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The effect of a ban on gender-based pricing on risk selection in the German health insurance market

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Abstract

Starting from December 2012, insurers in the European Union were prohibited from charging gender-discriminatory prices. We examine the effect of this unisex mandate on risk segmentation in the German health insurance market. Although gender used to be a pricing factor in Germany's private health insurance (PHI) sector, it was never used as a pricing factor in the social health insurance (SHI) sector. The unisex mandate makes PHI relatively more attractive for women and less attractive for men. Based on data from the German socio-economic panel, we analyze how the unisex mandate affects the difference between women and men in switching rates between SHI and PHI. We find that the unisex mandate increases the probability of switching from SHI to PHI for women relative to men. On the other hand, the unisex mandate has no effect on the gender difference in switching rates from PHI to SHI. Because women have on average higher health care expenditures than men, our results imply a worsening of the PHI risk pool and an improvement of the SHI risk pool. Our results demonstrate that regulatory measures such as the unisex mandate can affect risk selection between public and private health insurance sectors.

KEYWORDS
Germany, public and private health insurance, risk selection, unisex mandate

JEL CLASSIFICATION
I13; D82; H51

1 | INTRODUCTION

Gender is one of the most frequently used pricing factors in health insurance markets. Information on gender is easy to collect and accounts for a higher average use of health care services among women. However, on March 1, 2011, the European Court of Justice held discriminatory prices between men and women to be unacceptable on the grounds of gender equality (European Union, 2012). The ruling placed a ban on using gender as a pricing variable and forced insurance companies to offer new "unisex" health plans.

In this study, we examine the effect of this ban on gender-based pricing on risk segmentation in the German health insurance market. The German health insurance market consists of a social health insurance (SHI) and a private health insurance (PHI) system. The two systems differ in many aspects, including benefit packages, eligibility rules,

and how premiums are calculated. Eligibility for PHI is restricted to certain employment groups such as high-income employees, the self-employed, mini-jobbers,[1] and civil servants, whereas SHI is, in principle, open to all German residents. Although insurance premiums in the PHI market are based on individual health risk, SHI premiums depend solely on income.

The ban on gender-based pricing can affect risk segmentation between SHI and PHI by placing both systems on equal grounds regarding gender as a pricing factor. Risk segmentation between SHI and PHI is at the heart of an ongoing debate about fairness and financial sustainability in the German health insurance system (Panthöfer, 2016; Polyakova, 2016). One concern is that cherry-picking of better health risks by PHI leads to a worse risk-pool for SHI. For example, Bünnings and Tauchmann (2015) find that healthier individuals are more likely to opt into PHI, and Grunow and Nuscheler (2014) find that individuals in poorer health are more likely to leave PHI, which benefits the private system. Furthermore, men are more likely to be enrolled and to switch into PHI than women.

In this study, we examine the effect of the unisex mandate on risk segmentation between both systems using data from the German socio-economic panel (SOEP). Outcome variables are switching decisions from SHI to PHI, and vice versa. The treatment is the introduction of the unisex mandate. Our empirical approach is based on a before/after comparison of the difference in switching rates between women and men.

We find that the unisex mandate reduces the difference in switching rates from SHI to PHI between genders. After the mandate, relatively more women switched from SHI to PHI. This result is robust to alternative definitions of the sample, and it cannot be explained by pre-trends. The effect is strongest for the self-employed and mini-jobbers. For these groups, the prior difference in switching rates between men and women is entirely eliminated by the change in regulation. In contrast, we find a somewhat weaker effect for high-income employees and no significant effect for civil servants. The unisex mandate has no significant effect on the difference in switching rates from PHI to SHI between genders. The lack of a measurable effect is likely related to regulatory restrictions on switching from PHI to SHI.

Furthermore, we find that the unisex mandate reduces PHI premiums for women relative to men. We also examine the effect of the unisex mandate on health care utilization. However, health care utilization is imprecisely measured in our data, and we do not find a significant effect.

As women constitute the higher-risk group in terms of health care utilization, our results imply a reduction in the risk segmentation in the German health insurance market. After the unisex mandate was implemented, PHI premiums strongly increased for men but did not decrease for women compared with the premiums before the unisex mandate was announced. Furthermore, switching rates from SHI to PHI decreased for men but did not increase for women. If fewer men with relatively good health and high incomes leave SHI, then the risk pool of SHI improves.

Our study contributes to the literature on how community rating affects adverse selection in health insurance markets. Community rating policies imply that insurance companies are not allowed to charge different premiums according to risk factors such as gender, age, and health conditions. Under community rating, disproportionately more high-risk individuals are found to enroll in insurance markets. As the risk pool deteriorates, premiums rise, which may drive low-risk individuals out of the market. Therefore, community rating can lead to inefficient outcomes (Buchmueller & Dinardo, 2002; Cutler & Zeckhauser, 2000).

Some theoretical studies specifically discuss the effect of unisex policies on demand for insurance and distributional effects (Finkelstein, Poterba, & Rothschild, 2009; Oxera, 2011). Aseervatham, Lex, and Spindler (2016) show that the policy's effect on prices may be negligible if gender is strongly correlated with other predictors of risk that can still be used for determining insurance premiums.

In contrast to previous studies, we examine the effect of a unisex mandate not only on the insurance market that is affected by the mandate, but also on another market where the mandate does not lead to a change in regulation. In Germany, the unisex mandate only affects premiums in PHI, whereas premiums in SHI never depended on gender. One of the unintended consequences of the unisex mandate can be a reduction in risk segmentation between SHI and PHI. Thus, limiting the ability of PHI to discriminate based on risk factors such as gender can improve the risk pool for SHI. This mechanism could also be relevant for other countries where private and public health insurance systems coexist.

Our paper is organized as follows. Section 2 describes the institutional background. Section 3 presents the data and describes our empirical strategy. Section 4 shows the estimation results. Finally, Section 5 concludes.

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[1]Mini-jobbers are defined as part-time workers with low income who are not subject to payroll taxes. In 2017, the maximum income for mini-jobbers was €450 per month.

2 | BACKGROUND

Germany's health insurance system consists of two sectors. Most Germans are covered by SHI. However, a nonnegligible part of the population is eligible to opt out of SHI and about 10% are covered by PHI (Mossialos, Wenzl, Osborn, & Anderson, 2016).

There is no risk selection in the SHI system. SHI cannot reject applicants based on their health, and it covers family members without income for free. Premiums are determined purely based on income rather than individual health. Benefit packages and copayments are uniform across SHI providers.

In contrast, PHI premiums are calculated based on individual health risk. To determine risk, a screening process takes place, which may also result in a rejection of the applicant. Once approved, the insurer cannot drop a policy holder and may reassess risk only if the insuree switches to a different insurance plan. PHI offers family coverage, but it is not free. PHI providers offer a wide range of different, often nonlinear, contracts with varying copayment and premiums.

Treatment for private patients is often perceived as better. Care providers receive higher reimbursement rates for PHI-insured patients than for SHI-insured patients (Jürges, 2009), and waiting times are considerably longer for SHI-insured patients (Lungen, Stollenwerk, Messner, Lauterbach, & Gerber, 2008). Hullegie and Klein (2010) find a positive causal effect of PHI on self-reported health.

Switching between the SHI and the PHI systems is subject to requirements on employment and income. In general, SHI is mandatory. Opting out of SHI into PHI is possible only for self-employed, civil servants, employees with incomes above a threshold[2], and mini-jobbers. Once a person enters PHI, switching back to SHI is possible only if her income falls under the compulsory SHI threshold and she is no older than 55 years.

The decision to join the SHI or PHI system is also determined by how insurance premiums are shared between employees and employers. Regular employees share contributions with their employer in equal parts in both SHI and PHI. Special rules apply to civil servants, the self-employed, and mini-jobbers. Civil servants pay the full premium in SHI but obtain substantial subsidies for PHI. The self-employed pay the full premium in both systems. Mini-jobbers do not obtain contributions from their employer but are eligible for family insurance, PHI, and voluntary SHI. Under voluntary SHI, they pay a premium of about €150 monthly. These regulatory differences make PHI more attractive for some employment groups than for others. For example, incentives to join PHI are much stronger for civil servants than for other employment groups.

In the year 2004, the European Union passed a directive on equal treatment between men and women in the access to and supply of goods and services (European Union, 2004). However, insurance providers were exempted. On March 1, 2011, the European Court of Justice ruled this exemption to be unacceptable. The ruling placed a ban on gender-based pricing in the insurance sector, which was implemented on December 21, 2012. Private insurers were no longer allowed to charge prices based on statistical discrimination between male and female applicants for any contract signed after this target date. Policyholders with existing insurance contracts had the choice to either keep them or change into new unisex health plans.

3 | METHODS

3.1 | Data

Our analysis is based on the German SOEP, which conducts an annual survey of a representative sample of the German population. We use version v32.1[3] and include observations from Waves 2004 to 2015 (1,366,080 individual-year observations).

We remove observations on individuals aged 55 years or older from the sample because they are not allowed to switch back to SHI (drops 363,059 observations). We also drop observations aged 25 years or younger because SHI covers nonworking children for free (454,899 observations). Military personnel are excluded as they are covered outside of the health insurance system (four observations). We also drop observations with missing information on gender, insurance status, health status, children, family status, education, or employment (13, 423,698, 2,594, 182, 6,442, 2,463, and 133 observations, respectively).

Furthermore, we exclude observations which likely reflect measurement errors. Individuals are excluded if they are not eligible to choose PHI but report to be enrolled in PHI, or if they are not eligible in neither of two consecutive periods but

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[2]In 2017, the threshold on annual gross income was €57.600.
[3]For further information on the SOEP, see Goebel et al. (2019).

report to switch into PHI (1,954 observations). We define eligibility as being a civil servant, mini-jobber, self-employed, a regular employee with an income of at least 75% of the compulsory insurance threshold,[4] or reporting voluntary coverage under SHI. We further remove individuals with more than one switch in either direction (307 observations) as this may indicate measurement error rather than actual choice (see ; Grunow & Nuscheler, 2014).

To study switching between systems, we use the subsample of individuals enrolled in SHI and the subsample of PHI insurees, respectively. Our sample for the baseline estimation consists of 96,594 observations for the SHI sample and 13,002 observations for the PHI sample.

3.1.1 | Variables

Switching

As dependent variables, we construct two binary variables which indicate whether an individual's insurance status changed from SHI to PHI or from PHI to SHI in a given year, respectively. The switching indicator *Switch to PHI* (or *Switch to SHI*) is set to one for the year before an individual is first observed to be privately (or publicly) insured. In this way, we make sure that the covariates refer to the situation before the individual decides to switch (see Bünnings and Tauchmann, 2015).

Unisex mandate

Our main explanatory variable of interest, *Implementation × Female*, interacts gender with the years 2013 and 2014 when the unisex mandate was implemented. In addition, we include three control variables that interact gender with the "pre-announcement" period in 2010, the actual announcement period in 2011, and the "pre-implementation" period in 2012.[5] The baseline period refers to the years 2009 and before.

Socioeconomic controls

Our selection of control variables closely follows Bünnings and Tauchmann (2015). We include variables for gender, residence in West Germany, blue-collar employment, white-collar employment, German nationality, missing nationality, age categorized in 5-year age bins, years of education, having children, having a nonworking spouse, having a spouse in PHI, being a civil servant, being a mini-jobber, being self-employed, not working, quartiles of individual income,[6] income above 75% of the income threshold for PHI coverage, and missing income. Many of these variables affect eligibility or financial incentives for switching between insurance systems. A nonworking spouse qualifies for free coverage in SHI, and a spouse insured in PHI may allow for discounts on PHI premiums. We use income quartile categories as measure of income that is less sensitive to measurement error.

Health

The SOEP surveys self-assessed health on a scale from 1 (*very good*) to 5 (*bad*). We include a "good health" indicator if self-reported health is good or very good.[7]

Risk attitude

Uncertainty over future health care needs and family size may affect choice between SHI and PHI (Thomson & Mossialos, 2006). We use one of Bünnings and Tauchmann's (2015) measures of risk attitude by constructing an indicator that is one if self-reported willingness to take risks is above 6 on a scale from 1 (*low*) to 10 (*high*). We include an indicator for missing observations and interpolate values for years 2005 and 2007, in which the question was dropped. We include an interaction term for the interpolated values and the years 2005 and 2007.

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[4]Income in the socio-economic panel is likely to be measured imprecisely and is more prone to error than reported insurance status (see Hullegie & Klein, 2010). Although 75% of the income threshold is an arbitrary cutoff, using the actual compulsory income threshold does not change the main results (see Table S3.4 in Appendix S3).

[5]This choice is related to the annual nature of the socio-economic panel, due to which the timing of the treatment is not straightforward. Unisex pricing was implemented by the end of 2012, following the announcement in March 2011. Because the switching variables are constructed using current insurance status, we are not able to pin down whether a switch coded for year 2012 took place when the unisex regulation was already implemented or not. For example, consider someone who switches to PHI before December 2012 but only reports to hold private health insurance (PHI) to the SOEP in 2013. Then, *Switch to PHI* is coded 1 in year 2012 although it should correctly be coded 1 in 2011 if the exact date of the switch was available.

[6]Annual gross income is computed using the respondents' reported monthly salary as well as 13th and 14th month salaries and all further bonuses.

[7]Following Grunow and Nuscheler (2014) and Bünnings and Tauchmann (2015) in treating self-assessed health as a continuous variable with measurement error, we also estimate an instrumental variable specification (see Tables S3.4 and S3.5 in Appendix S3).

TABLE 1 Sample characteristics

Panel A: Number of Observations by calendar year				
2004: 9,947	2005: 9,315	2006: 9,613	2007: 8,961	2008: 8,341
2009: 8,286	2010: 6,846	2011: 12,141	2012: 13,127	2013: 11,508
2014: 12,247	Total: 110,332			

Panel B: Number of Individuals by years of observation				
1: 6,029	2: 3,241	3: 3,466	4: 4,872	5: 1,146
6: 999	7: 1,165	8: 822	9: 1,052	10: 614
11: 2,352	Total: 25,758			

Panel C: Means for main variables[a]	SHI		PHI	
	Male	**Female**	**Male**	**Female**
Switch to PHI (from SHI)	0.012	0.006		
	(0.107)	(0.078)		
Switch to SHI (from PHI)			0.038	0.044
			(0.192)	(0.204)
Number of doctor visits	1.757	2.382	1.505	2.537
	(3.376)	(3.608)	(2.777)	(3.774)
Good health	0.571	0.560	0.667	0.644
	(0.495)	(0.496)	(0.471)	(0.479)
Observations	41,664	55,416	8,338	4,914

Abbreviations: PHI, private health insurance; SHI, social health insurance.

[a]Standard deviations in parentheses. Variable means are shown only for the main health-related variables of our analysis. Table S2.1 in Appendix S2 shows means for the full list of variables that we use in our main estimation.

Other controls

We also include a number of variables specifically for estimating switches from SHI to PHI. Time at risk dummies capture the number of years in a row that an individual has already been eligible to opt out of SHI. A binary variable for left-censoring marks individuals who are eligible for PHI at the time when they enter the panel. We measure awareness about the possibility to choose PHI by an indicator of whether insurance in SHI was reported as voluntary. Finally, we control for the sampling process: we add indicators for employees whose income is higher than 75% but lower than the compulsory insurance threshold, for individuals who report voluntary insurance in SHI but are not eligible to take up PHI according to their employment or income and for mini-jobbers or employees with an income above 75% but below 100% of the compulsory insurance threshold.

Premiums

In addition to analyzing the effect of the unisex mandate on switching rates, we also examine the effect of the mandate on insurance premiums. For individuals insured in PHI, monthly insurance premiums are reported in the SOEP. However, information on PHI premiums is missing from the survey in the year 2013.

3.1.2 | Descriptive statistics

The final sample consists of 110,332 person–year observation from 25,758 unique individuals. Table 1 presents the number of individuals observed by calendar year in Panel A[8] and by the number of years they participate in the survey in Panel B. Our panel is unbalanced, but about half of all individuals are included for at least 4 years.

Panel C of Table 1 presents summary statistics by insurance type and gender.[9] Insurance enrolment differs strikingly between men and women. About 16.7% of male observations are insured in PHI, whereas this is the case for only about 8.2% of female observations. There are 820 switches from SHI to PHI and 533 switches from PHI to SHI in our sample. Switches from SHI to PHI occur about twice as often for men than for women, whereas switches from PHI to SHI occur with almost equal probabilities for both genders. In both systems, the average number of doctor visits is lower for men than for women. Good health is reported more often by PHI than SHI insurees.

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[8]The variation in the number of individuals observed by year can be attributed to changes in the sample sizes of the underlying survey (see Glemser et al., 2016) and availability of our key dependent variable, health insurance type.

[9]The full sample presented in Table 1 includes observations from a small number of individuals who switched from one insurance system to the other and back. The subsample of social health insurance (SHI) insurees (private health insurance [PHI] insurees) used in the baseline estimation includes individuals only until they switch to PHI (SHI) for the first time. For individuals who switched back and forth once, some observations may be dropped in the subsamples but not in the full sample.
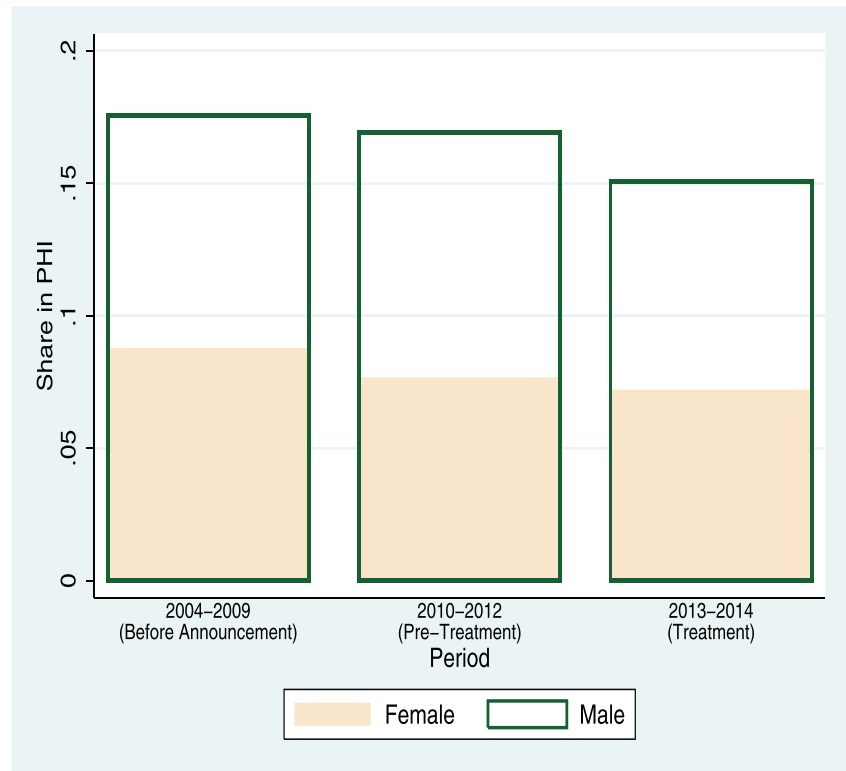
FIGURE 1 Enrolment in private health insurance (PHI) in the full sample over time, by gender [Colour figure can be viewed at wileyonlinelibrary.com]

Figure 1 shows the share of PHI insurees among men and women for different periods. In all subperiods, this share is higher for men than for women.[10]

Figure 2 shows switching rates between insurance systems across years for both men and women without yet controlling for other observable characteristics. Figure 2a shows that at any point in time, opting out of SHI is more common for men. The difference in switching rates from SHI to PHI between men and women is relatively constant at about 0.6% before 2010 but becomes smaller after the unisex mandate is implemented. For women, switching rates from SHI to PHI stay constant or slightly declined after the implementation of the unisex mandate. For men, there was a strong reduction in switching rates from SHI to PHI. In contrast, Figure 2b shows that switching rates from PHI to SHI fluctuate widely across years and that the variation in the gender difference is quite high.

Figure 3 shows that before the unisex mandate, average PHI insurance premiums were higher for women than for men once civil servants are excluded from the sample.[11] After the unisex mandate was implemented, PHI premiums for women stayed roughly constant compared with premiums before the unisex mandate was announced (in Figure 3a) or even increased (in Figure 3b), whereas PHI premiums for men strongly increased.

3.2 | Empirical framework

Our main analysis examines how the unisex mandate affects switching decisions between insurance systems. We analyze both switching from SHI to PHI and from PHI to SHI, and we examine the relationship between gender and switching decisions before and after the implementation of the unisex mandate. The unisex mandate can lead to relatively lower insurance premiums for women and higher insurance premiums for men. Thus, the unisex mandate makes PHI relatively more attractive for women. We test two main hypotheses related to the effects of the unisex mandate as follows:

1. The implementation of the unisex mandate increases the probability to switch from SHI to PHI for women relative to men.

2. The implementation of the unisex mandate decreases the probability to switch from PHI to SHI for women relative to men.

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[10]This pattern persists once possibly confounding factors are accounted for (see Table S2.3 in Appendix S2).

[11]Regression results shown in Table S4.1 in Appendix S4 confirm that women pay significantly higher premiums than men, once employment as civil servant is controlled for. Civil servants have to pay substantially lower PHI premiums because of employer subsidies, and many PHI-insured women are civil servants.
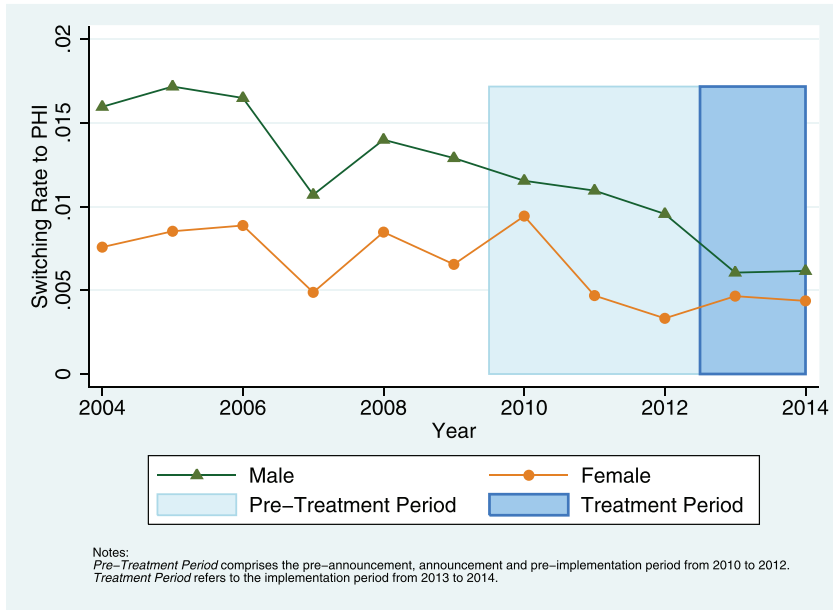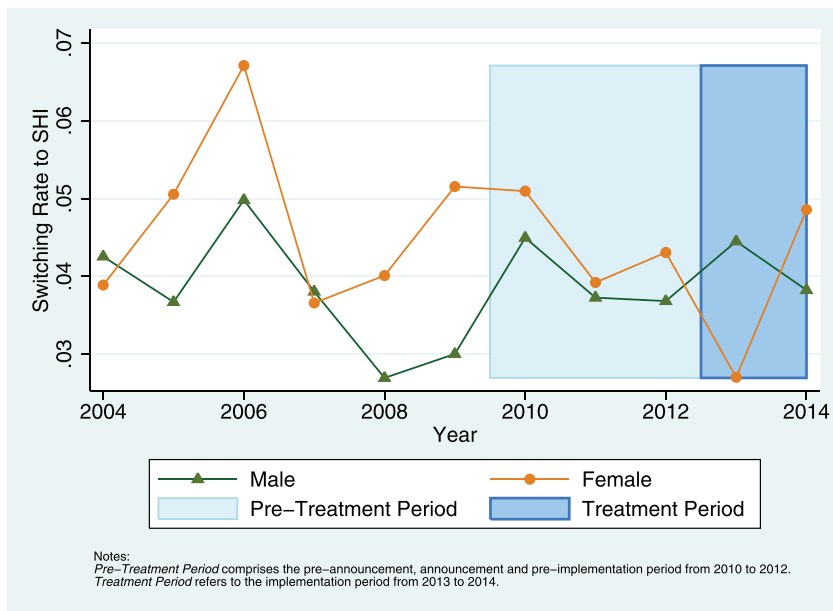
FIGURE 2 Switching rates for male and female, aggregated by years [Colour figure can be viewed at wileyonlinelibrary.com]

3.2.1 | Switching from SHI to PHI

To study the effects of the unisex policy onto switching from SHI to PHI, we estimate the following equation:

$$
\begin{aligned}
SwitchPHI_{it} = {} & \alpha_1 + \beta_1(impl_t \times fem_i) + \gamma_1 fem_i \\
& + \delta_1'(pre - treat_t \times fem_i) + \zeta_1' d_t + \eta_1' X_{it} + \theta' W_{it} + \epsilon_{1,it}.
\end{aligned}
\tag{1}
$$

The dependent variable is $SwitchPHI_{it}$, a binary variable which indicates whether there was a switch from SHI to PHI for individual i in year t. fem_i indicates whether i is female. $impl_t$ is a binary indicator for the implementation period of the unisex mandate in 2013-2014. $pre\text{-}treat_t$ includes three indicators for the pre-announcement period in 2010, the actual announcement period in 2011, and the pre-implementation period in 2012. d_t includes year dummies. X_{it} is a vector containing individual-time-specific control variables. In the main specification, X_{it} includes socioeconomic indicators, health, and risk attitude. W_{it} includes additional variables used for analyzing switching to PHI.
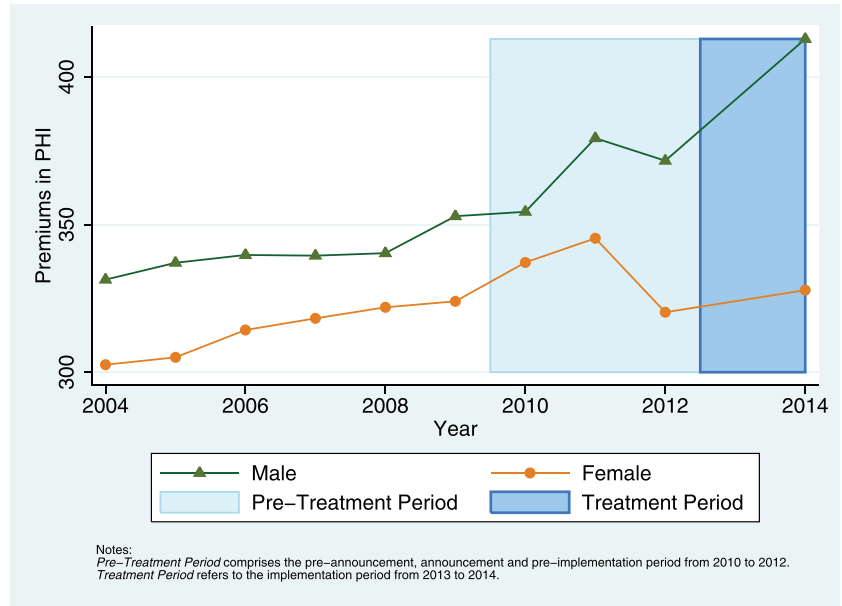
(a)
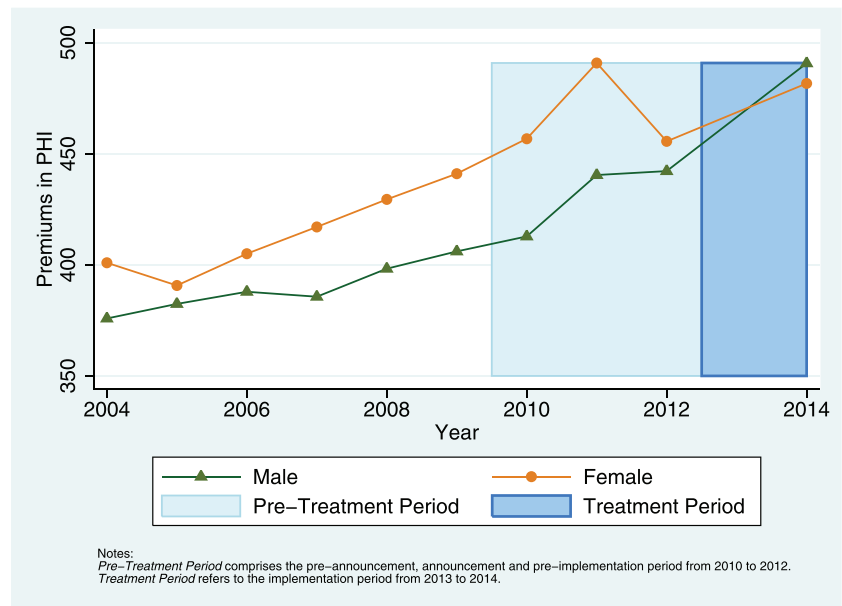
(b)

FIGURE 3 Average premiums in private health insurance (PHI) over time [Colour figure can be viewed at wileyonlinelibrary.com]

α_1, β_1, γ_1, δ_1, ζ_1, η_1, and θ are parameters. β_1 is the main parameter of interest, and it captures the effect of the unisex mandate on differences in switching decisions between women and men. If $\beta_1 > 0$, this provides evidence in favor of Hypothesis 1, which predicts that the unisex mandate increases switching rates from SHI to PHI for women relative to men.

Our empirical approach is based on a before/after comparison of the difference in switching rates between women and men. The implementation of the unisex mandate affects incentives for both men and women. Thus, there are no clearly defined treatment and control groups. Instead of estimating the effect of the unisex mandates on only one group, our approach estimates the effect of the unisex mandate on the *difference* in switching rates between women and men.

The estimation coefficient for β_1 is unbiased if the following exogeneity assumption holds: $\mathbb{E}[\epsilon_{1,it}|fem_i, d_t, X_{it}, W_{it}] = 0$. The error term includes unobserved determinants of switching decisions, such as unobserved aspects of health. These unobserved characteristics can reflect private information of insurees which cannot be observed by the econometrician. Such unobserved characteristics can vary by gender. However, the variable for *female* controls for differences in unobserved characteristics between women and men as long as they are constant over time.

The exogeneity assumption requires that the difference in switching rates between women and men would have been constant over time in the absence of the unisex mandate, conditional on the control variables. Contemporaneous changes other than the unisex mandate can lead to biased estimation results, but only if they affect men and women differently. For example, a change in regulation that reduces switching rates from SHI to PHI and affects men and women in the same way would not lead to a violation of the exogeneity assumption. On the other hand, if switching rates from SHI to PHI were increasing already before the announcement of the unisex mandate for women, but not for men, this would indicate that the exogeneity assumption might not hold.

We examine the plausibility of the exogeneity assumption by looking at pre-trends in the difference in switching rates between women and men. Specifically, we test whether this difference was constant over time in the years before the unisex mandate took effect. We also examine whether our results can be attributed to a change in child care policies during our study period.

The empirical approach in Equation (1) is based on a linear regression model for a binary outcome variable. As an alternative specification, we also use a probit model. Because interaction terms in nonlinear models are difficult to interpret, we use a method proposed by Norton, Wang, and Ai (2004) to compute the marginal effect and standard error of the interaction term.

3.2.2 | Switching from PHI to SHI

We also examine the effect of the unisex mandate on switching from PHI to SHI based on an empirical approach that mirrors the approach described above. We estimate the following equation:

$$
\begin{aligned}
SwitchSHI_{it} = \alpha_2 + \beta_2(impl_t \times fem_i) + \gamma_2 fem_i \\
+ \delta_2'(pre-treat_t \times fem_i) + \zeta_1' d_t + \eta_2' X_{it} + \epsilon_{2,it}.
\end{aligned}
\tag{2}
$$

The outcome variable is $SwitchSHI_{it}$, a binary variable which indicates whether there was a switch from PHI to SHI for individual i in year t. The other variables are defined above. α_2, β_2, γ_2, δ_2, ζ_2, and η_2 are parameters.

The main parameter of interest is β_2, which measures the effect of the unisex mandate on differences in switching decisions between women and men from PHI to SHI. If $\beta_2 < 0$, this is in line with Hypothesis 2 which predicts that the unisex mandate reduces switching rates from PHI to SHI for women relative to men.

4 | RESULTS

4.1 | Baseline results

Table 2 shows results for the effects of the unisex mandate on switching decisions between the two health insurance systems in Germany. Column 1 shows results for switches from SHI to PHI based on estimating Equation (1). The main coefficient of interest measures the interaction effect between female and the implementation period. The unisex mandate increases switching rates of women by 0.4 percentage points relative to men. The coefficient is statistically significant at the 1% level.

Moreover, the coefficient for female shows that before the unisex mandate was announced women were 0.7 percentage points less likely than men to switch from SHI to PHI after controlling for covariates. Thus, the unisex mandate decreased the gender differences in switching probabilities by more than a half. Coefficients for interaction terms between female and time periods between the announcement and the implementation of the unisex mandate are not statistically significant at the 5% level.

Column 2 of Table 2 shows results for a probit model when we apply the method of Norton et al. (2004) to compute the marginal effect of the interaction term between female and the implementation period. The marginal effect is unchanged compared with the linear probability model, and it is significant at the 5% significance level.[12]

Columns 3 and 4 of Table 2 show results for switching from PHI to SHI based on the linear probability model in Equation (2) and a probit model, respectively. For both models, the point estimate indicates that the unisex mandate decreases switching rates from PHI to SHI for women relative to men. However, these coefficients are not statistically

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[12]The complete estimation results for the probit model are displayed in Table S3.2 of Appendix S3.

TABLE 2 Results from the main switching analysis

	Switch to PHI		Switch to SHI	
	Full sample (SHI)		Full sample (PHI)	
	(1)	(2)	(3)	(4)
Variables	Linear	Probit[a]	Linear	Probit[a]
Female × Implemented	.004***	.004**	-.011	-.011
	(.001)	(.002)	(.009)	(.010)
Female × Pre-announcement	.005*	Yes	.002	Yes
	(.003)		(.017)	
Female × Announced	-.001	Yes	-.009	Yes
	(.002)		(.012)	
Female × Pre-implementation	.000	Yes	-.002	Yes
	(.002)		(.012)	
Female	-.007***	Yes	.008	Yes
	(.001)		(.005)	
Civil servant	.205***	Yes	-.157	Yes
	(.022)		(.112)	
Self-employed	.017*	Yes	-.119	Yes
	(.009)		(.112)	
Mini-job	-.021***	Yes	.012	Yes
	(.007)		(.036)	
Good health	.003***	Yes	-.007*	Yes
	(.001)		(.004)	
Constant and year dummies	Yes	Yes	Yes	Yes
Socioeconomic controls[b]	Yes	Yes	Yes	Yes
Switch to PHI controls[c]	Yes	Yes	No	No
Self-assessed risk[d]	Yes	Yes	Yes	Yes
Observations	96,594	96,594	13,002	13,002

Note. Estimation by ordinary least squares. Cluster-robust standard errors in parentheses. Abbreviations: PHI, private health insurance; SHI, social health insurance.

[a]Marginal effects and standard errors of the interaction term are computed using the stata package `inteff`, and the method described in Norton et al. (2004). Full estimation results for the probit specification are displayed in Table S3.2 of Appendix S3.

[b]Socioeconomic controls include the variables *Age*, *Income Quartiles*, *Income Above 75% of the Threshold*, *Income Missing*, *Years of Education*, *West Germany*, *German Nationality*, *Nationality Missing*, *Not Working*, *Industrial Sector Worker*, *White-Collar Worker*, *Any Child*, *Spouse in PHI*, and *Spouse Not Working*.

[c]Switch to PHI controls include the variables *Time at Risk*, *Left-censored*, *Awareness*, *Lower income threshold*, *Voluntarily in SHI*, and *Extended Eligibility*.

[d]Self-assessed risk includes the variables *Risk-Loving*, *Risk-Loving missing*, and *Risk-Loving Interpolated*.

* ($p < .10$).
** ($p < .05$).
*** ($p < .01$).

significant. One possible explanation for the lack of a significant effect is that switching from PHI to SHI is highly restricted. PHI-insured individuals can switch to SHI only in special situations, for example, if their income falls below a threshold.

We interpret our findings as evidence that the unisex mandate reduces risk segmentation between PHI and SHI. The private sector tends to attract better health risks (Bünnings & Tauchmann, 2015; Grunow & Nuscheler, 2014), and PHI insurees have on average better self-reported health than SHI insurees (see Table 1). The unisex mandate can reduce the gap in average risk between the two systems if it improves the risk pool of SHI relative to PHI.

Women have on average higher health care expenditures than men.[13] In the summary statistics in Table 1, we have seen that the average number of doctor visits is higher for women than for men. In Table S5.1 of Appendix S5, we show that this finding holds even after controlling for numerous covariates. However, it is possible that reduced premiums for women attract healthier women to join PHI who were not interested in switching at higher prices.

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[13]In Appendix S5, we show this based on aggregate statistics from the Federal Financial Supervisory Authority (BAFIN) for private health insurance (PHI) and from the Federal Insurance Office (BVA) for social health insurance (SHI) for the year 2012. Average health care expenditures are higher for women than for men both within the PHI system and the SHI system.
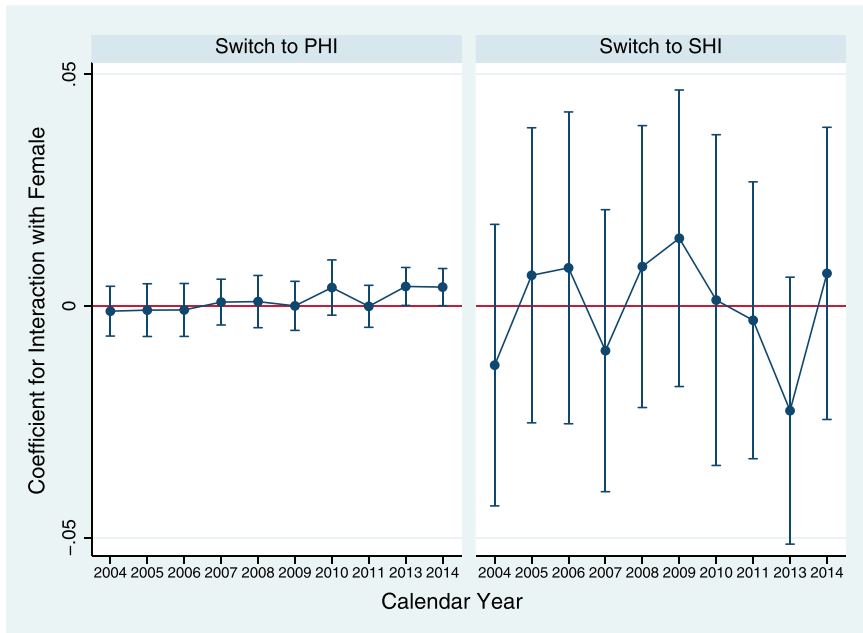
FIGURE 4 Estimated coefficients and 95% confidence intervals for the interaction terms between female and periods, full sample linear switching specification with pretrends [Colour figure can be viewed at wileyonlinelibrary.com]

Yet, the descriptive evidence in Figure 3b does not support this notion. PHI premiums for women were higher after the unisex mandate was implemented than in the baseline period before it was announced. The increase in premiums for both women and men can be explained either by an underlying trend of increasing health care expenditures or by changes in the PHI risk pool (adverse selection) after insurers are no longer allowed to charge different premiums for men and women (Cutler & Zeckhauser, 2000; Buchmueller & Dinardo, 2002).

These findings on premiums are a possible explanation for the observed time trends in switching rates.[14] Figure 2a shows that switching rates from SHI to PHI decrease for men after the unisex mandate is implemented, but do not increase for women. Reduced switching by men can have an effect on risk selection between SHI and PHI. If fewer men with relatively good health and high incomes leave SHI, then the risk pool of SHI improves. Thus, the unisex mandate can affect risk selection between the two systems even if switching rates for women do not change.

4.2 | Sensitivity analysis

The exogeneity assumption requires that in the absence of the unisex mandate, the difference in switching rates between women and men would have been constant over time. Although we cannot test this assumption for the period when the unisex mandate took effect, we can look at pre-trends in switching rates for earlier periods. In Figure 2, we have already seen that switching rates to PHI followed a similar pattern for both genders in the years before the unisex mandate was announced. For switching to SHI, the pattern is more noisy.

In a more formal analysis, we conduct a "placebo" estimation in which we interact female with year dummies. This allows testing whether the difference in switching rates between women and men was constant over time in the years before the mandate was implemented. Estimation coefficients for these interaction terms are shown in Figure 4.[15] None of the coefficients for the years before the implementation is statistically significant. This supports the exogeneity assumption.

Furthermore, we show that our results are broadly robust to alternative specifications of the sample and to alternative choices of covariates and that they cannot be explained by a simultaneous reform in child benefits. These results are shown in Tables S3.4 and S3.5 in Appendix S3.

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[14]In addition to the effect of premiums, changes in switching rates to private health insurance could also reflect the publicity about unisex tariffs.
[15]Numerical results are reported in Table S3.3 in Appendix S3.

TABLE 3 Results from the heterogeneity analysis for switching from SHI to PHI

	Switch to PHI			
	Employees	Civil servants	Self-employed	Mini-jobbers
	(1)	(2)	(3)	(4)
Variables	Linear	Linear	Linear	Linear
Female × Implemented	.003**	-.112	.037***	.022***
	(.001)	(.096)	(.011)	(.007)
Female	-.004***	-.036	-.032***	-.019**
	(.001)	(.060)	(.008)	(.008)
Good health	.003***	.041	.015***	.000
	(.001)	(.041)	(.005)	(.002)
Constant and year dummies	Yes	Yes	Yes	Yes
Socioeconimic controls[a]	Yes	Yes	Yes	Yes
Switch to PHI controls[b]	Yes	Yes	Yes	Yes
Self-assessed risk[c]	Yes	Yes	Yes	Yes
Observations	64,605	630	4,938	6,754

Note. Estimation by ordinary least squares. Cluster-robust standard errors in parentheses. Abbreviations: PHI, private health insurance; SHI, social health insurance.

[a]Socioeconomic controls include the variables *Age*, *Income Quartiles*, *Income Above 75% of the Threshold*, *Income Missing*, *Years of Education*, *West Germany*, *German Nationality*, *Nationality Missing*, *Industrial Sector Worker*, *White-Collar Worker*, *Any Child*, *Spouse in PHI*, and *Spouse Not Working*.

[b]Switch to PHI Controls include the variables *Time at Risk*, *Left-censored*, *Awareness*, *Lower income threshold*, *Voluntarily in SHI*, and *Extended Eligibility*.

[c]Self-assessed risk includes the variables *Risk-Loving*, *Risk-Loving missing*, and *Risk-Loving Interpolated*.

* ($p < .10$).
** ($p < .05$).
*** ($p < .01$).

4.3 | Heterogeneity analysis

Next, we examine the effect of the unisex mandate on switching to PHI separately for employment groups that face different incentives to join PHI. Estimation results are shown in Table 3.[16]

For self-employed individuals and mini-jobbers, we find large and significant effects of the unisex mandate on the difference in switching rates between women and men. For these groups, the unisex mandate completely eradicates the preexisting gender difference. For regular employees, we also find a positive and significant effect but the effect size is somewhat smaller. In contrast, we find no significant effect for civil servants.

These heterogeneous effects reflect differences in incentives between employment groups. Civil servants have strong financial incentives to be privately insured, regardless of whether unisex tariffs are offered or not because they receive subsidies from their employers for PHI, but not for SHI. In contrast, self-employed individuals, mini-jobbers, and regular employees face weaker financial incentives to be privately insured. This can explain why their choice to switch to PHI is more price-sensitive and why price changes due to the unisex mandate have a larger effect for these employment groups.

4.4 | Effects on Premiums

So far, we have shown that the unisex mandate increases switching probabilities from SHI to PHI for women relative to men. Next, we examine the effect of the unisex mandate on insurance premiums. Table 4 shows results for the effect of the unisex mandate on PHI premiums for women relative to men based on a regression model similar to Equation (1).[17] After the unisex mandate was implemented, premiums for women decreased by 5.8% relative to men for the full sample and by 7.9% for the sample excluding civil servants.[18] These effects are significant on the 5% and the 10% significance level, respectively. The coefficient for the sample excluding civil servants is estimated less precisely due to a smaller sample size.

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[16]As these specifications do not include nonworking individuals, the number of observations does not fully add up to the number of observations in the full sample.

[17]The regression equation is shown in Appendix S4.

[18]It is possible to interpret the ratio of the estimation coefficients for the effect of the unisex mandate on switching behavior in Table 2 and the estimation coefficient for the effect of the unisex mandate on premiums in Table 4 as an instrumental variables estimator which measures the effect of premiums on switching behavior. We discuss this instrumental variable estimator and the underlying assumptions in Appendix S4.

	Log (premiums)	
	Full sample (PHI) (1)	No civil servants (2)
Variables	Linear	Linear
Female × Implemented	-.058**	-.079*
	(.028)	(.043)
Female × Pre-announcement	.083***	.096**
	(.027)	(.040)
Female × Announced	.037	.086**
	(.035)	(.040)
Female × Pre-implementation	.024	.000
	(.027)	(.038)
Female	.156***	.125***
	(.020)	(.027)
Civil servant	-.704***	
	(.146)	
Self-employed	-.027	.085
	(.143)	(.148)
Mini-job	-.353***	-.259**
	(.098)	(.101)
Good health	-.023*	-.010
	(.012)	(.016)
Year dummies	Yes	Yes
Socioeconomic controls[a]	Yes	Yes
Premiums controls[b]	Yes	Yes
Self-assessed risk[c]	Yes	Yes
Constant	Yes	Yes
Observations	10,032	6,004

TABLE 4 Results from the analysis of the reform's effects on premiums

Note. Estimation by ordinary least squares. Cluster-robust standard errors in parentheses.

Abbreviation: PHI, private health insurance.

[a]Socioeconomic controls include the variables *Age, Income Quartiles, Income Above 75% of the Threshold, Income Missing, Years of Education, West Germany, German Nationality, Nationality Missing, Not Working, Industrial Sector Worker, White-Collar Worker, Any Child, Spouse in PHI,* and *Spouse Not Working.*
[b]Premium controls includes the variable *Left-censored (Premiums).*
[c]Self-assessed risk includes the variables *Risk-Loving, Risk-Loving missing,* and *Risk-Loving Interpolated.* *(p < .10).
**(p < .05).
***(p < .01).

The results on PHI premiums should be interpreted with caution. PHI plans can differ widely in terms of coverage and copayments, such that premiums are not directly comparable between different plans. Although information on premiums is included in the SOEP, we have no information on other PHI plan characteristics. We also do not observe when individuals switch between PHI plans.

4.5 | Effects on utilization

If the unisex mandate increases the share of women in PHI and if women have on average higher health care expenditures, then we would expect an increase in average health care expenditures per person for PHI relative to SHI. Ideally, we would like to test this hypothesis using data on health care expenditures for PHI and SHI. Unfortunately, the SOEP includes no data on health care expenditures and data from official statistics are not comparable over our study period.[19]

Instead, we examine the effect of the unisex mandate on the number of doctor visits for PHI insurees relative to SHI insurees. However, we find no significant effect.[20] One possible reason why we do not find a significant effect is that the

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[19]The Federal Financial Supervisory Authority (BAFIN) collects data within the private health insurance (PHI) system and the Federal Insurance Office (BVA) collects data from the social health insurance (SHI) system. From 2010 to 2013, data reporting, format and sampling within PHI underwent several changes. Similarly, data sampling within SHI changed between 2008 and 2011.
[20]Estimation results are shown in Table S5.2 in Appendix S5.

number of doctor visits is a relatively crude measure of heathcare utilization. Because the data on health care utilization is limited, our study focuses on the effect of the unisex mandate on switching decisions between SHI and PHI and on PHI premiums.

5 | CONCLUSION

We assess the effect of a unisex mandate on risk segmentation in the German health insurance market. The unisex mandate forbids to use gender as a determinant of insurance premiums. Although gender has never been used in the SHI system, it was a common pricing factor in the PHI system. We examine how this change in regulation affects switching between both sectors.

We find that the unisex mandate increases the probability of switching from SHI to PHI for women relative to men, although it has no significant effect on gender differences in switching rates from PHI to SHI. The impact on the probability to switch from SHI to PHI varies across employment groups. The response to the mandate is strongest for self-employed individuals and mini-jobbers, whereas we find a somewhat weaker effect for regular employees and no significant effect for civil servants. This could be related to differences in financial incentives. In addition, we find that the unisex mandate decreases premiums of women relative to men. Our results imply a worsening of the PHI risk pool and an improvement of the SHI risk pool.

Risk segmentation in the German health insurance market is a topic of great policy relevance. The ability of PHI to pick better risks is often regarded as unfair. The pricing based on statistical health risk by PHI providers yields strong incentives for self-selection. In our study, we demonstrate that regulations such as the unisex mandate can affect risk selection between the private and public health insurance system.

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