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Adam Pilny, Ansgar Wübker, and Nicolas R. Ziebarth[1]

# Introducing Risk Adjustment and Free Health Plan Choice in Employer-Based Health Insurance: Evidence from Germany

## Abstract

*To equalize differences in health plan premiums due to differences in risk pools, the German legislature introduced a simple Risk Adjustment Scheme (RAS) based on age, gender and disability status in 1994. In addition, effective 1996, consumers gained the freedom to choose among hundreds of existing health plans, across employers and state-borders. This paper (a) estimates RAS pass-through rates on premiums, financial reserves, and expenditures and assesses the overall impact on market price dispersion. Moreover, it (b) characterizes health plan switchers and their annual and cumulative switching rates over time. Our main findings are based on representative enrollee panel data linked to administrative RAS and health plan data. We show that sickness funds with bad risk pools and high pre-RAS premiums lowered their total premiums by 42 cents per additional euro allocated by the RAS. Consequently, post-RAS, health plan prices converged but not fully. Because switchers are more likely to be white collar, young and healthy, the new consumer choice resulted in more risk segregation and the amount of money redistributed by the RAS increased over time.*

*JEL Classification: D12, H51, I11, I13, I18*

*Keywords: Employer-based health insurance; free health plan choice; risk adjustment; health plan switching; adverse selection: German sickness funds; SOEP*

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# 1 Introduction

Health insurance markets that combine health plan choice with community rating regulations also require a risk adjustment mechanism. Risk adjustment means to adjust for predictable variation in enrollees' medical expenses due to structural differences in health risk pools across insurers. Risk adjustment can ensure a stable and competitive market. Without an adjustment of health risks across insurer risk pools, and without giving insurers the option to charge higher risks higher prices (i.e., under "community rating"), insurers would compete in cherry-picking "good risks" (healthy enrollees) and reject "bad risks" rather than competing in improving health plans. In other words, without any mechanism that compensates for the higher costs that sicker enrollees naturally produce, insurers in markets with free consumer health plan choice have strong incentives to cream-skim healthy enrollees. They would then engage either in active risk selection (to cherry-pick good risks and reject bad risks) or in passive risk selection (to induce self-selection by enrollees) or both (Nuscheler, 2004). Without risk adjustment, *ceteris paribus*, attracting young and healthy switchers ensures lower market prices (van Vliet, 2006; van de Ven et al., 2007). For these reasons, the question of how to effectively design and implement risk adjustment mechanisms has become one of the spotlights in the health policy debates in health insurance markets with consumer choice and community rating regulations, such as the Netherlands, Switzerland, Germany, Israel, and the US.

The German multi-payer Statutory Health Insurance (SHI) covers 70 million individuals, or 90% of the population. Most of them are compulsorily insured under the SHI. It combines a tight regulation of the benefit package and cost-sharing rules with the free choice of dozens of non-profit health plans (called "sickness funds").[1] Unlike in the US, however, where access to employer-sponsored health insurance is still restricted to employees of the company, German employees do not have to switch health plans when they switch employers. In principle, today, they can keep their health plan from birth (when they are covered under a family plan) to death (Medicare does not exist in Germany).

The free choice of health plans was introduced in 1996. Prior to 1996, most Germans were assigned to plans based on their occupation or industry, or had a heavily restricted choice set among employer-provided plans. Restricting health plan choice based on occupation or industry meant that health plan premiums differed substantially across sickness funds (for essentially the same plan and benefits). These price differences were (at least partly) due to differences in risk pools absent any risk adjustment.

Hence, two years before free health plan choice became a legal right, in 1994, a simple Risk Adjustment Scheme (RAS) based on three factors—age, gender, and disability status—was implemented. The goal of the RAS was precisely to adjust differences in risk pools across sickness funds to level the playing field for a "fair" market competition with a focus on reducing administrative costs and improving product quality—and to eliminate incentives for insurers to cream-skim good risks.

[1] Henceforth, we will use the terms "health plan", "sickness fund", "insurer" and "insurance" interchangeably.

This paper combines representative survey panel data with administrative health plan data on prices and RAS allocations to study, first, how the introduction of this RAS scheme affected insurer premiums, pass-through rates, and overall market price dispersion. Estimating pass-through rates is important for several reasons: It opens the black box of how insurers in a given country operate. Specifically, it offers insights into how much consumers benefit from additional insurer revenues through lower health plan premiums—dampening premium growth is a key objective for policymakers around the world. Estimating pass-through rates also facilitates a comparison of the consumer impacts of different regulatory tools, e.g., tax-funded consumer premium subsidies vs. insurer risk corridors or other risk adjustment schemes. Moreover, the premium pass-through rate is also a measure of the competitiveness of the market; *ceteris paribus*, we would expect higher pass-through rates in more competitive markets (c.f. Weyl and Fabinger, 2013; Cabral et al., 2014). Finally, comparing pass-through rates in markets with for-profit and non-profit insurers may offer an explanation for why premium growth is large in the US, the only country whose health care system is predominantly based on for-profit insurers who pass additional revenues also through to shareholders (Duggan et al., 2016).

The second main objective of this paper is to investigate how the introduction of consumer choice was associated with actual switching behavior and risk segregation in Germany. Assessing whether free consumer choice leads to more or less risk segregation and adverse selection is important for economic welfare analysis. To the extent that it induces *more* risk segregation, it also provides empirical support for a risk-adjustment mechanism to level the playing field for a competitive market.

The empirical identification strategies for these two objectives differ slightly. First, when estimating the impact of RAS allocations on pass-through rates, we discuss why conditional changes in annual RAS allocations—which were calculated retrospectively by an independent federal agency—likely represent quasi-exogenous variation. Second, when assessing the relationship between health plan choice and switching behavior, we do not rely on a classical causal reduced-form framework. Rather, we present several pieces of empirical evidence which strongly suggest that risk segregation has increased as a result of more consumer choice.

As a starting point, the paper shows that before the introduction of free health plan choice and the RAS, insurer risk pools differed by socio-demographics because coverage was tied directly to occupation or industry. Sickness funds with worse risk pools (had to) charge higher prices. A common price spread of two percentage points of the contribution rate would translate into total premium differences of more than € 1000 per year, which were predominately paid by older and poorer employees and their employers.

Second, market price dispersion decreased in the post-RAS era, but prices did not converge fully. We show that the main reason for this incomplete convergence is an incomplete pass-through of RAS payments to premiums. As described in more detail in the next section, the RAS was carried out by an independent regulatory agency which calculated standardized health care expenditures by age-gender-disability cells. Depending on the exact standardized expenditures for year t-1 and the number of insured enrollee days in each age-gender-disability cell, sickness funds had to pay money into the RAS or obtained money out of the RAS in year t. We exploit variation in changes in RAS allocations across sickness fund types and over time to estimate that total premiums decreased by at least 42 cents when sickness funds with bad risk pools received one euro more per enrollee out of the RAS fund. We also find that the non-profit sickness funds increased their reserves (by 5.5 cents), assets (by 13 cents) and health care spending (by 22 cents, imprecisely estimated) for every additional euro per enrollee.

Third, after a strong increase in the first two years of the free consumer choice era, the annual switching rate first stabilized at around six percent but then continued to increase further. Eight years after switching became a legal right, almost a quarter of all enrollees had actively switched health plans. Despite the reduction in market price dispersion due to the RAS, we find a relatively stable savings rate for health plan switchers. Because switchers tend to be younger, white collar, and healthier, the sorting of good risks into the switching decision has increased risk segregation across risk pools under free health plan choice. As a consequence, the volume of money redistributed by the RAS has also increased over time.

The paper contributes to a growing empirical economic literature on risk adjustment in health care markets (see van de Ven and Ellis (2000) and Ellis (2008) for overviews). Several European countries such as the Netherlands, Belgium, Switzerland, Germany as well as Israel have implemented risk adjustment schemes (Chernichovsky and van de Ven, 2003; van de Ven et al., 2007; Shmueli, 2015). In the US, the risk adjustment in Medicare Part C—the privatized version of the public health insurance program for the elderly and disabled—has already been a talking point for two decades (Newhouse et al., 1997; Glazer and McGuire, 2000; McGuire, 2007; McGuire et al., 2014; Brown et al., 2014; Cabral et al., 2014; Duggan et al., 2016). In a paper that is similar in spirit to ours, Cabral et al. (2014) study the effect of increases in capitated payments to insurers in Medicare Part C. They find that insurers reduce premiums by 45 cents for every additional dollar they receive (in addition to an increase in the actuarial value by 8 cents). In another closely related paper, Duggan et al. (2016) find a lower Medicare Part C pass-through rate of one-eights in addition to higher insurer profits and advertising expenditures.

Recent US papers discuss risk adjustment on the newly created state-level "Exchanges" (marketplaces for private insurance) of the Affordable Care Act (ACA) (Cunningham, 2012; Rose et al., 2015; Cox et al., 2016; Layton et al., 2016) or in Medicare Part D (supplemental drug insurance for the elderly) (Carey, 2017). Another set of papers studies how different regulator objectives, such as reducing adverse selection, would theoretically translate into differently designed risk adjustment schemes (Glazer and McGuire, 2002; Breyer et al., 2011; McGuire et al., 2013; Layton et al., 2016), while yet another deals with optimizing risk adjustment by incorporating new risk adjusters or innovative statistical methods (van de Ven and Ellis, 2000; Manning et al., 2005; Breyer et al., 2011; Buchner et al., 2013; Lorenz, 2014; van Kleef et al., 2015; Buchner et al., 2017; Geruso and McGuire, 2016).[2] van de Ven et al. (2007) compare distinctive features of the early German RAS and the RAS' of other European countries. Differences include (i) how the money is redistributed between insurers, (ii) how risk sharing between insurers and high risk pools is carried out, (iii) whether there exists a legally determined open enrollment period, and (iv) whether and how insurers pay for capital costs of hospitals. In contrast to the first German RAS evaluated in this paper, more sophisticated RAS' are based on regression models, high-cost diagnoses, and sometimes detailed pharmaceutical information (Juhnke et al., 2016). Moreover, unlike the German RAS, most RAS' are prospective rather than retrospective schemes.

Our work also builds on papers and reports that specifically discuss the German RAS (Felder, 2000; Breyer and Kifmann, 2001; Lauterbach and Wille, 2002; v. d. Schulenburg and Vieregge, 2003; Göpffarth, 2004; Buchner and Wasem, 2003; Glazer and McGuire, 2006; McGuire and Bauhoff, 2007; Schneider et al., 2007; Wissenschaftlicher Beirat, 2011). These papers primarily discuss institutional details of the German RAS and aggregated data and trends. To our knowledge, ours is the first paper that combines representative SOEP enrollee panel data with administrative price, RAS, and other health plan level data to study the impact of the RAS on contribution rates, premiums, reserves, assets and expenditures and estimates these pass-through rates for Germany.

The next section describes the German Health Insurance System, the functioning of the German RAS, and pre-RAS differences in risk pools across sickness fund categories. Section 3 describes the different data sources that we use in this study, how we selected the sample, and how we generated the variables for the empirical analyses. Section 4 provides the empirical results and Section 5 concludes.

## 2 The German Employer-Based SHI System

The German health insurance system is characterized by the coexistence of public SHI and Private Health Insurance (PHI). This paper focuses on the public system which covers 90% of the population. Insurance under the public system is compulsory for employees with gross wage earnings below the defined income threshold, or *Versicherungspflichtgrenze* (in 2017: €57.6K/$64.5K per year), see Karlsson et al. (2016) or Schmitz and Ziebarth (2017) for more institutional details. In 2017, the SHI market consists of 113 not-for-profit health insurers, also called "sickness funds", roughly half of which operate nationwide while other half solely operate in select federal states (GKV Spitzenverband, 2017). Due to

[2] This paper also contributes to the literature on health plan switching and adverse selection more generally, e.g. in the Netherlands (Schut and Hassink, 2002; Dijk et al., 2008; Boonen et al., 2015), in Switzerland (Becker and Zweifel, 2008; Frank and Lamiraud, 2009; Ortiz, 2011), in the US (Dowd and Feldman, 1994; Cutler and Reber, 1998; Royalty and Solomon, 1999; Strombom et al., 2002; Atherly et al., 2004; Buchmueller, 2006; Bundorf, 2010; Dusansky and Koç, 2010; Parente et al., 2011; Ketcham et al., 2012; Buchmueller et al., 2013; Ketcham et al., 2015; Abaluck and Gruber, 2016), and in Germany (Schwarze and Andersen, 2001; Schut et al., 2003; Nuscheler and Knaus, 2005; Tamm et al., 2007; Andersen et al., 2007; Schmitz, 2011; Bauhoff, 2012; Wuppermann et al., 2014; Grunow and Nuscheler, 2014; Polyakova, 2016; Panthöfer, 2016; Schmitz and Ziebarth, 2017). Most of these papers estimate demand price elasticities which, however, differ widely across settings and countries.

historical reasons, each sickness fund basically only offers one standardized health plan, which is why we use the terms "sickness fund" and "health plan" interchangeably.

Health plan premiums are charged as social insurance contributions in percent of the gross wage, up to the legally defined contribution ceiling, or *Beitragsbemessungsgrenze*, which is set at the federal level and increases every year by about two percent (in 2017: €52.2K/$58.5K per year). The average contribution rate increased from 11.4% in 1984 to 13.9% in 2004 (and meanwhile further to 15.7% in 2017). Contribution rates are automatically deducted from employees' paychecks; social law stipulates that half of the contribution rate is formally paid by the employee and the other half by the employer.[3]

About 95% 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, and 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). To differentiate their product and attract enrollees, in addition to engaging in price competition, sickness funds can add non-essential benefits to their benefit package, or improve the quality of their customer service (Bünnings et al., 2015).

Social insurance legislation also restricts cost-sharing. Deductibles and co-insurance rates are prohibited in SHI, and only small copayments can be charged for hospital stays (€10 per day), medical devices (€5-10 per device) and prescription drugs (€5-10 per drug). These copayments must not vary across sickness funds. Hence, cost-sharing differences across health plans are not part of the objective function when enrollees consider switching sickness funds.

Switching funds is uncomplicated: the minimum contract period is 18 months and there exists no formal enrollment period; guaranteed issue exists; and, today, several specific search engine websites help consumers to compare and switch health plans. If sickness funds increase prices, which happens regularly, they have to inform enrollees in written form. Enrollees may then immediately cancel their contract and switch funds.

## 2.1 Pre-1996 Allocation of Enrollees to Employer-Based Health Plans

Germany was the first country worldwide to implement compulsory public health insurance for some population subgroups in 1883.[4] Traditionally, employees were allocated to sickness funds based on their occupation or industry and had no right to switch funds. Since the 1980s, the number of sickness funds has sharply decreased from more than one thousand to 113 remaining funds (GKV Spitzenverband, 2017). These sickness funds have traditionally been categorized into six categories. Large parts of

[3]Since January 1, 2015 the contribution rate has been equalized and standardized at 14.6% of gross wages. Only these 14.6% are equally shared by employees and employers. See Schmitz and Ziebarth (2017) for more details on the reform that standardized and equalized contribution rates.

[4]Gesetz, betreffend die Krankenversicherung der Arbeiter (KGV), passed May 29, 1883.

the empirical analysis are based on differences between these sickness fund categories (*Krankenkassenarten*).

Table 1 provides a concise overview of each of the six German names, their acronyms, their English translation, and their historical employee target group along with some characterizing sociodemographics from Table A2.

**[Insert Table 1 about here]**

The BKN has been the *Federal Miners' Guild*. Its risk pool is the oldest, most male, and the one with the highest incomes. IKK was for craftsmen with roughly three-quarters of blue collar workers, below average incomes, but also a lower share of disabled. Hundreds of small BKKs existed even in the 1990s as each of them was reserved for employees of the specific company. BKK enrollees pretty much represent the average enrollee in our dataset (Table A2). EAR and EAN were specifically for blue and white-collar workers, respectively. This is reflected in the very high shares of blue and white collar enrollees. EARs also had the highest share of disabled enrollees. Finally, most Germans have been enrolled in AOKs which were traditionally reserved for blue collar workers who could not be assigned to other funds. As we will see below, the AOKs have been the biggest beneficiary of risk adjustment since 1994. Because AOKs have the least healthy (and the least wealthy) enrollees, they have consistently been allocated money by the RAS. Their prices have been the highest in the pre-RAS era and decreased substantially since then.

Table A3 in the Appendix shows statistically significant differences in enrollee populations when regressing enrollment in each of the six sickness fund types on a set of covariates (see Section 3). One finds that AOK enrollees are significantly older, poorer and lower educated than the average enrollee. In addition, EAN enrollees are significantly more likely to be female, better educated, and have higher self-reported health. As we will see below, consequently, the EAN has been consistently paying into the RAS.

### 2.2 The German Risk Adjustment Scheme (RAS)

In 1996, to foster market competition, switching sickness funds became a legal right. As a result of this new option for consumers, an RAS had already been implemented in 1994 for the following three reasons (Deutscher Bundestag, 1992): (a) To ensure a "fair" market-based competition between sickness funds by equalizing differences in risk pools across insurers. (b) To equalize the enormous price differences across sickness funds in this social insurance pillar, which is based on the "solidarity principle." As illustrated by Figure 1, in pre-RAS years, the average AOK enrollee (and their employers) paid a two percentage points (ppt) higher contribution rate than BKK enrollees. We will show in the Results Section that this spread translates into premium differences of more than €500 for each of the paying parties, employees and employers. And (c) to avoid cream-skimming on the insurer side and undo adverse selection in the market. Since its inception in 1994, the Federal Insurance Agency (FIA) (*Bundesversicherungsamt*) has been administering the RAS.

**[Insert Figure 1 about here]**

At its inception in 1994, the German RAS was based on three factors: age, gender, and disability status (Bundesversicherungsamt, 2004).[5] Because the SHI is funded by income-dependent contributions, the RAS required a two-sided adjustment. It was based on (a) differences in expenditures due to age, gender and disability status, and (b) differences in revenues due to differences in income. Roughly half of the money was redistributed as a result of differences in health risks and the other half as a result of differences in income (Bundesversicherungsamt, 2004).

From 1994 to 2008, the RAS worked as follows (Bundesversicherungsamt, 2004; IGES and Lauterbach and Wasem, 2004).[6] In a first step, to address differences in health risks (a) above, the FIA generated 91 age cells for males and 91 age cells for females ($<1,..,\geq 90$). In addition, disabled individuals were categorized into 31 age cells for each gender.[7] Then, for each age-gender-disability cell, the FIA calculated the average health care expenditures that were produced by the essential benefit package. The calculations were based on administrative claims data and carried out without regression models retrospectively at the end of the calendar year. Administrative costs and voluntarily provided benefits were not considered in these standardized expenditure calculations.

Considering the number of insured enrollee days that each sickness fund provided for each of the age-gender-disability cells, the risk-adjusted "Contribution Needs (CN)" were simply the sum of average expenditures over each cell, multiplied with the number of insured enrollee days for each cell. Formally,

$$CN_{i,t} = \sum_{c=1} Days_{c,i,t} \times \overline{E}_{c,t} \tag{1}$$

where $\sum_{c=1} Days_{c,i,t}$ is the sum of insured days for age-gender-disability cell c, sickness fund i, and calendar year t. $\overline{E}_{c,t}$ are average expenditures for age-gender-disability cell c in year t due to medically necessary treatments (which are covered by the essential benefit package).

[5] In 2002, a jointly financed high risk pool was additionally added and, in 2003, enrollees in disease management programs (DMP) were added as an additional risk adjustment factor. However, because only 0.2% were enrolled in such DMPs, this factor has been considered negligible (Bundesversicherungsamt, 2004). Until 1999, there existed one RAS for East Germany and one RAS for West Germany. They were entirely independent. Beginning in 2000, both systems have been gradually unified. To be precise, "disability status" means an officially diagnosed "reduced earnings capacity" due to health limitations; see Burkhauser et al. (2016) for a comprehensive description of the German disability insurance system.

[6] Since 2008, the RAS also considers 80 different chronic (and very expensive) diagnosed diseases, which is why it is sometimes called Morbi(dity)-RAS (Bundesversicherungsamt, 2008; Wissenschaftlicher Beirat, 2011).

[7] Moreover, because the essential benefit package also covers income-dependent long-term sick pay from week 7 up to week 78 of a sickness episode (Ziebarth, 2013), all age-gender-disability cells are differentiated by three different eligibility categories for long-term sick leave (and two for the disabled cells). Hence, in total, there are $3\times2\times91 + 2\times2\times31=670$ cells. Moreover, since 2003, the cells have been further differentiated by DMP.

Second, to address differences in income (b) above, the FIA calculated the total "Contribution Base (CB)" by summing up all taxable employee gross wages (up to the contribution ceiling) for all sickness funds in a given year.

$$CB_t = \sum_{i=1} \sum_{e=1} W_{e,i,t} \tag{2}$$

where $W_{e,i,t}$ are gross wages of enrollee e of sickness fund i in year t. By dividing $\sum_{i=1} CN_{i,t}/CB_t = \overline{CR}$, one obtains the average contribution rate that would be necessary in a single payer system to cover all expenditures of the essential benefit package (without considering administrative costs and supplemental benefits). By multiplying $\overline{CR}$ with $CB_{i,t}$ for each sickness fund, one obtains the "Financial Power (FP)" of each sickness fund.

$$FP_{i,t} = \overline{CR} \times CB_{i,t} \tag{3}$$

Finally, the difference between FP and CN is the "Adjustment Amount (AA)" that was paid out or charged by the FIA through the RAS.

$$AA_{i,t} = FP_{i,t} - CN_{i,t} \tag{4}$$

**Timing of RAS Calculation and Pay-Outs.** Based on the functioning of the German RAS, we specify our empirical model in the next section. Specifically, to estimate pass-through rates, we regress premiums in year t (and other financial indicators of sickness funds) on (changes in) RAS allocations in year t-1. We lag RAS allocations by one year because the FIA carried out the calculations in equations (1) to (4) at the beginning of year t retrospectively for year t-1. While advanced monthly RAS installments were made throughout the year t-1, the final calculations were only carried out in t when total SHI claims and premiums (which are based on time-varying wages) for t-1 were fully known for all SHI enrollees of all funds (Bundesversicherungsamt, 1994).

To the extent that the three risk-adjustment factors predicted systematic differences in health care utilization, the RAS equalized structural differences in health care spending across risk pools and eliminated incentives for active or passive risk selection. A constant criticism of the German RAS has been the claim—supported by official reports (IGES and Lauterbach and Wasem, 2004; Wissenschaftlicher Beirat, 2011)—that simple expenditure averages over age-gender-disability cells $\overline{E}_{c,t}$ would not consider differences in health risks comprehensively. In other words, there would still exist incentives for insurers to cream-skim. In an audit study, Bauhoff (2012) finds some (limited) evidence that insurers try to actively cherry-pick good risks. However, other studies do not find much evidence for risk selection by sickness funds (Nuscheler and Knaus, 2005).

If sickness funds were unable to cover their total costs by their contribution rate revenues and RAS allocations, they could either (i) charge higher contribution rates and increase revenues, (ii) reduce their savings (reserves or assets), or (iii) reduce expenditures. Reducing spending could be achieved by managing enrollees' health care better (e.g., by providing preventive care, education, or special bonus programs such as disease-management programs), by cutting back on customer service or other administrative costs, or by reducing non-essential voluntary benefits. One main objective of this paper is to empirically identify the monetary flows into these diverse channels when RAS allocations increase or decrease from one year to the next.

# 3 SOEP Enrollee Panel Data Linked to Administrative Data

The German Socio-Economic Panel Study (SOEP) contains enrollee-level panel data for Germany. The SOEP is a representative longitudinal survey that started in 1984 and surveys information annually at the household and at the individual level. Currently, the SOEP interviews more than 20,000 individuals from more than 10,000 households each year (Wagner et al., 2007).

## 3.1 Sample Selection

In total, we use 21 waves from 1984 to 2004 and focus on West Germany.[8] Specifically, we make use of respondents' self-reported type of sickness fund (*Krankenkassenart*), which has been consistently surveyed since 1984.

We focus on the 90% of Germans who were covered by SHI and exclude those 10% who were covered by PHI. Moreover, we focus on policyholders to obtain exactly one observation per health plan choice decision and year. In doing so, we restrict the sample to policyholders who were full-time employed. This excludes all those insured under SHI family insurance, the part-time employed (who may only pay a reduced price depending on their income), the self-employed (whose income and thus premiums may fluctuate significantly), the unemployed (for some of whom the unemployment insurance pays the premium), full-time students (who just pay a reduced flat premium), pensioners as well as other special population groups such as draft soldiers.

We use SOEP-provided sample weights for all quantitative analyses. In addition, we express all monetary values in 2015 euros using the official German CPI (German Federal Statistical Office, 2016b). Overall, we make use of three different time periods and samples: (a) To analyze differences in risk pools before and after free health plan choice became a legal right, we use the full time period and compare 1984 to 1995 vs. 1996 to 2004. (b) To estimate pass-through rates and the impact of RAS

[8]We disregard East Germany because of the existence of the GDR until 1990 and the subsequent transition period to the West German system that does not allow a clean analysis.

allocations on various financial indicators, we use the time period from 1991 to 2004. Financial indicators by sickness fund type have been available since 1991 (see below). (c) To analyze health plan switching and characterize switchers, we make use of the time period from 1996 to 2004.

### 3.2 Contribution Rates, RAS Allocations, and Financial Indicators

We collect publicly available administrative data by year and sickness fund type and merge these data with the SOEP.

**Prices and Premiums**. SHI sickness funds do not charge absolute insurance premiums in euros, but contribution rates (up to a contribution ceiling) as a share of the gross wage. The annual contribution rates, by type of sickness fund and separately for East and West Germany, are publicly available (Deutscher Bundestag, 1998; Müller and Lange, 2010; German Ministry of Health, 2016; German Federal Statistical Office, 2017). We merge these price data with the SOEP based on respondents' self-reported type of sickness fund and the interview date. Then, using the monthly gross wage, the contribution rate and the contribution ceiling, we calculate the employee share of the monthly premium. The upper panel of Table A1 contains descriptive statistics and shows an average contribution rate of 13.1%, which translates into an average annual employee share of € 2200 (∼ $2500[9]); employers contributed the same amount.

**RAS Allocations**. Total RAS allocations per type of sickness fund, year, and East-West are publicly available and released by the FIA (Bundesversicherungsamt, 2016). These are net payments or charges. We normalize net RAS allocations by the number of sickness fund enrollees in that year. The average value per enrollee is € -67 and varies between € -767 and € 1426 (Table A1).

**Financial Indicators**. Furthermore, we collect financial indicators at the yearly sickness fund type level for 1991 to 2004 and also normalize them by the number of enrollees.[10] Sickness funds have to submit these balance sheet statistics annually to the Federal Ministry of Health (German Ministry of Health, 2016; Deutscher Bundestag, 2004; German Federal Statistical Office, 2016a). Table A1 shows that, on average, financial reserves were € 72 per enrollee[11] and assets € 191 per enrollee. Annual health care spending was € 2109 and administrative costs € 119 per enrollee.

[9] Using the euro-dollar exchange rate as of writing (1:1.12).

[10] Prices and financial reserves are reported separately for East and West Germany; all other indicators are only available for reunified Germany. Asset data are only available until 2002.

[11] The Social Code Book V stipulates guidelines for the minimum and maximum amount of financial reserves (§ 260(2), 261(2)). Accordingly, the minimum amount is one quarter of the insurer's (average) monthly expenditures and the maximum amount 2.5 times average monthly expenditures. In practice, these limits are not strictly enforced but sickness funds need approval by a government agency every time they change prices (§70(5) SGB V).

### 3.3 Socio-Demographics and Health Plan Switching at the Individual Level

Table A1 also shows weighted means of all other covariates. The first set contains *Demographics* like gender, age, marital status, or household size. The second set contains *Education and Labor Market* indicators and the third the self-reported *Health Status* of respondents.

The top panel *Health Insurance* also lists *Switched HI last year* which indicates whether enrollees switched their sickness fund between the end of the year before the previous calendar year and the interview (which were carried out between January and March). This variable is generated from individual-level survey responses. Specifically, after respondents indicate their sickness fund type, the questionnaire directly asks, e.g., in interviews carried out in spring 2000: “Since December 31, 1998, have you switched sickness funds?” In German, it is very clear that this question refers to *any* switch of health plans, also within the same sickness fund type. This means that we can identify every health plan switch of a policyholder with minimal reporting bias.[12] In contrast, it should be kept in mind that the administrative data discussed above (which we merged into the SOEP) vary at a higher aggregated level, the sickness fund *type* level.

The mean enrollee switching rate for the years 1996 to 2004 is 7.5% (not shown in Table A1). When analyzing how many enrollees have switched their plan *at least once* since 1996, one finds a steadily increasing share over time. In 2004, about a quarter of all SHI enrollees had switched their sickness fund at least once since 1996.

## 4 Results

### 4.1 Descriptive Evidence

Figure 1 shows market price dispersion from 1991 to 2004. Specifically, it shows the deviations from the average contribution rate by sickness fund type and year. Several points are noteworthy.

First, prior to 1994, differences in contribution rates were significant. The BKKs charged contribution rates that were 1.5ppt lower than the average rate, while the AOKs consistently charged the highest contribution rates. As we will learn in Section 4.5 below, a two percentage point spread in contribution rates represents a difference in the employee share alone of more than €500 annually, reflecting the status quo in the absence of risk adjustment. Note that Figure 1 just shows average price differences by sickness fund *type*. While the individual-level income information allows us to calculate the spread

[12] The number of sickness funds has decreased substantially over time, almost exclusively due to mergers between two funds. When sickness funds merge, enrollees are automatically transferred to the new sickness fund and remain enrolled; they do not lose their insurance and do not have to take any action. This means that mergers are not recorded as switches here. However, enrollees will be informed about the merger in written form and have an extraordinary right to cancel the agreement and switch funds if prices increase simultaneously.

in euro premiums quite accurately (min €752, max €3618 p.a., Table A1), the true variation was even larger because contribution rates also differed considerably *within* sickness fund types.[13]

Second, after the implementation of the RAS in 1994, contribution rates converged. The spread in contribution rates had been halved from roughly 2ppt in 1993 to 1ppt in 1999 (Figure 1). Next we investigate the underlying mechanism that reduced market price dispersion but did not result in a full convergence of prices.

Figure 2a (top) plots RAS allocations per enrollee on the x-axis and contribution rates on the y-axis. Not surprisingly, one finds a significant positive correlation coefficient of 0.34: Sickness funds that (had bad risk pools and) charged high contribution rates were also those that received RAS allocations. On the other hand, sickness funds with a good risk pool and low contribution rates had to pay into the RAS (Section 2.2).

**[Insert Figure 2 and Figure 3 about here]**

Figure 2b (bottom) now relates *changes* in RAS allocations (from t-2 to t-1) to *changes* in contribution rates (from t-1 to t). Because nominal contribution rates have been increasing over time, we plot changes in contribution rates relative to market price increases. As seen, Figure 2b now shows a negative association between changes in RAS allocations and changes in contribution rates. The correlation coefficient is -0.05 but not statistically significant. Still, Figure 2b yields first evidence that sickness funds may have passed the allocated RAS money partly through to consumers via lower prices.

Next, Figure 3 correlates changes in RAS allocations and changes in sickness funds' (a) financial reserves, (b) assets, (c) administrative costs, and (d) health care spending. Three of the four scatterplots have positive slopes and (a) and (b) are even statistically significant. The next section will formally evaluate these pass-through rates via parametric regression models which net out common time shocks, geographic differences and control for a rich set of enrollee background characteristics.

## 4.2 Estimating RAS Pass-Through Rates

**Model.** This section estimates the following parametric model:

$$y_{it} = \beta_0 + \beta_1 RAS_{p,t-1} + \gamma X_{it} + \rho_s + \phi_t + \delta_p + \sigma_i + \varepsilon_{it} \quad (5)$$

[13]Moreover, recall that we focus on West Germany, which additionally understates the true variation in contribution rates in reunified Germany.

where $y_{it}$ indicates the price of enrollee's $i$ health plan in year $t$. $X_{it}$ includes socio-economic control variables of enrollee $i$ in period $t$. These are demographics, educational and labor market characteristics as well as enrollees' health status (see Table A1). $\rho_s$ are state fixed effects that net out permanent differences across the 11 West German federal states. Year fixed effects, $\phi_t$, net out common year shocks. $\delta_p$ represent sickness fund type fixed effects and $\sigma_i$ individual fixed effects. The standard errors $\varepsilon_{it}$ are clustered at the sickness fund type level (Bertrand et al., 2004).

**Identifying Assumptions.** In Section 2.2, we laid out why our empirical pass-through model regresses health plan prices in t on RAS allocations in t-1. In short, the reason is that health plans are only informed about their true RAS t-1 allocations in year t (but the data record them for t-1). This is because the exact risk adjustment for more than 70 million SHI enrollees can only be carried out retrospectively after all claims and premiums of year t-1 are known. In the Appendix, we also show robustness checks with $RAS_{p,t}$.

Second, one main, yet reasonable, assumption of equation (5) is that RAS allocations—which are calculated by the FIA based on equations (1) to (4)—are exogenous. More precisely, the exogeneity assumption only has to hold conditional on $X_{it}$ which includes measures of *all* risk adjusters such as age, gender and disability status. In addition, equation (5) controls for state fixed effects, year fixed effects, *and* sickness fund type fixed effects, meaning that the pass-through rate is identified by linking *changes* in RAS allocations for $\delta_p$ to changes in prices. It appears very plausible that, conditional on $X_{it}$, $\rho_s$, $\phi_t$, $\delta_p$, and $\sigma_i$, changes in RAS allocations between t-2 and t-1 (which are declared in t) are exogenous and not correlated with $\varepsilon_{it}$.

Third, if this main identifying assumption holds up, equation (5) identifies the pass-through rate. It provides an answer to the question: By how much do health plan prices (here: contribution rates and premiums in euros) change when RAS payments increase by one euro per enrollee compared to the other years and other funds. Moreover, as discussed in Section 3.2, we did not just collect annual price data of health plans, but also financial measures such as health care spending, reserves, assets, and administrative costs. These data are available for the years 1991 to 2004. We use them as alternative dependent variables $y_{it}$ in equation (5) to test whether redistributed RAS money only results in higher or lower premiums, or whether sickness funds also alter their health care spending, savings and administrative costs.

Finally, in heterogeneity tests, we will differentiate by RAS increases and decreases and test for asymmetric effects.

**[Insert Table 2 about here]**

**Main Results.** Each column in each panel of Table 2 represents one model as in equation (5). We add control variables stepwise from column (1) to column (3) and always cluster standard errors at the type of sickness fund level. All models include the years 1991 to 2004 where the pre-RAS years 1991 to 1993 are the baseline years. Also, it is worthwhile to mention that, whenever we talk about price increases or price decreases, we actually mean price changes in *relative* terms—relative to the market average. Nominal health plan prices have been steadily increasing and absolute price decreases are very rare.

Panel A uses contribution rates in percentage points as the dependent variable. Model 1 only includes year and state fixed effects and yields a non-significant and positive regression coefficient analogous to Figure 2a. When adding sickness fund type fixed effects, we obtain a regression similar to Figure 2b. The pass-through rate is now identified via *changes* in RAS allocation between t-2 and t-1. As seen, we find a negative and highly significant relationship between changes in RAS allocations and contribution rates. The interpretation of the (scaled) coefficient suggests that, for every €1000 in RAS allocations per enrollee, the contribution rate decreases (relative to average market prices) by 0.78ppt. It is reassuring that adding the RAS adjusters age, gender, disability as well as other socio-demographics does not alter either coefficient sizes nor significance (Model 3). This suggests that, as expected, individual-level changes in these socio-demographics are not correlated with RAS allocations and health plan prices via a third unobserved variable.[14]

The dependent variable in Panel B is the employee share of the annual health insurance premium (in 2015 euros). To recall, based on the contribution rate, the individual gross wage and the annual contribution ceiling, we calculate premiums at the individual level (see Section 2). Again, the coefficient estimates are very robust whether we include individual-level adjusters or not. Our preferred model in column (3) shows an employee premium pass-through rate of 0.21 meaning that, for every additional euro per enrollee, employee premiums decrease by 21 cents on average. Interestingly, this is exactly the same figure that we obtain when multiplying the 0.78ppt contribution rate increase in Panel A with the IV estimate in Section 4.5 below.[15] Adding the employer share to this 0.21 (which is the same as the employee share) the pass-through rate to consumers increases to 0.42. This is very close to what similar studies find for Medicare Part C in the US (Cabral et al., 2014).

The incomplete pass-through rate can explain why market price dispersion has decreased after the introduction of the RAS, but not been fully eliminated (Figure 1).

Panels C to G of Table 2 shed more light on where the remaining 58 cents per RAS euro likely went. Recall that sickness funds are non-profit organizations and cannot disburse profits to shareholders. Panel C demonstrates that financial reserves increase by 5.5 cents for every additional RAS euro. The point estimate is statistically significant at the ten percent level. Panel D shows an increase in assets by a significant 12.8 cents for every RAS euro. And Panel E does not provide any evidence that, on

[14] Note that we use the socio-demographic covariates as of year t in the main model. However, the findings are very robust to using the values for t-1 for respondents who were interviewed in both years (available upon request).

[15] In Section 4.5 we use RAS allocations as instruments for contribution rates to correct for possible endogenous price setting at the health plan level. The results show that a one percentage point higher contribution rate translates into a €268 higher annual premium. Here we find an almost identical pass-through rate of 0.78×0.268=0.209.

average, administrative costs increase when sickness funds are allocated more money. In contrast, the imprecisely estimated 0.22 coefficient in Panel F suggests that some funds may also alter their spending on health care as a response to more (or less) money.

However, underlined by Panel G, which uses total revenues from contribution rates (i.e. employee *and* employer contributions) at the sickness fund level as dependent variable, the premium pass-through appears to be clearly the most important channel. The coefficient in column (3) of Panel G is 0.75 and significantly larger than the estimated pass-through rate at the individual level in Panel B (even when adding the employer share in Panel B which yields 0.42, see above). There are several explanations for this larger premium pass-through rate. Recall that Panel B yields the consumer pass-through rate whereas Panel G the revenue pass-through rate. Both are measured at different levels and by different concepts. For example, the estimate in Panel B controls for changes in the risk pool in response to lower prices and also adjusts for wage differences at the individual level. Panel G just measures net changes in overall revenues from premiums at the (type of) sickness fund level. However, the downside of the estimate in Panel B is that it is based on self-reported gross wages which are known to contain measurement error and under reporting (Bound et al., 2001; Schräpler, 2004). Hence we interpret the consumer pass-through rate in Panel B as lower bound estimate and the revenue pass-through rate in Panel G as upper bound estimate. Assessing heterogeneity in the pass-through rate by RAS revenue increases or decreases will shed further light on its size.

**Heterogeneity by RAS Increases or Decreases.** Table 3 tests heterogeneity in the pass-through rate and differentiate by whether RAS allocations increased or decreased. One can hypothesize that it may make a difference whether an insurer's budget expands or contracts relative to expectations. Specifically, we add an additional dummy variable—indicating whether RAS allocations increased between t-2 and t-1—to equation (5), both in levels and in interaction with $RAS/enrollee_{t-1}$. Otherwise the setup of Table 3 is the same as in Table 2. The plain $RAS/enrollee_{t-1}$ coefficient yields the effect for insurers with decreases in allocations, and the sum of $RAS/enrollee_{t-1}$ and $RAS/enrollee_{t-1} \times RAS\ increase_{t-1}$ yields the effect for insurers with increases in allocations (which could, however, still be net RAS payers).

**[Insert Table 3 about here]**

Panels A and B of Table 3 provide some suggestive evidence that insurers whose RAS allocations increase (relative to the year before) pass this increase through to lower premiums at a higher rate. Accordingly, they would decrease prices more than insurers whose RAS allocations decrease would increase prices. However, both interaction terms are not statistically significant.

Panel C suggests that the potential change in financial reserves is driven by funds whose allocations increase but, again, we lack statistical power. Panel D does not deliver much evidence for asymmetric effects when it comes to using assets as financial buffer. Sickness funds whose RAS allocations decrease relative to the year before, reduce their assets by 12 cents for every euro decrease. The elasticity is almost the same for funds that receive more money. However, interesting, Panel E strongly suggests that sickness funds with higher RAS allocations also increase their administrative spending by 2.9 cents for every euro (Model 3); but funds who have to pay more do not or cannot cut administrative costs in the short-run.

Finally, Panel F and G provide some interesting insights, too. Accordingly, funds whose RAS allocations increase do not spend more on health care, but when a fund's budget contracts, they do spend 36 cents per euro decrease less. Moreover, the revenue pass-through rate is higher and almost 0.9 (-0.446 + (-0.417), Model 3) when funds get more money. This means that sickness funds appear to spend almost all of their additional revenues on the revenue side (consistent with *no* higher health care spending in Panel F). In contrast, the pass-through rate for funds whose budgets contract is just 0.45 suggesting that those funds increase prices by less than funds with expanding budgets decrease them (as also suggested by Panel A).

As a last point, the counterfactual scenario here could be thought of as a world without RAS. Compared to a world without RAS, it should not matter whether the redistributed money stems from revenue equalization due to income differences across risk pools, or from expenditure equalization due to health differences across risk pools. Analyses suggest that both operate in the same direction and that about half of the total RAS amount charged (or assigned) is due to income and health differences, respectively (Bundesversicherungsamt, 2004).

### 4.3 Who Switches? Has Consumer Choice Led to More Risk Segregation?

In addition to estimating RAS pass-through rates and the impact of the RAS on price dispersion, the second main objective of this paper is to analyze switching behavior. Specifically, we intend to assess whether risk segregation has increased or decreased after free health plan choice became a legal right in 1996. This second research question cannot be answered in a standard causal effects reduced-form framework but rather by providing several pieces of empirical evidence that, we believe, suggest an answer to this question.

**[Insert Figure 4 about here]**

Figure 4 provides two main stylized facts that strongly suggest an increase in risk segregation over time. First, it shows that RAS recipients and payers have largely remained identical over time; their status has even been exacerbated: AOKs have always been the beneficiaries of the RAS schemes. As a result of their worse risk pool and the lower income of their enrollees (Table 1 and A3), their real RAS allocations have increased from €101 in 1994 to €499 per enrollee and year in 2004. The other sickness fund types paid into the RAS. In particular, the EAR consistently paid between €181 and €668 per year and enrollee. The BKKs developed from a minor payer to the biggest payer in 2004 (€712 per enrollee), suggesting that healthy and young switchers have predominately chosen the cheap BKK plans.

Second, Figure 4 shows that the volume of real and normalized RAS redistribution has steadily increased over time. In 1996, when the RAS system had been fully implemented[16], the total volume of RAS redistribution equaled €14.1 billion. This volume increased by 51% to €21.3 billion until 2004 (Bundesversicherungsamt (2016), values not shown). By comparison, SHI health care spending increased only by 23% and real gross wages increased only by 11% between 1994 and 2004 (German Federal Statistical Office, 2017, 2016a). The fact that the volume of RAS redistributions increased substantially faster than health care spending and real gross wages strongly suggests that health risk and income segregation have increased over time. The FIA and official reports confirm this conjecture and estimate that 60% of the increase in the volume is attributable to greater health risk segregation, and the other 40% to more income segregation (Lauterbach and Wille, 2002; Jacobs et al., 2002; Bundesversicherungsamt, 2004). We will now characterize health plan switchers and examine in more detail why the freedom to switch plans has resulted in more risk segregation.

**[Insert Table 4 about here]**

The first two columns of Table 4 characterize the sample of switchers. The dependent variable is *Switched HI last year* and equals one if the respondent switched sickness funds in the previous year. Recall that this measure identifies every switch, not just across types of sickness funds.[17] The two models condition on the years from 1996 to 2004 referring to switches from 1995 to 2003. Column (1) just includes the covariates age, gender, sickness fund type fixed effects, state fixed effects, and year fixed effects—in addition to several health measures. Column (2) adds all other socio-demographics.

With 36 to 45 year olds serving as baseline category, we clearly find that younger enrollees are significantly more likely to switch. Moreover, the relationship is large in size and highly significant. Relative to the mean switching rate of 6.8% for people aged 36 to 45 years, age groups younger than 36 are around 2ppt more likely to switch health plans. By contrast, enrollees who are 56 to 64 years old are around 4ppt less likely to switch.

The self-reported health satisfaction (SWH) point estimates are small in size and lack statistical precision, which may be a function of either their crude measurement or the fact that they include measurement error (c.f. Ziebarth, 2010b). In contrast, our only objective health measure *Hospital stay* yields a marginally significant relationship with the likelihood to switch plans (column (1) of Table 4): Enrollees who were hospitalized in the past calendar year are 1ppt, or about 15%, less likely to switch health plans in the same year.

[16]The first year was a phase-in period and did not fully consider all risks.

[17]However, unfortunately, the specific question that identifies every single switch even within types of funds was only asked in 1997 for the first time. This means that the base year, switches in 1995, only identifies sickness fund *type* switchers. Thus we likely overestimate the true increase in switching after 1995.

When we split the general switching indicator into sickness fund type dummies indicating whether respondents selected an AOK, BKK, IKK, EAR or EAN one finds the same basic pattern but also some notable differences (available upon request): first of all, all switchers are more likely to be younger. In the refined regressions, it also becomes clear(er) that switchers are healthier (*SWH highest* is significant in 4 out of 6 models). However, while switchers into the AOK system are also younger and healthier, unlike the average switcher, they are also more likely to be blue collar and have lower education. This is probably related to state dependence and reputation effects of the AOK system among blue collar workers.

Note that these findings are entirely in line with earlier SOEP studies which also found that switchers in the German SHI are younger and healthier (Andersen and Schwarze, 1999; Schwarze and Andersen, 2001; Andersen and Grabka, 2006). Based on administrative claims data, Jacobs et al. (2002) report that switchers have significantly lower health care costs. Moreover, an increase in risk segregation has also been found by several other studies based on different methods and data (Jacobs et al., 2002; IGES and Lauterbach and Wasem, 2004).

**[Insert Figures 5 and 6 about here]**

Figure 5 plots the year dummies of the regression in column (1) of Table 4. After switching health plans became a legal right, the probability to switch increased sharply by about 6ppt in the first year and then continued to increase further in the following years. One could speculate that the decrease in sickness funds has even dampened the increase in switching rates due to less choice. On the other hand, Frank and Lamiraud (2009) have shown that more choice—more than 50 plans to choose from—may actually reduce enrollees' willingness to switch.

Next, we examine whether the same enrollees switched every year, or whether the switching rate is produced by different sets of switchers every year. To do so, we use *Switched HI since '96* as outcome measure. Columns (3) and (4) of Table 4 display the results. Again, one finds that older people, blue collar workers, and less educated employees are significantly less likely to switch. And, again, we plot the year dummies (Figure 6). As seen, the likelihood of having switched at least once increases almost linearly over time to around 28% over the eight years from 1996 to 2003. In the first decade after switching health plans became a legal right, about a quarter of all policyholders have actively taken advantage of this new consumer right to switch.

**[Insert Figures 7 and 8 about here]**

Figures 7 and 8 show simple before-after comparisons of socio-demographics across sickness funds over time. Using our representative SOEP data, the figures plot changes in enrollees' socio-demographics and health statuses of all five health plan types before and after 1996. More specifically, we calculate

$$\widetilde{X}_{p,post-pre} = \frac{\overline{X}_{p,post} - \overline{X}_{p,pre+post}}{\sqrt{Var(X_{p,pre+post})}} - \frac{\overline{X}_{p,pre} - \overline{X}_{p,pre+post}}{\sqrt{Var(X_{p,pre+post})}} \tag{6}$$

where $\overline{X}$ stands for the variable mean, p is the sickness fund type, and pre is the pre-switching period from 1984 to 1995. Take the BKK and females as an example: According to Figure 7, the standardized pre vs. post 1996 difference is +0.19. We obtain this value because the share of females in the BKK substantially increased between the pre and the post-switching period. From 1984 to 1995, the share was just 19% and, from 1996 to 2004, it increased to 27%—by 8ppt. The average of the entire period was 24% (std. dev. 0.42). According to our standardization in equation (6), we thus obtain a post-1995 value of (0.27-0.24)/0.42=0.071 and a pre-1996 value of (0.19-0.24)/0.42=-0.119. The difference is 0.19. This is the difference in percentage points scaled by the standard deviation.

The reason for this substantial increase in female BKK enrollees is likely attributable to the increase in the labor supply of females over the two decades investigated here. More women worked full-time, became SHI policyholders, and overproportionally often chose the cheap BKK. Note that Figure 7 also allows us to benchmark this change in the share of females in the BKK risk pool with the general trend for all other sickness funds. As seen, the share of females increased in three of the five sickness fund types but the BKKs witnessed the largest increase, suggesting it has been overproportionally often selected by new female SHI policyholders. Figure 7 also shows that the BKKs were the only sickness funds whose risk pool became younger over time.

Several pieces of additional evidence suggest that the cheap BKK system profited most from the new switching possibilities and attracted primarily young and healthy enrollees (Table 4). For example, when descriptively analyzing how many of our SOEP switchers have chosen the BKK vs. the AOK system, we find that about ten times as many switchers chose the BKK rather than the much larger AOK system (detailed results available upon request). This conclusion can also be derived from the facts that BKKs had the lowest prices (Figure 1) and that prices are by far the main switching determinant (Bünnings et al., 2015).

Figure 8 also reveals some interesting patterns. First, over the two decades, fewer enrollees needed inpatient treatments (recall that this measure excludes retirees and outpatient treatments) or were disabled. Second, in line with the other findings, one clearly observes that BKK enrollees became healthier over time: The BKK system not only witnessed less hospital stays and disabled enrollees; compared to the other funds, the share of BKK enrollees in the lowest SWH categories decreased and the share in the highest SWH categories increased over time.

**[Insert Table 5 about here]**

Our final empirical exercise to answer the question "Has risk segregation increased over time?" is to regress the contribution rate on our standard set of covariates and an interaction with the dummy *Post-RAS*. Table 5 displays the results.

The first column shows that younger enrollees paid significantly lower contribution rates than older enrollees—pre- and post-RAS. However, the age gradient has *steepened* over time in the RAS era, as seen by the significant and large interaction terms of *Post-RAS* and age groups 46 to 64. This holds despite the fact that sickness funds of older enrollees are significantly more likely to receive RAS payments (column (2) of Table 5). One reason for this finding is that older people are about 50% less likely to switch (Table 4).

Moreover, pre-RAS, white collar workers paid significantly lower contribution rates. In the post-RAS era, this statistical relationship flipped. Now white collar workers paid relatively *more* as indicated by the significant and positive interaction term; their funds had to pay into the RAS and thus raise contribution rates overproportionally (column (2) and Table 2). By contrast, blue collar workers benefited from the risk equaliziation.

Summing up, we provide several pieces of evidence suggesting that free consumer choice led to more risk segregation across sickness funds. However, because of the RAS redistribution and its significant impact on premiums, some socio-demographic subgroups such as blue collar workers still paid relatively less for health insurance in the post RAS era.

### 4.4 How Much do Switchers Save?

Realized savings can be calculated as the difference in the employee share of the annual premium between the old and the new sickness fund types. Switchers save on average €50 ($55) per year (Table A1). When regressing realized savings on our set of covariates (not shown), we find that younger enrollees, females, full-time and white collar workers are more likely to generate savings (not surprisingly because they are more likely to switch). However, the calculated savings underestimate true savings because we only have information on prices by sickness fund type but prices also varied within types of sickness funds. For example, Schmitz and Ziebarth (2017) show that the true savings rate for switchers was slightly below €10 per month from 2002 to 2008 in Germany.

Still we use our savings measure to explore whether there is evidence that the observed reduction in price dispersion (Figure 1) affected the savings rate. Figure A1 in the Appendix plots the year dummies of a model similar to the ones in Table 5. It shows that, despite some fluctuations, the savings rate remained relatively stable over time.

## 4.5 How Higher Contribution Rates Translate into Higher Premiums Across the Income Distribution

This final subsection serves two purposes: First, to provide evidence on how differences in contribution rates translate into euro premium differences across the income distribution. Recall that, pre-RAS, the average market price dispersion between sickness fund types was about two percentage points. And second, to correct for possible endogenous insurer price setting by instrumenting prices with RAS allocations. It seems plausible that contribution rates (and changes therein) are exogenous from the perspective of an individual enrollee, at least in Germany where the average health plan had 250K enrollees in the time period from 2002 to 2011 (Schmitz and Ziebarth, 2017). However, in particular in the US where employer-based plans can be very small, catastrophic health care expenditures of a single enrollee may affect premiums. In addition, the IO literature on health care markets typically assumes that prices are endogenous (at the market level) and models price setting explicitly.

For these reasons, we instrument health plan prices—the contribution rate—with annual normalized RAS allocations. To produce unbiased estimates, instruments have to be relevant and valid (Angrist and Pischke, 2009). Relevance means that the first stage relationship between the instrumented variable and the instrument is statistically significant and strong. The rule of thumb requires the F-statistic of the first stage to lie above 12. As Panel B of Table 6 shows, our instrument is highly relevant and the association between RAS allocations and prices is very strong. The F-statistic for the main model in column (1) is 60. Unfortunately, the second condition—validity—cannot be unambiguously tested and requires good reasoning. Validity implies the absence of a third unobserved variable that is correlated with both the instrument and the variable of interest. Given how the German RAS functions (Section 2.2), and especially when controlling for all risk adjusters as well as state, sickness fund type, and year fixed effects, it is very hard to imagine an unobservable variable that is driving the relationship between changes in RAS allocations and individual-level premiums. One theoretical candidate could be deliberate manipulation of the RAS scheme to favor specific health plans, i.e., corruption. Overall, it seems very plausible that our instrument is valid and that individual premiums are only affected by RAS allocations through their effect on contribution rates.

Panel A of Table 6 shows the potentially biased relationship between contribution rates and annual premiums. The first column shows that an increase in the contribution rate by one percentage point increases the employee share of the premium by €222 per year. Panel B shows that the IV estimate remains highly significant and increases in size. Accordingly, when the contribution rate increases by one percentage point, the employee share of the annual premium increases by €268. This implies that a contribution rate differences of 2ppt in the pre-RAS era (Figure 1) would translate into annual premium differences of about €500 ($560) per year just for the employee (and €1000 when considering the total premium).

**[Insert Table 6 about here]**

Next, we stratify the findings by income quartile. Columns (2) to (5) of Table 6 show the OLS (Panel A) as well as the IV (Panel B) results on how higher contribution rates translate into higher premiums. First of all, notice that the OLS and IV results are relatively close in magnitude and robust.

Second, not surprisingly, the impact of contribution rates—which are charged as a share of the wage up to the contribution ceiling—on absolute premiums in euros increases over the income distribution. For the first income quartile, the relationship suggests that a one percentage point higher contribution rate increases employee premiums by €105. For the second quartile, the increase is €163, for the third quartile, it is €207, and for the highest quartile €254 (Panel B).

Third, related to the average income in each quartile, these absolute premium increases represent 8.5%, 10.2%, 10.8%, and 9.1% of a monthly net wage, respectively. Consequently, we conclude that the premium burden as a share of the net wage is relatively stable between 8 and 11% over the income distribution when contribution rates increase by one percentage point. Thus, the funding of the health care system via contribution rates appears to serve its purpose and is roughly proportional to employees' net incomes. Although the fourth quartile only contributes up to the legally defined contribution ceiling (2017: €4350 per month), their relative burden is only slightly lower than for the second and third quartiles which, however, contribute the most as a share of their incomes.

# 5 Conclusion

To disincentivize insurers from cherry-picking good risks and to undo adverse selection of consumers, more and more countries with multi-payer health insurance markets have been implementing risk adjustment mechanisms. The specific designs of these risk adjustment schemes (RAS) differ across countries and markets, but they all share the feature that the regulator redistributes money from insurers with good risk pools to insurers with bad risk pools.

This paper has two main objectives. First, to study the impact of a simple RAS in the German multi-payer public health insurance market on premium pass-through rates and market price dispersion. Premium pass-through rates are crucial information for policymakers to assess the outcome of market regulation; for example, incomplete pass-through rates imply that policies which increase insurer revenues will only partially passed-through to consumers. The second objective is to study the introduction of free health plan choice in 1996 and its impact on switching rates and risk segregation. Whether more consumer choice increases or decreases risk segregation and adverse selection is also a crucial information for policymakers as it informs about the necessity of risk adjustment.

The German SHI market covers about 70 million enrollees who can choose between 40 and 70 not-for-profit health plans (“sickness funds”), depending on their state of residency. This free health plan choice was introduced in 1996, two years after the RAS went into effect. Prior to allowing consumers to choose between several dozen plans, Germans had very limited choice and most consumers were allocated to plans based on their employer or occupation. This system resulted in large structural differences in health plan prices and a very limited market competition.

Our findings are based on representative enrollee panel data from Germany over two decades. We link these panel data to administrative data on annual RAS allocations, health plan prices, and other financial indicators by sickness fund type. Our findings show that, prior to the RAS and the free choice of health plans, significant differences in risk pools existed. These differences translated into significant price differences. After the RAS implementation, sickness funds with “bad risk pools”—many old, lower income, and unhealthy enrollees—received risk-adjusted payments from the RAS. We show that these RAS allocations significantly reduced health plan premiums, by at least 42 cents per enrollee and euro allocated by the RAS. Depending on the specification, the upper bound of our revenue pass-through rate is almost 0.9 and higher than the findings for the (for profit) Medicare Part C market in the US (Cabral et al., 2014; Duggan et al., 2016). We also find evidence for asymmetric pass-through rates: Insurers seem to reduce prices more when they obtain more money, and raise prices less when their budget contracts. The findings also show that assets decrease by 13 cents when insurer budgets contract by one euro and a small increase in administrative costs of 3 cents per RAS euro when budgets expand.

Because of the significant but partial pass-through of RAS allocations to consumers, market prices converged over time but not fully. Despite the price convergence, we find that the savings of switchers remained relatively stable over time. Because switchers are younger, have higher incomes and better health than stayers—and because they are significantly more likely to switch to cheaper plans (Schmitz and Ziebarth, 2017)—free health plan choice increased the segregation of risk pools in Germany. Consequently, the volume of money that the RAS redistributed increased over time. Overall, one can conclude that the first version of the simple German RAS was effective and reduced market price dispersion while increasing consumer choice. However, several reports concluded that the simple RAS would not fully eliminate insurer incentives to cream-skim good risks and that a more refined RAS would be indispensable (IGES and Lauterbach and Wasem, 2004). Following these recommendations, a more sophisticated “Morbidity-RAS” with higher predictive power (which considers 80 expensive diseases) was introduced in 2008.

More research on the consequences of free health plan choice and different types of risk adjustment is indispensable to improve risk adjustment, consumer choice, and market competition.

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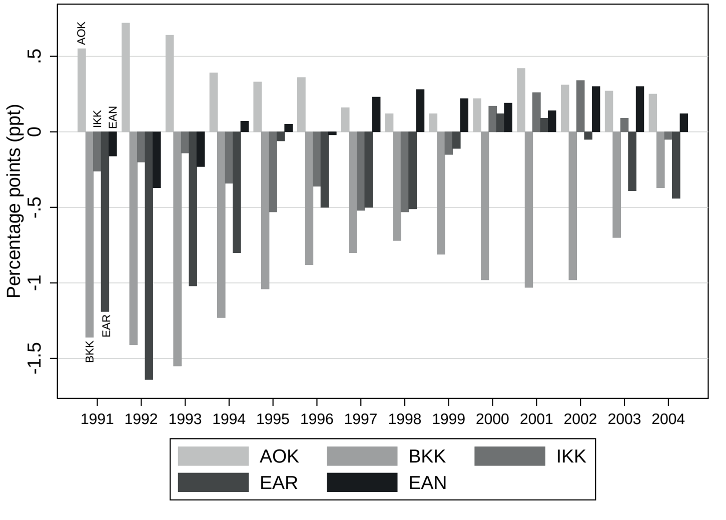
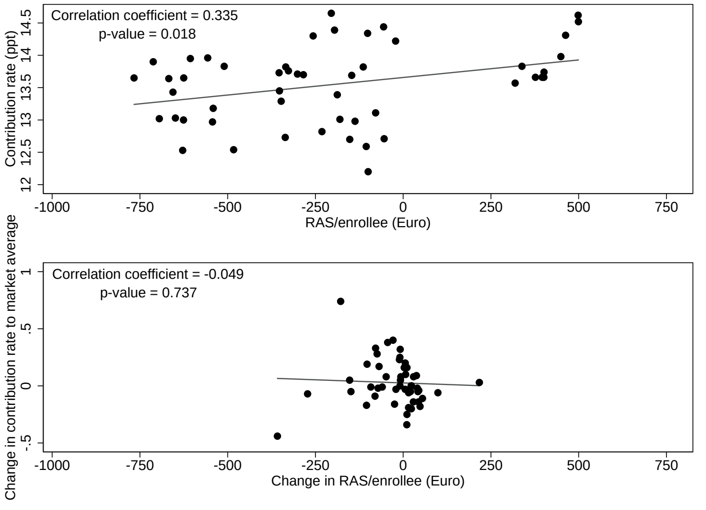
# Figures and Tables

Figure 1: Contribution Rates Relative to Market Average by Sickness Fund Categories



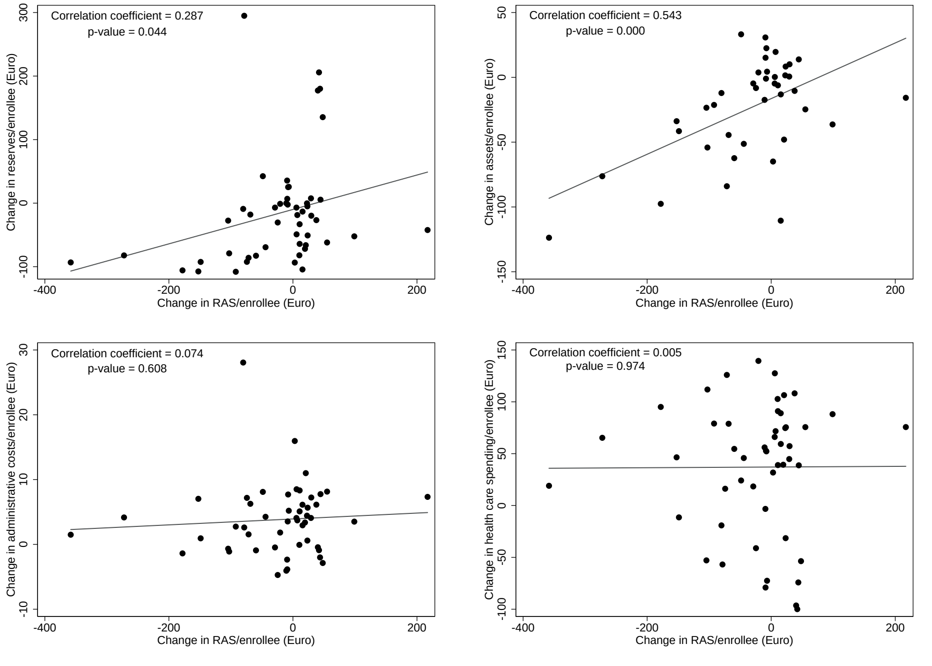

*Source:* German Ministry of Health (2016), own calculations, own illustration. Only values for West Germany are shown.

Figure 2: RAS Allocations per Enrollee and (Change in) Contribution Rates



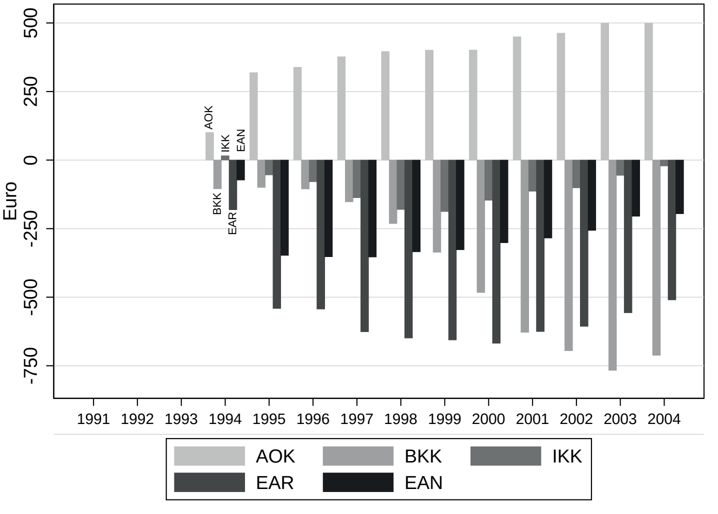

*Source:* German Ministry of Health (2016); Bundesversicherungsamt (2016), own calculations, own illustration. Values in 2015 euros. Only values for West Germany are shown. In bottom figure: Changes in RAS allocations on the x-axis are between t-2 and t-1 and contribution rate changes on the y-axis are between t-1 and t.

Figure 3: Changes in RAS/Enrollee Allocations and (a) Reserves, (b) Assets, (c) Administrative Costs, (d) Health Care Spending per Enrollee



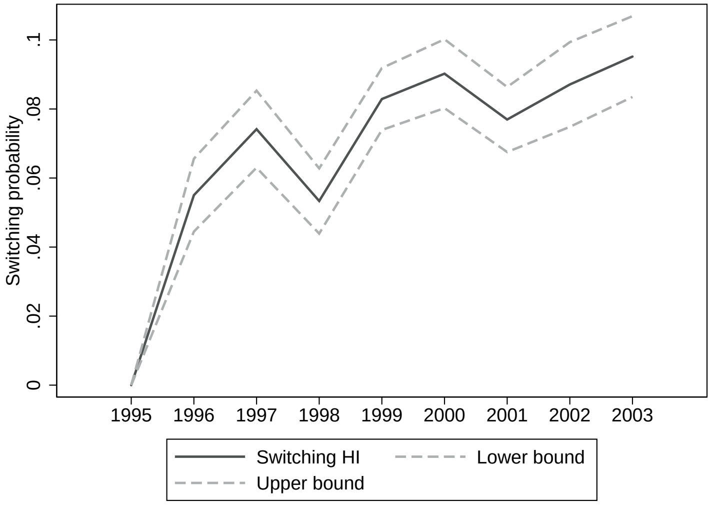

*Source:* German Ministry of Health (2016); Bundesversicherungsamt (2016); Deutscher Bundestag (2004); German Federal Statistical Office (2016a), own calculations, own illustration. Values in 2015 euros. All scatter plots show post-RAS data. Changes in RAS allocations on the x-axes are between t-2 and t-1 and changes on the y-axes are between t-1 and t.

Figure 4: RAS Allocations per Enrollee and Sickness Fund Type



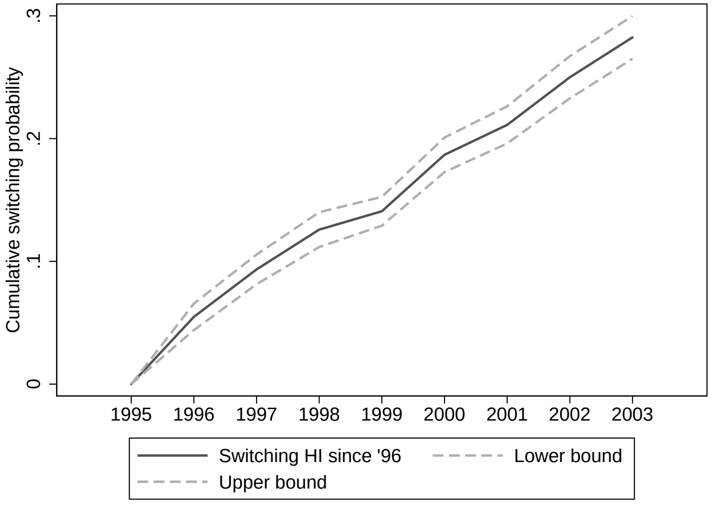

*Source:* German Ministry of Health (2016); Bundesversicherungsamt (2016), own calculations, own illustration. Values in 2015 euros. Only values for West Germany are shown.

Figure 5: Increase in Switching Probability after Introduction of Free Health Plan Choice



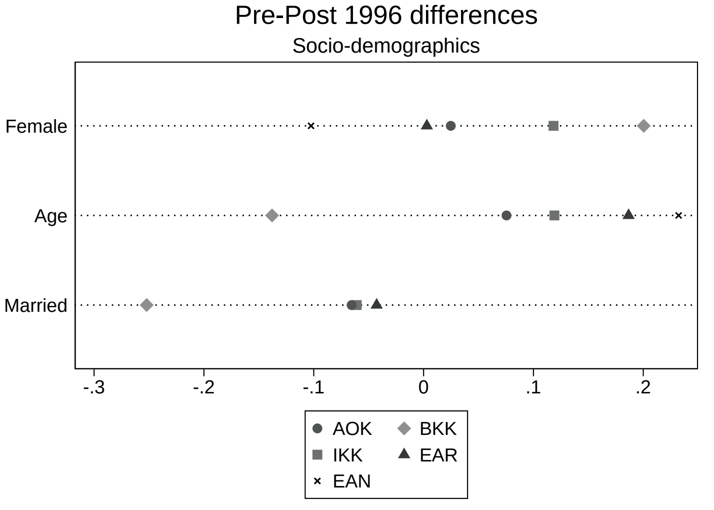

*Note:* Year dummies of column (2) in Table 4 are plotted. The reference point is the year before switching became a legal right, 1995.

Figure 6: Cumulative Switching Probability after Introduction of Free Health Plan Choice



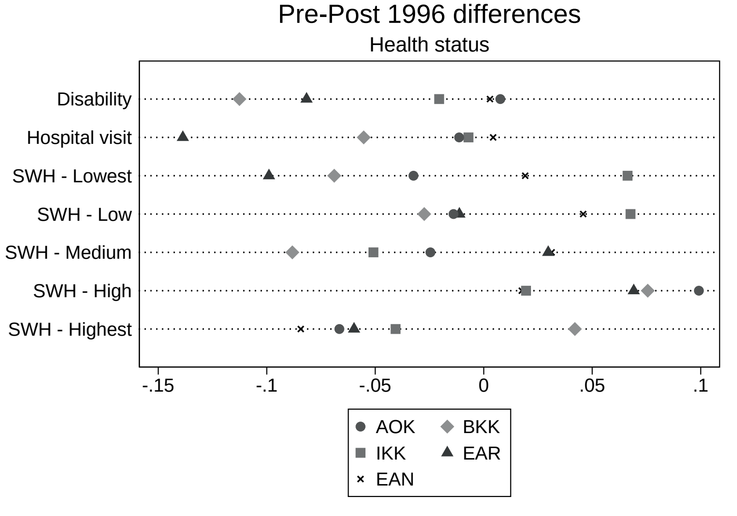

*Note:* Year dummies of column (4) in Table 4 are plotted. The reference point is the year before switching became a legal right, 1995.

Figure 7: Change in Socio-Demographics across Sickness Fund Categories Pre and Post 1996




*Source:* SOEP Long v30. The figure is a nonparametric plot of equation (6).

Figure 8: Change in Health Status across Sickness Fund Categories Pre and Post 1996




*Source:* SOEP Long v30. The figure is a nonparametric plot of equation (6).

Table 1: Meaning and History of Sickness Fund Categories

| German Name | English Translation | Abbr. | History and Enrollment |
|---|---|---|---|
| Bundesknappschaft | Federal Miners' Guild | BKN | Miners and relatives. In 1995: 1.2M enrollees.<br>4.8% female, age 42.4, gross wage €3719, 59.3% blue collar, disabled: 3.7% |
| Innungskrankenkasse | Guilds' Sickness Fund | IKK | Craftsmen and relatives. In 1995: 2.9M enrollees.<br>12.7% female, age 37.2, gross wage €2692, 78.9% blue collar, disabled: 4.6% |
| Betriebskrankenkassen | Company Sickness Fund | BKK | Employees and relatives. In 1995: 5.2M enrollees.<br>23.9% female, age 39.5, gross wage €3309, 49.1% blue collar, disabled: 5.8% |
| Ersatzkassen für Arbeiter | Alternative Funds for Blue Collar Workers | EAR | Blue collar workers prior to 1883. In 1995: 0.9M enrollees.<br>17.7% female, age 38.0, gross wage €2854, 86.4% blue collar, disabled: 7.3% |
| Ersatzkassen für Arbeitnehmer | Alternative Funds for White Collar Workers | EAN | White collar workers prior to 1883. In 1995: 17.5M enrollees.<br>42.7% female, age 39.5, gross wage €3370, 4.4% blue collar, disabled: 5.9% |
| Allgemeine Ortskrankenkassen | General Town Sickness Funds | AOK | Blue collar workers who could not be assigned. In 1995: 22.3M enrollees.<br>25.5% female, age 39.7, gross wage €2610, 74.2% blue collar, disabled: 6.7% |

*Sources:* German Federal Statistical Office (2017), Table A2

Table 2: Estimating the RAS Pass-Through Rate

| | **Model 1** **(1)** | **Model 2** **(2)** | **Model 3** **(3)** |
|---|---|---|---|
| **Panel A** | | | |
| $y_{it}$: Contribution rate in ppt. | | | |
| RAS/[enrollee$_{t-1}$ × 1000] | 0.558 | -0.794*** | -0.782*** |
| | (0.325) | (0.121) | (0.099) |
| Mean dependent variable | 13.451 | 13.451 | 13.451 |
| **Panel B** | | | |
| $y_{it}$: Annual employee share of premium (in 2015 euros) | | | |
| RAS/enrollee$_{t-1}$ | -0.291* | -0.181** | -0.211*** |
| | (0.121) | (0.068) | (0.039) |
| Mean dependent variable | 2,339 | 2,339 | 2,339 |
| **Panel C** | | | |
| $y_{it}$: Reserves/enrollee | | | |
| RAS/enrollee$_{t-1}$ | 0.026 | 0.054 | 0.055* |
| | (0.053) | (0.027) | (0.027) |
| Mean dependent variable | 71.986 | 71.986 | 71.986 |
| **Panel D** | | | |
| $y_{it}$: Assets/enrollee | | | |
| RAS/enrollee$_{t-1}$ | 0.144** | 0.136*** | 0.128*** |
| | (0.053) | (0.027) | (0.027) |
| Mean dependent variable | 190.847 | 190.847 | 190.847 |
| **Panel E** | | | |
| $y_{it}$: Administrative costs/enrollee | | | |
| RAS/enrollee$_{t-1}$ | 0.031 | -0.001 | 0.002 |
| | (0.018) | (0.017) | (0.013) |
| Mean dependent variable | 119.048 | 119.048 | 119.048 |
| **Panel F** | | | |
| $y_{it}$: Health care spending/enrollee | | | |
| RAS/enrollee$_{t-1}$ | 0.574*** | 0.257 | 0.222 |
| | (0.047) | (0.152) | (0.122) |
| Mean dependent variable | 2,109 | 2,109 | 2,109 |
| **Panel G** | | | |
| $y_{it}$: Premium revenues/enrollee | | | |
| RAS/enrollee$_{t-1}$ | -0.557*** | -0.769*** | -0.752*** |
| | (0.061) | (0.105) | (0.093) |
| Mean dependent variable | 2,230 | 2,230 | 2,230 |
| Year FE | × | × | × |
| State FE | × | × | × |
| Sickness fund category FE | | × | × |
| Individual FE | | | × |
| Age, gender, disability | | | × |
| Other covariates | | | × |

*Sources:* SOEP Long v30; Wagner et al. (2007); Socio-Economic Panel (SOEP) (2015); Deutscher Bundestag (2004); Müller and Lange (2010); German Ministry of Health (2016); Bundesversicherungsamt (2016); German Federal Statistical Office (2016a). * p<0.1, ** p<0.05, *** p<0.01; standard errors in parentheses are clustered on the health plan type level. Each column in each panel represents one regression with N=50,501 and the years 1991-2004 (except for Panel D where N=42,548 and the years include 1991-2002). SOEP provided weights are used and monetary values are in 2015 euros. Descriptive Statistics are in Table A1.

Table 3: RAS Pass-Through Rate: Heterogeneity by Increases and Decreases in RAS Allocations

| | **Model 1** | **Model 2** | **Model 3** |
|---|---|---|---|
| | **(1)** | **(2)** | **(3)** |
| **Panel A** | | | |
| $y_{it}$: Contribution rate in ppt. | | | |
| RAS/[enrollee$_{t-1}$ ×1000] | 0.092 | -0.554 | -0.617* |
| | (0.352) | (0.307) | (0.274) |
| RAS/[enrollee$_{t-1}$ ×1000] × RAS increase$_{t-1}$ | -0.080 | -0.351 | -0.223 |
| | (0.379) | (0.399) | (0.394) |
| **Panel B** | | | |
| $y_{it}$: Annual employee share of premium in Euro | | | |
| RAS/enrollee$_{t-1}$ | 0.076 | -0.028 | -0.155* |
| | (0.209) | (0.112) | (0.072) |
| RAS/enrollee$_{t-1}$ × RAS increase$_{t-1}$ | -0.558 | -0.264 | -0.125 |
| | (0.301) | (0.142) | (0.107) |
| **Panel C** | | | |
| $y_{it}$: Reserves/enrollee | | | |
| RAS/enrollee$_{t-1}$ | 0.084* | -0.002 | -0.014 |
| | (0.039) | (0.094) | (0.097) |
| RAS/enrollee$_{t-1}$ × RAS increase$_{t-1}$ | -0.071 | 0.047 | 0.075 |
| | (0.117) | (0.129) | (0.142) |
| **Panel D** | | | |
| $y_{it}$: Assets/enrollee | | | |
| RAS/enrollee$_{t-1}$ | 0.210** | 0.119* | 0.119* |
| | (0.062) | (0.056) | (0.047) |
| RAS/enrollee$_{t-1}$ × RAS increase$_{t-1}$ | -0.026 | 0.023 | 0.014 |
| | (0.085) | (0.054) | (0.037) |
| **Panel E** | | | |
| $y_{it}$: Administrative costs/enrollee | | | |
| RAS/enrollee$_{t-1}$ | 0.034 | -0.019 | -0.010 |
| | (0.027) | (0.010) | (0.009) |
| RAS/enrollee$_{t-1}$ × RAS increase$_{t-1}$ | -0.031 | 0.038*** | 0.029*** |
| | (0.037) | (0.006) | (0.005) |
| **Panel F** | | | |
| $y_{it}$: Health care spending/enrollee | | | |
| RAS/enrollee$_{t-1}$ | 0.362 | 0.447** | 0.358** |
| | (0.181) | (0.112) | (0.109) |
| RAS/enrollee$_{t-1}$ × RAS increase$_{t-1}$ | 0.181 | -0.391** | -0.286* |
| | (0.206) | (0.143) | (0.130) |
| **Panel G** | | | |
| $y_{it}$: Premium revenues/enrollee | | | |
| RAS/enrollee$_{t-1}$ | -0.438* | -0.422** | -0.446** |
| | (0.190) | (0.147) | (0.137) |
| RAS/enrollee$_{t-1}$ × RAS increase$_{t-1}$ | -0.133 | -0.499* | -0.417* |
| | (0.252) | (0.209) | (0.205) |
| Year FE | × | × | × |
| State FE | × | × | × |
| Sickness fund category FE | | × | × |
| Individual FE | | | × |
| Age, gender, disability, other | | | × |

*Sources:* SOEP Long v30; Wagner et al. (2007); Socio-Economic Panel (SOEP) (2015); Deutscher Bundestag (2004); Müller and Lange (2010); German Ministry of Health (2016); Bundesversicherungsamt (2016); German Federal Statistical Office (2016a). * p<0.1, ** p<0.05, *** p<0.01; standard errors in parentheses are clustered on the health plan type level. Each column in each panel represents one regression with N=50,501 and the years 1991-2004 (except for Panel D where N=42,548 and the years include 1991-2002). SOEP provided weights are used and monetary values are in 2015 euros. Descriptive Statistics are in Table A1.

Table 4: Who Switches?

| *Demographics* | Switched Health Plan Last Year (1) | (2) | Switched Health Plan Since 1996 (3) | (4) |
|---|---|---|---|---|
| Age 18 to 25 | 0.0278*** | 0.0251*** | 0.0012 | 0.0034 |
| | (0.0069) | (0.0072) | (0.0084) | (0.0090) |
| Age 26 to 35 | 0.0339*** | 0.0287*** | 0.0669*** | 0.0601*** |
| | (0.0048) | (0.0048) | (0.0065) | (0.0065) |
| Age 46 to 55 | -0.0205*** | -0.0244*** | -0.0415*** | -0.0484*** |
| | (0.0042) | (0.0044) | (0.0061) | (0.0065) |
| Age 56 to 64 | -0.0431*** | -0.0493*** | -0.0791*** | -0.0897*** |
| | (0.0043) | (0.0048) | (0.0071) | (0.0078) |
| Female | 0.0128*** | 0.0021 | 0.0120** | 0.0009 |
| | (0.0039) | (0.0044) | (0.0051) | (0.0058) |
| # persons $<$ 16 in HH | | -0.0071*** | | -0.0123*** |
| | | (0.0019) | | (0.0027) |
| Owner | | -0.0051 | | 0.0047 |
| | | (0.0036) | | (0.0051) |
| *Education and Labor Market* | | | | |
| White collar | | 0.0210*** | | 0.0251*** |
| | | (0.0042) | | (0.0057) |
| 1st wage quartile | | 0.0007 | | -0.0026 |
| | | (0.0054) | | (0.0070) |
| 3rd wage quartile | | 0.0070 | | 0.0219*** |
| | | (0.0051) | | (0.0069) |
| 4th wage quartile | | 0.0022 | | 0.0085 |
| | | (0.0055) | | (0.0073) |
| Vocational degree | | 0.0180* | | 0.0466*** |
| | | (0.0093) | | (0.0121) |
| Higher education | | 0.0054 | | 0.0226** |
| | | (0.0070) | | (0.0095) |
| *Health Status* | | | | |
| Disability | -0.0062 | -0.0062 | -0.0140 | -0.0133 |
| | (0.0059) | (0.0060) | (0.0101) | (0.0103) |
| Hospital stay | -0.0108* | -0.0100 | 0.0043 | 0.0062 |
| | (0.0063) | (0.0063) | (0.0104) | (0.0104) |
| SWH - low | -0.0032 | -0.0044 | 0.0080 | 0.0059 |
| | (0.0104) | (0.0104) | (0.0167) | (0.0166) |
| SWH - medium | 0.0044 | 0.0043 | 0.0102 | 0.0099 |
| | (0.0097) | (0.0097) | (0.0152) | (0.0152) |
| SWH - high | 0.0060 | 0.0039 | 0.0098 | 0.0056 |
| | (0.0097) | (0.0097) | (0.0153) | (0.0152) |
| SWH - highest | -0.0061 | -0.0083 | -0.0167 | -0.0209 |
| | (0.0099) | (0.0099) | (0.0156) | (0.0155) |
| Mean dependent variable | 0.0675 | 0.0675 | 0.1498 | 0.1498 |
| $R^2$ | 0.0219 | 0.0248 | 0.0713 | 0.0758 |

*Sources:* SOEP Long v30. *Notes:* Wagner et al. (2007); Socio-Economic Panel (SOEP) (2015); Müller and Lange (2010); German Ministry of Health (2016); Bundesversicherungsamt (2016). * p<0.1, ** p<0.05, *** p<0.01; standard errors in parentheses are clustered on the individual level. Each column represents one regression. All columns use the years 1996-2004. n=34,038. SOEP provided weights are used. *Middle vocational* and *higher vocational* covariates not shown (small and n.s.). All regressions include state and year fixed effects. Descriptive Statistics are in Table A1.

Table 5: Who Paid Higher Premiums Pre and Post-RAS?

| | Contribution Rate (1) | RAS Allocation (2) |
|---|---|---|
| *Demographics* | | |
| Age 18 to 25 | -0.0674*** | -0.0150 |
| | (0.0161) | (0.0103) |
| Age 18 to 25 × Post-RAS | 0.0338* | |
| | (0.0198) | |
| Age 26 to 35 | -0.0121 | -0.0190*** |
| | (0.0126) | (0.0061) |
| Age 26 to 35 × Post-RAS | -0.0277* | |
| | (0.0147) | |
| Age 46 to 55 | -0.0286** | 0.0412*** |
| | (0.0140) | (0.0068) |
| Age 46 to 55 × Post-RAS | 0.0787*** | |
| | (0.0162) | |
| Age 56 to 64 | 0.0500*** | 0.0717*** |
| | (0.0193) | (0.0085) |
| Age 56 to 64 × Post-RAS | 0.0455** | |
| | (0.0219) | |
| Female | 0.0333*** | -0.0264*** |
| | (0.0116) | (0.0057) |
| Female × Post-RAS | -0.0271** | |
| | (0.0135) | |
| # persons < 16 in HH | 0.0174*** | 0.0231*** |
| | (0.0055) | (0.0027) |
| # persons < 16 in HH × Post-RAS | 0.0008 | |
| | (0.0065) | |
| Owner | 0.0488*** | -0.0145*** |
| | (0.0095) | (0.0049) |
| Owner × Post-RAS | -0.0569*** | |
| | (0.0113) | |
| *Education and Labor Market* | | |
| White collar | -0.1012*** | -0.2092*** |
| | (0.0115) | (0.0060) |
| White collar × Post-RAS | 0.1343*** | |
| | (0.0135) | |
| 1st wage quartile | 0.0998*** | 0.0364*** |
| | (0.0128) | (0.0074) |
| 1st wage quartile × Post-RAS | -0.0426*** | |
| | (0.0152) | |
| 3rd wage quartile | -0.0898*** | -0.0673*** |
| | (0.0137) | (0.0068) |
| 3rd wage quartile × Post-RAS | -0.0036 | |
| | (0.0160) | |
| 4th wage quartile | -0.1898*** | -0.1257*** |
| | (0.0156) | (0.0073) |
| 4th wage quartile × Post-RAS | 0.0453** | |
| | (0.0180) | |
| Higher education | 0.0366* | -0.1110*** |
| | (0.0203) | (0.0091) |
| Higher education × Post-RAS | -0.0302 | |
| | (0.0234) | |
| *Health Status* | | |
| Disability | -0.0240 | 0.0102 |
| | (0.0207) | (0.0103) |
| Disability × Post-RAS | 0.0427* | |
| | (0.0238) | |
| Hospital stay | -0.0168 | 0.0134 |
| | (0.0174) | (0.0099) |
| Hospital stay × Post-RAS | 0.0239 | |
| | (0.0208) | |

*Sources:* SOEP Long v30. *Notes:* Wagner et al. (2007); Socio-Economic Panel (SOEP) (2015); Müller and Lange (2010); German Ministry of Health (2016); Bundesversicherungsamt (2016). * p<0.1, ** p<0.05, *** p<0.01; standard errors in parentheses are clustered on the individual level. Each column in each panel represents one regression. Column (1) use the years 1984-2004 (N=68,641) and column (2) uses the years 1994-2004 (N=40,387). SOEP provided weights are used. All regressions include year fixed effects. The following insignificant covariates in levels and interaction are not shown due to space contrains: all SWH measures, middle vocational, vocational and higher vocational. Descriptive Statistics are in Table A1.

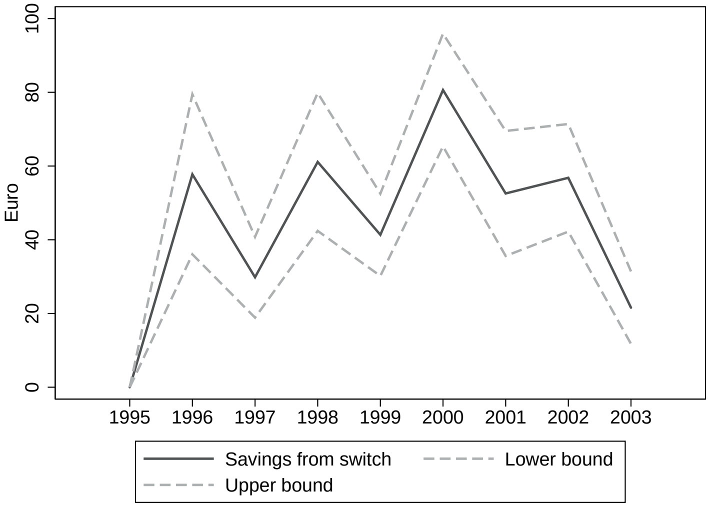
Table 6: Relationship between Contribution Rates and Premiums: RAS Allocations as IV

| Income Quartiles | Mean | Q1 | Q2 | Q3 | Q4 |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| **Panel A** | | | | | |
| Dependent variable: Annual premium in euro (prices as of 2015) | | | | | |
| Contribution rate$_t$ | 222.317*** | 128.055*** | 146.154*** | 200.596*** | 250.915*** |
| | (18.107) | (11.311) | (3.162) | (5.630) | (12.713) |
| $R^2$ | 0.315 | 0.219 | 0.467 | 0.492 | 0.678 |
| N | 50,501 | 10,727 | 11,957 | 12,959 | 14,858 |
| Mean dependent variable | 2,339 | 1,468 | 1,942 | 2,375 | 3,093 |
| **Panel B** | | | | | |
| Dependent variable: Annual premium in euro (prices as of 2015) | | | | | |
| Variable of interest: RAS/enrollee$_{t-1}$ as instrument for contribution rate | | | | | |
| Contribution rate$_t$ | 268.111*** | 104.912*** | 162.608*** | 206.789*** | 254.152*** |
| | (11.244) | (15.271) | (9.073) | (11.129) | (13.304) |
| F-statistic (first stage) | 59.595*** | 223.618*** | 138.050*** | 64.728*** | 22.230*** |
| $R^2$ | 0.314 | 0.218 | 0.467 | 0.492 | 0.678 |
| N | 50,501 | 10,727 | 11,957 | 12,959 | 14,858 |
| Year FE | × | × | × | × | × |
| State FE | × | × | × | × | × |
| Sickness fund category FE | × | × | × | × | × |
| Individual FE | × | × | × | × | × |
| Age, gender, disability | × | × | × | × | × |
| Other covariates | × | × | × | × | × |

*Sources:* SOEP Long v30; Wagner et al. (2007); Socio-Economic Panel (SOEP) (2015); Müller and Lange (2010); German Ministry of Health (2016); Bundesversicherungsamt (2016). * p<0.1, ** p<0.05, *** p<0.01; Standard errors in parentheses are clustered on the health plan type level. All models use the years 1994-2004. SOEP provided weights are used. Each column in each panel represents one regression model. Panel A contains OLS regressions and Panel B IV-2SLS regressions where the contribution rate is instrumented with RAS allocations per year and enrollee. Descriptive Statistics are in Table A1.

# Appendix

Figure A1: Consumer Savings after Health Plan Switching




*Note:* Year dummies of a regression of *Savings per switch* on year dummies and all covariates are plotted. The reference point is the last year before switching became a legal right, 1995.

Table A1: Descriptive Statistics

| | Mean | SD | Min | Max | N |
|---|---|---|---|---|---|
| *Health Insurance* | | | | | |
| Contribution rate | 13.058 | (0.959) | 10.130 | 14.650 | 75,646 |
| Contribution | 2,200 | (636) | 752 | 3,618 | 75,646 |
| RAS/enrollee | -66.757 | (369.195) | -766.748 | 1,426 | 50,501 |
| Reserves/enrollee | 71.986 | (114.443) | -212.054 | 935.383 | 50,501 |
| Assets/enrollee | 190.847 | (85.461) | 68.333 | 1,118 | 42,548 |
| Administrative costs/enrollee | 119.048 | (29.057) | 28.073 | 166.451 | 50,501 |
| Health care spending/enrollee | 2,109 | (258) | 1,575 | 3,674 | 50,501 |
| Premium revenues/enrollee | 2,230 | (265) | 1,602 | 2,709 | 50,501 |
| Switched HI last year | 0.031 | (0.174) | 0.000 | 1.000 | 75,646 |
| Switched HI since '96 | 0.069 | (0.254) | 0.000 | 1.000 | 75,646 |
| # Changes since '96 | 0.228 | (0.610) | 0.000 | 6.000 | 75,646 |
| Savings per switch | 1.569 | (19.690) | -312.737 | 452.228 | 75,646 |
| Cond. savings per switch | 50.401 | (99.996) | -312.737 | 452.228 | 2,241 |
| *Demographics* | | | | | |
| Female | 0.299 | (0.458) | 0.000 | 1.000 | 75,646 |
| Age | 39.397 | (11.141) | 18.000 | 64.000 | 75,646 |
| 18-25 years | 0.116 | (0.320) | 0.000 | 1.000 | 75,646 |
| 26-35 years | 0.299 | (0.458) | 0.000 | 1.000 | 75,646 |
| 36-45 years | 0.263 | (0.440) | 0.000 | 1.000 | 75,646 |
| 46-55 years | 0.227 | (0.419) | 0.000 | 1.000 | 75,646 |
| 56-64 years | 0.095 | (0.294) | 0.000 | 1.000 | 75,646 |
| Married | 0.629 | (0.483) | 0.000 | 1.000 | 75,646 |
| # persons in HH | 2.891 | (1.325) | 1.000 | 17.000 | 75,646 |
| # persons $<$ 16 in HH | 0.551 | (0.890) | 0.000 | 9.000 | 75,646 |
| Owner | 0.436 | (0.496) | 0.000 | 1.000 | 75,646 |
| *Education and Labor Market* | | | | | |
| Gross wage | 3,007 | (1,312) | 940 | 58,450 | 75,646 |
| 1st wage quantile | 0.225 | (0.417) | 0.000 | 1.000 | 75,646 |
| 2nd wage quantile | 0.236 | (0.425) | 0.000 | 1.000 | 75,646 |
| 3rd wage quantile | 0.255 | (0.436) | 0.000 | 1.000 | 75,646 |
| 4th wage quantile | 0.284 | (0.451) | 0.000 | 1.000 | 75,646 |
| Net wage | 1,941 | (796) | 60.000 | 18,514 | 75,646 |
| White collar | 0.532 | (0.499) | 0.000 | 1.000 | 75,646 |
| Blue collar | 0.468 | (0.499) | 0.000 | 1.000 | 75,646 |
| Inadequate + elementary edu. | 0.161 | (0.367) | 0.000 | 1.000 | 75,646 |
| Middle vocational | 0.583 | (0.493) | 0.000 | 1.000 | 75,646 |
| Vocational degree | 0.053 | (0.224) | 0.000 | 1.000 | 75,646 |
| Higher vocational degree | 0.096 | (0.295) | 0.000 | 1.000 | 75,646 |
| Higher education | 0.107 | (0.309) | 0.000 | 1.000 | 75,646 |
| *Health Status* | | | | | |
| Disability | 0.062 | (0.241) | 0.000 | 1.000 | 75,646 |
| Hospital stay | 0.080 | (0.272) | 0.000 | 1.000 | 68,641 |
| SWH - lowest (0-2/10) | 0.030 | (0.171) | 0.000 | 1.000 | 75,646 |
| SWH - low (3-4/10) | 0.082 | (0.275) | 0.000 | 1.000 | 75,646 |
| SWH - medium (5-6/10) | 0.218 | (0.413) | 0.000 | 1.000 | 75,646 |
| SWH - high (7-8/10) | 0.432 | (0.495) | 0.000 | 1.000 | 75,646 |
| SWH - highest (9-10/10) | 0.238 | (0.426) | 0.000 | 1.000 | 75,646 |

*Sources:* SOEP Long v30; Wagner et al. (2007); Socio-Economic Panel (SOEP) (2015); Müller and Lange (2010); German Ministry of Health (2016); Bundesversicherungsamt (2016). SWH–satisfactions with health. SOEP provided weights are used.

Table A2: Descriptive Statistics by Type of Sickness Fund

| | Mean | AOK | BKK | IKK | BKN | EAR | EAN |
|---|---|---|---|---|---|---|---|
| *Health Insurance* | | | | | | | |
| Contribution | 2,200 | 2,059 | 2,242 | 2,055 | 2,549 | 2,098 | 2,373 |
| | (636) | (578) | (619) | (561) | (547) | (621) | (675) |
| Contribution rate | 13.058 | 13.428 | 12.266 | 12.992 | 13.125 | 12.523 | 13.121 |
| | (0.959) | (0.724) | (1.083) | (0.913) | (0.392) | (1.074) | (0.846) |
| RAS/enrollee | -66.757 | 307.424 | -439.258 | -82.047 | 1,383 | -445.821 | -224.528 |
| | (369.195) | (182.305) | (282.657) | (65.653) | (51.847) | (257.064) | (134.315) |
| Reserves/enrollee | 71.986 | 55.171 | 39.594 | 76.969 | 669.831 | 60.226 | 102.070 |
| | (114.443) | (85.484) | (135.541) | (136.874) | (329.638) | (134.367) | (84.786) |
| Assets/enrollee | 190.847 | 208.224 | 164.017 | 297.613 | 1,036 | 180.475 | 158.349 |
| | (85.461) | (23.562) | (68.208) | (112.884) | (79.566) | (109.466) | (59.393) |
| Administrative costs/enrollee | 119.048 | 128.098 | 72.391 | 123.256 | 156.672 | 100.346 | 137.566 |
| | (29.057) | (14.944) | (25.687) | (7.904) | (7.802) | (5.234) | (9.221) |
| Health care spending/enrollee | 2,109 | 2,352 | 1,980 | 1,761 | 3,538 | 1,740 | 2,013 |
| | (258) | (145) | (96) | (101) | (113) | (97) | (151) |
| Premium revenues/enrollee | 2,230 | 2,065 | 2,436 | 1,980 | 2,194 | 2,244 | 2,334 |
| | (265) | (95) | (248) | (173) | (52) | (333) | (261) |
| Switched HI last year | 0.031 | 0.009 | 0.111 | 0.021 | 0.042 | 0.041 | 0.015 |
| | (0.174) | (0.092) | (0.314) | (0.144) | (0.201) | (0.198) | (0.121) |
| Switched HI since 1996 | 0.069 | 0.024 | 0.229 | 0.056 | 0.067 | 0.073 | 0.038 |
| | (0.254) | (0.152) | (0.420) | (0.230) | (0.250) | (0.261) | (0.190) |
| # Changes since 1996 | 0.228 | 0.163 | 0.437 | 0.229 | 0.116 | 0.252 | 0.189 |
| | (0.610) | (0.498) | (0.832) | (0.615) | (0.437) | (0.659) | (0.553) |
| Savings by switch | 1.569 | -0.103 | 9.049 | 0.152 | 8.566 | 1.209 | -0.287 |
| | (19.690) | (3.628) | (42.667) | (10.909) | (54.667) | (16.253) | (7.180) |
| Cond. savings per switch | 50.401 | -11.991 | 81.448 | 7.149 | 203.364 | 29.559 | -19.205 |
| | (99.996) | (37.421) | (102.443) | (74.895) | (186.790) | (75.403) | (55.644) |
| *Demographics* | | | | | | | |
| Female | 0.299 | 0.255 | 0.239 | 0.127 | 0.048 | 0.177 | 0.427 |
| | (0.458) | (0.436) | (0.426) | (0.333) | (0.215) | (0.381) | (0.495) |
| Age | 39.397 | 39.718 | 39.466 | 37.235 | 42.429 | 38.015 | 39.508 |
| | (11.141) | (11.493) | (10.528) | (11.111) | (9.983) | (10.776) | (11.043) |
| 18-25 years | 0.116 | 0.129 | 0.091 | 0.159 | 0.036 | 0.137 | 0.104 |
| | (0.320) | (0.335) | (0.288) | (0.365) | (0.186) | (0.344) | (0.305) |
| 26-35 years | 0.299 | 0.273 | 0.311 | 0.351 | 0.264 | 0.324 | 0.311 |
| | (0.458) | (0.446) | (0.463) | (0.477) | (0.442) | (0.468) | (0.463) |
| 36-45 years | 0.263 | 0.255 | 0.285 | 0.227 | 0.230 | 0.262 | 0.267 |
| | (0.440) | (0.436) | (0.452) | (0.419) | (0.422) | (0.440) | (0.442) |
| 46-55 years | 0.227 | 0.236 | 0.236 | 0.194 | 0.406 | 0.205 | 0.220 |
| | (0.419) | (0.425) | (0.424) | (0.395) | (0.492) | (0.404) | (0.414) |
| 56-64 years | 0.095 | 0.107 | 0.077 | 0.069 | 0.065 | 0.072 | 0.099 |
| | (0.294) | (0.309) | (0.267) | (0.254) | (0.246) | (0.259) | (0.299) |
| Married | 0.629 | 0.650 | 0.656 | 0.626 | 0.789 | 0.635 | 0.590 |
| | (0.483) | (0.477) | (0.475) | (0.484) | (0.409) | (0.481) | (0.492) |
| # persons in HH | 2.891 | 3.060 | 2.862 | 2.987 | 3.163 | 2.980 | 2.684 |
| | (1.325) | (1.384) | (1.265) | (1.358) | (1.550) | (1.329) | (1.245) |
| # persons $<$ 16 in HH | 0.551 | 0.606 | 0.565 | 0.602 | 0.658 | 0.624 | 0.464 |
| | (0.890) | (0.924) | (0.886) | (0.906) | (0.959) | (1.008) | (0.827) |
| Owner | 0.436 | 0.410 | 0.436 | 0.395 | 0.421 | 0.464 | 0.470 |
| | (0.496) | (0.492) | (0.496) | (0.489) | (0.495) | (0.499) | (0.499) |
| *Education and Labor Market* | | | | | | | |
| Gross wage | 3,007 | 2,610 | 3,309 | 2,692 | 3,719 | 2,854 | 3,370 |
| | (1,312) | (892) | (1,373) | (903) | (1,689) | (936) | (1,597) |
| 1st wage quantile | 0.225 | 0.308 | 0.130 | 0.256 | 0.065 | 0.218 | 0.177 |
| | (0.417) | (0.462) | (0.336) | (0.436) | (0.248) | (0.413) | (0.382) |
| 2nd wage quantile | 0.236 | 0.290 | 0.200 | 0.286 | 0.131 | 0.211 | 0.186 |

*Continued on next page...*

*... table A2 continued*

| | Mean | AOK | BKK | IKK | BKN | EAR | EAN |
|---|---|---|---|---|---|---|---|
| | (0.425) | (0.454) | (0.400) | (0.452) | (0.338) | (0.408) | (0.390) |
| 3rd wage quantile | 0.255 | 0.252 | 0.292 | 0.293 | 0.334 | 0.315 | 0.226 |
| | (0.436) | (0.434) | (0.455) | (0.455) | (0.473) | (0.465) | (0.418) |
| 4th wage quantile | 0.284 | 0.150 | 0.379 | 0.165 | 0.469 | 0.256 | 0.410 |
| | (0.451) | (0.357) | (0.485) | (0.371) | (0.500) | (0.436) | (0.492) |
| Net wage | 1,941 | 1,726 | 2,125 | 1,782 | 2,423 | 1,867 | 2,121 |
| | (796) | (584) | (850) | (590) | (883) | (597) | (943) |
| White collar | 0.532 | 0.259 | 0.509 | 0.211 | 0.407 | 0.137 | 0.956 |
| | (0.499) | (0.438) | (0.500) | (0.408) | (0.492) | (0.343) | (0.204) |
| Blue collar | 0.468 | 0.742 | 0.491 | 0.789 | 0.593 | 0.864 | 0.044 |
| | (0.499) | (0.438) | (0.500) | (0.408) | (0.492) | (0.343) | (0.204) |
| Inadequate + elementary edu. | 0.161 | 0.256 | 0.156 | 0.139 | 0.056 | 0.146 | 0.060 |
| | (0.367) | (0.436) | (0.363) | (0.346) | (0.230) | (0.354) | (0.237) |
| Middle vocational | 0.583 | 0.609 | 0.578 | 0.718 | 0.687 | 0.669 | 0.522 |
| | (0.493) | (0.488) | (0.494) | (0.450) | (0.465) | (0.471) | (0.500) |
| Vocational degree | 0.053 | 0.040 | 0.067 | 0.030 | 0.034 | 0.031 | 0.068 |
| | (0.224) | (0.196) | (0.250) | (0.170) | (0.181) | (0.175) | (0.251) |
| Higher vocational degree | 0.096 | 0.062 | 0.083 | 0.089 | 0.115 | 0.130 | 0.140 |
| | (0.295) | (0.242) | (0.276) | (0.285) | (0.320) | (0.336) | (0.347) |
| Higher education | 0.107 | 0.032 | 0.116 | 0.024 | 0.108 | 0.024 | 0.210 |
| | (0.309) | (0.177) | (0.320) | (0.153) | (0.312) | (0.152) | (0.407) |
| *Health Status* | | | | | | | |
| Disability | 0.062 | 0.067 | 0.058 | 0.046 | 0.037 | 0.073 | 0.059 |
| | (0.241) | (0.250) | (0.233) | (0.211) | (0.190) | (0.260) | (0.236) |
| Hospital stay | 0.080 | 0.086 | 0.077 | 0.075 | 0.103 | 0.083 | 0.075 |
| | (0.272) | (0.280) | (0.267) | (0.263) | (0.304) | (0.277) | (0.264) |
| SWH - lowest | 0.030 | 0.035 | 0.026 | 0.028 | 0.013 | 0.036 | 0.027 |
| | (0.171) | (0.183) | (0.160) | (0.165) | (0.112) | (0.187) | (0.161) |
| SWH - low | 0.082 | 0.087 | 0.087 | 0.073 | 0.088 | 0.083 | 0.076 |
| | (0.275) | (0.282) | (0.281) | (0.260) | (0.284) | (0.276) | (0.265) |
| SWH - medium | 0.218 | 0.239 | 0.219 | 0.220 | 0.179 | 0.209 | 0.193 |
| | (0.413) | (0.426) | (0.414) | (0.414) | (0.384) | (0.407) | (0.395) |
| SWH - high | 0.432 | 0.402 | 0.437 | 0.446 | 0.448 | 0.449 | 0.458 |
| | (0.495) | (0.490) | (0.496) | (0.497) | (0.498) | (0.498) | (0.498) |
| SWH - highest | 0.238 | 0.237 | 0.231 | 0.234 | 0.273 | 0.222 | 0.246 |
| | (0.426) | (0.425) | (0.422) | (0.423) | (0.446) | (0.416) | (0.431) |
| Observations | 75,646 | 33,658 | 14,181 | 4,617 | 221 | 2,023 | 20,946 |

*Sources:* SOEP Long v30; Wagner et al. (2007); Socio-Economic Panel (SOEP) (2015); Müller and Lange (2010); German Ministry of Health (2016); Bundesversicherungsamt (2016). SWH – satisfactions with health; SAH – self-assessed health. SOEP provided weights are used.

Table A3: Differences in Socio-Demographics by Sickness Fund Type

| | AOK | BKK | IKK | BKN | EAR | EAN |
|---|---|---|---|---|---|---|
| 18-25 years | -0.115*** | 0.075*** | 0.042*** | 0.001 | 0.019*** | -0.022 |
| | (0.019) | (0.015) | (0.009) | (0.001) | (0.007) | (0.015) |
| 26-35 years | -0.090*** | 0.070*** | 0.031*** | 0.001 | 0.017*** | -0.028** |
| | (0.016) | (0.013) | (0.008) | (0.001) | (0.006) | (0.013) |
| 36-45 years | -0.056*** | 0.048*** | 0.010 | -0.001 | 0.010* | -0.011 |
| | (0.015) | (0.013) | (0.008) | (0.001) | (0.005) | (0.013) |
| 46-55 years | -0.039*** | 0.037*** | 0.009 | 0.003** | 0.006 | -0.014 |
| | (0.012) | (0.010) | (0.006) | (0.001) | (0.004) | (0.010) |
| Female | -0.017 | -0.007 | -0.042*** | -0.002*** | 0.008* | 0.060*** |
| | (0.012) | (0.010) | (0.005) | (0.001) | (0.004) | (0.011) |
| Married | 0.003 | 0.020** | -0.001 | 0.001 | -0.006 | -0.017* |
| | (0.011) | (0.009) | (0.005) | (0.001) | (0.004) | (0.009) |
| # persons $<$ 16 in HH | 0.018*** | -0.014*** | -0.002 | -0.000 | -0.000 | -0.001 |
| | (0.005) | (0.005) | (0.003) | (0.000) | (0.003) | (0.004) |
| Owner | -0.010 | -0.008 | -0.001 | -0.001 | 0.008** | 0.012 |
| | (0.010) | (0.009) | (0.006) | (0.001) | (0.004) | (0.008) |
| Disability | 0.011 | -0.007 | -0.013 | -0.002* | 0.009 | 0.002 |
| | (0.019) | (0.016) | (0.012) | (0.001) | (0.007) | (0.016) |
| SWH - lowest | -0.004 | -0.013 | -0.003 | -0.000 | 0.003 | 0.017 |
| | (0.016) | (0.013) | (0.007) | (0.001) | (0.007) | (0.013) |
| SWH - low | -0.005 | 0.008 | -0.005 | 0.001 | -0.000 | 0.001 |
| | (0.010) | (0.010) | (0.005) | (0.001) | (0.003) | (0.008) |
| SWH - high | -0.013* | -0.006 | 0.002 | 0.000 | 0.004 | 0.013** |
| | (0.007) | (0.006) | (0.004) | (0.001) | (0.003) | (0.006) |
| SWH - highest | 0.002 | -0.008 | -0.005 | 0.001 | 0.001 | 0.009 |
| | (0.010) | (0.008) | (0.005) | (0.001) | (0.003) | (0.008) |
| 1st wage quantile | 0.056*** | -0.055*** | 0.009* | 0.000 | 0.006 | -0.017** |
| | (0.009) | (0.007) | (0.005) | (0.000) | (0.004) | (0.007) |
| 3rd wage quantile | -0.071*** | 0.057*** | -0.006 | 0.001* | 0.013*** | 0.006 |
| | (0.009) | (0.008) | (0.005) | (0.001) | (0.004) | (0.007) |
| 4th wage quantile | -0.142*** | 0.104*** | -0.024*** | 0.002** | 0.021*** | 0.039*** |
| | (0.012) | (0.011) | (0.006) | (0.001) | (0.005) | (0.011) |
| White collar | -0.342*** | -0.036*** | -0.069*** | -0.001 | -0.071*** | 0.519*** |
| | (0.012) | (0.010) | (0.006) | (0.001) | (0.005) | (0.010) |
| Middle vocational | -0.084*** | -0.031** | 0.041*** | 0.002** | 0.023*** | 0.050*** |
| | (0.014) | (0.012) | (0.008) | (0.001) | (0.005) | (0.009) |
| Vocational degree | -0.085*** | -0.004 | 0.006 | -0.001 | 0.016*** | 0.068*** |
| | (0.021) | (0.021) | (0.010) | (0.001) | (0.006) | (0.020) |
| Higher vocational degree | -0.107*** | -0.073*** | 0.047*** | 0.001 | 0.050*** | 0.082*** |
| | (0.021) | (0.018) | (0.011) | (0.002) | (0.008) | (0.018) |
| Higher education | -0.133*** | -0.064*** | 0.018** | -0.000 | 0.017*** | 0.163*** |
| | (0.019) | (0.019) | (0.008) | (0.002) | (0.005) | (0.019) |
| Constant | 0.726*** | 0.092*** | 0.044*** | -0.004*** | 0.043*** | 0.099*** |
| | (0.034) | (0.026) | (0.016) | (0.002) | (0.013) | (0.028) |
| $R^2$ | 0.240 | 0.057 | 0.053 | 0.013 | 0.036 | 0.405 |
| Mean dependent variable | 0.386 | 0.181 | 0.064 | 0.003 | 0.034 | 0.333 |

*Sources:* SOEP Long v30. * p<0.1, ** p<0.05, *** p<0.01; standard errors in parentheses are clustered at the individual level. Each column in each panel represents one regression with N=75,646. All regressions use year and state fixed effects. SOEP provided weights are used.

Table A4: Estimating the RAS Pass-Through Rate: Robustness with T=0

| | **Model 1** **(1)** | **Model 2** **(2)** | **Model 3** **(3)** |
|---|---|---|---|
| **Panel A** | | | |
| $y_{it}$: Contribution rate in ppt. | | | |
| RAS/[enrollee$_t$ $\times$1000] | 0.608* | -0.773*** | -0.773*** |
| | (0.300) | (0.187) | (0.167) |
| **Panel B** | | | |
| $y_{it}$: Annual employee share of premium in Euro) | | | |
| RAS/enrollee$_t$ | -0.266* | -0.174* | -0.209** |
| | (0.118) | (0.081) | (0.054) |
| **Panel C** | | | |
| $y_{it}$: Reserves/enrollee | | | |
| RAS/enrollee$_t$ | 0.021 | 0.059* | 0.061* |
| | (0.047) | (0.025) | (0.027) |
| **Panel D** | | | |
| $y_{it}$: Assets/enrollee | | | |
| RAS/enrollee$_t$ | 0.120** | 0.120*** | 0.110*** |
| | (0.046) | (0.025) | (0.025) |
| **Panel E** | | | |
| $y_{it}$: Administrative costs/enrollee | | | |
| RAS/enrollee$_t$ | 0.031 | -0.004 | 0.000 |
| | (0.017) | (0.018) | (0.014) |
| **Panel F** | | | |
| $y_{it}$: Health care spending/enrollee | | | |
| RAS/enrollee$_t$ | 0.543*** | 0.297 | 0.259* |
| | (0.040) | (0.149) | (0.128) |
| **Panel G** | | | |
| $y_{it}$: Premium revenues/enrollee | | | |
| RAS/enrollee$_t$ | -0.510*** | -0.783*** | -0.800*** |
| | (0.054) | (0.146) | (0.123) |
| Year FE | × | × | × |
| State FE | × | × | × |
| Sickness fund category FE | | × | × |
| Individual FE | | | × |
| Age, gender, disability | | | × |
| Other covariates | | | × |

*Sources:* SOEP Long v30; Wagner et al. (2007); Socio-Economic Panel (SOEP) (2015); Deutscher Bundestag (2004); Müller and Lange (2010); German Ministry of Health (2016); Bundesversicherungsamt (2016); German Federal Statistical Office (2016a). * p<0.1, ** p<0.05, *** p<0.01; standard errors in parentheses are clustered on the health plan type level. Each column in each panel represents one regression with N=50,501 and the years 1991-2004 (except for Panel D where N=42,548 and the years include 1991-2002). SOEP provided weights are used and monetary values are in 2015 euros. Descriptive Statistics are in Table A1.