the price, but omit the characteristics that were used in the construction of the price variable. Specifications (7) and (8) include all characteristics, but omit the price. Note importantly that the effects of the characteristics that are not connected to pricing and are expected to represent heterogeneous consumer preferences remain stable across the specifications.

Table 7: Demand for private health insurance using different income brackets

	(1) OLS Model 1	(2) Logit MFX Model 1	(3) OLS Model 2	(4) Logit MFX Model 2	(5) OLS Model 3	(6) Logit MFX Model 3	(7) OLS Model 4	(8) Logit MFX Model 4
Premium difference PHI-SHI	-0.00128***	-0.00148***	-0.00139***	-0.00154***	-0.00140***	-0.00165***	-0.00238***	-0.00340***
	(0.000147)	(0.000179)	(0.000260)	(0.000288)	(0.000294)	(0.000365)	(0.000267)	(0.000531)
Age	0.00191	0.00187	0.00673*	0.00679*	0.00346	0.00315	0.00821*	0.0116*
	(0.00182)	(0.00202)	(0.00306)	(0.00329)	(0.00347)	(0.00401)	(0.00391)	(0.00545)
Female (d)	0.143	0.171	0.264	0.314	0.212	0.212	0.488	0.568**
	(0.149)	(0.168)	(0.223)	(0.260)	(0.318)	(0.392)	(0.394)	(0.201)
Age x female	-0.00439	-0.00520	-0.00547	-0.00621	-0.00469	-0.00459	-0.0107	-0.0164
	(0.00318)	(0.00361)	(0.00473)	(0.00534)	(0.00686)	(0.00832)	(0.00814)	(0.0108)
Self-employed (d)	0.0233	0.0215	-0.0982	-0.105	0.0685	0.0696	-0.168	-0.289**
	(0.0360)	(0.0402)	(0.0884)	(0.0816)	(0.0821)	(0.0951)	(0.0884)	(0.110)
Premium difference PHI-SHI x self-employment	0.000995***	0.00120***	0.000419	0.000564	0.00128***	0.00156***	0.00187***	0.00274***
	(0.000170)	(0.000203)	(0.000305)	(0.000333)	(0.000336)	(0.000397)	(0.000339)	(0.000553)
Log income	0.0870***	0.0944***	0.336*	0.373*	0.112	0.123	0.430	0.585
	(0.0245)	(0.0281)	(0.155)	(0.173)	(0.226)	(0.266)	(0.351)	(0.460)
Single (d)	0.0869***	0.0974***	0.0776*	0.0875*	0.166***	0.196***	0.0887	0.114
	(0.0256)	(0.0288)	(0.0371)	(0.0417)	(0.0495)	(0.0580)	(0.0597)	(0.0746)
Risk averse in health (d)	-0.0435	-0.0492	-0.0130	-0.0166	-0.0185	-0.0176	-0.0498	-0.0673
	(0.0288)	(0.0327)	(0.0410)	(0.0463)	(0.0504)	(0.0620)	(0.0626)	(0.0812)
Healthy eating (d)	0.0267	0.0319	0.0153	0.0193	0.0442	0.0576	0.0134	0.0251
	(0.0198)	(0.0227)	(0.0276)	(0.0313)	(0.0368)	(0.0446)	(0.0425)	(0.0563)
Life Insurance (d)	0.0369	0.0434	0.0307	0.0371	0.0765*	0.101*	0.111*	0.148*
	(0.0205)	(0.0232)	(0.0303)	(0.0344)	(0.0381)	(0.0446)	(0.0486)	(0.0606)
Employ household help (d)	0.164***	0.188***	0.208***	0.235***	0.136**	0.160**	0.132**	0.167**
	(0.0260)	(0.0297)	(0.0400)	(0.0459)	(0.0468)	(0.0559)	(0.0486)	(0.0609)
Center-left politics (d)	-0.0738**	-0.0885**	-0.0133	-0.0163	-0.0957	-0.116*	-0.0205	-0.0437
	(0.0277)	(0.0320)	(0.0356)	(0.0420)	(0.0494)	(0.0585)	(0.0585)	(0.0797)
Higher education (d)	0.0333	0.0381	0.0437	0.0513	0.0902*	0.106*	0.0809	0.0980
	(0.0238)	(0.0270)	(0.0326)	(0.0368)	(0.0428)	(0.0504)	(0.0519)	(0.0655)
Smoker (d)	0.0354	0.0399	-0.00573	-0.00706	0.0876	0.105	-0.000332	-0.00481
	(0.0259)	(0.0295)	(0.0359)	(0.0409)	(0.0481)	(0.0594)	(0.0587)	(0.0781)
Constant	-0.409*		-2.798*		-0.804		-3.580	
	(0.206)		(1.311)		(1.948)		(3.095)	
Observations	5701	5701	1950	1950	1236	1236	669	669
R^2	0.133		0.155		0.198		0.255	
Income brackets	all	all	[4000,5000]	[4000,5000]	[5000,6000]	[5000,6000]	[6000,7000]	[6000,7000]

Marginal effects; Individual-level clustered standard errors in parentheses
(d) for discrete change of dummy variable from 0 to 1
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The table reports the specifications (3) and (4) from the original demand estimation table conducted on different sub-samples. As in the original PHI demand regression, the dependent variable is the indicator for PHI enrollment. Both price and all individual characteristics are included in the set of the explanatory variables. Columns (1) and (2) replicate columns (3) and (4) from the original demand regression - the sample in this regression includes all full-time employees with income above the PHI eligibility threshold and the self-employed in years 2005-2009. Columns (3) and (4) report the same regression on the sub-sample with income restricted to the [4000,5000] bracket - this is approximately the 1000 EUR bracket above the PHI eligibility cutoff. Columns (5) and (6) repeat the specification for the [5000,6000] income bracket, and (7) and (8) report the results for [6000,7000] bracket.

Table 9: Mean values of observed covariates for full-time employees

Variable	All full-time employees	PHI-eligible	PHI-eligible with SHI	PHI-eligible with SHI	t-statistic PHI/SHI
Income	3036	5789	5595	6141	-7.79
PHI	.08	.35	0	1	-
Age	43	46	47	46	3.48
Health status (1=excellent, 5=bad)	2.5	2.4	2.4	2.27	5.3
Female	.33	.15	.15	.17	-2.7
Number outpatient visits	1.8	1.7	1.7	1.6	1.8
Probability outpatient visit	.62	.61	.62	.58	2.6
Number inpatient visits	.09	.09	.1	.07	2.2
Probability inpatient visits	.07	.07	.07	.07	0.6
Older than 50	.26	.33	.34	.304	3.02
Older than 60	.03	.04	.047	.046	0.3
Younger than 35	.23	.07	.07	.07	-0.94
BMI	26	26	26.4	25.8	3.4
Smoker	.34	.22	.22	.22	-0.25
Risk aversion in health (0=risk averse)	3.06	3.47	3.44	3.52	-1.09
Risk aversion (0=risk averse)	4.7	5.1	5.05	5.28	-3.4
Disability	.06	.05	.0668	0.03	5.7
Healthy eating (1=always, 4=never)	2.6	2.5	2.6	2.46	4.93
Sport (1=never, 4=often)	2.5	2.9	2.9	3.09	-5.51
Health satisfaction (10=most satisfaction)	6.9	7.1	7.02	7.25	-4.22

The table provides basic summary statistics for the sample of all full-time employees in 2005-2009. Columns (1)-(4) report means of the respective covariates. Column (1) includes all observations. Column (2) includes all employees with income above the eligibility threshold. Columns (3) and (4) report the means of the latter groups differentially for those employees who chose PHI and those who chose SHI. Column (5) provides a two-tailed mean comparison t-test for the last two groups.

Table 10: Covariate balance: means of observed covariates for full-time employees within 500EUR bandwidth around the threshold

Variable	500 EUR below threshold	500 EUR above threshold	t-test difference in means
Income	3697	4182	-73.9
Age	44.2	44.4	-0.6
Health status (1=excellent, 5=bad)	2.4	2.4	0.9
Female	0.25	0.21	2.5
Number outpatient visits	1.8	1.8	0.4
Probability outpatient visit	0.63	0.62	0.4
Number inpatient visits	0.09	0.09	-0.3
Probability inpatient visits	0.06	0.06	0.3
Older than 50	0.265	0.255	0.6
Older than 60	0.024	0.025	-0.06
Younger than 35	0.15	0.13	1.8
BMI	26.1	26.2	-0.38
Smoker	0.31	0.24	3.7
Risk aversion in health (0=risk averse)	3.2	3.3	-1.5
Risk aversion (0=risk averse)	4.8	4.8	-0.45
Disability	0.06	0.07	-1.1
Healthy eating (1=always, 4=never)	2.6	2.6	-0.844
Sport (1=never, 4=often)	2.65	2.7	-0.95
Health satisfaction (10=most satisfaction)	6.9	7.0	-0.83

The table provides a basic covariate balance summary statistics for the sample of all full-time employees in 2005-2009. Column (1) reports the means of the respective covariates for all full-time employees with income level within a 500 EUR window below the cutoff. Column (2) reports the same for the employees with income within a 500 EUR window above the cutoff. Column (3) provides a two-tailed mean comparison t-test for the two groups. The comparison bandwidth is relatively wide due to the sparsity of data at smaller bandwidth restrictions.

Figure 1: Local-linear smoothing of several diagnosis probabilities by insurance type for all income levels

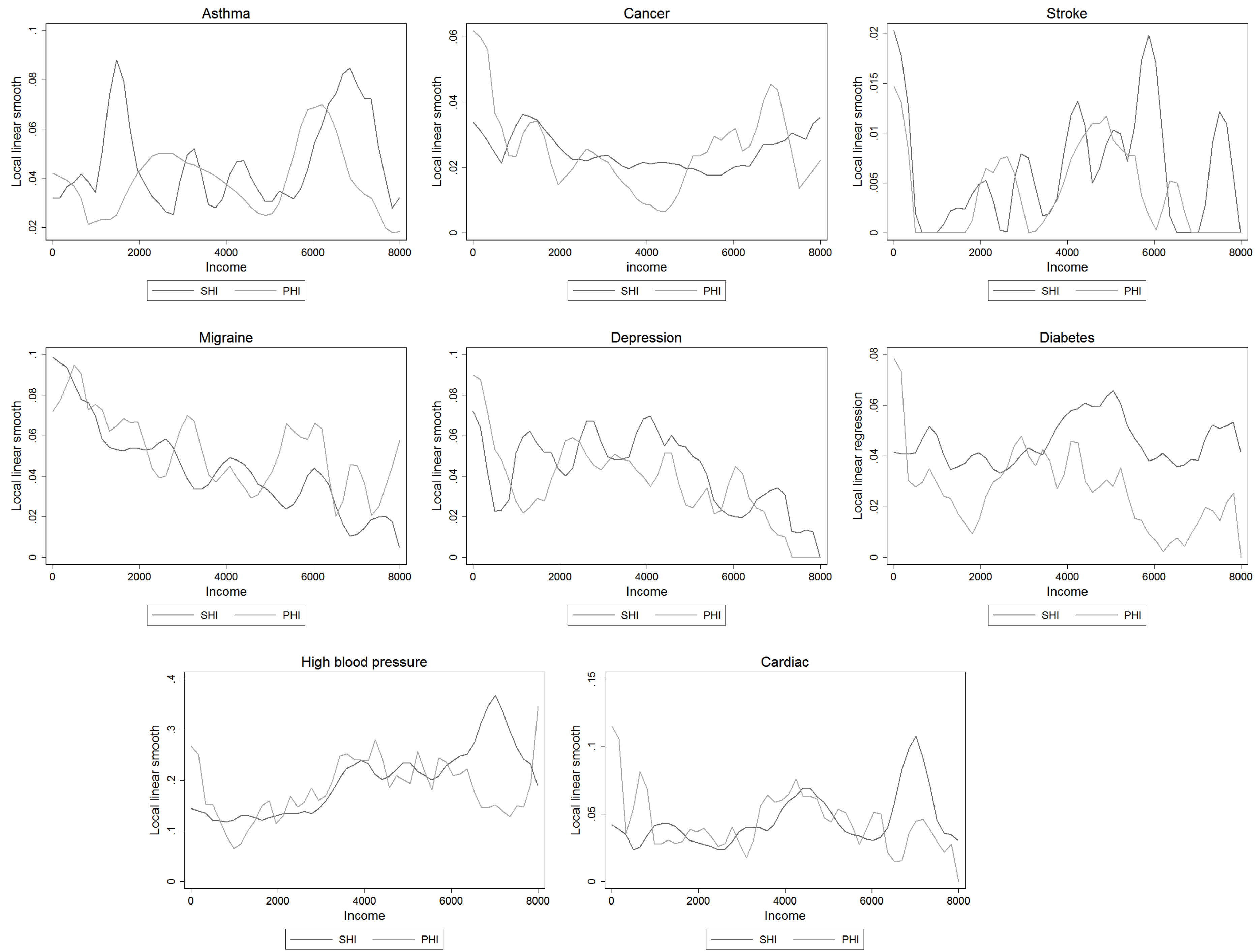
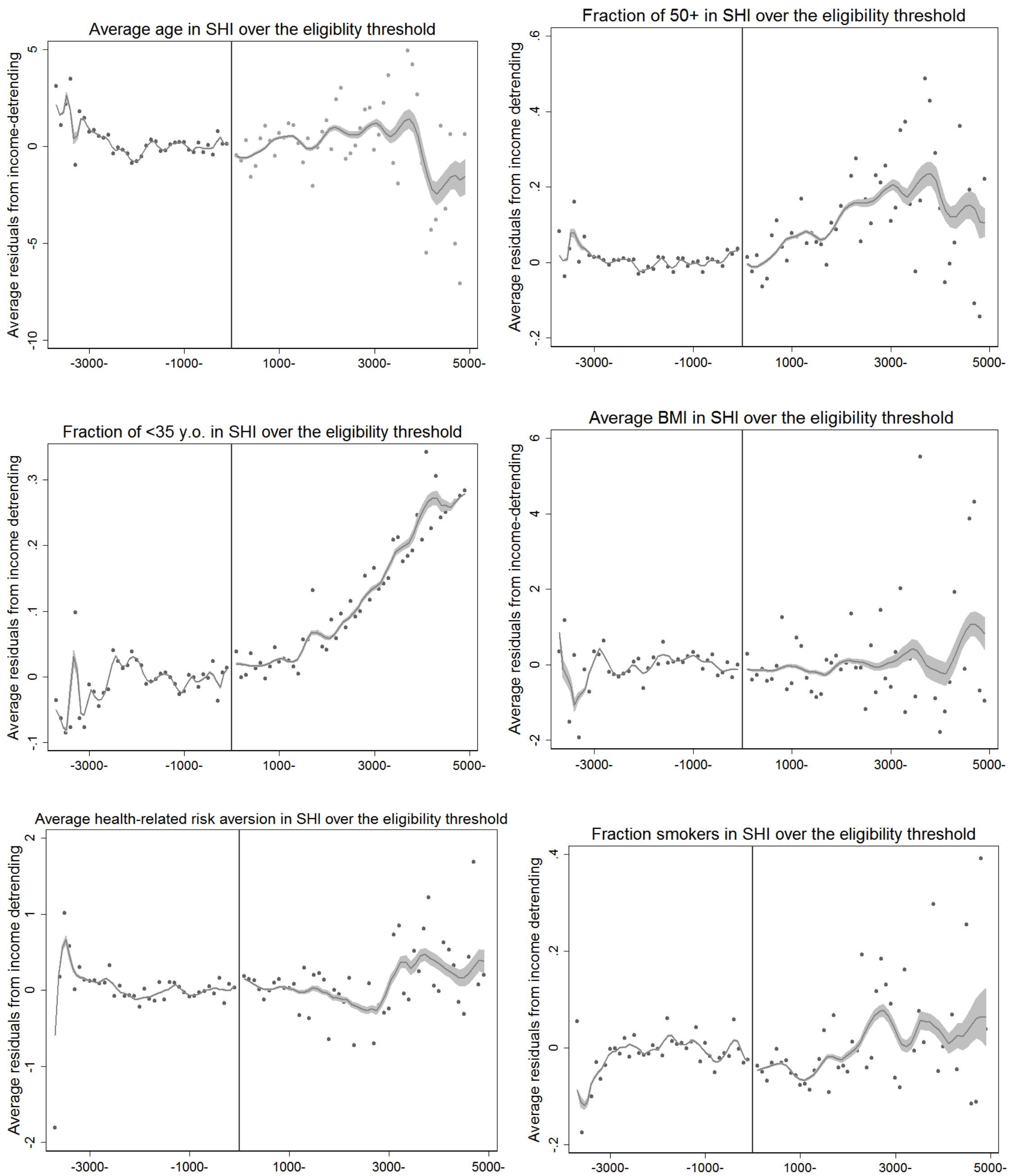
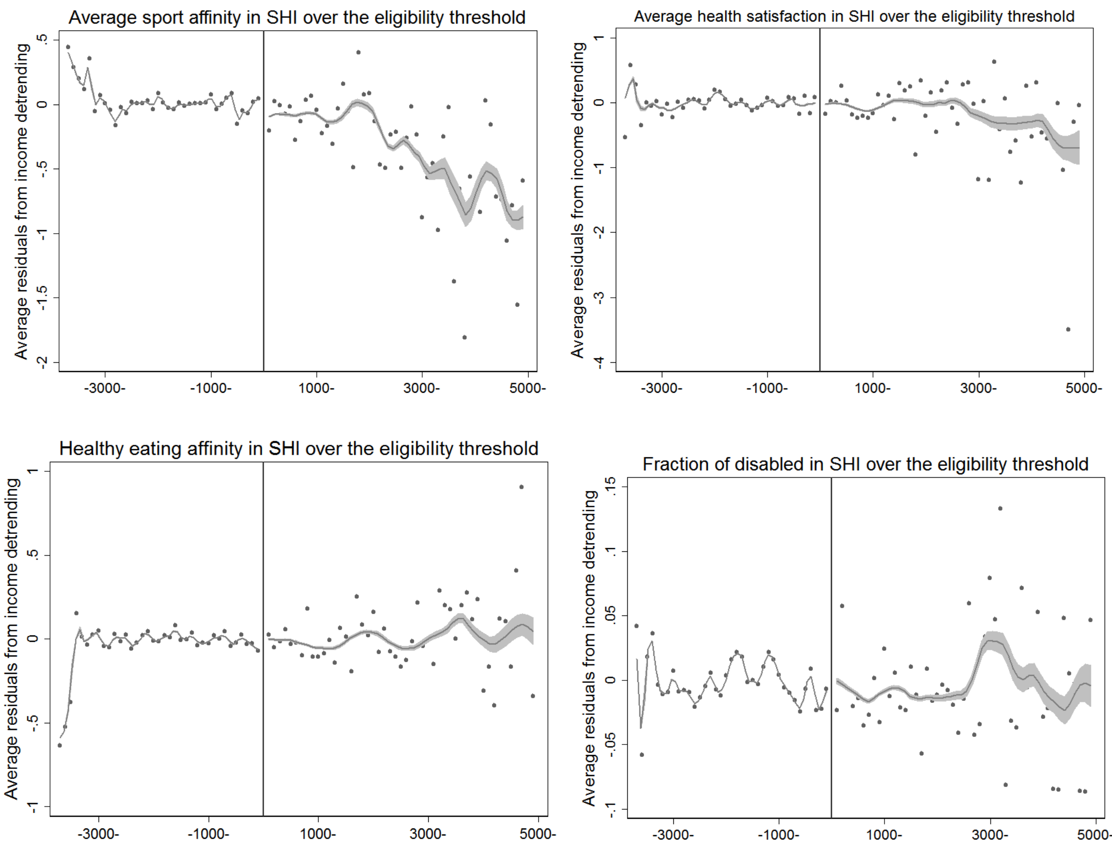


Figure 2: Characteristics of the SHI-insured above and below PHI-eligibility threshold



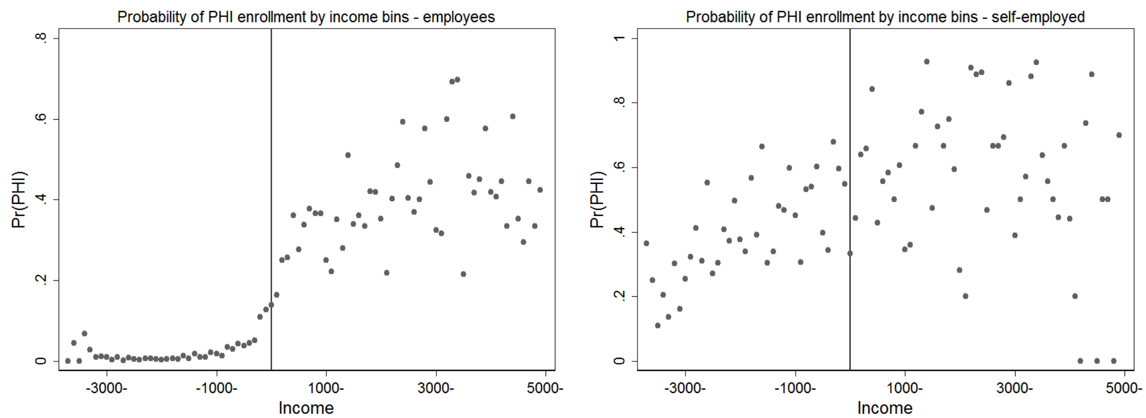
The panels aim to graphically detect the presence or lack of a significant discontinuity in the characteristics of the SHI-insured at the crossing of the PHI-eligibility threshold. Since many of the characteristics are correlated with income, the covariates were first regressed on the income categories in order to eliminate the natural income-induced trend. The regressions did not allow for breaks at the income eligibility threshold. Then, average residuals per income bin were computed and plotted separately to the left and to the right of the cutoff. The sample includes all employees in years 2005-2009 that reported SHI enrollment.

Figure 3: Characteristics of the SHI-insured above and below PHI-eligibility threshold, continued



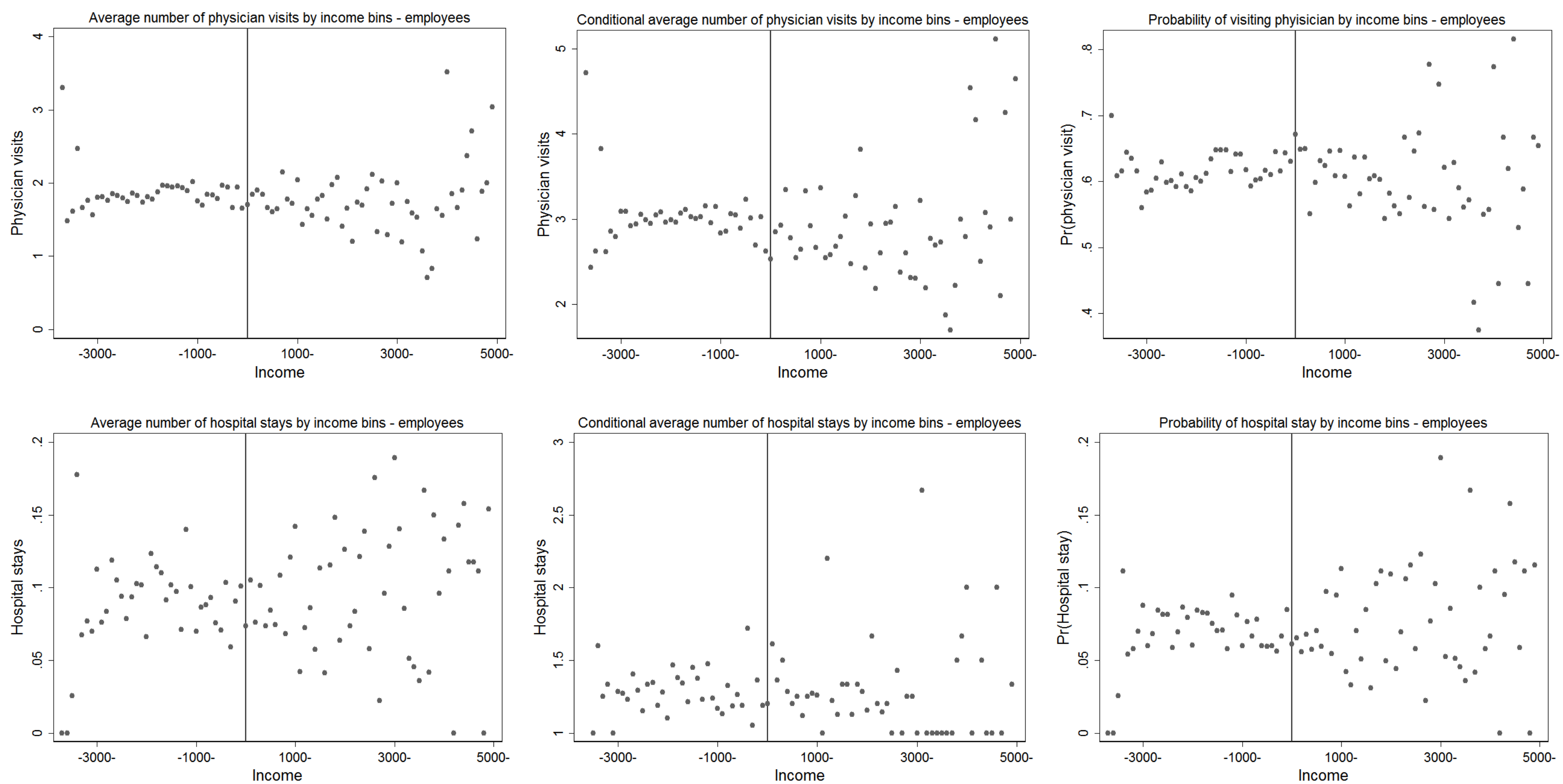
The panels aim to graphically detect the presence or lack of a significant discontinuity in the characteristics of the SHI-insured at the crossing of the PHI-eligibility threshold. Since many of the characteristics are correlated with income, the covariates were first regressed on the income categories in order to eliminate the natural income-induced trend. The regressions did not allow for breaks at the income eligibility threshold. Then, average residuals per income bin were computed and plotted separately to the left and to the right of the cutoff. The sample includes all employees in years 2005-2009 that reported SHI enrollment.

Figure 4: First stage: graphical representation of the relationship between PHI-eligibility and PHI enrollment



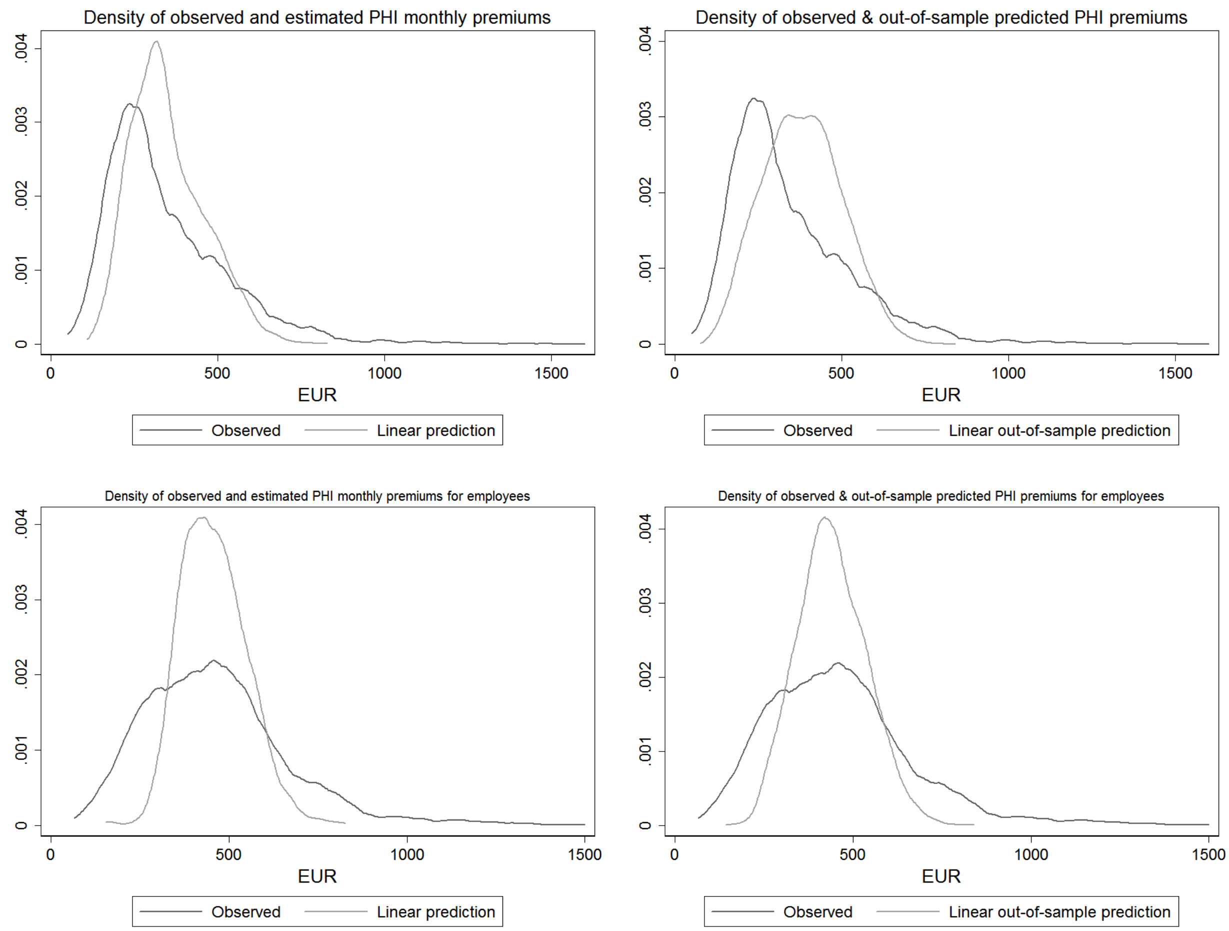
The left panel shows the employees' probability of PHI-enrollment by equally-sized income bins of 100 EUR. Income refers to self-reported monthly pre-tax employment income. All full-time employees of the 2005-2009 survey years are included. Income is centered around the eligibility threshold for the respective years. The reference line indicates the eligibility threshold. The right panel shoes the same PHI-enrollment probability by income bins for the sub-sample of the self-employed in years 2005-2009. The PHI eligibility threshold rule does not apply to the self-employed.

Figure 5: Reduced form: graphical representation of the relationship between healthcare utilization and PHI-eligibility



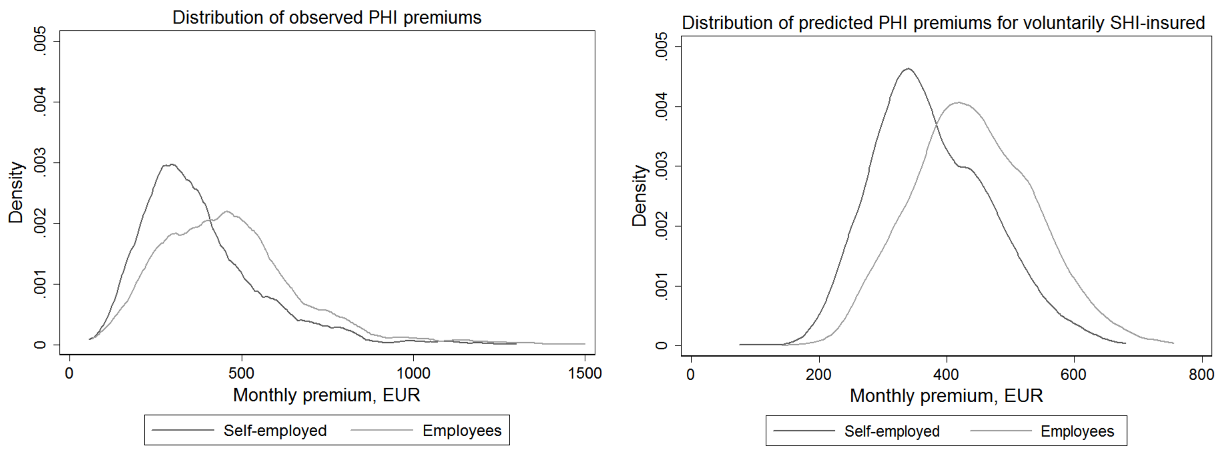
The sample includes all full-time employees in 2005-2009. The income is centered at the PHI eligibility threshold and divided into equally spaced bins of 100 EUR. For each bin, the average of several measures of healthcare utilization is plotted. The reference line corresponds to the PHI eligibility threshold. The threshold was computed individually. For most individuals it just corresponds to the official eligibility threshold in years 2005-2009 respectively. For individuals that are observed to have had PHI before 2005, a lower threshold is applied as was specified by the regulation after the changes in the threshold in 2005. The healthcare utilization measures are the same as the ones used in the reduced form regressions.

Figure 6: In-sample and out-of-sample predictions of the linear PHI pricing approximation



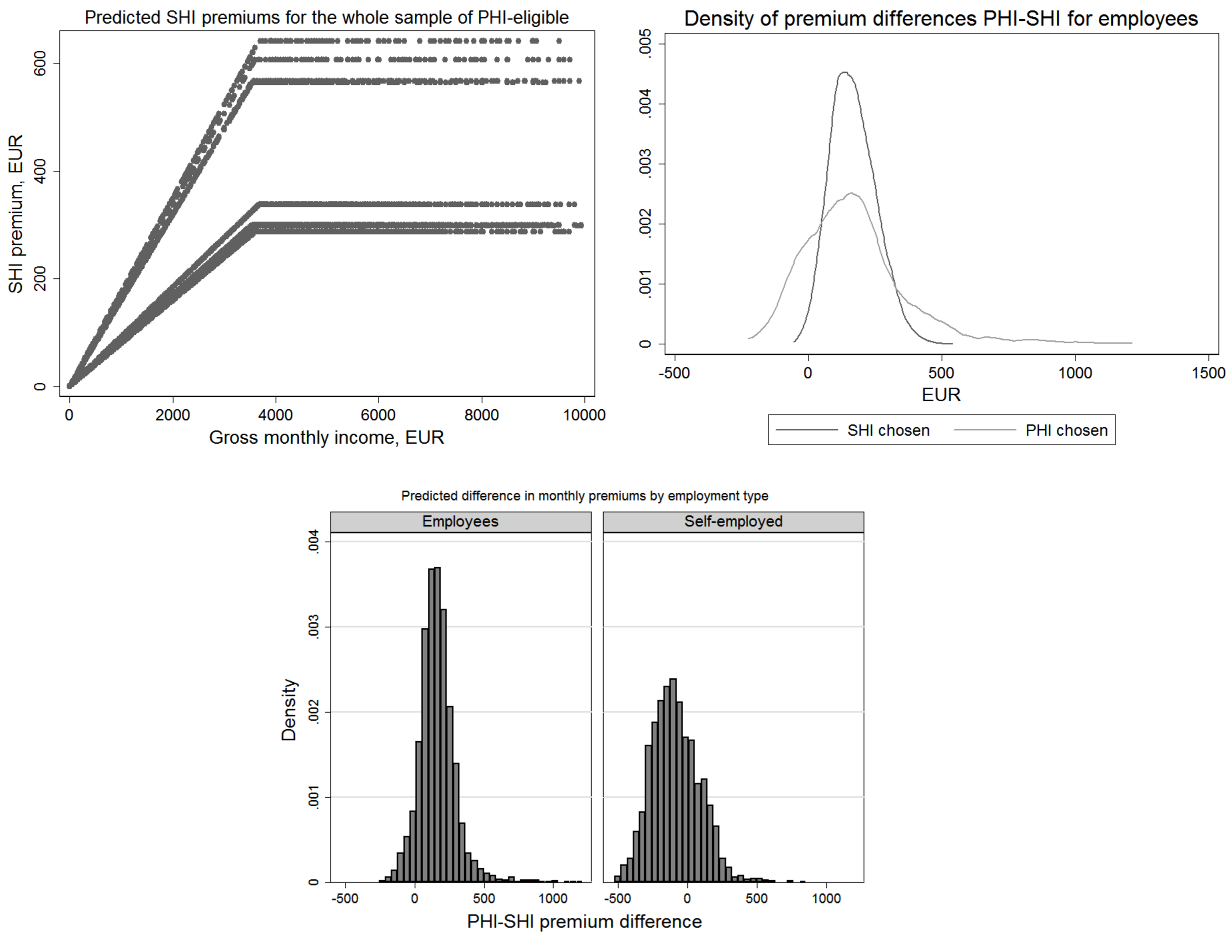
The four panels present different kernel density estimates of the goodness-of-fit and out-of-sample predictions calculated using model (5) of the linear PHI pricing specification. Left-top panel compares the observed premiums and the calculated in-sample predictions. The sample includes all individuals in 2005-2009 that reported PHI monthly premiums. Right-top panel compares the distributions of the observed premiums and the premium predictions for all PHI-eligible but SHI-insured individuals. The bottom two panel provide the same comparisons, but the sample is restricted to full-time employees only.

Figure 7: Distribution of observed and imputed PHI premiums



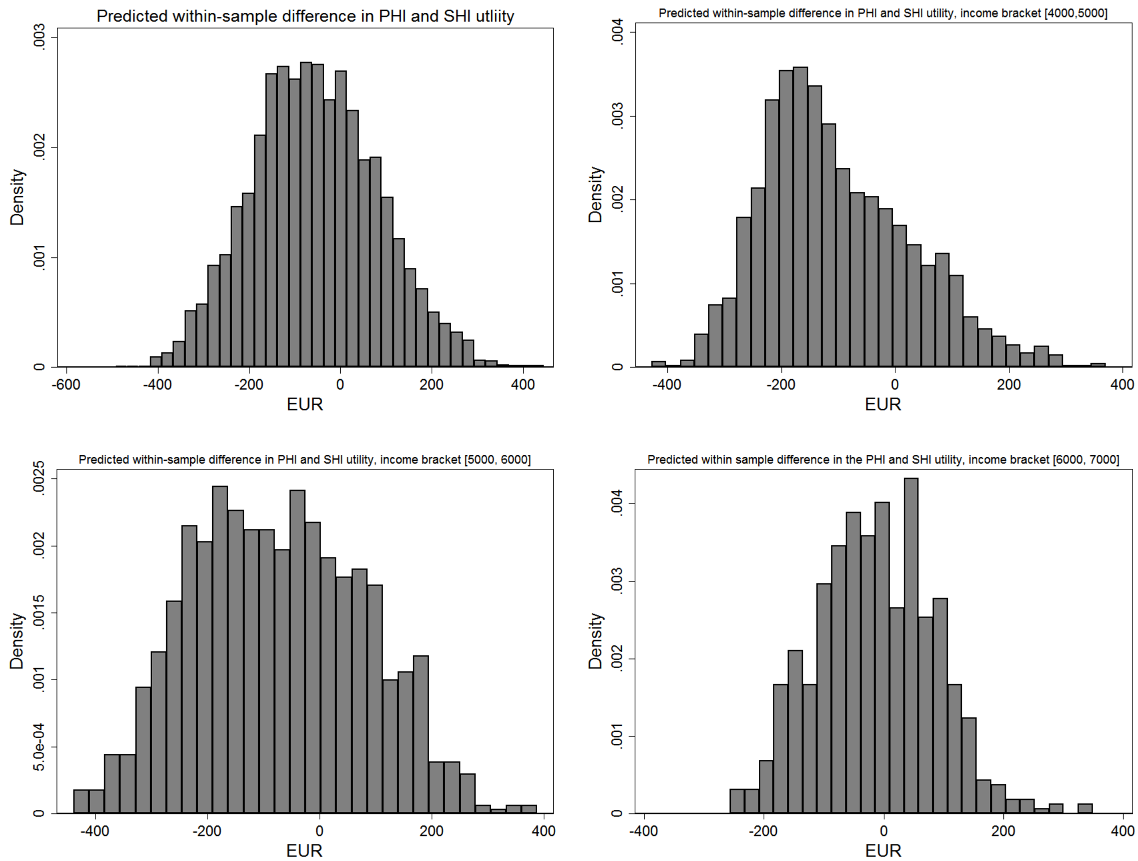
The left panel shows a kernel estimation of the empirical density for the PHI premiums reported in the data. The density is shown separately for the self-employed and the employees. Note that a critical assumption about the data here is that the premium reported by the employees are the actual payments by the employees and do not include the employer subsidy. Unfortunately, the way the question was formulated in the survey does not allow any check on whether this is the right assumption. The right panel shows kernel estimates of densities for premiums that were imputed for the SHI-insured individuals that could have chosen to opt out into the PHI. The predictions followed model (5) of the linear PHI pricing specification.

Figure 8: SHI premiums and implied PHI-SHI premium differences



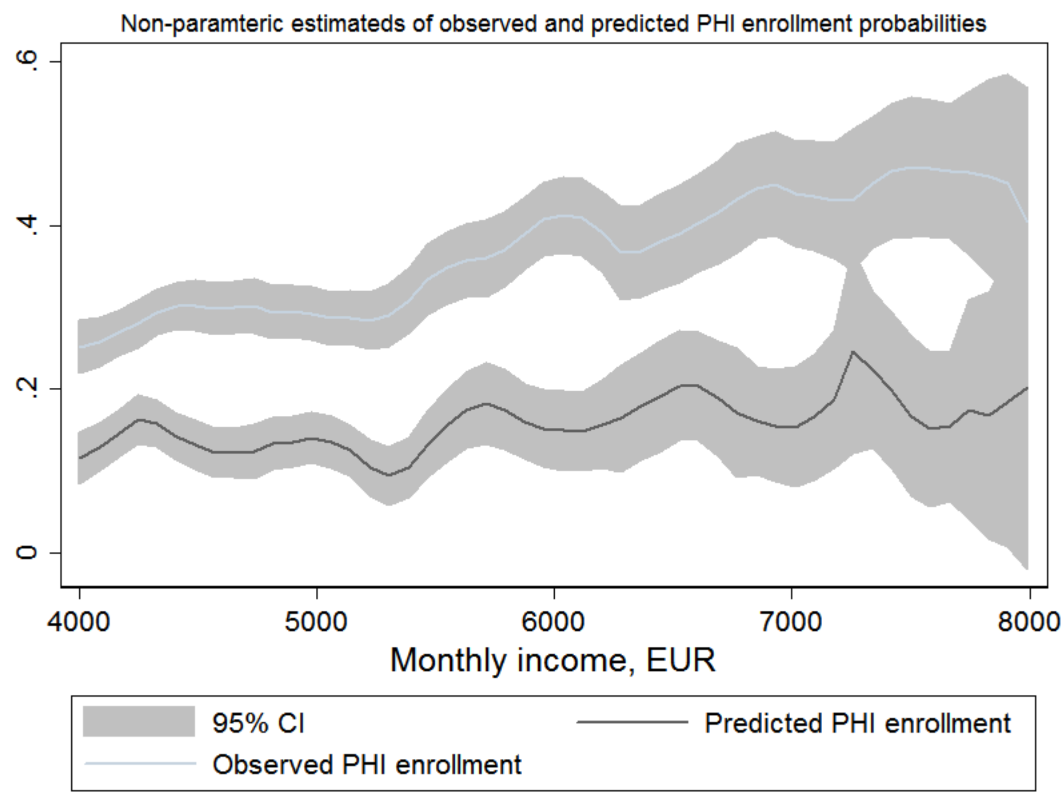
The top-left panel shows the individual predictions of SHI premiums for all PHI-eligible full-time employees and the self-employed. The rule for the SHI premium calculations relies on the SHI regulations for 2005-2009. The SHI premium includes long-term-care insurance premiums, so as to facilitate the comparison to the PHI premiums that usually include the long-term-care tariff. For 2005, the SHI premium was calculated as 8.45% of income for employees and 16% for the self-employed, with caps at 297.86 and 564 EUR respectively. For 2006 and 2007, the percentages are 8.4% and 15.9% with caps at 299.25 and 566.43 EUR. For 2008, the percentages are 7.975% and 16.85%, capped at 287.1 and 606.6 EUR. Finally, for 2009 the rates are 9.175% and 17.45% respectively, capped at 337.18 EUR and 641.26 EUR. The top-right panel plots the imputed differences that PHI-eligible employees faced for a PHI vs. SHI coverage. The SHI premiums were computed as above, while PHI premiums were either taken as reported or imputed from the pricing function (model 5). The densities are reported separately by the observed choice of insurance. The bottom panel splits the predicted differences in the premiums by the employment type rather than by the choice of insurance.

Figure 9: Distribution of predicted PHI representative utility relative to the SHI for PHI-eligible individuals



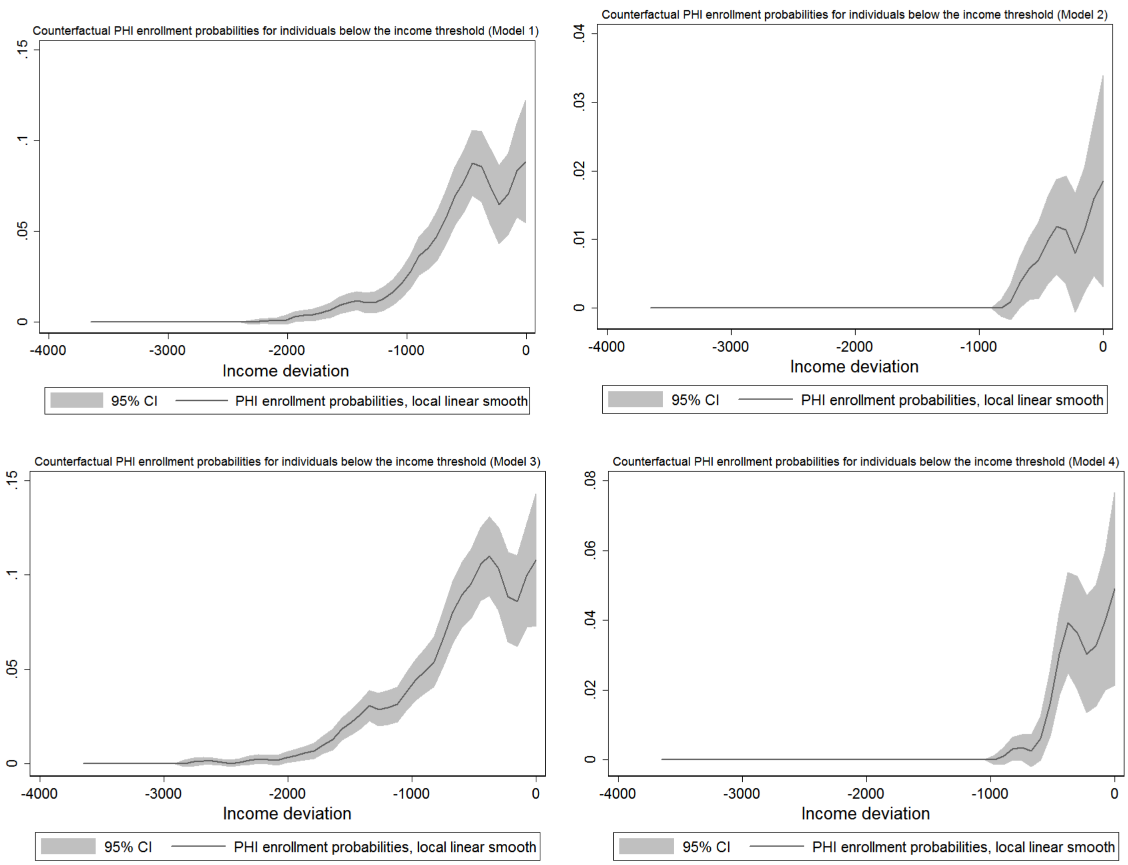
The panels show the distribution of the difference in the predicted levels of the representative utility ($V_{iPHI} - V_{iSHI}$). The sample includes all PHI eligible employees and the self-employed in years 2005-2009. Four panels correspond to the four different demand models estimated on four income sub-samples. That is, the top-left panel was constructed using the estimated coefficients from the logit specification on the full sample of PHI-eligible employees and self-employed of all income levels. The top-right panel uses coefficients from the logit specification on the individuals with income between 4000 and 500 EUR. Since there are only two alternatives, the difference in the representative utility estimate is constructed by simply multiplying the matrix of the logit coefficients with the matrix of individual characteristics. To represent the utility in monetary terms, the demand coefficients were first multiplied by the inverse of the coefficient on price. The representation does not account for the unobserved stochastic component of utility.

Figure 10: Predicted and observed PHI enrollment probabilities



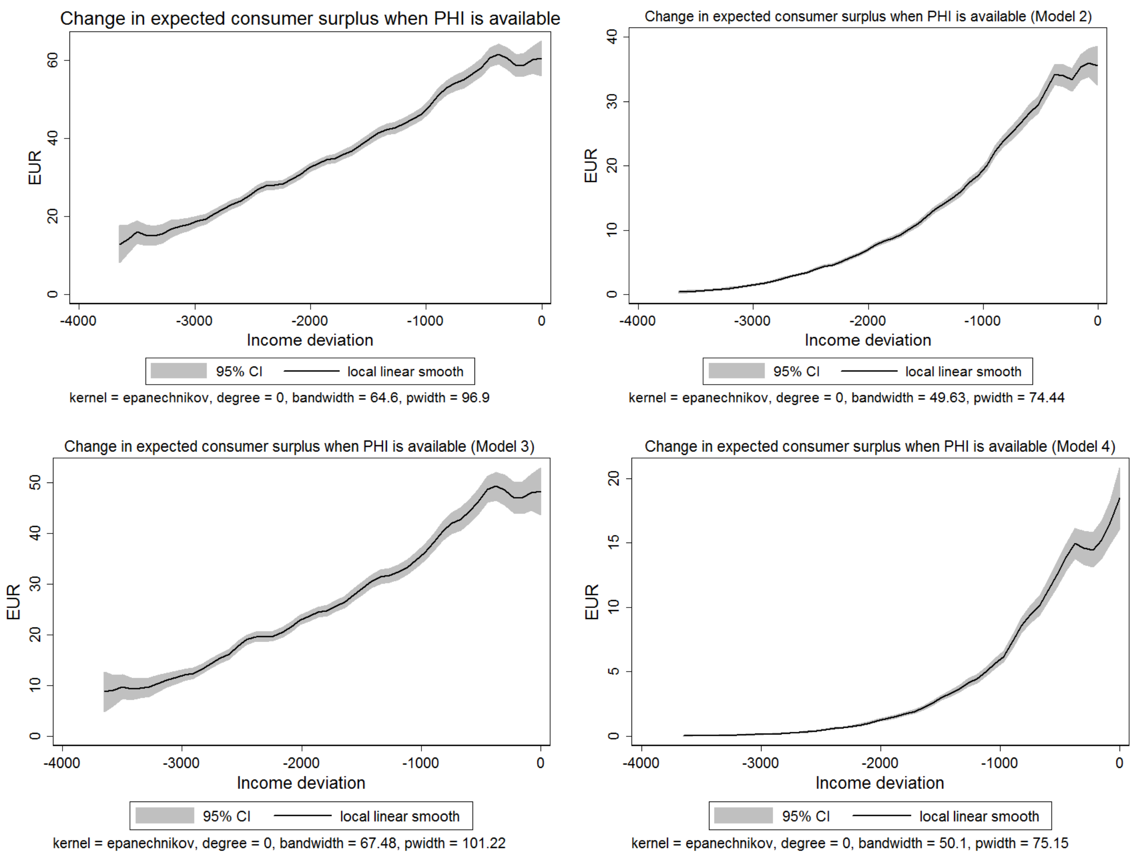
The panel provides a graphical summary of the PHI demand model enrollment predictions. The sample includes all employees with income above the PHI-eligibility income threshold in 2005-2009. The “observed PHI enrollment” plots the local linear regression estimates, which is the averages of PHI enrollment for small income bandwidths, using the reported insurance system status. The “predicted PHI enrollment” uses predicted insurance status for the same individuals. The prediction is calculated from Model 1 of the demand estimation. First, the representative utility is computed and then all individuals with positive representative utility for PHI relative to the SHI are classified into choosing PHI.

Figure 11: Logit PHI choice predictions for the ineligible individuals based only on the representative utility



The panels provide a local linear summary of the predicted PHI enrollment for full-time employees with income below the PHI eligibility threshold. The sample includes all full-time employees with income below the eligibility thresholds in 2005-2009. To construct the predicted PHI enrollment, the logit demand specifications were used to compute the representative utility from the PHI. All individuals with positive estimate of $(V_{iPHI} - V_{iSHI})$ were classified into choosing the PHI. The differences among the panels come from using different demand coefficients from Model 1 to 4 of the demand estimation.

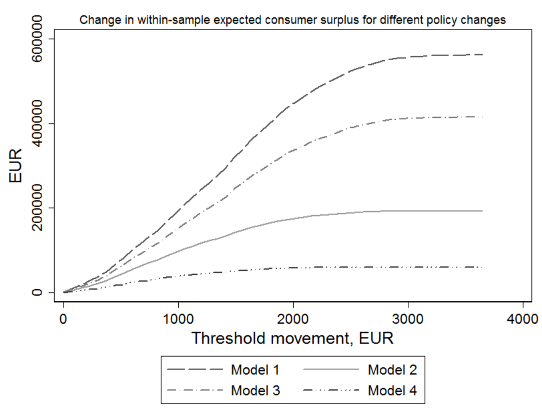
Figure 12: Estimated gain in expected consumer surplus for consumers of different income levels from the policy change

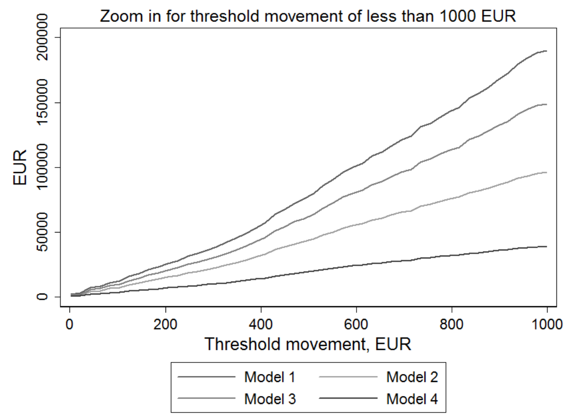


The graphs represent the average per caputa changes in expected consumer surplus at different income levels. The changes in expected surplus were calculated for each individual using $\triangle E(CS_i) = \frac{1}{\hat{\gamma}}[ln(1+e^{\hat{V}_{iPHI-SHI}})]$. To show the difference in the consumer surplus changes across different income categories, the consumer surplus values were plotted against the deviations from the income threshold using local linear regression. The sample includes employees with monthly income below the PHI eligibility threshold.

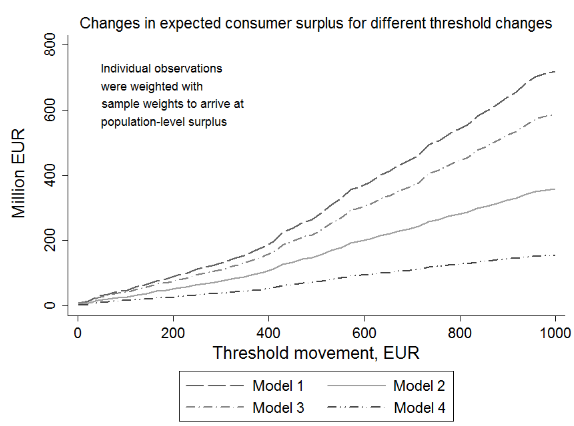
Figure 13: Changes in expected consumer surplus for different policy counterfactuals

1. Changes in the expected consumer sample within the observed sample; individual observations were not weighted





2. Changes in the expected consumer sample for the population; individual observations were weighted with the sample weights of the survey



These graphs were constructed by adding up changes in the individual consumer surplus as calculated with $\triangle E(CS_i) = \frac{1}{\hat{\gamma}}[ln(1 + e^{\hat{V}_{iPHI-SHI}})]$ for different levels of changes in the income threshold policy. That is, to get the welfare effect of moving the threshold by 200 EUR, changes in the expected consumer surplus of the individuals with income that is within 200 EUR of the threshold was added up. The last graph adds up individual consumer surplus calculations weighted by population sample weights of the survey.