The Role of Prices Relative to Supplemental Benefits and Service Quality in Health Plan Choice [‡]

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Abstract

This paper links representative enrollee panel data to health plan data on *(i)* prices, *(ii)* service quality, and *(iii)* non-essential benefits for the German statutory multi-payer market and the years 2007 to 2010. We first show that, although heavy federal regulation ensures a simple choice architecture, the majority of health plans are dominated—even when considering four non-price attributes. Enrollees in dominated plans are older, less educated, and unhealthier. Second, we assess how switchers value prices relative to non-price health plan attributes. Our mixed logit models incorporate a total of 1,700 health plan choices with each more than 50 choice sets. While prices are an important determinant for nearly everyone, 40% of all switchers do not seem to value service quality and supplemental benefits when choosing health plans.

Keywords: dominated health plans, market frictions, choice determinants, service quality, non-essential benefits, health plan switching, German sickness funds, SOEP

JEL classification: D12; H51; I11; I13; I18

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1 Introduction

When it comes to regulating health insurance markets, economists and policymakers around the world debate the fundamental question of how much choice would be optimal for consumers. On the one side of the spectrum are single-payer markets like in Canada or the UK which, except for supplemental private insurance, do not provide any choice. On the other side of the spectrum is the US where, despite an increasingly stringent regulation, private insurers still dominate the scene. While the US has been increasingly moving into the direction of more insurance regulation, other countries already run multi-payer systems that combine heavy state regulation with consumer choice. Examples are Switzerland, the Netherlands and Germany.

Recent health economic research also directly relates to the question of how much regulation would be optimal for consumers. A rich stream of papers analyzes the Medicare Part D market in the US (supplemental drug insurance for the elderly) and find that many consumers do not choose the health plan that would minimizes their out-of-pocket spending (e.g. Heiss et al., 2006, 2013; Abaluck and Gruber, 2011). Basically, out-of-pocket spending is a function of (uncertain) demand for health care, deductibles, co-insurance rates, copayments and stop-loss limits. Because many consumers seem to have difficulties to understand complex insurance products (Loewenstein et al., 2013; Abaluck et al., 2015; Karaca-Mandic et al., 2017), research has surrounded the question of why consumers "leave money on the table"—explanations range from general inertia or market frictions, to inattention, heuristic decision rules, and switching costs (Cebul et al., 2011; Ericson and Starc, 2012; Kling et al., 2012; Handel, 2013; Ericson, 2014; Ho et al., 2017; Ericson and Starc, 2015; Handel and Kolstad, 2015).[1] Other papers have suggested—as well as rejected—that consumers learn and that their choices improve over time (Ketcham et al., 2012, 2015; Abaluck and Gruber, 2016). In one of the few non-Medicare papers, Bhargava et al. (2017) use data from a big US employer to show that most employees choose *financially* dominated health plans with excess spending amounting to almost half of the employee share of the premium.

This paper is based on uniquely compiled panel data that allows us to cast light on the demand and supply side of the health plan architecture of the German statutory multi-payer market. We link representative enrollee survey data to publicly available data on health plan prices as well as standardized quality information. Then we exploit annual changes in these health plan characteristics across 120 plans and over 4 years. The standardized supply-side information stems from a private company that surveys and ranks all German health plans. Thus, the empirical approach exploits the same health plan information that German consumers can access in online portals and magazine rankings to select health

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[1]There exists also a rich US literature on health plan choice that is not focused on irrational behavior (Dowd and Feldman, 1994; Cutler and Reber, 1998; Royalty and Solomon, 1999; Strombom et al., 2002; Atherly et al., 2004; Buchmueller, 2006; Dusansky and Koç, 2010; Bundorf, 2010; Dusansky and Koç, 2010; Parente et al., 2011; Buchmueller et al., 2013). Excellent literature overviews are provided by Kolstad and Chernew (2009) and Gaynor and Town (2012).

plans. In addition to prices, we make use of two non-essential benefit indicators and two service quality indicators. *Non-essential benefits* are voluntarily provided on top of the generous German mandated benefit package (e.g., ayurveda, homeopathy, osteopathy, urine therapy, preventive check-ups, specific immunizations). *Service quality* is measured by the density of the brick-and-mortar branch network (where face-to-face customer service is provided but no medical services) and the quality and accessibility of information via telephone hotlines and the internet.

The main theme of the paper is to study the role of prices as compared to these non-price health plan attributes from a demand and supply-side perspective. The existing literature largely focuses on prices, cost-sharing and financial health plan attributes. Our descriptive supply-side analysis suggests significant market frictions between the 120 plans, but also demonstrates a clear trade-off between price and non-price factors. We show that a large share of health plans are in fact not only financially dominated, but also dominated when considering the multi-dimensional attributes price, service quality, and non-essential benefits. Our demand-side analysis replicates over 100K choice options from 1,700 actual plan choices with each more than 50 plans to choose from. Using mixed logit models, we find that that prices are the dominant choice determinant for the majority of consumers when switching plans. However, preference heterogeneity is large—a small share of consumers value non-price attributes such as the quality of hotline services highly.

The paper makes several contributions to the literature. First, it is one of the few studies that comprehensively investigates the supply and demand-side of a multi-payer market outside the US.[2] The German market has attractive features; due to its heavy federal regulation, many potential confounding factors are shut down. Specifically, Germany has no provider networks and reimbursement rates are centrally determined. Deductibles and co-insurance rates are prohibited; only small and uniform co-payments apply to all plans. About 120 sickness funds (=health plans[3]) compete for 90 percent of the population whose large majority is mandatorily insured. Many health plans operate nationwide and, depending on the state of residency, the publicly insured can choose between 40 and 70 health plans. As a comparison: In the US non-group market, which is organized at the state level around the so called 'Exchanges', on average 50.9 plans were offered by 3.9 insurers in 2014 (Dafny et al., 2015). The Medicare Part D market and the Swiss health care market also offer comparable choice sets for consumers.

Second, in addition to prices, we exploit four consistently surveyed non-price attributes outlined above (two for service quality and two for non-essential benefits) and representative enrollee information over four years. This allows us to cast a complete picture of the entire market representing a total of 70 million insured.

[2] Schut and Hassink (2002) and Dijk et al. (2008) study the Netherlands, Frank and Lamiraud (2009) the Swiss market, and Schmitz and Ziebarth (2017) as well as Wuppermann et al. (2014) the effects of a price framing reform in Germany. Christiansen et al. (2016) studies switching in the private long-term care market in Germany.

[3]We use the terms "health insurance (company)," "sickness fund," and "health plan" interchangeably.

Third, we show that substantial market frictions even exist in heavily regulated markets that simplify the consumer optimization problem substantially. Between 70 and 90 percent of all plans in the German statutory market are dominated, even when taking four non-price attributes (plus prices) into account.[4] Just focusing on the one-dimensional price dimension (absent non-linear cost-sharing), the share of dominated plans even increases to 95 percent. In line with Bhargava et al. (2017), we find that the stock of enrollees in dominated plans is older, less educated, and less likely to be in very good self-reported health (as compared to enrollees in dominating plans). Switchers who chose the absolute cheapest plan in the market are healthier and better educated.

Finally, as suggested by the title, we study the importance of prices as compared to the other four non-price attributes from a supply and demand perspective.[5] We show that some plans, which would clearly be dominated when just focusing on the price dimension, differentiate their product along these non-price dimensions, and that there exists a clear trade-off between the different plan attributes. However, the selective subset of enrollees who actively switch plans seem to mostly value prices as the dominating demand-side choice factor. While non-switchers in plans that diversify along the non-price dimensions may not lack from inertia but simply value these quality characteristics, we can show that consumers in "fully" dominated plans do leave money on the table due to inattention, inertia, or very high switching costs. Overall, our analysis illustrates the importance of incorporating non-price attributes into the analysis of consumer choice and inertia.

The remainder of the paper is organized as follows: The next section covers the institutional details of the German public health insurance market. Section 3 presents the data. The supply-side analysis is in Section 4 and Section 5 contains the analysis of the demand-side. Section 6 concludes.

2 Institutional Background

The German health insurance system is characterized by the coexistence of statutory health insurance (SHI) and substitutive private health insurance (PHI). This paper focuses on the SHI, which covers roughly 90% of the population most of whom are compulsorily insured. Insurance under the SHI is mandatory for employees with gross wage earnings below a defined threshold (in 2016: € 56,250/$62K per year). Nonworking spouses and dependent children under 25 years are covered free of charge by SHI family insurance. Further regulations apply to specific groups of the population, such as students and the unemployed, although most of them are covered by SHI. High-income employees, the self-

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[4]By "dominated" we mean that at least one competitor dominates a plan in at least one of the five dimensions without scoring worse in any other dimension.

[5] Not many existing papers explicitly study the role of quality information in the decision to choose health plans. Scanlon et al. (2002) and Chernew et al. (2008) study the impact of quality report cards using US data from General Motors; Beaulieu (2002), Wedig and Tai-Seale (2002), Dafny and Dranove (2008), Jin and Sorensen (2006), and Abraham et al. (2006) study health plan ratings in "natural" US settings, whereas Harris (2002) conduct a discrete choice experiment in West Los Angeles to conclude that large quality differences would be required for consumers to accept provider access restrictions. Kolstad (2013) studies the impact of quality report cards for cardiac surgery on surgeon's behavior.

employed and civil servants may opt out of SHI and buy substitutive PHI or remain publicly insured as voluntary members.

Currently, the SHI market consists of about 120 not-for-profit health insurers, also called "sickness funds", roughly half of which are operating nationwide, while the remaining ones solely operate in some federal states. Due to historical reasons, see below, each sickness fund basically only offers one standard health plan, which is why we use the terms sickness fund and health plan interchangeably.

Switching sickness funds is uncomplicated: the minimum contract period is 18 months and there is no enrollment period; guaranteed issue exists and several specific search engine websites help consumers to compare and switch health plans. When sickness funds increase prices, enrollees have an extraordinary right to cancel the contract and switch funds. In a given year, only about five percent of all SHI insured switch plans (Schmitz and Ziebarth, 2017) but from 1996 (when free health plan choice became a legal right) to 2002, about a quarter of all policy holder had switched at least once (Pilny et al., 2017).

2.1 Essential Benefits and Cost-Sharing Regulation

About 95 percent of the SHI benefit package is predetermined by social legislation at the federal level. The federally mandated essential benefit package is generous relative to international standards. It basically includes all medically necessary treatments in addition to prescription drugs, birth control, preventive and rehabilitation care as well as rest cures (c.f. Ziebarth, 2010a).

German social legislation additionally heavily restricts cost-sharing. Deductibles and co-insurance rates are prohibited in SHI and the law stipulates that only small copayments, which do not vary across health plans, can be charged. Hence variation in cost-sharing parameters is not part of the objective function when enrollees search for new health plans.

2.2 Price Regulation

Health plan premiums are charged in form of social insurance contributions. To calculate the employee share of the premium, a sickness fund specific contribution rate is applied to the gross wage, including all fringe benefits, up to a defined contribution ceiling (in 2016: €50,850 per year). One half of the contribution rate is formally paid by the employee and the other half by the employer.

In January 2009 and as part of a health policy reform (*GKV-Wettbewerbsstärkungsgesetz*), price framing in the SHI system was reorganized. Pre-reform, contribution rates were set individually by each sickness fund, resulting in a variety of contribution rates, ranging from 12.2 to 16.9% of individuals' gross wages. The reform equalized the contribution rates across all health plans. Post-reform, if allocated revenues generated by the 15.5% standardized contribution rate did not cover the funds'

expenses, sickness funds had to charge an additional monthly euro add-on premium. In contrast, if allocated revenues exceeded expenses, sickness funds could reimburse their members a monthly bonus payment. For our demand-side analysis, to make them comparable, we express health plan premiums in monthly euro amounts—pre- as well as post-reform.

Because it has been shown that the price framing reform increased the likelihood to switch health plans significantly (Schmitz and Ziebarth, 2017; Wuppermann et al., 2014), we exploit the reform in a robustness check to correct for endogeneity in the switching decision. In the main analysis, we deliberately allow for selection into the switching decision in order to characterize the subset of switchers empirically (c.f. Einav et al., 2013).

2.3 Non-Price Product Differentiation

To differentiate their product, in addition to engaging in price competition, sickness funds can add supplemental non-essential benefits to their benefit package, or improve the quality of their customer service. As discussed below, we extract two non-essential benefit measures and two service quality measures to investigate how these non-price attributes are traded-off by decision makers on the supply and demand-side.

Optional Non-Essential Benefits. These are measured by one variable for *(i)* alternative medicine, and one variable for *(ii)* other non-essential benefits. *Alternative medicine* consist of complementary treatments such as ayurveda, homeopathy, osteopathy, and urine therapy. Although the effectiveness of alternative medicine is discussed controversially, there exists a steady demand for such treatments in Germany.

In addition to alternative medical treatments, sickness funds may also offer conventional "non-essential" medical treatments. Examples are preventive check-ups (e.g. the 'J2' check-up for adolescents) or certain types of immunizations (e.g., malaria prophylaxis). Typically these benefits have rather low monetary values, e.g., a single combined vaccination shot against diphtheria and typhoid fever costs about € 15. However, non-essential benefits may also comprise more expensive medical treatments, such as coverage for in-vitro fertilizations.

Service quality. Is measured by accessibility of insurers and the quality of information provided. Most sickness funds still operate a brick-and-mortar network of physical branches but also offer hotline services. Operating a large number of physical branches may be preferable to (some) members—e.g., the elderly—but also implies higher operational costs. To cut costs, some sickness funds have reduced their branch network significantly over time. Other funds do not run any brick-and-mortar offices but are exclusively available by telephone or online (*Direktversicherer*).

Better customer service and accessibility by phone or the internet was part of the Health Care Reform Bill 2000 (*GKV-Gesundheitsreformgesetz*). The bill required all sickness funds to improve their customer service and the quality of their consulting. As a result, sickness funds started to operate different types of hotlines. While some hotlines are fairly general, others provide detailed information by trained health care professionals such as information about preventive care or drugs and their side effects.

2.4   The German Risk Adjustment Scheme (RSA)

At its inception, in 1994, the German RSA was only based on the three factors age, gender, and disability status (c.f. Pilny et al., 2017). Today, the RSA also considers 80 different chronic (and expensive) diagnoses, which is why it is sometimes called 'Morbi(dity)-RSA.'

In principle, the RSA works as follows: Employers automatically deduct the standardized contribution rate (14.6% as of writing) from their employees' gross wages. The total sum is collected in a central Health Care Fund (*Gesundheitsfond*) which is administered by the Federal Insurance Agency (FIA, *Bundesversicherungsamt*). The FIA then carries out the risk-adjustment based on the factors age, gender, disability and 80 diagnosed diseases. Based on age and gender, enrollees are grouped into 40 age-gender groups. And based on 80 diagnoses, enrollees are categorized into 106 hierarchical morbidity groups. Then, via regression models, standardized and risk-adjusted payments for providing health care to SHI members in each of these cells are calculated. Finally, the FIA pays out the total sum of risk-adjusted payments based on actual enrollee characteristics to each sickness fund.

If sickness funds cannot cover their total costs using the allocated capitated payments, they have the option to *(i)* increase prices, or to *(ii)* reduce expenditures. The latter can be achieved by managing the health care needs of their enrollees better (e.g., by providing preventive care, education, or special bonus programs such as disease-management programs), by reducing customer service, by reducing non-essential benefits or by becoming more efficient and cutting unnecessary administrative costs.

A constant criticism of the RSA has been the claim—supported by official reports (Buchner and Wasem, 2003; IGES, 2004; Wissenschaftlicher Beirat zur Weiterentwicklung des Risikostrukturausgleichs beim Bundesversicherungsamt, 2011; Pilny et al., 2017)—that the capitated payments for sick enrollees would not be sufficient to cover their expenditures. In other words, the RSA would be incomplete and there would still exist incentives for insurers to cream-skim. In an audit study, Bauhoff (2012) find some (limited) evidence that insurers try to actively cherry-pick good risks. In the empirical analysis, in a robustness check, we will use changes in insurer risk pools as instruments for changes in prices. We construct our instruments by aggregating enrollees' age and Self-Assessed Health (SAH) up to the yearly plan level (excluding switchers' contribution). As we will see, changes in risk pools are highly predictive of price changes (but not of non-price attributes), yielding support for the notion that the

German RSA incompletely adjusts health risks across plans and that insurers primarily adjust price margins in the short-run. This is in line with Pilny et al. (2017) who show that between 42 and 75 cents per additional euro revenue are passed through to lower prices (or charged in form of higher prices when costs increase).

3 Data

3.1 Individual Level Data

The German Socio-Economic Panel Study (SOEP) provides us with individual-level panel data. The SOEP is a representative longitudinal survey that started in 1984 and collects annual information at the household and at the individual level. Currently, the SOEP comprises more than 20,000 individuals from more than 10,000 households (Wagner et al., 2007). We use the waves 2008 to 2011.

Sample Selection

We use information on enrollees' current health plan and insurance status. First, we exclude those individuals who are covered by PHI.

Second, we restrict the sample to SHI policyholders, not the total number of insured. The latter would also include family members insured at no cost under SHI family insurance. We focus on the paying members to obtain exactly one observation per health plan choice decision. Paying members are policyholders who gainfully employed and earn more than € 400 gross per month.[6]

[Insert Table 1 about here]

Third, to ensure that the empirical results are not driven by the high degree of state dependence— only five percent switch health plans every year—the main part of the demand-side analysis deliberately focuses on health plan *switchers* and those who leave the family insurance because they are not eligible any more, not the stock of enrollees. There are several advantages to focusing on the subsample of switchers. *(a)* Switchers likely inform themselves about the existing health plan options and trade-offs. *(b)* Similar to Einav et al. (2013), we argue the we deliberately focus on individuals who switch plans to be able to analyze their characteristics and study adverse selection. *(c)* In a robustness check, we use the price framing reform of 2009, which exogenously increased the likelihood to switch, to study the empirical relevance of endogenous switching. In addition to its external validity for the policy-relevant subgroup of enrollees who actively switch plans, the findings likely also have validity for those

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[6] This excludes all those insured under SHI family insurance, the unemployed for some of whom social security pays the health insurance premium, full-time students who just pay an income-independent flat premium (2016: € 66,33 per month) or who are insured under their parents' family insurance, pensioners as well as special population groups, such as draft soldiers or low-income earners.

who express a willingness to switch plans. A representative survey among SHI enrollees (as of 2006) revealed that almost half of all respondents ever switched plans and that almost one fifth is currently considering switching plans (Zok, 2006).

Our final estimation sample consists of 1,726 health plan choices from 1,594 different individuals.

Choice Sets

We precisely replicate individuals' choice sets. To do so, we consider enrollees' state of residence because some plans only operate in specific states. Panel A of Table 1 shows that the average choice set includes 58 sickness funds. The minimum number of plans to chose from is 41 and the maximum is 73. Choice sets are smallest for those living in Mecklenburg-Western Pomerania, ranging from 41 to 53 between 2008 and 2011. Individuals residing in North Rhine-Westphalia have the largest choice sets, ranging from 55 (2011) to 73 (2008).[7]

Overall, the empirical identification relies on 400 to 500 observed health plan choice per year, with choice sets between 50 to 60 health plans. Thus, we observe about 100,000 total plan options over the four years under consideration. We use the self-reported gross wages to calculate health plan premiums for *all* potential choices in euro amounts in every year.

SOEP interviews are typically carried out in the first quarter of the year, while sickness fund characteristics were collected at the end of a calendar year in November and December. Thus we link the respondents' health plan choice sets at the time of the interview in the first months of a year with the health plan information as provided at the end of the previous calendar year. In the interviews at the beginning of the year, enrollees indicate their current sickness fund and whether they had switched in the course of the previous year. Consequently, we make use of switching and health plan data for the years 2007 to 2010.

Panel B of Table 1 shows the demographics for our sample of switchers: 55 percent are female and the average age is 37 years. Thirteen percent self-rate their health as "very good" and 49 percent as "good."

3.2 Health Plan Level Data

Health plan characteristics (contribution rate, non-essential benefits and service quality) are provided by a private company (*Kassensuche GmbH*). The information are collected via questionnaires that are sent out annually to all existing sickness funds. Sickness funds have a strong incentive to participate in the survey, as *Kassensuche GmbH* operates a large German web portal where consumers can compare a broad range of characteristics across all sickness funds. Moreover, at the end of each year, a popu-

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[7]Due to several mergers of sickness funds, the number of active health plans is decreasing over time.

lar weekly business magazine (*Focus Money*) publishes a detailed overview and ranking of the best 50 sickness funds that were surveyed by *Kassensuche GmbH*. This sickness fund ranking includes sub-scores for several subcategories, measured on continuous scales. These subscores provide the basis for the benefit and service quality measures used in this study. Note that the information exploited in this study is identical to the information provided to consumers. Being able to directly exploit its variation is one main advantage of our approach.

The main drawback of using these data is the interpretation of the (sub)scores which is not straight-forward as we discuss below. We use the subscore data as provided by *Kassensuche GmbH* because we are unaware of the algorithm that had been used to calculate the subscores. Hence, we cannot directly interpret the subscores and check, for example, how a higher density of the brick-and-mortar network translates into a higher score.

To account for minor differences in the calculation of the sub-scores over time, the regression models use the *z*-transformed subscores.[8] In total, we have information on 115 different sickness funds covering the years 2007 to 2010. The health plans that are included every year have a total market share of around 80 percent and also represent 80 percent of all existing plans (Müller and Lange, 2010).

Prices

Annual prices for all German sickness fund are publicly available from Müller and Lange (2010), the National Association of Statutory Health Insurance Funds, and the annual reports of the sickness funds. Post-2009, when contribution rates were unified, we also consider fund's add-on premiums and refunds (see Section 2). To calculate the exact monthly premiums (in euros) for each enrollee, we link plan specific contribution rates with individuals' gross wages and consider the federal contribution ceiling of each given year.[9]

We ignore the employer share of the premium, which is legally fixed at 50 percent of the total pre-mium[10], simple because employees likely make decisions solely based on their share of the premium. As seen in Panel C of Table 1, hypothetical average employee shares (assuming monthly gross wages of € 2,000) range between € 133 and € 178, with a mean value of € 153. To the extend that employees base their health plan choices on the full premium, we obtain a lower bound for the price effect in the regression models below.

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[8]The *z*-transformation is carried out for each year separately. The number of subcategories has slightly changed over time, therefore we use only those subscores which were part of the survey in each of the four years.

[9]The contribution ceiling is determined by the federal regulator and has been increasing every year by about two percent.

[10]Effective July 1, 2005, the strict equal sharing of contributions was altered. Between 2005 and 2015, the employees' share was $[0.9 + 0.5 \times (cr - 0.9)]$ percent of their gross wage up to the contribution ceiling, where cr denotes the overall contribution rate. In the example above, this amounts to an employee share of 7.45 percent and an employer share of 6.55 percent of the gross wage.

Service Quality

Two indicators measure health plan service quality: *(i) hotline service* and *(ii) brick-and-mortar network*. *Hotline service* considers the different types of available hotlines (medical, non-medical) and how many hours these hotlines are staffed. Differences in staff quality—e.g., the share of staff with special qualifications such as social insurance clerks, physicians, nurses or pharmacist—are accounted for by weighting the hotline's operating hours accordingly, where higher staff quality receives a higher weight.

The score of *brick-and-mortar network* measures the density of the brick-and-mortar network relative to the plan's operating region. More precisely, the original score (before the z-transformation) is derived from the log of the total number of brick-and-mortar stores divided by the number of federal states in which the sickness fund operates.

Optional Non-Essential Benefits

Two indicators also measure optional non-essential benefits: *(i) alternative medicine* and *(ii) other non-essential benefits*. The score of *alternative medicine* is mainly based on the number of different alternative medical treatments offered by each sickness fund. Sickness funds are not entirely free to offer any additional treatment, but have to choose from a list of approximately 20 approved treatments (e.g., ayurveda or homeopathy). The score also considers whether the treatments are restricted to certain regions or physicians.

Other non-essential benefits measures supplemental benefits outside of the essential SHI benefit package (*Kassenleistungen*). Examples are certain immunizations (e.g., for tropical diseases) or preventive screenings for breast or skin cancer in younger ages.

4 The Supply-Side of the German Health Plan Landscape

4.1 How Insurers Trade-Off Prices and Non-Price Attributes

The following analysis is based on our health plan data which contain prices and four non-price attributes over four years. The purpose of this exercise is to investigate how insurers diversify health plans and position themselves on the price vs. non-price dimensions. Since the *z*-transformation is rather uninformative, Figures 1 plot the original non-price scores, as observed and published by *Focus Money* in their sickness fund ranking.

Prices vs. Service Quality

Figures 1a and b show the trade-off between prices and service quality as measured by *hotline service* and *brick-and-mortar network*. One would expect a positive relationship between these plan characteristics because fewer stores and hotlines imply lower (administrative) costs. Figure 1a visualizes exactly this trade-off. The x-axis plots the sickness fund specific contribution rate, and the y-axis the (non-transformed) hotline service quality score as calculated and published by *Kassensuche GmbH*.

We observe a clear positive relationship, where cheaper plans also exhibit significantly less hotline service quality (Figures 1a). The slope of a simple linear regression is 0.03 implying that for each point increase of the *hotline service* score, on average, the contribution rate is 0.3ppt higher. This equals a €3.82 higher monthly premium ($50 per year) when just considering the employee share of the premium. In the demand-side analysis below, we will investigate whether switchers are actually willing to accept such a trade-off. Also note that, across the entire price distribution in the market, consumers could easily choose plans that dominate others and get better hotline quality for less money. A detailed analysis of dominated plans will also follow below.

[Insert Figure 1 about here]

Figure 1b plots the trade-off between *brick-and-mortar network* and prices. Again, one observes a clearly positive and significant relationship between prices and the density of brick-and-mortar stores. The slope here is even 0.073 implying that, on average, sickness funds with a one ppt higher physical store network score charge customers about $10 more per month. Here as well, at least when just considering these two dimensions, we observe plans that clearly dominate others.

Prices vs. Optional Non-Essential Benefits

Figure 1c shows a significantly positive trade-off between *other non-essential benefits* and the price. The slope is 0.037 and the trade-off similar to the trade-off between *hotline service* and prices.

While all *other non-essential benefits* and prices imply a significant trade-off, this is not the case for a very specific, supplemental benefit: *alternative medicine*. As Figure 1d shows, the slope is flat and not statistically different from zero. This finding is plausible because the number of enrollees who actually use alternative medicine is estimated to lie below ten percent (Robert Koch Institut, 2002).

Changes in Prices and Quality over Time

Next, Figure 2 shows the distribution of year-to-year changes in the health plan parameters *price*, *hotline service*, *other non-essential benefits*, and *alternative medicine*. Figure 2a shows that most health plans increase prices over time. We observe a significant share of plans that increased contribution rates by

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up to 2ppt. As an example, increasing the contribution rate by 1ppt increases the employee share of the monthly premium by € 10, given the average gross wage of switchers in our sample. Figure 2a also shows that very few plans decrease prices.

[Insert Figure 2 about here]

Figure 2b illustrates changes in the hotline service quality score. The mass point is around zero and one observes an almost symmetric distribution with some plans gaining up to 10 score points and some plans loosing up to 10 score points. Loosing or gaining 10 score points actually represents a significant change, given that the overall scale ranges from 0 to 30 points.

Figures 2c and d likewise show substantial variation of *other non-essential benefits* and *alternative medicine* over time. Despite the mass points around zero, many health plans got upgraded or down-graded by 10 (*other non-essential benefits*) or 5 sore points (*alternative medicine*) from one year to the next.

4.2 Analyzing Dominated Plans and Their Enrollees

Studying the joint distribution of all four non-price parameters, one finds positive correlations between all four indicators, ranging from 0.10 (*other non-essential benefits* and *brick-and-mortar network*) to 0.55 (*alternative medicine* and *hotline service*). As also suggested by Figure 1, these positive correlations between non-price attributes show that sickness funds position themselves either at the high or low non-price segment of the market. It also suggests that sickness funds are aware of the quality-price trade-off when differentiating their product.

Considering all five health plan parameters jointly, the majority of plans in the market are dominated by at least one competitor. That is, there is at least one competitor that dominates the plan in at least one of the five dimensions without being worse in all other dimensions. This holds for every single year. Figure 3 illustrates the share of dominated plans in the German SHI multi-payer market. We differentiate by plans that operate nationwide vs. all plans, including those that only operate in specific states. In addition, the figure illustrates how the share of dominated plans varies, depending on the criteria used.

[Insert Figure 3 about here]

Because German social legislation essentially bans cost-sharing, when just considering the one-dimensional price criterion, one or two health plans—the absolute cheapest—always dominates all other plans. This holds for all years and whether we focus on the black solid black line in Figure 3 representing all health plans (whose number decreased from 94 in 2008 to 70 in 2011), or the dashed black line representing just nationwide operating plans (whose number decreased from 45 in 2008 to 36 in 2011).

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Expressed in percent, about 97 percent of all German health plans are dominated when just considering the one-dimensional price criterion.

When additionally considering the other four non-price factors, naturally, the share of dominated plans decreases. As discussed above and illustrated by Figure 1, the reason is the trade-off between price and non-price attributes; some plans clearly position themselves on the quality dimension. Defining that a plan is dominated when another plan is at least as good as the dominated plan in four dimensions but better in at least one dimension, we obtain the red solid and dashed lines in Figure 3. Prior to the price framing reform (see Section 2.2), the share of dominated plans was slightly below 70 percent; this share increased to almost 90 percent in 2010 (due to the equalization of the contribution rate and the initial hesitation of plans to charge add-on premiums) and then fell back to around 80 percent.

We can conclude that *(a)* considering non-price attributes decreases the number of dominated plans. And *(b)* between 70 and 90 percent of all plans are dominated—even when using five different parameter dimensions—suggesting substantial frictions in the German SHI market.

[Insert Tables 2 and 3 about here]

Table 2 shows a summary statistic of dominated vs. non-dominated plan characteristics. Not surprisingly, on average, dominated plans exhibit poorer values for all plan characteristics, although none of these differences is statistically significant.

Table 3 characterizes the stock of enrollees in dominated plans (columns (3) and (4)) as well as enrollees who actively choose these plans when switching (columns (1) and (2)). Each column represents on linear probability model where the dependent binary variable indicates whether the SOEP respondent is enrolled in a dominated plan. Columns (2) and (4) and just the price as dominance criterion and Columns (1) and (3) all five health plan attributes.

When applying solely the price criterion in columns (2) and (4), few health plans dominate all other plans in a given year (Figure 3). Hence, given our sample size, it is challenging to identify significant enrollee characteristics that are correlated with the 97 percent of dominated plans. However, there is some evidence that younger and healthier individuals are more likely to choose the absolute cheapest plan in the market.

When applying all five dominance criteria, we find: First, switchers into these plans are older, less educated, and less likely to be in very good self-reported health (column (1)). Particularly the regression coefficient on "SAH bad"—the lowest of all five SAH categories—is very large (but also imprecisely estimated). These findings are entirely in line with Bhargava et al. (2017).

Second, when looking at the entire pool of enrollees in dominated health plans—this includes individuals who never switch, e.g. due to inattention, inertia, or because of high switching costs (Kling et al., 2012; Handel, 2013; Ericson, 2014; Ho et al., 2017; Handel and Kolstad, 2015)—-the following mixed pic-

ture emerges (column (3)): Enrollees in these plans are younger, more likely to be male, less educated, and more likely to be in "good" or "satisfactory" SAH (compared to 'very good' SAH).

5   The Demand-Side of the German Health Plan Landscape

This section empirically studies consumer demand. The last section, which characterized enrollees in dominated health plans, already investigated the demand-side a little bit. This section deepens the analysis of the demand-side. Following the arguments in Einav et al. (2013), we deliberately focus on the subset of enrollees who actively switch health plans. By explicitly allowing for selection into the switching decision, we are able to profile switchers' socio-demographics and study adverse selection. We exploit the fact that switchers make active decisions and reveal preferences about how they trade-off price and non-price attributes of health plans. Note that we differentiate between all switchers and those who switch because they (have to) leave the SHI family insurance.

According to a representative survey among SHI enrollees, 57 percent of actual switchers indicated that the price played an important role in their switching decision. However, "better benefits" were still relevant for 34 percent and a "good service" for 26 percent of all respondents (Insurer's image: 10 percent). Among enrollees who were actively considering to switch, the shares were even higher (80 percent price, 85 percent benefits, 59 percent service, and 18 percent image) (Zok, 2006). While these (hypothetical) numbers are informative and underscore the potential relevance of non-price factors in the decision to switch, the analysis below will study *actual* choices and the trade-offs that switchers are willing to make under real world conditions.

5.1   Prices and Non-Prices Differences of Switchers' Old and New Plans

To obtain a first impression about the relevance of prices, supplemental benefits, and service quality in individuals' decisions to choose health plans, Table 4 compares switchers' new and old plan characteristics.[11]

[Insert Table 4 about here]

Table 4 shows that the monthly premium of the new health plan is, on average, a significant € 2.37 lower than the premium of the old health plan. On average, there are no significant differences for *brick-and-mortar network*, *hotline service*, and *other non-essential benefits*. However, new plans are significantly more likely to offer *alternative medicine* suggesting that consumers value these therapies. Overall, the non-price differences between old and new plans are very small, below 0.05 of a standard

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[11]The results are based on a subset of 729 switches for which we know all five parameters for both the old and the new plan. Note that, for the main analysis, we only need information on the new plan.

deviation. On the other hand, if heterogeneity in consumer preferences is large, a mean of zero may not be very informative.

5.2 Choice Determinants Identified by Mixed Logit Models

Next, we exploit discrete choice methods to model health plan choice determinants (c.f. Beaulieu, 2002; Wedig and Tai-Seale, 2002; Jin and Sorensen, 2006; Dafny and Dranove, 2008). We use the random parameters model (RPL), also called mixed logit model, which is a generalization of the conditional logit model. The definition of the mixed logit model is based on the functional form of its choice probabilities; it has the following strengths (McFadden, 1973; Revelt and Train, 1998; McFadden and Train, 2000):

First, the mixed logit model explicitly allows for heterogeneity in consumer preferences by modeling the preference parameters as random variables. Preferences for alternative medicine or service quality are likely heterogeneously distributed across the population. Second, the RPL does not rely on the restrictive independence of irrelevant alternatives (IIA) assumption. Third, the model is closely to the theoretical concept of a utility maximizing individual i who reveals her preferences by choosing health plan j and thereby maximizing utility u_{ij} according to the following representation:

$$u_{ij} = \gamma_i' Price_{ij} + \delta_i' Benefits_j + \zeta_i' Service_j + \alpha_j + \varepsilon_{ij} \tag{1}$$

where $Price_{ij}$ is the monthly insurance premium in euro which varies across enrollees and sickness funds (because it is income-dependent in Germany). $Benefits_j$ and $Service_j$ include vectors of *non-essential benefits* and *service quality*.

To account for time- and individual-invariant unobservable health plan characteristics, we include 315 health plan fixed effects (α_j). Essentially, the model assumes that the unobserved utility part consists of a health plan specific fixed effect and a random error term.[12] ε_{ij} is assumed to be iid and to follow a type I extreme value distribution.

As discussed, we condition on individuals who make active health plan choices and, by revealed preferences, thus provide information on how they value the trade-off between $Price_{ij}$, $Benefits_j$ and $Service_j$. The coefficient vectors γ_i, δ_i and ζ_i are thus the preference parameters of interest.[13] Because the likelihood function has no closed-form solution, we use maximum simulated likelihood methods to estimate the parameters.

[Insert Table 5 about here]

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[12]We do not directly include socio-economics in equation (1). Because socio-demographics are invariant over alternatives, including them would require interacting them with each alternative in the individual choice sets. Because choice sets range from 41 to 73 health plans, for computational reasons, this approach is not feasible. This is similar to the approach adopted by Chernew et al. (2004).

[13]We assume that the individual preferences are normally distributed, a diagonal variance-covariance matrix of the coefficients, and hence uncorrelated coefficients. We use the Add-On package `mixlogit` for Stata (Hole, 2007). Estimation results are based on 50 Halton draws. Any data or computational errors are our own.

Table 5 reports the estimated means and standard deviations of the random coefficients. Incorporating health plan fixed effects nets out time-invariant plan characteristics, such as brand loyalty or the reputation of the fund, and exploits the timely variation shown by Figure 2.

As indicated by the significantly negative mean of *price*, cheaper sickness funds are preferred by consumers who choose new health plans. The corresponding standard deviation is close to zero and not statistically significant, suggesting that price is a homogeneous choice determinant among switchers.[14]

In contrast, the mean coefficients for *service quality* and *non-essential benefits* are not statistically significant, but of similar size than *price*. However, not only are the standard errors much larger, the variables are also measured on different scales. Comparing the effect of an increase by one standard deviation—which is about 8 for the premium and 1 for the non-price measures (cf. Table 1, Panel C)—the response to a price increase equals eight times an increase in service quality or supplemental benefits.

The standard deviations of *hotline service* and *other non-essential benefits* are relatively small and insignificant, whereas those for *brick-and-mortar network* and *alternative medicine* suggest significant heterogeneity in consumer preferences. One finds that 40 to 60 percent of switchers either place a positive or negative value on *brick-and-mortar network* and *alternative medicine*.[15]

Although the effectiveness of alternative medicine not been proven in standard randomized controlled trials, some consumers seem to value alternative treatment methods. For example, in one of the few studies on actual usage of alternative medicine by SHI enrollees, Robert Koch Institut (2002) investigate claims of one nationwide operating German sickness fund (the *BKK Securvita*), which has 92K enrollees and a specific reputation for offering generous alternative medicine packages. Robert Koch Institut (2002) counted 21K alternative treatments in 2001—i.e. a share of 23 percent—but estimate that this share is three times larger than for the average sickness fund.

In summary, the results suggest that prices are the main determinant in health plan choice for those who actually switch plans. Non-essential supplemental benefits and service quality play, on average, a negligible role in consumers' decision to choose plans. An explanation could be that quantitative premium differences are easy to understand. The monetary trade-off with service quality may only become salient when customers actually need help (Schram and Sonnemans, 2011). Another explanation could be a low consumer awareness of non-price attributes across plans. However, according Zok (2006) 85 percent of SHI enrollees who seriously consider switching plans find "better benefits" an important factor in their decision to switch. Almost 60 percent indicate that "a good service" would be important for them.

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[14] Computing expected price elasticities for the mixed logit model is very cumbersome (cf. Train (2009), p. 141) because expected price elasticities vary across both individuals and health plans. For this reason, it is not obvious which (average) elasticity to report in order to provide the reader with an informative measure. We refer to Schmitz and Ziebarth (2017) who report an out-of-pocket elasticity of about -1 for 2007 and 2008 using the same dataset as this study.

[15] The share of enrollees who value these characteristics (Train, 2009) are for *alternative medicine*: $P(X > 0) = 1 - F_X(0) = 1 - \Phi(0 - 0.069/0.371) \approx 0.57$, where Φ represents the cumulative distribution function of the standard normal distribution.

5.3 Testing for the Potential Endogeneity of Health Plan Characteristics

Endogenous Changes of $Price_{ij}$**,** $Benefits_j$ **and** $Service_j$**?** So far, we have assumed that annual changes in $Price_{ij}$, $Benefits_j$ and $Service_j$ are not simultaneously correlated with the error term and the health plan choice. It appears to be plausible that this assumption is satisfied in the German SHI context, particularly when focusing on *short-term* (annual) changes in plan characteristics. However, to be on the safe side, we solely interpret them as "determinants" and abstain from a strict causal interpretation.

Unlike in the US, where employer-sponsored health plans may have very small numbers of enrollees (and single enrollees may indeed affect prices and other plan characteristics), most German sickness funds have a large number of enrollees. For example, in 2008, the average number of enrollees in all 155 sickness funds was 319K (Schmitz and Ziebarth, 2017; Pilny et al., 2017). The largest health plan had more than 5 million enrollees. Given these large enrollee pools, it is basically impossible that one individual has an impact on prices (particularly given the German RSA, see Section 2.4). Moreover, our model includes health plan fixed effects which net out unobserved time-invariant plan characteristics such as a basic network infrastructure or a fund's reputation.

Second, while annual changes in health plan attributes are likely to be exogenous from an individual's perspective, we have shown above that insurers position themselves on the price vs. quality dimensions (see Section 4). If this strategic decision was driven by unobserved and time-variant plan characteristics that also matter for plan choice, the coefficient estimates could be biased. However, switchers are unlikely to have systematic private unobserved (insider) information about funds; their decision is likely based on the same public quality and price information that we exploit in our empirical model. For example, some insurers may decide to specifically engage in price competition, cutting back customer service. This would only be threat to our main estimates if the reduction in service quality was not captured by our service quality measure which is unlikely.

Control Function Approach: To test for the relevance of potentially endogenous changes in health plan parameters, we apply a Control Function Approach (CFA) as suggested by Petrin and Train (2010). We consider this as a suggestive robustness check and are aware that the crucial exclusion restrictions cannot be tested, but require good reasoning. We use two variables that measure changes in the insurer risk pool (at the plan level) to instrument for annual changes in prices. We measure risk pool changes by aggregating the enrollee data up to the yearly health plan level while excluding the information that switchers themselves contribute. Specifically, we use one indicator that measures (changes in) the age of the risk pool and one indicator that measures (changes in) in the health of the risk pool.[16] By focusing

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[16]SAH is a comprehensive health measure that includes information beyond the 80 specific illnesses considered in the RSA. Despite its simplicity, SAH has been shown to be a good predictor of true health (McGee et al., 1999). Issues related to reporting heterogeneity seem to be mostly limited to age and gender (Ziebarth, 2010b). Moreover, SAH represents recent up-to-date information on enrollees' health.

on price changes and carrying out a CFA, we provide suggestive empirical evidence on the empirical relevance of endogenous price changes.

First, we carry out the first stage regression at the health plan level. As discussed, we measure annual changes in the risk pool of an insurer and exploit the fact that the German RSA is incomplete (see Section 2.4). Below we show that changes in the risk pool are highly correlated with changes in prices (*relevance*). The exclusion restriction requires that these risk pool changes only operate through their impact on prices (*validity*). It would be violated if short-term changes in risk pools also had a direct impact on enrollees' decision to choose plans, which is unlikely to be the case. We also test whether our instruments (and their interactions) are predictive of changes in non-price attributes and found no evidence for that. This reassures us that prices are the main margin that German insurers use to make adjustments in the short-run (recall that we use plan fixed effects) and that changes in risk pools are the main determinant of prices in a system without provider network, fixed reimbursement rates, and a generous essential benefit package.

Second, we include the residuals from this first stage as a control function in our structural model.

[Insert Table 6 about here]

Table 6 reports the CFA robustness checks using two different models. The first just uses the price as the only potentially endogenous regressor of interest, and the second uses our five health plan attributes jointly, assuming that four of them are not significantly correlated with the error term and the outcome measure at the same time. Panel A reports the first stage results which include plan fixed effects. As seen, changes in the age structure of a risk pool as well as changes in the health structure of a risk pool are significant predictors of price changes. When the risk pool ages by one year, the contribution rate is 0.09 percentage points higher. For both specifications, the F-statistic lies above the weak instrument threshold of "12" implying that the instruments are relevant.

Panel B reports the second CFA stage, which includes the residuals from the first stage. The residuals are not statistically significant and the results are quite robust in the CFA specification which corrects for potentially endogenous price changes. The benchmark estimate from the potentially biased regular mixed logit model just using price as a main regressor is -0.057 (Std. Err. 0,007, not shown). The benchmark estimate from the potentially biased regular mixed logit model with all five plan attributes is in Table 5.

As seen, the price coefficients are almost identical and remain statistically significant. The standard deviations of *brick-and-mortar network* and *alternative medicine* also remain statistically significant and barely change in size. All other estimates are also very robust, reinforcing the notion that annual *changes* in health plan characteristics (while netting out time invariant health plan fixed effects) can probably be considered exogenous from the perspective of a single consumer in a market where the

average health plan enrolls 319K individuals (and very few margins to adjust). However, as mentioned, as the exclusion restriction cannot be formally tested, we remain cautious and interpret the parameter estimates in the mixed logit models not as causal but call them "determinants."

5.4 How Consumers Trade-off Price and Non-Price Factors

Let us now assess how switchers trade off the five health plan determinants. When using discrete choice models—which are based on a linear index as in equation (1)—the ratios of the coefficients represent marginal rates of substitution (*MRS*). We are interested in $-\delta_i^k/\gamma_i$ and $-\zeta_i^k/\gamma_i$ indicating at which rate enrollee *i* is willing to trade off additional benefits or service quality against a lower premium, where *k* indexes benefit and quality characteristics.

Interpreting these ratios, however, requires scales that measure a one unit change. As no natural scale is available for service quality and supplemental benefits, we define a unit as one standard deviation in the sample distribution. Similarly, we define one price unit—an increase in the monthly premium by one standard deviation equals an € 8 increase (cf. Table 1, Panel C). This value has intuitive appeal, as it represents the average difference in health plans prices.

Mixed-logit estimation does not yield estimates for $-\delta_i^k/\gamma_i$ and $-\zeta_i^k/\gamma_i$ at the individual level and, for this reason, does not allow for the calculation of individual marginal rates of substitution. Instead, we obtain normally distributed population parameter estimates μ_k and σ_k. Because MRS_k is a ratio of normal random variables, its distribution involves a Cauchy-component rendering the mean (and higher-order moments) undefined. It cannot be consistently estimated (cf. Cohen Freue, 2007), which is why we discuss quantiles instead of means of MRS_k. In particular, we focus on the median of MRS_k. Rather than directly interpreting $-\hat{\mu}_k/\hat{\mu}_{premium}$ as *ML*-estimate for the median of MRS_k, we simulate the percentiles of the *MRS*-distributions—-along with the corresponding 95-% confidence bands.[17]

Prices vs. Non-Price Factors

Let us start with MRS_{store}. The simulated median of MRS_{store} is 0.128, indicating that the median enrollee trades off lower prices against a more dense brick-and-mortar network at a rather small rate: An increase in the store network by one standard deviation (SD) is just valued as one-eighth SD of the premium, which is € 1 per month. However, the simulated 95%-confidence interval of $[-0.324,\ 0.564]$ indicates

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[17] The ratio of the means μ_k/μ_l does not provide an accurate approximation of the median of the corresponding ratio distribution—if the denominator distribution has a mean close to zero and a non-vanishing density at zero. To estimate the percentiles, we draw 2 million random numbers from the relevant ratio distributions, with the point estimates $\hat{\mu}_k$, $\hat{\mu}_{premium}$, $\hat{\sigma}_k$, and $\hat{\sigma}_{premium}$ entering the normal distributions, and then average the simulated quantiles over 2,000 replications. Due to the large size of the pseudo sample, the estimated percentiles exhibit very little sampling variability and averaging has almost no effect. To simulate the confidence bands, we also sample 2,000 times where, in each replication, the four relevant parameters are drawn from the (estimated) jointly-normal distribution of the *ML*-estimator.

that this value is imprecisely estimated.[18] Nevertheless, even the upper confidence bound is only 0.56 and lets us exclude—with 95% statistical certainty—that consumers would trade an increase in the store network by one SD for more than € 8.50 per month.

This picture somewhat changes when we consider the estimated heterogeneity in the *MRS*. Although the exact shape of the estimated *MRS* distribution depends heavily on distributional assumptions (and should be interpreted with caution), assessing other quantiles may provide insights into the heterogeneity of consumer preferences. At the 95th percentile, the rate of substitution is more than ten times larger than at the median (point estimate 1.307). This means that, according to our estimates, those five percent of enrollees who have the strongest preferences for face-to-face services and a high store density are willing to accept a 1.3 SD increase in the monthly premium (€ 10) for a one SD increase in the store density. However, this number carries a lot of uncertainty (confidence interval: [0.286, 3.064]).

On the other hand, according to the estimated distribution of MRS_{store}, 42 percent of all switchers do not accept higher prices in return for more physical branches. However, we find large consumer heterogeneity and a small fraction of consumers who value physical branches highly.

The remaining *MRS*s resemble what has been just discussed for *brick-and-mortar network*. The estimated median *MRS*s range from 1/7 to 1/10 (*hotline service*: 0.106; *alternative medicine*: 0.140; *other supplemental benefits*: 0.118), indicating a rather low median willingness to pay (WTP) for optional supplemental benefits like immunization shots, alternative medicine as well as hotline services. However, the point estimates carry wide confidence intervals. At the 95th percentile, the estimated *MRS*s (*hotline service*: 0.808; *alternative medicine*: 1.379; *other supplemental benefits*: 0.723) are 6 to 10 times larger than the median. On the other hand, about 40 percent of active consumers are not willing to accept any price increase in return for more benefits or a better service.

A Simulataneous Increase in all Non-Price Factors

In a final step, we analyze how consumers would trade off a *simultaneous* increase in all four non-price parameters by one SD. The calculation yields an estimated median value of 0.491 (confidence interval: [−0.181, 1.181]). Although—not surprisingly—the median WTP for joint improvements in quality and benefits exceeds the median WTP for single improvements, the point estimate is still smaller than one.

Again, the joint rate of substitution exhibits considerable heterogeneity. At the 95th percentile, the rate is 2.438, i.e., five times larger than at the median. A third of all switchers are not willing to accept higher premiums at all, even if all four non-price attributes would simultaneously increase by one SD.

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[18]Using $-\hat{\mu}_{store}/\hat{\mu}_{premium}$ directly as estimate for $\mathrm{med}(MRS_{store})$ and applying the delta-method for calculating confidence intervals yields results (point estimate: 0.128, confidence interval: [−0.306, 0.561]) that just marginally deviate from the simulation-based counterpart. This can be explained by the small value of $\hat{\sigma}_{premium}$ that lets the density of the denominator almost vanish at zero.

5.5 The Selection into Health Plan Switching

Health Risks and the Potential for Cream Skimming

The German SHI system combines guaranteed issue with income-dependent contribution rates. Individual risk rating is prohibited. This regulation, however, creates an incentive for sickness funds to engage in active or passive risk selection. To minimize this incentive, the German RSA exists (see Section 2.4). However, because the risk adjustment scheme is incomplete, the risk-adjusted capitated payments for unhealthy enrollees are likely smaller than their actual costs. However, it is unclear to what extent risk selection exists in the German market. Bauhoff (2012) finds evidence for risk selection based on the state of residence of the insured—which is found to be very small, however, in quantitative terms—whereas Nuscheler and Knaus (2005) and McGuire (2007) find no evidence for risk selection in the German SHI.

This paper cannot directly test whether plans actively cream skim. However, in the following we assess the *potential* for risk selection by analyzing whether enrollees sort into plans with specific characteristics, e.g., whether young and healthy switchers prefer specific plans. Section 4.2 has already shown that dominated health plans have less educated and less healthy enrollees (and switchers into these plans).

[Insert Table 7 about here]

To classify individuals into different risk types, we make use of the factors SAH, age, and gender. However, the difference to Section 5.3 is that we do not aggregate these information at the plan-year level to use them as instruments, but test whether switchers with these individual-level characteristics are more likely to choose specific plans.

We construct mutually exclusive subsets of the two dichotomous indicators G^1 (group 1) and G^2 (group 2) which represent different health risks. "Good health risks" report at least good health (SAH category 1 or 2). Age is collapsed into two binary variables—younger than 50 (G^1) and older than 50 (G^2). We also use indicators for males (G^1) and females (G^2).

Then, we run regressions for each of these stratifying variables and interact them with all five health plan characteristics. Table 7 presents the results. Significant differences between the distributions of the preference parameters are indicated by $^+$.

With respect to health plan prices, no significant differences are found when we stratify by age, gender, or health status. This implies that the sick and the healthy, the young and the old, as well as males and females all seem to value (low) prices. The same holds for *brick-and-mortar network*.

With respect to *hotline service*, the null hypothesis of equal distributions is rejected when we stratify by gender and health status (*p*-values: 0.0059 and 0.0179). The fraction of new enrollees who value a

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good hotline service differs significantly by the SAH specification (G^1 (good health): 71 percent, G^2 (bad health): 19 percent). Interestingly, good health risks seem to value hotline services *more* than bad health risks.

The opposite holds for *alternative medicine*. The hypothesis of equal distributions for gender and health is rejected (*p*-values: 0.0823 and 0.0309), but the fraction of those who value alternative treatments is much larger among bad health risks and women (SAH: G^1: 52 percent, G^2: 85 percent; gender: G^1 (men): 54 percent, G^2 (women): 98 percent).

With respect to *other non-essential benefits*, the null hypothesis of equal distributions is again rejected for gender and health (*p*-values: 0.0823 and 0.0309), indicating that those in good health and women value non-essential benefits (like certain immunizations and preventive check-ups) *more* than bad health risks (SAH: G^1: 71 percent, G^2: 56 percent; gender: G^1 (men): 75 percent, G^2 (women): 55 percent).

In sum, preference differences by age, gender and health status seem to be rather small. To the extent that they exist, they do not point into one clear direction. Females value alternative treatments and non-essential benefits more than males. The unhealthy also value alternative medicine more than the healthy, who—in turn—have stronger preferences for other non-essential benefits like immunizations. One could argue that non-price attributes do not seem to be powerful tools for indirect risk selection in the German SHI.

Using the Price Framing Reform of 2009 as Exogenous Shifter of the Switching Decision

As mentioned in Section 2, our sample period covers a price framing reform that became effective on January 1, 2009. Schmitz and Ziebarth (2017) and Wuppermann et al. (2014) find substantial effects of this reform on the likelihood to switch plans. As seen in Figure 3, the share of dominated plans decreased post-reform because market price dispersion shrunk (Schmitz and Ziebarth, 2017).

This subsection tests whether consumers' valuation of of prices, service quality and optional benefits structurally changed post- as compared to pre-reform. Using the price framing reform as an exogenous shifter of the decision to switch health plans, this exercise also provides us with an intuition how our results would change if we corrected the endogenous decision to switch plans.

To carry out our test, we split the sample into a pre- (2008/2009) and post-reform (2010/2011) period.[19] As can be seen in Table A1, the estimated mean coefficient of the price is about twice as large post-reform, which is in line with Schmitz and Ziebarth (2017) and Wuppermann et al. (2014). The estimated coefficients for *alternative medicine* and *other non-essential benefits*, however, are very similar in pre and post-reform years. The estimates for *brick-and-mortar network* and *other non-essential benefits*

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[19]We opt for assigning the wave 2009 to the pre-reform period, as SOEP interviews are typically carried out at the beginning of a year and, hence, switching most likely refers to the previous year.

remain non-significant but increase in size which could indicate an increase in their mean relevance.[20] However, an LR-test fails (*p*-value 0.599) to reject the null hypothesis of equal distributions.

6   Conclusion

This paper studies a multi-payer market that combines consumer choice with heavy government regulation. We exploit health plan level data on almost all German health plans. The health plan level data contain price and non-price information of these plans. The non-price features are measured by consistently collected information on service quality (*hotline service, brick-and-mortar stores*) as well as non-essential supplemental benefits (*alternative medicine, other non-essential benefits*).

Our supply-side analysis reveals, first, that a clear and significant trade-off between non-price and prices attributes exist. Cheaper plans offer less service quality and less optional benefits. Second, we find that the large majority of health plans are dominated—not only dominated on the financial dimension, but simultaneously dominated on the price and non-price dimensions. This suggests the existence of significant market frictions, despite the fact that consumer choice is significantly simplified through the regulatory framework (for example, the price dimension is one-dimensional). Enrollees in dominated plans (as well as those who are observed actively choosing them) are significantly less healthy and less educated than enrollees in dominating plans. This finding is in line with recent evidence from the US (Bhargava et al., 2017).

Our demand-side analysis is based on representative enrollee panel data, which we link to the health plan level data to assess the relative roles of prices, non-essential benefits, and service quality in the decision to choose health plans. We model individuals' health plan choices using a random parameters model which accounts for health plan heterogeneity and time-invariant unobserved factors. In total, the empirical setting exploits 1,724 health plan switches and almost 100,000 potential choice sets between 2007 and 2010.

While substantial variation in all investigated health plan characteristics exist, we find that prices play the dominant role in consumers' decision to choose health plans (when they decide to switch). For the median enrollee, an increase in any of the non-price factors (density of brick-and-mortar stores, hotline quality, alternative medicine, and other non-essential supplemental benefits) by one standard deviation is offset by a decrease in premiums by only one-eighth of a standard deviation, or €1 per month. In contrast, from a supply-side perspective, the positioning of health plans between the various price and non-price dimensions suggest a much higher trade-off that consumers are evidently not willing to pay. For example, health plans trade-off €10 per month per standard deviation increase in the density of the branch network. In other words, even when service quality and non-essential benefits

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[20] If this was true, the effects could either stem from the higher price sensitivity, the price compression in the market, or a different subset of enrollees who actually switched plans.

are valued by consumers (which survey evidence suggests they do), they are only willing to trade them for higher prices at a much smaller rate. This could explain why the number of sickness funds has been decreasing substantially over the past decades.

Finally, we find substantial consumer heterogeneity in the valuation of non-price attributes; a minority of consumers seem to value service quality very highly. On the other hand, we find that up to 70 percent of enrollees who switch plans do not value non-essential benefits and service quality at all, a finding that is reinforced by survey evidence.

As in every empirical study, the strict interpretation of our results is limited to the specific setting, in our case the German market. However, we believe that the findings are of broader relevance, in particular because few papers are able to explicitly study the role of supplemental benefits and service quality relative to health plan prices both from a demand and supply perspective. For example, we illustrate the relevance of considering non-price attributes when analyzing dominated plans; non-price attributes are important because we find that a share of consumers value them highly and may stay in expensive plans precisely for that reason. However, we also show that—among the selective sample of switchers—prices are clearly the dominant factor in the decision to choose plans. Lastly, the paper illustrates that substantial choice frictions also exist in markets with heavy government regulation and a much simpler choice architecture than in the US. Future research should try to carve out the exact reasons for why so many consumers remain enrolled in clearly dominated health plans.

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Figures and Tables

Figure 1: Trade-Off Between Health Plan Prices, Service Quality, and Optional Supplemental Benefits

Price=13.8513 + 0.0292*Hotline [p-value=4.46]

Price=13.8963 + 0.0731*Density [p-value=4.93]

Price=13.9183 + 0.0366*Benefits [p-value=4.19]

Contribution Rate in ppt of Gross Wage ('Price')

Price=14.2907 + 0.0172*AlternativeMedicine [p-value=1.44]

Contribution Rate in ppt of Gross Wage ('Price')
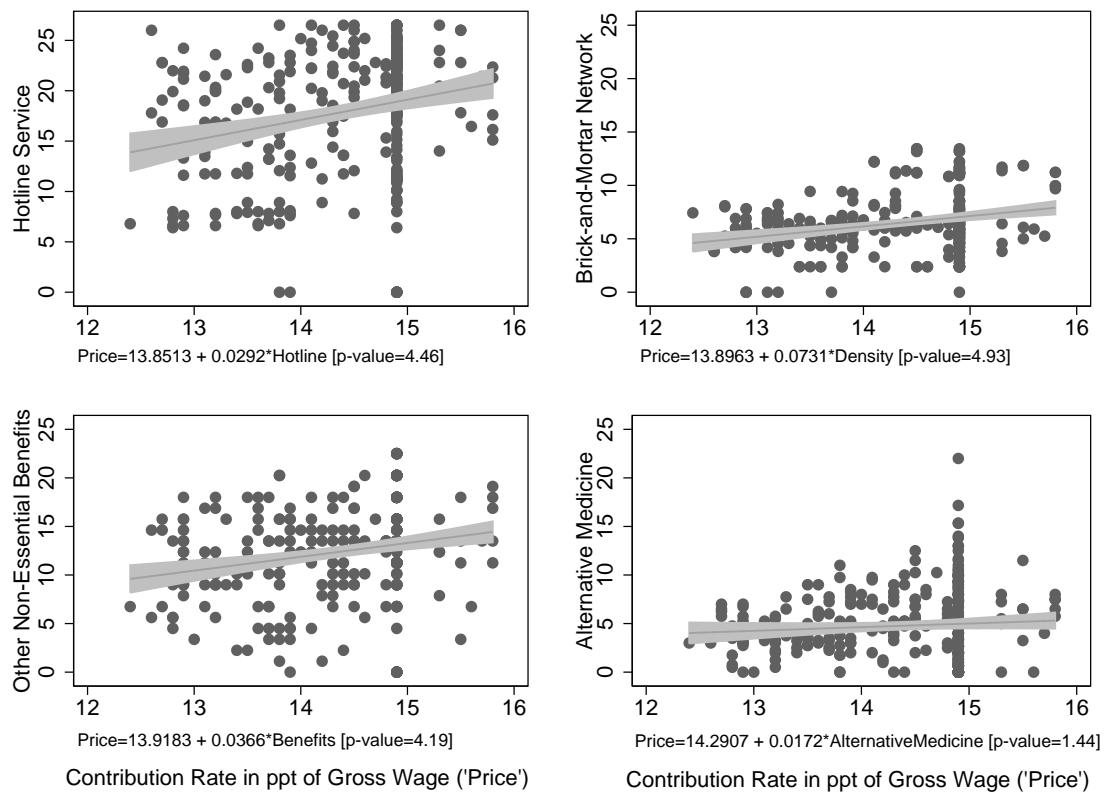
Figure 2: Changes in Health Plan Prices, Supplemental Benefits, and Service Quality Over Time

Change in Contribution Rates btw. t=0 and t=1

Change in Hotline Service Quality Score btw. t=0 and t=1

Change in Non-Essential Benefit Score btw. t=0 and t=1

Change in Alternative Medicine Score btw. t=0 and t=1
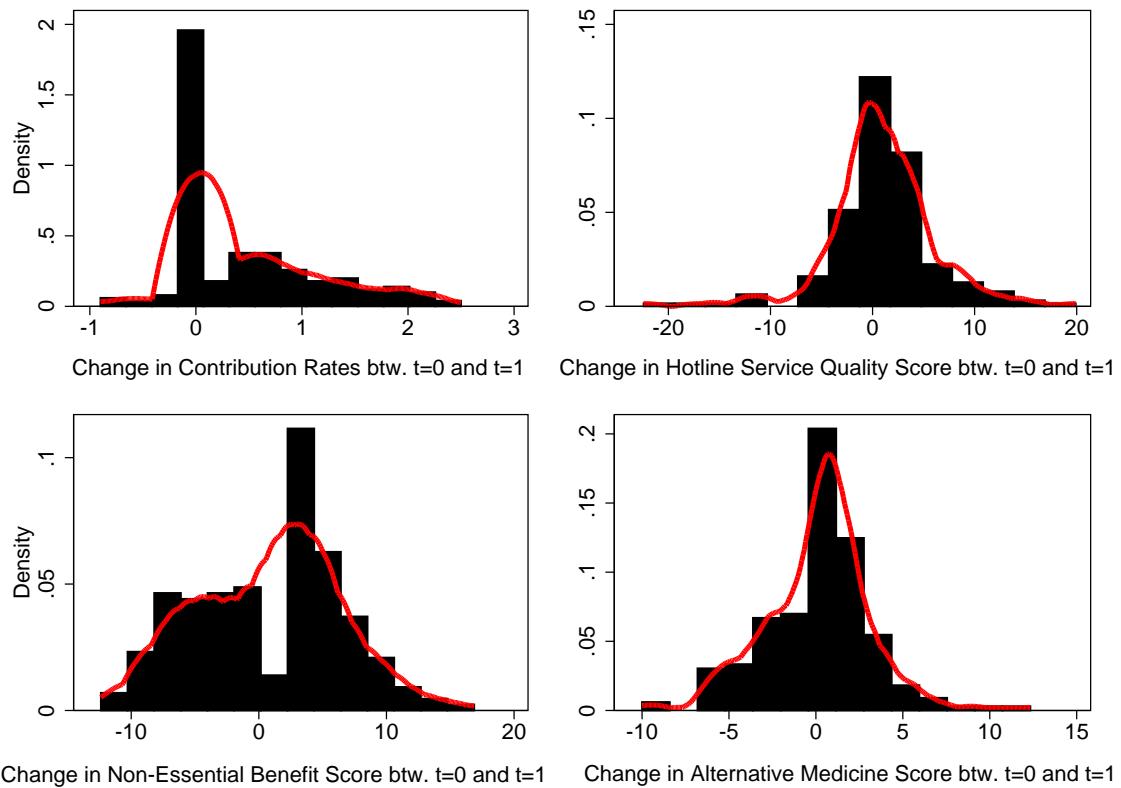
Figure 3: Share of Dominated Plans Using different Dominance Criteria

All health plans, all 5 criteria · · · · · All health plans, only price
· · · Only national health plans, all 5 criteria · · · Only national health plans, only price
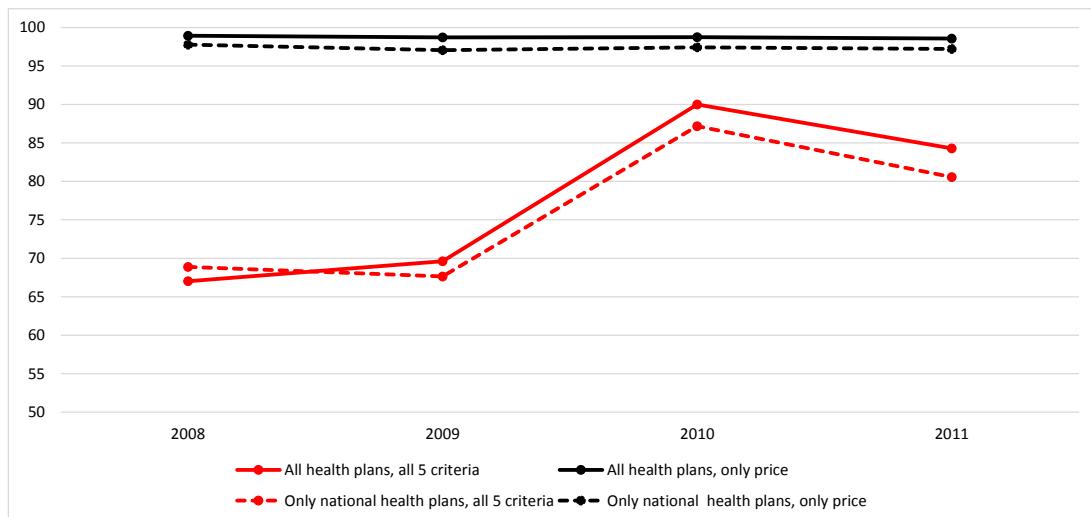
Note: Own calculations, own illustration.

Table 1: Descriptive Statistics

Panel A: Sample Characteristics		2008	2009	2010	2011	Total
Observations (=switches×#plans)		25,920	25,476	27,352	21,140	99,888
Health Plan Switches		388	447	477	414	1,726
Standard Switchers		231	293	318	285	1,127
Exit Family Insurance		157	154	159	129	599
#Health Plans						
Mean		66.8	57.0	57.3	51.1	57.9
S.D.		5.4	4.4	4.7	3.9	7.1
Min.		53.0	48.0	48.0	41.0	41.0
Max.		73.0	63.0	63.0	55.0	73.0

Panel B: Individual Characteristics	Mean	S.D.	Med.	Min.	Max.	Obs.
Self-Assessed Health	2.34	0.84	2	1	5	1,724
Very Good	0.13	0.34	0	0	1	1,724
Good	0.49	0.50	0	0	1	1,724
Satisfactory	0.29	0.45	0	0	1	1,724
Poor	0.08	0.27	0	0	1	1,724
Bad	0.01	0.10	0	0	1	1,724
Age	37.03	12.63	37	18	80	1,726
Female	0.55	0.50	1	0	1	1,726
Monthly Gross Income [EUR]	1,959	1,413	1,700	400	12,885	1,726

Panel C: Health Plan Characteristics	Mean	S.D.	Med.	Min.	Max.	Obs.
Premium [EUR][+]	152.98	8.04	158	133	178	323
Brick-and-Mortar Network	0.00	1.00	-0.15	-2.42	2.48	323
Hotline Service	0.00	1.00	0.28	-2.95	1.39	323
Alternative Medicine	0.00	1.00	-0.17	-2.16	3.16	323
Other Non-Essential Benefits	0.00	1.00	0.06	-4.73	1.93	323

Sources: Müller and Lange (2010); Lange (2011), German Federal (Social) Insurance Office, National Association of Statutory Health Insurance Funds, annual reports of the sickness funds, information by sickness funds. SOEP.v28. Authors' calculation based on the SOEP. [+] denotes fictive absolute EUR premiums based on a monthly gross income of €2,000 for illustrative purposes because premiums depend on three factors: the contribution rate, the individual income, and the add-on premium (after 2009). In order to show average euro amounts on the health plan level, we use a hypothetical monthly gross wage of €2,000. In the regression models, exact premiums are calculated.

Table 2: Dominated vs. Non-Dominated Health Plans: All 5 Attributes as Dominance Criteria

	All health plans		Dominated health plans		Non-dominated health plans	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Contribution rate	14.41	0.75	14.53	0.66	14.02	0.88
Brick-and-Mortar Network	5.71	2.47	5.26	2.09	7.16	2.99
Hotline Service	19.13	5.65	18.26	5.76	21.86	4.30
Alternative Medicine	4.97	4.07	3.79	3.12	8.70	4.48
Other Non-Essential Benefits	12.80	4.93	12.33	5.06	14.29	4.21
Share of Female Enrollees	0.46	0.19	0.44	0.21	0.54	0.11
Average Age of Enrollees	43.04	3.63	42.83	3.90	43.71	2.57
Share of Enrollees SAH good	0.56	0.20	0.55	0.22	0.57	0.12
Observations	154		117		37	

Sources: Müller and Lange (2010); Lange (2011), German Federal (Social) Insurance Office, National Association of Statutory Health Insurance Funds, annual reports of the sickness funds, information by sickness funds. SOEP.v28. Authors' calculation based on the SOEP and on 154 plan-year observations. Only plans that operate nationwide are included. The same set of plans is considered in Table A2 below.

Table 3: Characteristics of Enrollees and Switchers in Dominated Health Plans

	Only Switchers				All Enrollees			
	All attributes (1)		Only price (2)		All attributes (3)		Only price (4)	
Age > 50	0.035	(0.037)	−0.001	(0.007)	−0.053***	(0.008)	0.004***	(0.001)
Female	0.030	(0.028)	−0.002	(0.005)	−0.088***	(0.007)	−0.001	(0.001)
Education (= hs)	−0.081*	(0.044)	0.003	(0.009)	−0.010	(0.015)	0.003	(0.003)
Education (> hs)	−0.095*	(0.051)	0.015*	(0.009)	−0.078***	(0.016)	0.005	(0.003)
Married	0.026	(0.029)	−0.004	(0.005)	−0.002	(0.008)	−0.000	(0.001)
SAH good	0.078*	(0.041)	0.004	(0.010)	0.022*	(0.013)	0.001	(0.002)
SAH satisfactory	0.071	(0.045)	0.012	(0.010)	0.027*	(0.014)	0.002	(0.002)
SAH poor	0.058	(0.062)	0.006	(0.014)	0.017	(0.017)	0.000	(0.003)
SAH bad	0.226	(0.139)	0.016*	(0.009)	0.004	(0.034)	0.001	(0.005)
Constant	0.308***	(0.052)	0.984***	(0.015)	0.402***	(0.019)	0.989***	(0.004)
# Observations	1188		1188		15,998		15,998	
Mean dep. var.	0.338		0.992		0.330		0.994	

Sources: Müller and Lange (2010); Lange (2011), German Federal (Social) Insurance Office, National Association of Statutory Health Insurance Funds, annual reports of the sickness funds, information by sickness funds. SOEP.v28. Authors' calculation based on the SOEP. Each column represents one linear probability model. The dependent variable in columns (1) and (3) is a dummy that is 1 of the plan is dominated considering all five health plan attributes as dominance criteria; the dependent variable in columns (2) and (4) is a dummy that is 1 of the plan is dominated only considering prices as dominance criterion. Only plans that operate nationwide are included. The results are robust to including all health plans (available upon request). Robust standard errors are in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 4: New and Old Health Plan Characteristics of Switchers

Characteristic	$\bar{X}^{new}$	$\bar{X}^{old}$	Δ	$s.e._{\Delta}$
Price	133.12	135.49	-2.37***	(0.20)
Brick-and-Mortar Network	1.01	0.96	0.05	(0.03)
Hotline Service	0.80	0.80	0.00	(0.02)
Alternative Medicine	0.96	0.89	0.07**	(0.03)
Other Non-Essential Benefits	0.45	0.42	0.03	(0.03)

Notes: Authors' calculation. The table shows sickness fund characteristics of switchers' new and old health plans. The calculations are based on 729 observations. Standard errors of the differences in means are in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Table 5: Health Plan Choice Determinants (Mixed Logit Models)

	Mean		SD	
Price				
Price	-0.061***	(0.008)	0.002	(0.014)
Service Quality				
Brick-and-Mortar Network	0.063	(0.110)	0.354***	(0.128)
Hotline Service	0.052	(0.152)	0.210	(0.335)
Non-Essential Benefits				
Alternative Medicine	0.069	(0.071)	0.371***	(0.108)
Other Non-Essential Benefits	0.058	(0.064)	0.182	(0.150)
Health Plan Fixed Effect		yes		
# Observations (=switches×#plans)		99,888		
# Health Plan Switches		1,726		

Notes: Authors' calculation. The table shows estimated means and standard deviations of the random parameters. Estimated standard errors are in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Table 6: Robustness—Health Plan Choice Determinants (Control Function Approach)

Panel A: First Stage—Contribution Rate	Coefficient	SE	Coefficient	SE
Instruments at Health Plan Level				
Risk Pool Age	0.089***	(0.021)	0.086***	(0.021)
Risk Pool Health	−0.685*	(0.353)	−0.691*	(0.361)
Other Non-Price Controls	no		yes	
Health Plan Fixed Effect	yes		yes	
F-statistic instruments	13.37		12.91	
# Observations	316		316	
# Health Plans	112		112	

Panel B: Second Stage—Choice Model	Mean		SD		Mean		SD	
First stage residual	0.056	(0.119)			0.049	(0.127)		
Price								
Price	−0.060***	(0.010)	0.000	(0.013)	−0.064***	(0.011)	0.001	(0.016)
Service Quality								
Brick-and-Mortar Network					0.054	(0.108)	0.313**	(0.139)
Hotline Service					0.110	(0.139)	0.274	(0.198)
Supplemental Benefits								
Alternative Medicine					0.062	(0.072)	0.325***	(0.126)
Other Non-Essential Benefits					0.036	(0.060)	0.093	(0.178)
Health Plan Fixed Effect	yes				yes			
# Observations (switches×#plans)	98,224				98,224			
# Health Plan Switches	1,706				1,706			

Notes: Authors' calculation. Panel A shows OLS estimation results on the health plan level using annual changes in the risk pool (age and health status) as instruments for annual changes in contribution rates. Panel B shows the standard mixed logit model on the enrollee level which controls for the residual of the first stage. Estimated standard errors in the second stage are in parentheses and corrected using the Murphy and Topel (1985) correction for two-step models. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Table 7: Characterizing Switchers by Risk Types (Mixed Logit Models)

	Age $(G^1$: age $< 50)$		Gender $(G^1$: males$)$		SAH $(G^1$: SAH $< 3)$	
	Mean	SD	Mean	SD	Mean	SD
Price						
Price$\times G^1$	-0.063^{***}(0.009)	0.001 (0.015)	-0.054^{***}(0.010)	0.015 (0.028)	-0.059^{***}(0.009)	0.005 (0.020)
Price$\times G^2$	-0.053^{***}(0.013)	0.000 (0.028)	-0.070^{***}(0.010)	0.004 (0.015)	-0.069^{***}(0.011)	0.002 (0.022)
Service Quality						
Stores$\times G^1$	0.056 (0.112)	0.350^{**} (0.145)	0.083 (0.122)	0.317^{*} (0.177)	0.041 (0.119)	0.302^{*} (0.183)
Stores$\times G^2$	0.004 (0.134)	0.154 (0.398)	-0.008 (0.112)	0.264 (0.192)	0.054 (0.124)	0.422^{***}(0.147)
Hotline$\times G^1$	0.187 (0.154)	0.442^{***}(0.158)	$^{+}0.128$ $^{+}$(0.167)	$^{+}0.384^{**+}$(0.178)	$^{+}0.307^{*\,+}$(0.166)	$^{+}0.560^{***}$(0.155)
Hotline$\times G^2$	-0.069 (0.172)	0.153 (0.277)	$^{+}0.236$ $^{+}$(0.174)	$^{+}0.519^{***+}$(0.172)	$^{+}-0.098$ $^{+}$(0.149)	$^{+}0.114$ $^{+}$(0.329)
Benefits						
Alternative Medicine$\times G^1$	0.064 (0.074)	0.325^{***}(0.123)	$^{+}0.058$ $^{+}$(0.087)	$^{+}0.523^{***+}$(0.105)	$^{+}0.023$ $^{+}$(0.080)	$^{+}0.499^{***+}$(0.112)
Alternative Medicine$\times G^2$	0.021 (0.114)	0.272 (0.262)	$^{+}0.064$ $^{+}$(0.074)	$^{+}0.030$ $^{+}$(0.219)	$^{+}0.170^{*+}$(0.090)	$^{+}0.164$ $^{+}$(0.222)
Non-Essential Benefits$\times G^1$	0.060 (0.065)	0.143 (0.158)	$^{+}0.121$ $^{+}$(0.077)	$^{+}0.178$ $^{+}$(0.156)	$^{+}0.083$ $^{+}$(0.069)	$^{+}0.150$ $^{+}$(0.142)
Non-Essential Benefits$\times G^2$	0.072 (0.114)	0.357^{**} (0.216)	$^{+}0.042$ $^{+}$(0.077)	$^{+}0.319^{**+}$(0.141)	$^{+}0.058$ $^{+}$(0.089)	$^{+}0.375^{**+}$(0.168)
Health Plan Fixed Effects	yes		yes		yes	
# Observations	99,888		99,888		99,790	
# Health Plan Switches	1,726		1,726		1,724	

Notes: Authors' calculation. The table shows estimated means and standard deviations of the random parameters. G^1 and G^2 denote good health risks (age < 50; males, SAH < 3) and bad health risks (age ≥ 50; females, SAH ≥ 3), respectively. $^{+}$ significant differences (90% level) between distributions of estimated preference parameters. Estimated standard errors are in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Online Appendix

Table A1: Robustness—The Price Framing Reform of 2009 as Exogenous Shifter in the Decision to Switch

	Mean		SD	
Price				
Premium × pre	−0.056***	(0.009)	0.001	(0.014)
Premium × post	−0.092***	(0.031)	0.069	(0.042)
Service Quality				
Branch Network × pre	−0.010	(0.119)	0.276	(0.200)
Branch Network × post	0.203	(0.139)	0.475***	(0.167)
Hotline Service × pre	0.152	(0.189)	0.428*	(0.223)
Hotline Service × post	−0.008	(0.171)	0.125	(0.341)
Benefits				
Alternative Medicine × pre	0.073	(0.115)	0.260	(0.168)
Alternative Medicine × post	0.093	(0.107)	0.651***	(0.177)
Non-Essential Benefits × pre	0.010	(0.068)	0.012	(0.180)
Non-Essential Benefits × post	0.076	(0.102)	0.136	(0.167)
Health Plan Fixed Effects		yes		
# Observations		99,888		
# Health Plan Switches		1,726		

Notes: Authors' calculation. The table shows estimated coefficients of both, mean and standard deviation. The binary indicator "pre" is one for the SOEP waves 2008 and 2009, while "post" is one for the waves of 2010 and 2011. Estimated standard errors are in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Table A2: Dominated vs. Non-Dominated Plan Characteristics–Only Price as Dominance Criterion

	All health plans		Dominated health plans		Non-dominated health plans	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Contribution rate	14.41	0.75	14.43	0.73	13.60	1.16
Branch Network	5.71	2.47	5.74	2.49	4.53	0.83
Hotline Service	19.13	5.65	19.11	5.69	19.72	4.20
Alternative Medicine	4.97	4.07	5.03	4.10	2.88	1.30
Other Non-Essential Benefits	12.80	4.93	12.78	4.92	13.50	6.02
Share of Female Enrollees	0.46	0.19	0.46	0.20	0.54	0.14
Average Age of Enrollees	43.04	3.63	43.12	3.64	40.09	1.76
Share of Enrollees SAH good	0.56	0.20	0.55	0.20	0.63	0.09
Observations	154		150		4	

Sources: Müller and Lange (2010); Lange (2011), German Federal (Social) Insurance Office, National Association of Statutory Health Insurance Funds, annual reports of the sickness funds, information by sickness funds. SOEP.v28. Authors' calculation based on the SOEP and 154 plan-year observations. Only plans that operate nationwide have been considered.