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Does it really make a difference? Health care utilization with two high deductible health care plans

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March 2016

Abstract

Deductibles are commonly used to tame increasing health care costs. Numerous studies find that higher deductibles reduce health care utilization. In this paper we compare utilization in Switzerland between two health care plans with deductibles of 1,500 CHF and 2,500 CHF (1CHF≅1$) per calendar year. While there is a minimum deductible level in Switzerland, individuals are free to increase their deductible and thereby reduce their insurance premium. In order to distinguish between selection and moral hazard we use regional variation in premiums as an instrument. Moreover, we take advantage of a policy change in 2005 that introduced the higher deductible for the first time. The results show that selection leads to considerable differences in utilization between the two groups, while we find no behavioral differences across both groups. If anything health care expenditures are higher for male individuals with the higher deductible, while for females there are no differences between the two deductible levels.

JEL-Classification: I13, I12, C23, C26,
Keywords: Health insurance, moral hazard, advantageous selection, deductible, instrumental variables

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1 Introduction

Starting with the RAND experiment researchers show consistently that price differences in health care affect utilization (Manning et al., 1987; Aron-Dine et al., 2013). However, in terms of deductibles it is less clear what happens at higher ranges. This paper tries to fill this gap by comparing utilization between two high deductible health care plans (1,500 vs 2,500 CHF per year) in Switzerland.

Individuals in Switzerland can freely choose their deductible on a predefined scale, with the lowest deductible amounting to 300 CHF and the highest deductible to 2,500 CHF. While deductibles in general are studied intensively, this is the first paper to compare the deductibles of 1,500 CHF and 2,500 CHF in terms of health care expenditures. This is promising for several reasons.

Firstly, a large share of the population concentrates on the upper end of the deductibles and this share is increasing over time. In the US an estimated 17.4 million Americans were enrolled in a high deductible health care plan (American's Health Insurance Plans, 2014). The Kaiser Family Foundation (2015) find for the US that the share of employees with a deductible over 1,000 $ increased from 10% in 2006 to 46% in 2015. The Affordable Health Care Act is likely to increase these rates even further. Within Switzerland, 35.3% of the population choose a deductible of 1,500 and 2,500 CHF in 2013 (Federal Office of Public Health FOPH, 2013, pg. 182). While comparing lower and higher deductibles is surely interesting, it has already been analyzed in numerous studies which mostly find that the higher deductible leads to lower health care expenditures, even after controlling for selection. Comparing the highest deductible levels allows a comparison between individuals with lower expected health care costs. This group is interesting because it is less experienced in obtaining health care, but also in general healthier than individuals who choose other deductible options. Therefore the effect of different deductibles for this group is less clear.

Secondly, there are several reasons to believe that after a certain point increasing the deductible further will not affect health care costs. When comparing two high deductible insurance plans out-of-pocket-prices are identical over large intervals of health utilization.[1] Moreover, when looking at total yearly expenditures a large share of individuals (40-50%) have no health care expenditures throughout the

[1]This argument holds only if individuals are myopic. In recent literature this is challenged by different studies (Gerfin et al., 2015; Aron-Dine et al., 2012) which show that individuals are forward-looking and take future expected costs into account. In this case out-of-pocket-prices are not the same for individuals with a 1,500 CHF and a 2,500 CHF deductible.

whole year.[2]

Thirdly, too high deductible levels might incentivice underconsumption and health neglect. This might be a particular issue, since recent literature shows that individuals prone to underconsumption are likely to self select into a high deductible health insurance (Einav et al., 2013). Especially men seem vulnerable to such underconsumption. Kozhimannil et al. (2013) compare the effect of high deductibles between men and women. Their findings suggest that men substantially reduce emergency department visits at all severity levels, while females only reduced low severity emergency visits. Thus they conclude that the higher deductibles incentivice men to forgo needed care. In order to analyze this underconsumption and the effects more in detail there is a need to look at high deductible cases and compare health care utilization between males and females.

A further reason is that the empirical findings in the literature regarding moral hazard of high deductibles in the US are mixed. The main explanation for these different findings is that most US studies look at consumer directed health plans (CDHP) where high deductibles are combined with personal medical accounts, partly financed by employer contributions. Within this setting it is difficult to isolate the effect of different deductibles from different employer contributions. Since our study focuses on Switzerland where personal medical accounts do not exist, we are able to look at a ceteris paribus effect of a higher deductible on health care expenditures.

Moreover, in Switzerland the 2005 reform introduced the high deductible (2,500 CHF) for the first time, while before the maximum deductible was 1,500 CHF. This policy led to a significant increase in the deductible level for some individuals who increase their deductible in 2005, while the majority of the individuals who start with the deductible of 1,500 CHF in 2004 do not change their deductible. The

[2]Not all of these individuals have zero costs. In particular, insurees might buy (non-expensive) medicines for treating frequent diseases such as the flu, which might not have been recorded by the health insurance. Moreover, individuals who have total expenditures lower than the deductible have no incentive to submit their bills, since they will not be refunded. However, a high share of the billings is transmitted from the provider of health services to the insurance company electronically. Moreover, CSS (the largest health care insurance provider in Switzerland and our data provider) conducted an internal study where they interact the billing mode with the deductible level. They do not find a higher probability of positive healthcare costs for this interaction term, which suggests that individuals submit their bills independent on the deductible level. Last but not least individuals with the lower deductible should be more likely to send in their bills, since the likelihood that their health care expenditures exceeds the deductible is higher. However, our results below show that individuals with higher deductibles do not have lower health care costs on average controlling for selection. Hence underreporting of individuals with the higher deductible cannot explain this finding.

policy change thus provides additional exogenous variation that we can use in order to identify causal effects of different variables. Furthermore, the question about the maximum deductible is interesting from a policy perspective. This paper will help to shed light on this discussion.

Looking at descriptive statistics of individuals in our sample with a deductible of 1,500 or 2,500 CHF, the policy seems to have been rather ineffective. The mechanic effect of a slower increase in premiums is obvious in the data: premiums on average increased by roughly 30 CHF from 2004 to 2005 (from 2,089 to 2,118 CHF), while from 2003 to 2004 premiums had increased by 200 CHF. However, in terms of health expenditures the policy seems to have failed in taming increasing health care costs which increased by 165 CHF on average (from an annual average of 735 CHF in 2004 to 903 CHF in 2005). This increase is even higher than the 110 CHF increase observed from 2003 to 2004. Of course this is only a descriptive analysis of average individual costs. This study will provide an in depth analysis and identify causal effects of a higher deductible on individual health care expenditures.

Since individuals choose their deductible themselves, we need to take care of selection in order to identify causal effects of a higher deductible in terms of moral hazard. To model selection into the high deductible, we use the policy reform in combination with a instrumental variable approach. The instrument is based on the regional variation in the difference in premiums between the 1,500 CHF and the 2,500 CHF deductibles. This difference depends upon place of residence (43 regions), the current health care plan (2 plans), additional casualty insurance and age group (18-25 vs. 26 or older). We instrument this choice by the difference in premiums between these two deductible levels. This difference in premiums amounts between 0 and 800 CHF a year or 0-30% of the yearly premium with a deductible of 1,500 CHF (see Figure 2).[3]

In terms of methods we employ both a standard linear IV strategy and a generalized linear model with a log link (as first suggested by Silva and Tenreyro, 2006) in order to better deal with both the large amount of zeros in the dependent variable and very high health care expenditures for some individuals.

The results show no reduced utilization for individuals with the 2,500 CHF de-

[3]An additional choice not considered here is the choice of the insurance provider. In this study we have data from the largest health insurance provider in Switzerland, who insures about 15% of the population. Since we do not have data from other providers we cannot model the switching between insurances. In order to analyze whether our results are sensible to this assumption below we will provide results for all individuals in the sample, and for individuals who stay with CSS and thus remain in our sample in the years 2003-2007.

ductible (as compared to the 1,500 CHF deductible) after controlling for selection through an instrumental variables strategy. This is remarkable given that the difference in the deductible amounts to 1,000 CHF. For men and for individuals who stay in our sample over the whole period from 2003 to 2007 our results even suggests that health care costs are slightly higher for individuals with the higher deductible. This result is consistent with health neglect by males associated with underinvestments in health leading to high health care expenditures. For individuals prone to such underinvestment, the high deductible of 2,500 CHF might well be another factor delaying necessary doctor visits resulting in even higher health care costs for this group.

The remaining of the paper is structured as follows. Section 2 gives an overview of the literature. In Section 3 we discuss the Swiss health insurance system and the institutional background. Section 4 prepares for the empirical analysis: we explain the construction of the dataset, present descriptive statistics and describe our identification strategy. Section 5 presents the results and Section 6 concludes.

2 Related literature

The effect of different deductibles on health care expenditures has been analyzed extensively in the literature. Brook et al. (1984) in their famous RAND experiment were among the first to analyze this relationship. Between 1974 and 1982 the experiment enrolled 7,706 persons aged between 14 and 61 and assigned them to 14 different health care plans with different copayments and deductibles. Newhouse et al. (1981) find that individuals with full coverage spend about 60% more on health as compared to individuals with a copayment rate of 95%. However, their focus is more on different copayment rates rather than on different deductibles. In particular the deductible levels vary between 150 and 1,000 $. For higher deductible levels they run a simulation analysis and conclude that deductibles above 1,500 $ (in 1991 $) have little effect on demand (Joseph P. Newhouse and the RAND Corporation Insurance Experiment Group, 1993, p. 193).

Once we move away from field experiments selection becomes an issue. In particular there are two challenging aspects of selection. First it is important to correct for the selection of individuals who choose their plan based on their (expected) health situation. Second, there is a selection of firms who choose the healthcare plans which they provide for their employees. The second selection problem does

not apply in Switzerland since insurance is mandatory for everybody and insurance companies directly provide the different health plans with the different deductible levels to their costumers. In what follows, we will first look at how researchers in the US tackle the different selection problems and then look at the Swiss environment.

In the US the economic literature mainly focuses on consumer directed health plans (CDHP). These are the most dominant high deductible health care plans. They include a high deductible coupled with additional personal medical accounts, partly financed by employer contributions, which can be used to finance uncovered health expenditures. Bundorf (2012) provide an extensive literature review on the effectiveness of CDHP in comparison to traditional health care plans and conclude that the effects vary between 5 and 14%. In terms of selection they point out that most studies rely on propensity score matching in order to control for selection on unobservables. In this review we will only present recent economic studies that focus on a causal estimation and deal with similar deductibles as the ones we analyze in Switzerland.

In a very recent study Haviland et al. (2016) compare 54 large employers in a differences-in-differences analysis. Since the employer chooses whether to adopt the health care plan or not the issue of individual selection is mitigated; moreover, they employ a machine learning technique in order to balance the sample of firms between plans. At the firm level they find that compared to traditional health care plans the introduction of CDHP, with deductible levels around 1,500 $, reduces yearly health expenditures by 5% in each of the three years subsequent to the CDHP choice. Looking at how many individuals in each firm choose a certain plan, this translates into a yearly reduction of 15%.

Lo Sasso et al. (2010) look at several hundred smaller firms. Since their data comes from a health insurance company that is only selling CDHPs, they make a within comparison between different CDHP, rather than comparing CDHPs to traditional plans. In terms of deductibles, their study looks at a wide range of deductibles, with an average deductible of about 2,000 $. Because there are no competing plan options at the firm level, individual selection is less of an issue. In terms of selection at the firm level they include firm fixed effects, but time varying firm selection might still be an issue. Their results suggest that even in this range a higher deductible decreases spending considerably. In particular an increase in the deductible by 1 $ is found to decrease spending by 0.5 $.

Borah et al. (2011) analyze CDHPs by comparing two medium sized employers,

where one firm switches to a CDHP leading to an increase in the deductible from 500 $ to 2,000 $. However, this sharp increase in the deductible is combined with the introduction of employer contributions of 1,000 $ and thus the effective increase in the deductible was only about 500 $. Overall their results suggest no impact on health care costs. Analyzing different cost subgroups they find a positive impact of higher deductibles on outpatient visits, especially for individuals in the upper percentiles.

Looking at Switzerland, firm selection is not an issue, due to mandatory health care and no involvement of the employer in terms of providing health care insurance. In terms of individual selection most studies rely on instrumental variables in order to create quasi natural experiments. Gerfin and Schellhorn (2006) use the premium level as an instrument to model the selection into the higher deductibles. They find that higher deductibles (1,200 and 1,500 CHF combined) lead to a lower probability of going to the doctor. A closely linked study uses the supplementary hospital insurance as identifying instrument (Schellhorn, 2001). The results suggests that most of the observed reduction in the number of physician visits is the result of self-selection of individuals into the respective insurance contracts, and not due to induced changes in healthcare utilization. Trottmann et al. (2012) model the selection into the higher deductibles with different instruments such as the premium level, applied premium reductions, number of years of CSS membership and a dummy indicating bad credit record. As previous studies they combine the deductibles 1,000, 1,500 and 2,500 CHF to one high deductible. In relation to the base category of 300 CHF they find reduced expenditures even after controlling for the endogeneity of the deductible by combining an instrumental variables strategy with a health proxy generated by health care expenditures in previous years.

Our analysis is in line with these studies but there are two major differences. First we concentrate on two high deductible levels of 1,500 and 2,500 CHF which has not be done so far. Nearly all studies focus on high deductibles and compare it with lower deductibles. These studies thus do not generalize to higher levels, where individuals are usually healthier and an increase in the deductible might have very different effects. Second we implement a novel instrument, namely the difference in premiums between the newly introduced deductible of 2,500 CHF and the already existing deductible of 1,500 CHF.

3 Swiss health system and the 2005 reform

3.1 Health insurance in Switzerland

Since January 1 1996, health insurance is compulsory for all individuals living in Switzerland. Moreover, in 1996 the Swiss federal law on health insurance[4] introduced the (yearly) deductible levels. In the year 2004 these amounted to 300, 400, 600, 1,200 and 1,500 CHF. These costs have to be paid out of pocket by the insured in case of health care utilization. After this limit is reached a copayment rate of 10% is in place, independent of the deductible level (or health care plan) up to a maximal copayment.[5] After this, all further costs are covered by the insurance.

Individuals are free in their choice of the insurance provider (86 insurance providers in 2005) and the deductible. In our sample we observe individuals living in Switzerland who are insured by CSS (the largest health insurance provider in Switzerland), CMVEO or INTRAS[6]. This sample contains about 15% of the Swiss population.

The deductible for the next year can be changed every year before the end of December. A higher deductible leads to a lower premium. In 2005 premiums varied considerably, amounting between 1,000 and 7,000 CHF a year, with the residence region and the deductible having the largest impact on the premium. Thus individuals need to tradeoff higher costs up front vs lower ex post payments for health care utilization. This tradeoff is depicted in Figure 1.

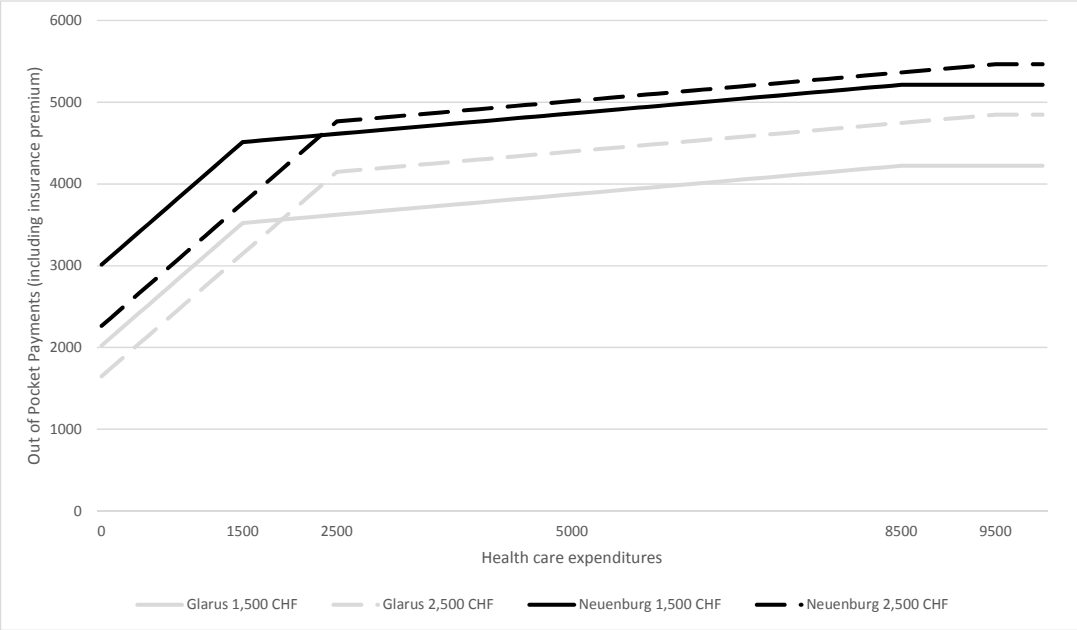
Figure 1 shows the payments for an adult in two different regions in Switzerland for two different deductibles. If health expenditures equal zero, only the premium is paid. In this case it is cheaper to have the higher deductible, resulting in a lower premium. However, once the health care expenditures exceed a certain level, the individual is better off by choosing the lower deductible and paying the higher premium. In the graph this occurs for health care expenditures of 1,900 CHF in Glarus (grey) and for 2,300 CHF in Neuenburg (black).

[4]Bundesgesetz über die Krankenversicherung (KVG)

[5]The maximum copayment was last changed in 2004 and currently amounts to 700 CHF a year.

[6]The latter two are small health insurances that have their database administrated by CSS and thus they are included in our sample

Figure 1: Example of payment schedule for insurances in two regions and with two deductible levels



The graphs shows the payment schedule for four different insurance types, for an adult (older than 25) in two different regions in Switzerland for two different deductibles. If the individual has no health care expenditures, only the premium is due, which is represented by the intercept. Then depending on the deductible the first 1,500 CHF or 2,500 CHF are paid directly by the individual. For health care expenditures exceeding this deductible the health insurance provider pays 90% of the bill, creating the first kink in the graph. Finally, all costs within a calendar year exceeding the deductible plus 7,000 CHF are entirely paid by the health insurance provider. This creates the second kink at 8,500 CHF and 9,500 CHF respectively.

Insurers can decide which plans to offer,[7] but have to accept all applications. In terms of coverage, the packages offered by the different health insurance providers are very similar, because basic health provision is regulated at federal level and ensures that most health expenses are covered. Finally, risk transfers between health insurances are in place.

Individuals who have low income and low wealth are subject to a reduced premium, i.e. part of their health insurance premium is paid directly or indirectly by the regional authority. The eligibility criteria for this reduction vary by region of residence and year. Moreover, the size of this reduction depends largely on the individual income situation. Thus this reduction has no effect on the income of

[7]To provide different plans insurance companies are required to provide the plan with the baseline deductible of 300 CHF in a region.

health insurance companies, but only affects the premium paid at the individual level.

To further control the health care expenditures starting from 1994 a supply side cost sharing is in place. The insurances provide a system of doctors namely a health maintenance organization (HMO) and insurees are obliged to first visit a specific HMO practice. Moreover, due to the lower cost of this insurance plan a premium reductions of up to 20% is granted.

Accident insurance is complementary to health insurance and compulsory as well. It covers all health care costs that result from accidents[8]. All employed workers are automatically insured through their employer if they are employed by the same employer for at least 8 hours per week. Self-employed, unemployed and non-working individuals are insured through their health insurance. In this case the health insurance premium increases by about 10%.

3.2 The 2005 reform

In 2005 the deductibles were adjusted from 300, 400, 600, 1,200 and 1,500 CHF to 300, 500, 1,000, 1,500, 2,000 and 2,500 CHF to further increase the cost awareness of individuals. The insurance companies were obliged to inform the insured persons by the end of September 2004. In case of no response individuals were automatically reclassified to the closest deductible. In case of a similar difference between the lower and the upper deductible to the original deductible the higher deductible was automatically selected.

Furthermore, the premium reductions of the different deductibles were newly regulated in 2005. In the year 2004 there was a clearly defined maximum premium reduction for every deductible in relation to the base category with a deductible of 300 and the respective age group, accident insurance and premium region. In the year 2005 the individual maximum premium reductions were abolished. As a first rule the state introduced a general maximum premium reduction of 50% to the baseline deductible of 300 CHF for all deductible levels. The second rule was that the premium reductions could not exceed 80% of the inherited risk.

Arguments against the reform were brought forward mainly by the left wing parties in Switzerland. The main critique was that the premium reductions are too high compared to the potential reduction of the moral hazard effect. Furthermore, there was the argument that the offered premium reductions undermines the

[8]Legal foundation: Bundesgesetz über die Unfallversicherung (UVG)

solidarity in the system, since the redistribution from healthy to unhealthy was reduced.

4 Data and identification

4.1 Original Sample

We obtained data from CSS on 644,088 individuals living in Switzerland who are insured by CSS, CMVEO or INTRAS.[9] The data contains detailed information of the insured such as age, gender, the broad residential location, contract choice (normal or HMO), additional accident insurance, received premium reductions (dummy), spoken language and health care costs for the years 2003 to 2007.

Table 1 shows the consequences of the reform in 2005. The rows display the deductible in 2004, while the columns display the deductible in 2005. The table shows that most individuals did not change their deductible level since the entries on the main diagonal show the highest values in terms of percentages.[10] Our main interest lies in the lower part of this table, i.e. all individuals who started out with a deductible of 1,500 CHF in 2005. The reform increased the maximum deductible from 1,500 to 2,500 CHF. However, only 15% of the individuals who start out with the 1,500 CHF deductible switch to the new maximum of 2500 CHF, while approximately 80% do not change their deductible.

[9]The original dataset has more individuals, but we drop all individuals who move in 2005, start or loose their job or who change their health care plan in 2005 such that these additional factors do not dilute the treatment effect of a different deductible. Moreover, we only keep individuals who are in the data both 2004 and 2005 in order to to be able to conduct placebo tests on exactly the same sample and including person specific fixed effects in some specifications.

[10]Some individuals were forced to change, since the deductible level of 400, 600 and 1,200 CHF were abolished. If these individuals did not choose a deductible explicitly they were assigned to the nearest (higher) deductible.

Table 1: Transition matrix of insurees from 2004 to 2005

deductible 2004	deductible 2005						
	300	500	1000	1500	2000	2500	total
300	329,974	1,261	1,076	6,960	558	2,074	341,903
	96.5%	0.4%	0.3%	2.0%	0.2%	0.6%	100.0%
400	13,907	111,830	670	4,537	443	1,319	132,706
	10.5%	84.3%	0.5%	3.4%	0.3%	1.0%	100.0%
600	2,234	38,875	1,327	4,352	452	1,239	48,479
	4.6%	80.2%	2.7%	9.0%	0.9%	2.6%	100.0%
1200	523	202	3,884	7,139	606	1,004	13,358
	3.9%	1.5%	29.1%	53.4%	4.5%	7.5%	100.0%
1500	3,081	502	154	85,390	2,034	16,481	107,642
	2.9%	0.5%	0.1%	79.3%	1.9%	15.3%	100.0%
total	349,719	152,670	7,111	108,378	4,093	22,117	644,088
	54.3%	23.7%	1.1%	16.8%	0.6%	3.4%	100.0%

The table shows the transitions in terms of deductible from 2004 to 2005. The rows display the deductible in 2004, while the columns display the deductible in 2005. Percentages refer to the row.

In the following analysis the sample is thus restricted to persons with a deductible of 1,500 CHF or higher in 2004 and 2005. Persons with deductibles below that are dropped from the sample, since the 2005 reform did hardly affect their deductible. Moreover, looking at the 2,500 CHF category in 2005 the main inflow (16,500 out of 22,000 individuals) comes from individuals who before had a deductible of 1,500 CHF, while the inflow from other categories is much more dispersed.

Furthermore, we drop individuals with a deductible of 2,000 CHF in 2005 (2,000 individuals) in order to have a binary treatment variable, between the high deductible (1,500 CHF) and the very high deductible (2,500 CHF). The main analysis is focused on the year 2005 directly after the reform and compares individuals who changed to the high deductible in comparison to individuals who kept the deductible of 1,500 CHF.

For the price difference between the premium of the 1,500 and the 2,500 CHF deductible and the respective health insurance provider, age group, region of residence, contract choice (HMO or normal) and additional accident insurance we use data of the federal office of statistics. Insurance companies are obliged to make all their premium public in every year.[11] The actual premium and the potential

[11] http://www.priminfo.ch/praemien/archiv/praemien/de/index.php

premium with the higher (or lower) deductible can therefore be matched and the price difference calculated either in absolute terms or as a percentage difference.

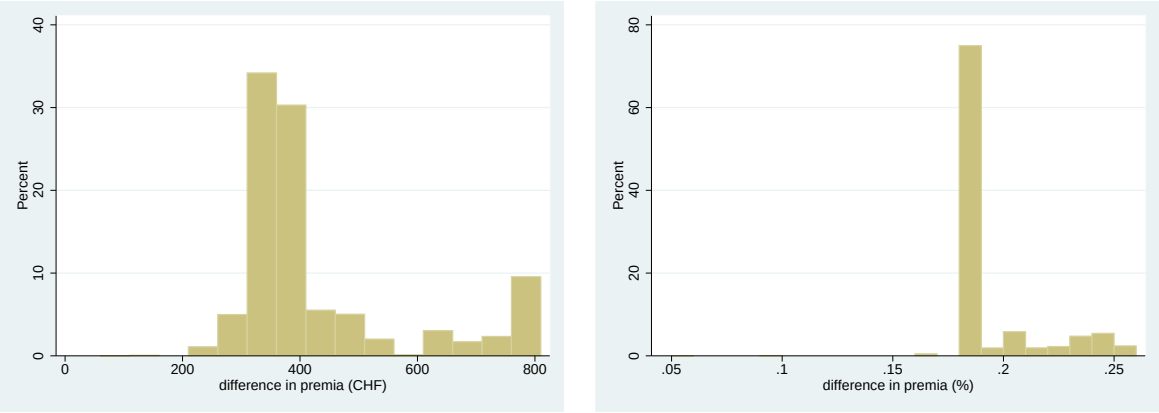
4.2 The identification strategy

The aim of this study is to causally estimate the effect of a higher deducible on health care costs. However, since healthy individuals self-select into higher deductibles and thus the deductible choice is endogenous a simple comparison will give biased results.

To correct for endogeneity of the deductible choice we use an instrumental variable approach. In particular, we employ the difference in premiums between the two deductible levels (1,500 vs. 2,500 CHF) as an instrument. This difference equals the opportunity cost of staying with the lower deductible for each individual. Figure 1 illustrates this choice for an adult in Glarus and Neuenburg. The difference between the two deductibles (our instrument) amounts to 375.6 CHF or 18.6% of 2,023.2 CHF (the premium for the 1,500 CHF deductible) in Glarus and to 748.8 CHF or 24.85% of 3,013.2 CHF in Neuenburg. Thus choosing the higher deductible is more attractive in Neuenburg. In fact in our sample 12% choose the higher deductible in Glarus compared to 19% in Neuenburg. Summing up, for individuals with a higher premium difference increasing their deductible will pay off more, while for others the (expected) costs of a higher deductible might outweigh the savings in terms of a lower premium. Thus it is likely (and we will show that it holds below) that the premium difference has a significant effect on whether the highest deductible is chosen after the reform or not.

Overall, the difference in premiums depends upon the health insurance provider (CSS, CMVEO or INTRAS), place of residence (43 regions), the current health care plan (2 plans), additional accident insurance and age group (18-25 vs. 26 or older) and amounts between 0 and 800 CHF a year or 0-30% of the yearly premium with a deductible of 1,500 CHF. Figure 2 shows the density of the difference in premiums between the two deductibles both in absolute and relative terms. In absolute terms the difference amounts to around 400 CHF on average. In terms of percentage - with an average premium for the 1,500 CHF deductible amounting to 2,000 CHF - this roughly translates into a 20% difference.

Figure 2: Density of the instrument



Δ premiums in CHF Δ premiums in percent

The graphs show the density of the difference between the two premiums for the deductible of 1500 CHF and the deductible of 2500 CHF. The first graph measures the difference in Swiss Francs and the second graph shows the density of the difference as a percentage of the premium for the 1500 deductible.

This instrument seems arguably exogenous, even though there are some possibilities of how the exclusion restriction could be violated. Firstly, it could be that CSS sets their prices of the deductible of 2,500 CHF based on the health care costs in the different regions. To mitigate this potential bias we control for the average and total costs in different cells determined by the health insurance provider, the different regions, the current health care plan (2 plans), accident insurance and the age group. The results are hardly affected by whether we include these costs or not, and thus it is unlikely that the exclusion is violated through this channel.

A second possible violation of the exclusion restriction could be that higher available income, resulting from the premium reduction, increases health spending. However, the income effect is negligible since a large share of individuals with a low income receive a premium subsidy (see also Trottmann et al., 2012). Furthermore, Schellhorn (2001) finds that the premium level has no significant effect on health care costs if other factors are controlled for.

Finally, the difference depends also on choices made by the individual. While location and causality insurance will hardly be a choice that is directly related to health insurance, the health insurance contract choice (HMO or normal) is more delicate. Thus we rerun our model exploiting only differences in premium resulting from location, age and causality insurance. Our results are not affected by this change.

4.3 Explanatory variables

Table 2 displays the explanatory variables in 2005 for the two groups, based on their deductible choice in 2005. In total our analyzed sample consists of 15,326 individuals who switch to the highest deductible and 80,832 individuals who stay with the 1,500 CHF deductible.[12] The higher deductible leads to a lower (paid) premium of about 450 CHF on average. However, this table also shows that there is considerable variation in premiums ranging from 990 to 4,700 CHF. The (hypothetical ceteris paribus) difference in premiums between the two deductible levels was already depicted in Figure 2. The table shows that this difference is slightly larger for the individuals who choose the higher deductible. This will be analyzed more in detail in the first stage of our regressions below. Moreover, in terms of insurance related variables, most individuals choose the standard package (instead of HMO). Finally, about 30% have additional accident insurance. As outlined in section 3 this means that these individuals have no employer who covers their accident insurance and thus are either self-employed or non-working.

[12]These number differ slightly from the number of individuals presented in table 1 since we drop individuals for whom their premium could not be matched with official data.

Table 2: Summary statistics in 2005

Panel A: 2,500 CHF deductible - 15,326 individuals				
Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**
insurance related variables				
premium	1,745.844	371.236	992.4	3,928.8
Δ premiums (CHF)	435.832	151.494	60	799.200
Δ premiums (%)	0.196	0.022	0.04	0.255
standard package	0.997		0	1
accident insurance	0.306		0	1
personal variables				
age	43.157	12.134	20	93
female	0.385		0	1
German	0.794		0	1
French	0.165		0	1
Italian	0.04		0	1
Panel B: 1,500 CHF deductible - 80,832 individuals				
Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**
insurance related variables				
premium	2,188.2	550.726	1,140	4,728
Δ premiums (CHF)	429.908	153.425	0	799.200
Δ premiums (%)	0.193	0.025	0	0.261
standard package	0.971		0	1
accident insurance	0.319		0	1
personal variables				
age	42.572	12.729	20	98
female	0.422		0	1
German	0.769		0	1
French	0.19		0	1
Italian	0.041		0	1

The table shows the descriptive statistics for the explanatory variables.

With respect to personal variables the average age is about 42, while about 43% of the sample is female. More females stay in the group with the lower deductible, which might be related to the higher health care costs on average for females in our sample (750 CHF in total for males and 1,100 CHF for females). Finally, the language shares roughly correspond to the overall shares in the population.

4.4 Outcome variables

In Table 3 the outcome variables are shown, together with their mean, standard deviation (sd), and the percentiles of the outcome distribution (q50, q75, q90, q95, q99). These variables are provided for the treatment group with a deductible of

2,500 CHF and the control group with a deductible of 1,500 CHF for the years before (2004) and after the policy shock (2005).

Table 3: Descriptive Statistics, Outcome Variables

	mean	sd	q50	q75	q90	q95	q99
outpatient expenditures							
2004, 1,500 CHF deductible in 2005	443.99	1,174.86	35.50	403.45	1,296.60	2,180.50	4,738.85
2005, 1,500 CHF deductible	500.17	1,392.83	52.20	450.60	1,435.45	2,379.65	5,333.50
2004, 2,500 CHF deductible in 2005	248.85	607.09	0.00	218.25	720.65	1,309.55	3,013.45
2005, 2,500 CHF deductible	318.84	1,004.16	0.00	247.95	840.95	1,587.55	4,025.20
inpatient expenditures							
2004, 1,500 CHF deductible in 2005	197.97	1,723.94	0.00	0.00	0.00	0.00	4,474.00
2005, 1,500 CHF deductible	279.07	2,525.59	0.00	0.00	0.00	1,046.00	6,244.00
2004, 2,500 CHF deductible in 2005	98.01	776.85	0.00	0.00	0.00	0.00	3,195.00
2005, 2,500 CHF deductible	143.04	1,712.42	0.00	0.00	0.00	0.00	3,903.00
medicine expenditures							
2004, 1,500 CHF deductible in 2005	126.25	599.69	0.00	80.35	299.90	586.80	1,674.60
2005, 1,500 CHF deductible	161.05	940.80	0.00	92.90	345.60	685.25	2,068.40
2004, 2,500 CHF deductible in 2005	64.06	219.99	0.00	35.15	170.30	351.20	912.55
2005, 2,500 CHF deductible	82.48	465.02	0.00	41.20	203.10	395.50	1,118.45
other expenditures							
2004, 1,500 CHF deductible in 2005	24.57	117.99	0.00	0.00	63.00	200.00	305.00
2005, 1,500 CHF deductible	26.93	131.14	0.00	0.00	78.25	200.00	339.35
2004, 2,500 CHF deductible in 2005	19.28	66.73	0.00	0.00	35.00	200.00	208.20
2005, 2,500 CHF deductible	22.34	104.59	0.00	0.00	44.00	200.00	224.10
total expenditures							
2004, 1,500 CHF deductible in 2005	792.78	2,604.74	110.90	585.55	2,022.30	3,852.15	9,301.35
2005, 1,500 CHF deductible	967.22	3,756.56	136.03	654.95	2,362.30	4,372.95	11,786.35
2004, 2,500 CHF deductible in 2005	430.20	1,244.81	12.58	325.25	1,018.70	2,082.25	5,707.50
2005, 2,500 CHF deductible	566.70	2,391.81	32.32	371.60	1,217.65	2,643.00	7,532.50

The table shows the outcome variables for two groups and two years. The groups are chosen based on their deductible in 2005, while the years shown are 2004 and 2005.

Outpatient costs (including outpatient hospital expenditures) form the largest cost group and amount to more than half of all costs. These costs include doctor visits, outpatient hospital costs and other treatments that do not require a hospital stay. Inpatient expenditures are made up of hospital expenditures and nursing home stays with patients staying in the medical facility over night. About 25% of total costs fall within this group. Moreover, another 15% are on average spent on medicines. Finally, other expenditures form the smallest category.

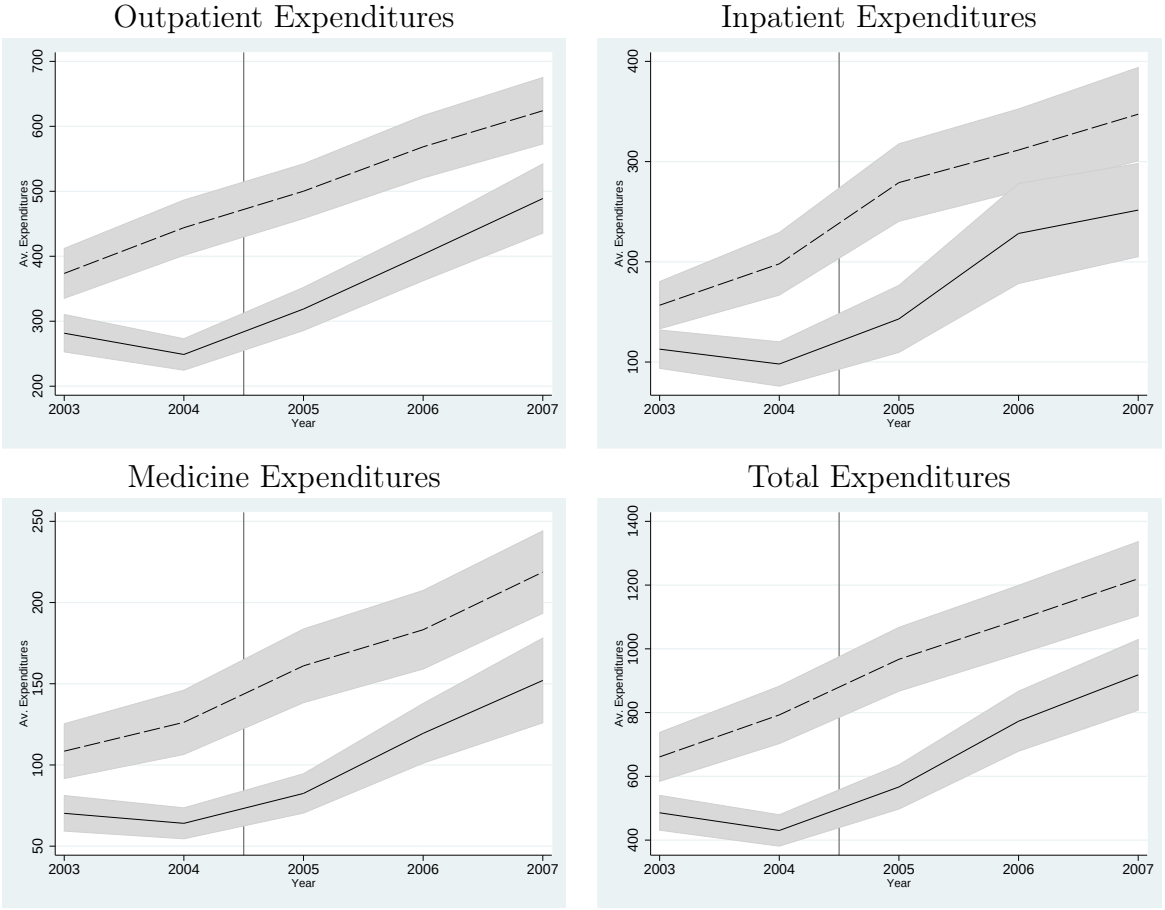
In terms of distribution the large number of zeros is noteworthy. These are expected, given that the analysis is restricted to individuals with a high deductible. For inpatient, medicine and other expenses more than 50% of the individuals show no costs. Inpatient expenditures have an even more skewed distribution with 90-95% showing no expenditures.

Finally, Table 3 shows that already before treatment the two groups are very different. Total health care expenditures for the individuals who choose the highest

deductible in 2005 are almost 50% lower as compared to individuals who stay with the lower deductible. This clearly shows that the healthier individuals self-select into the higher deductible in 2005. Moreover, the descriptive statistics suggest a positive treatment effect. Total health care expenditures increase by 22% for the control group (1,500 CHF deductible), but increase by 32% for the treatment group (2,500 deductible) between 2004 and 2005. Similarly in 2006 and 2007 we have stronger increases of 36% (13%) and 19% (12%) for the group with the higher (lower) deductible (not shown).

Figure 3 confirms this descriptive analysis. Both lines seem to be almost parallel in terms of health care costs. Thus the difference between the two groups seems rather constant over the observation period. Looking at the data and into deductible changes in later years, this persistence cannot be explained by individuals switching to different deductible levels, but rather results from a missing moral hazard effect of the higher deductible, as seen in our empirical analysis below. The only deviation from this parallel trend is a dip in 2004 for the group with the higher deductible. Since this dip occurs only for the group with the higher deductible, the common time trend assumption seems violated between 2003 and 2004 and thus a simple differences-in-differences model will lead to biased results.

Figure 3: Time Trend Graphs



The graphs show the cost development over time of individuals who stay at a deductible of 1500 CHF (dashed) and the individuals who switch to the 2500 CHF deductible (solid).

4.5 Estimation

Our analysis focuses on the health utilization effects of choosing a higher deductible. Since the choice of the higher deductible for individual i in cell r in 2005 (each cell is determined by the health insurance provider, the region of residence, age group, additional causality insurance and contract choice), $D_{i,r,2005}$, is endogenous we instrument it with the percentage difference in premiums ($\Delta P_{r,2005}$) in 2005 as explained above, controlling for other person specific characteristics ($X_{i,r,2005}$) and cell specific characteristics ($X_{r,2005}$) in 2005, namely total and average health care expenditures of all individuals in a cell. Results are similar - although somewhat weaker - when using the monetary difference instead of the percentage difference (results not shown). Person and time fixed effects fixed effects (not in the equation) are additionally included in some specifications where we include multiple years in

order to capture time invariant health related characteristics and $v_{i,r,2005}$ refers to the error term:

$$D_{i,r,2005} = \beta_0 + \beta_1 \Delta P_{r,2005} + \beta_2 X_{i,r,2005} + \beta_3 X_{r,2005} + v_{i,r,2005} \tag{1}$$

Finally, since the decision to choose a higher deductible is a binary choice we will employ two different strategies. First, we will estimate a linear model. In the second approach we will employ a three stage approach: first we estimate a probit model (zero stage), and then use the predicted values of this model as an instrument (first stage) as suggested by Wooldridge (2002, p. 623) in order to improve efficiency.

The second stage equation estimates the effect of the deductible on health care utilization:

$$Y_{i,r,2005} = \alpha_0 + \alpha_1 \hat{D}_{i,r,2005} + \alpha_2 X_{i,r,2005} + \alpha_3 X_{r,2005} + \epsilon_{i,r,2005} \tag{2}$$

where $Y_{i,r,2005}$ stands for the different outcome variables discussed in Section 4.4 and $\epsilon_{i,r,2005}$ refers to the error term.

We will estimate two different models. First we will estimate a standard linear model and employ a 2SLS estimation as described above. Then in a second step we will estimate a generalized linear model with a log link (as first suggested by Silva and Tenreyro, 2006) in order to better deal with both the large amount of zeros in the dependent variable and very high health care expenditures for some individuals. Silva and Tenreyro (2006) show that this estimator produces consistent estimates in the presence of zeros. Estimation of this generalized linear model will be implemented with a generalized methods of moments approach (GMM). In particular the population moment condition, given the model above reads:

$$E[\Delta P_{r,2005}(Y_{i,r,2005} - exp(\gamma_0 - \gamma_1 D_{i,r,2005} - \gamma_2 X_{i,r,2005} - \gamma_3 X_{r,2005}))] = 0, \tag{3}$$

where the exponential function enables the estimator to deal with zeros and very high health care costs. Standard errors in all regressions are clustered on the cell of the different health insurance providers, premium regions, age group, accident insurance and model.

5 Results

5.1 Regression analysis: Short term effects

Table 4, Panel A shows the results of the first stage regression in 2005. In all columns the difference in premiums is highly significant. The first column shows the results of a linear model. The point estimate suggests, that a one percentage point increase in the difference in premiums will increase the switching probability by 0.8 percentage points. Moreover, we present the average marginal effects of a probit estimation in column 2. Here the nonlinear model seems to suggest a slightly larger effect, namely, a one percentage point increase in the difference in premiums will on average lead to a one percentage point increase in the switching probability. In column 3 we estimate the first stage with the predicted value based on the probit regression in column 2 as the instrument (see Wooldridge, 2002, p. 623 for details). Finally, column 4 shows the results when both years (2004 and 2005) are included and a fixed effects model is estimated. Notice, that the explanatory variables can only affect the switching probability in 2005, because in 2004 the maximum deductible was at 1,500 CHF. Therefore for this regression all variables are interacted with a dummy equal to 1 if the year equals 2005 and zero otherwise. Thus by construction the results are similar to those of column 1.[13] Finally, we report the number of observations and the result of the F-test of the instrument in the last two rows. Our estimation is based on a sample of 96,158 individuals who are observed over one year (first three columns) and over two years (forth column). Moreover, the F-statistics is much larger than 10 in all cases, used as the common rule of thumb for testing the relevance of instruments.

Panel B shows the results on overall health utilization. Oddly numbered columns represent linear models, while evenly numbered columns display estimation results using a generalized linear model with a log link. In the first two columns we employ no instrumental variables but provide the estimates of the structural equation of expenditures on endogenous switching behavior. Here we obtain the expected result that individuals with the higher deductible have lower health care expenditures. Health care expenditures are about 380 CHF or 50% lower for this group. However, this difference could be driven by two mechanisms. First, this could be the result of the endogeneity of switching behavior where healthier individuals choose a higher

[13] Since for T=2 fixed effects model is equivalent to a first difference model, a different way of looking at this model is the difference between the values in 2005 and 2004, where for 2004 all variable values are equal to zero.

deductible (advantageous selection). Second, a higher deductible leads to a higher out-of-pocket-price which could reduce utilization.

The placebos in the next rows represent separate regressions, where utilization data from 2004 is combined with switching behavior in 2005. This is one attempt to separate moral hazard and advantageous selection, since in 2004 the out-of-pocket-price is the same for both groups and thus moral hazard should not play a role. The results show similar point estimates as in 2005, which suggests that most of the measured difference is driven by advantageous selection of healthier individuals into the higher deductible. This pattern of advantageous selection holds throughout all expenditure categories as shown in the first two columns of Panels B-E.

Looking at moral hazard, columns three and four of Panel B show the results for a 2SLS estimation. Notice that the first stage of this regression is presented directly above these regressions in column (1) of Panel A.[14] Here the results suggest a positive but insignificant effect for both models. Columns five and six show the results when using the predicted values of a probit estimation as an instrument in order to improve efficiency. Again the columns right above in Panel A show the first stages. Indeed this modified estimation leads to lower standard errors resulting in significant point estimates for the generalized linear model suggesting that health care expenses were by almost 80% higher in the treatment group (see column 6 of Panel B). However given that we only find significant results in this estimation, but not in the others indicates that we should take this result with a grain of salt.

Finally, columns seven and eight show the results from an estimation that takes into consideration 2004 and 2005 and estimates a fixed effects model. Including individual fixed effects improves the standard errors for the linear model, however, standard errors of the non-linear model almost double. Again the results suggest a positive but insignificant coefficient. With respect to the placebos the point estimates are smaller and all of them are insignificant, suggesting that the instrumental variable estimation seems to have taken care of selection.

Panel C shows the results for outpatient expenditures. The results for this subgroup are very similar as compared to total costs shown in Panel B, even though point estimates for this cost group are slightly smaller and we obtain no significant results even for the more efficient models (columns five and six). Again all placebo estimates except for the first two columns are statistically insignificant.

In Panel D we present the results for inpatient costs. Here we once more find

[14]Note that strictly speaking there is no real first stage for the generalized linear model with a log link as equation 3 is estimated directly via GMM.

marginally significant (10% level) and positive effects for the generalized linear IV. In columns seven and eight the effect seems to be slightly negative, but the standard errors are 3 times as large as the point estimates and thus we are unable to identify any effect in these two columns. Again the placebos are small and insignificant.

In the last Panel we look at medical expenditures. Once more the more efficient non-linear model suggests a marginally significant and positive effect, while all other point estimates are positive, but insignificant.

Table 4: Regression results

Panel A: first stage regressions								
			OLS	Probit	OLS	OLS		
			(1)	(2)	(3)	(4)		
Δ premiums (%)			0.845***	1.058***		0.845***		
			(0.0838)	(0.131)		(0.0836)		
$\hat{switch}$					0.981***			
					(0.109)			
N			96158	96158	96158	192316		
Fval			101.8	65.25	81.44	102.3		
Panel B: total expenditures								
	OLS	PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
switch	-379.7***	-0.509***	374.7	0.640*	755.4	0.799**	508.5	0.421
	(32.16)	(0.0367)	(918.6)	(0.386)	(967.1)	(0.373)	(454.6)	(0.643)
N	96,158	96,158	96,158	96,158	96,158	96,158	192,316	192,316
placebo	-342.6***	-0.581***	-243.8	-0.00842	95.49	0.272	343.4	0.309
	(26.73)	(0.0252)	(803.5)	(0.432)	(879.1)	(0.401)	(706.0)	(0.853)
N	96,158	96,158	96,158	96,158	96,158	96,158	180,060	180,060
Panel C: outpatient expenditures								
	OLS	PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
switch	-171.5***	-0.429***	-29.40	0.175	254.7	0.542	367.8	0.753
	(11.97)	(0.0278)	(542.0)	(0.795)	(542.9)	(0.608)	(238.3)	(0.559)
N	96,158	96,158	96,158	96,158	96,158	96,158	192,316	192,316
placebo	-186.1***	-0.557***	-396.9	-0.976	-192.2	-0.315	-236.8	-0.524
	(11.54)	(0.0165)	(511.2)	(1.755)	(536.8)	(1.013)	(325.8)	(0.688)
N	96,158	96,158	96,158	96,158	96,158	96,158	180,060	180,060
Panel D: inpatient expenditures								
	OLS	PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
switch	-127.7***	-0.629***	206.6	1.050*	234.1	0.932	-56.60	-1.025
	(18.73)	(0.102)	(364.0)	(0.537)	(382.8)	(0.581)	(355.0)	(2.953)
N	96,158	96,158	96,158	96,158	96,158	96,158	192,316	192,316
placebo	-92.71***	-0.653***	151.9	0.874	265.8	1.006	509.0	608.1
	(13.76)	(0.0955)	(441.9)	(0.877)	(449.2)	(0.832)	(488.3)	(.)
N	96,158	96,158	96,158	96,158	96,158	96,158	180,060	180,060
Panel E: medicine expenditures								
	OLS	PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
switch	-76.07***	-0.649***	136.6	0.937*	211.5	1.127*	159.8	0.495
	(8.348)	(0.0539)	(321.4)	(0.552)	(328.9)	(0.582)	(129.8)	(0.908)
N	96,158	96,158	96,158	96,158	96,158	96,158	192,316	192,316
placebo	-59.02***	-0.645***	-18.36	0.418	3.849	0.540	36.61	0.0551
	(6.148)	(0.0370)	(269.2)	(0.635)	(288.5)	(0.704)	(82.43)	(0.526)
N	96,158	96,158	96,158	96,158	96,158	96,158	180,060	180,060

The table shows the regression results. Panel A displays the first stage regressions. The dependent variable is equal to one if the individual switches to the higher deductible and zero otherwise. The instrument corresponds to the difference in premiums as a percentage of the premium for the 1500 deductible in 2005. Column (1) shows the results of a standard linear estimation, while column (2) shows the average marginal effects after a probit regression. Column (3) reports the OLS estimates with the predicted values from column (2) as an instrument. Finally, column (4) shows a fixed effects regression, however, since all values are interacted with a year dummy of 2005 the results are identical to column (1). Panels B-E show the second stage. The dependent variables are health care utilizations in the various categories. Oddly numbered columns represent linear models, while evenly numbered columns display estimation results using a generalized linear model with a log link. Columns (1) and (2) show regressions without IV, (3) and (4) show a normal IV, (5) and (6) show an IV where the instrument results form a probit regression and columns (7) and (8) present the results of a fixed effects estimation (first stages directly above the regression results in Panel A). Other control variables included in both stages are gender and language dummies, dummy variables for premium reduction, age controls (linear and squared term), total and average regional health care costs (all variables as measured in 2005). Standard errors in all regressions are clustered on the cell of the health insurance provider, different premium regions, age group, accident insurance and model, * p<0.10, ** p<0.05, *** p<0.01.

5.2 Gender specific effects

Many previous studies have shown that health behavior differs considerably by gender (see for instance Kozhimannil et al., 2013). Thus, we present gender specific results in Table 5. Panels A and C, show the first stage. While men seem to be slightly more responsive to premium differences, there is no significant difference

between the two.

In terms of outcomes in the second stage we only present the results for overall effects. In the first two columns, we see that once more individuals choosing the higher deductible have lower health care expenditures, for both women and men. However, once we take care of endogeneity of switching behavior by using IV, the results differ between the two groups: For women we find mostly negative and non significant coefficients, while for men we find positive and significant effects, indicating that individuals with the higher deductible have higher health care expenditures.

5.3 Robustness checks

One factor that could drive the results above are fatalities. In health economics it is commonly observed that individuals have very high health care expenditures during the last months and years of their life (see for instance Werblow et al., 2007). Thus we drop all individuals who are not present over the whole five year observation period, with deaths and change of health insurance provider being the most common causes. After this operation the sample drops from 96,158 observations to 80,295. Table 6 shows that the results are mostly unaffected by this change. Now the estimated effects are even more positive and significant, especially for inpatient and medicine expenditures.

Table 5: Gender specific results

Panel A: First stage regressions for women

	OLS	Probit	OLS	OLS
	(1)	(2)	(3)	(4)
	switch	switch	switch	switch
Δ premiums (%)	0.766***	0.924***		0.766***
	(0.0965)	(0.157)		(0.0962)
$\hat{switch}$			0.947***	
			(0.149)	
N	40,012	40,012	40,012	80,024
Ftest	63.03	34.57	40.42	63.35

Panel B: total expenditures for women

	OLS	PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
switch	-449.2***	-0.464***	-554.3	0.0506	-7.703	0.341	-635.4	-0.646
	(45.63)	(0.0471)	(1743.0)	(1.073)	(1816.3)	(0.842)	(1010.6)	(0.780)
N	40,012	40,012	40,012	40,012	40,012	40,012	80,024	80,024
placebo	-370.5***	-0.452***	-447.6	-0.146	-129.4	0.132	1750.8	2.036
	(33.56)	(0.0382)	(1143.6)	(0.730)	(1292.3)	(0.645)	(1136.0)	(2.088)
N	40,012	40,012	40,012	40,012	40,012	40,012	75,170	75,170

Panel C: First stage regressions for men

	OLS	Probit	OLS	OLS
	(1)	(2)	(3)	(4)
	switch	switch	switch	switch
Δ premiums (%)	0.906***	1.176***		0.906***
	(0.106)	(0.155)		(0.106)
$\hat{switch}$			1.001***	
			(0.115)	
N	56,146	56,146	56,146	112,292
Ftest	72.93	57.81	75.18	73.30

Panel D: total expenditures for men

	OLS	PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
switch	-332.0***	-0.552***	832.6	1.051***	976.8	1.106***	1182.2**	
	(35.94)	(0.0537)	(799.9)	(0.336)	(822.9)	(0.380)	(535.2)	
N	56,146	56,146	56,146	56,146	56,146	56,146	112,292	
placebo	-321.9***	-0.727***	-264.8	-0.0246	-22.32	0.318	-589.4	-1.500
	(29.72)	(0.0385)	(754.6)	(0.551)	(831.3)	(0.525)	(600.1)	(1.580)
N	56,146	56,146	56,146	56,146	56,146	56,146	104,890	104,890

The table shows the regression results. Panels A and C display the first stage regressions for women and men respectively. The dependent variable is equal to one if the individual switches to the higher deductible and zero otherwise. The instrument corresponds to the difference in premiums as a percentage of the premium for the 1500 deductible in 2005. Column (1) shows the results of a standard linear estimation, while column (2) shows the average marginal effects after a probit regression. Column (3) reports the OLS estimates with the predicted values from column (2) as an instrument. Finally, column (4) shows a fixed effects regression, however, since all values are interacted with a year dummy of 2005 the results are identical to column (1). Panels B and D show the second stage. The dependent variable is total health care utilization. Oddly numbered columns represent linear models, while evenly numbered columns display estimation results using a generalized linear model with a log link. Columns (1) and (2) show regressions without IV, (3) and (4) show a normal IV, (5) and (6) show an IV where the instrument results form a probit regression and columns (7) and (8) present the results of a fixed effects estimation (first stages directly above the regression results in Panel A). Other control variables included in both stages are gender and language dummies, dummy variables for premium reduction, age controls (linear and squared term), total and average regional health care costs (all variables as measured in 2005). Standard errors in all regressions are clustered on the cell of the health insurance provider, different premium regions, age group, accident insurance and model, * p<0.10, ** p<0.05, *** p<0.01.

Table 6: Results for individuals present from 2003-2007

Panel A: first stage regressions								
			OLS	Probit	OLS		OLS	
			(1)	(2)	(3)		(4)	
Δ premiums (%)			0.885***	1.123***			0.885***	
			(0.0978)	(0.138)			(0.0976)	
$\hat{switch}$					0.972***			
					(0.110)			
N			80,295	80,295	80,295		160,590	
Ftest			81.87	66.06	78.36		82.28	
Panel B: total expenditures								
	OLS	PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
switch	-351.2***	-0.479***	1780.3**	1.325***	2152.3***	1.440***	1109.4**	1.382
	(31.17)	(0.0421)	(738.0)	(0.369)	(767.9)	(0.356)	(441.3)	(0.997)
N	80,295	80,295	80,295	80,295	80,295	80,295	160,590	160,590
placebo	-327.9***	-0.558***	579.5	0.605	1000.6	0.820**	317.5	0.274
	(25.11)	(0.0260)	(580.1)	(0.451)	(669.9)	(0.413)	(641.6)	(0.828)
N	80,295	80,295	80,295	80,295	80,295	80,295	160,590	160,590
Panel C: outpatient expenditures								
	OLS	PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
switch	-166.5***	-0.418***	465.7	0.769	728.5	1.017**	555.1**	1.201*
	(12.20)	(0.0311)	(503.8)	(0.594)	(500.7)	(0.504)	(248.2)	(0.651)
N	80,295	80,295	80,295	80,295	80,295	80,295	160,590	160,590
placebo	-182.7***	-0.543***	-97.06	-0.176	129.7	0.211	-213.4	-0.496
	(11.40)	(0.0206)	(433.8)	(0.940)	(457.9)	(0.705)	(266.5)	(0.582)
N	80,295	80,295	80,295	80,295	80,295	80,295	160,590	160,590
Panel D: inpatient expenditures								
	OLS	PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
switch	-112.7***	-0.579***	738.5**	1.938***	750.0**	1.794***	162.8	0.0894
	(19.77)	(0.118)	(308.5)	(0.575)	(331.9)	(0.625)	(384.0)	(4.164)
N	80,295	80,295	80,295	80,295	80,295	80,295	160,590	160,590
placebo	-84.82***	-0.615***	499.9	1.588*	637.0	1.731*	544.5	14.17
	(13.15)	(0.0877)	(432.7)	(0.901)	(457.3)	(0.928)	(487.5)	(715583.6)
N	80,295	80,295	80,295	80,295	80,295	80,295	160,590	160,590
Panel E: medicine expenditures								
	OLS	PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
switch	-67.97***	-0.589***	518.0**	1.836***	621.1***	2.076***	353.9***	3.077
	(7.733)	(0.0578)	(215.0)	(0.507)	(235.5)	(0.591)	(120.0)	(4.021)
N	80,295	80,295	80,295	80,295	80,295	80,295	160,590	160,590
placebo	-56.11***	-0.616***	161.4	0.978*	221.4	1.135*	-40.56	-0.573
	(5.390)	(0.0383)	(176.5)	(0.520)	(205.5)	(0.588)	(53.92)	(0.403)
N	80,295	80,295	80,295	80,295	80,295	80,295	160,590	160,590

The table shows the regression results after keeping only those individuals who stay in the sample over the whole observation period. Panel A displays the first stage regressions. The dependent variable is equal to one if the individual switches to the higher deductible and zero otherwise. The instrument corresponds to the difference in premiums as a percentage of the premium for the 1500 deductible in 2005. Column (1) shows the results of a standard linear estimation, while column (2) shows the average marginal effects after a probit regression. Column (3) reports the OLS estimates with the predicted values from column (2) as an instrument. Finally, column (4) shows a fixed effects regression, however, since all values are interacted with a year dummy of 2005 the results are identical to column (1). Panels B-E show the second stage. The dependent variable are health care utilization in the various categories. Oddly numbered columns represent linear models, while evenly numbered columns display estimation results using a generalized linear model with a log link. Columns (1) and (2) show regressions without IV, (3) and (4) show a normal IV, (5) and (6) show an IV where the instrument results form a probit regression and columns (7) and (8) present the results of a fixed effects estimation (first stages directly above the regression results in Panel A). Other control variables included in both stages are gender and language dummies, dummy variables for premium reduction, age controls (linear and squared term), total and average regional health care costs (all variables as measured in 2005). Standard errors in all regressions are clustered on the cell of the health insurance provider, different premium regions, age group, accident insurance and model, * p<0.10, ** p<0.05, *** p<0.01.

5.4 Regression analysis: Medium term effects

Finally, Table 7 displays the effect of switching to the higher deductible in 2005 for later years. The switching decision for 2005 representing the first stage was already shown in the previous table. Thus we only present the results for the second stage

in later years. Moreover, in order to avoid problems of attrition we restrict our sample to individuals who are present from 2003-2007. Thus the results are directly comparable to the results of columns (3) - (6) from Table 6. The results seem to suggest that the effect becomes somewhat weaker in later years, especially for outpatient expenditures. However, all of the results are not significantly different from zero at any conventional significance levels.

Table 7: Results for later years

Panel A: first stage regressions (see Panel A of Table 6)

Panel B: total expenditures

	2006				2007			
	IV-OLS	IV-PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
switch	132.0	0.336	559.2	0.472	-190.2	0.139	539.8	0.435
	(1092.7)	(0.591)	(1069.3)	(0.524)	(1401.7)	(0.940)	(1399.4)	(0.744)
N	80,295	80,295	80,295	80,295	80,295	80,295	80,295	80,295

Panel C: outpatient expenditures

	2006				2007			
	IV-OLS	IV-PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
switch	138.8	0.290	504.8	0.661	-589.9	-1.038	-93.64	-0.0763
	(666.3)	(0.805)	(675.8)	(0.644)	(807.1)	(2.800)	(796.6)	(1.197)
N	80,295	80,295	80,295	80,295	80,295	80,295	80,295	80,295

Panel D: inpatient expenditures

	2006				2007			
	IV-OLS	IV-PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
switch	-171.6	0.0566	-130.6	-0.517	449.2	1.365*	594.1	1.232
	(542.3)	(1.386)	(517.3)	(2.155)	(585.4)	(0.748)	(615.4)	(0.848)
N	80,295	80,295	80,295	80,295	80,295	80,295	80,295	80,295

Panel E: medicine expenditures

	2006				2007			
	IV-OLS	IV-PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML	IV-OLS	IV-PQML
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
switch	160.3	0.786	190.7	0.840	-54.31	0.0779	31.91	0.321
	(244.7)	(0.516)	(265.0)	(0.565)	(246.7)	(0.875)	(280.9)	(0.806)
N	80,295	80,295	80,295	80,295	80,295	80,295	80,295	80,295

The table shows the regression results for 2006 and 2007 after keeping only those individuals who stay in the sample over the whole observation period. It compares health care costs of individuals who switch to the higher deductible in 2005. Once more we have an IV regression. The first stage is the switching decision and thus the results are already reported in Panel A of Table 7. The second stage displayed in Panels B-E show the effects of a higher deductible on health care expenditures in 2006 and 2007. The dependent variable are health care utilization in the various categories. Oddly numbered columns represent linear models, while evenly numbered columns display estimation results using a generalized linear model with a log link. Columns 1-4 show the results for 2006 while the remaining columns show the results for 2007. Finally, the first two columns of every year show a standard 2SLS estimation, while for the other two columns we show an IV where the instrument results form a probit regression. Other control variables included in both stages are gender and language dummies, dummy variables for premium reduction, age controls (linear and squared term), total and average regional health care costs. Standard errors in all regressions are clustered on the cell of the health insurance provider, different premium regions, age group, accident insurance and model, * p<0.10, ** p<0.05, *** p<0.01.

6 Conclusion

The analysis of the high deductibles is promising for several reasons. First a large share of individuals is concentrated in the highest deductible and this share is likely to increase due to policies such as the Affordable Health Care Act. Second, simulations based on the RAND experiment suggest that after a certain level a further increase of the deductible has limited effects on the health care expenditures (Joseph P. Newhouse and the RAND Corporation Insurance Experiment Group, 1993, p. 193). Third, there is a debate about the abolition of the highest deductible or a redefinition of the deductibles in general in Switzerland. Critics of deductibles make the argument that healthy people profit too much from lower premiums if they choose the highest deductible. Furthermore, it is argued that high deductibles lead to a weakening of the solidarity in the social health insurance, since the monetary redistribution from healthy to unhealthy is reduced by lower premiums for the highest deductible levels.

However, the empirical identification is challenging, especially without a randomized experiment at hand. This challenge is created by the advantageous selection of healthier individuals into higher deductibles and the selection of firms adopting high deductible health care plans. Another hurdle is created by the skewed distribution of health care expenditures. In order to address the latter we employ a generalized linear model with a log link (as first suggested by Silva and Tenreyro, 2006). Furthermore, this study focuses on Switzerland in order to avoid firm selection. Finally, we employ an instrumental variable together with a policy change in order to disentangle advantageous selection at the individual level from moral hazard.

Our results show that the difference in health expenditures between the highest deductible levels is mainly driven by advantageous selection. Once we isolate moral hazard using an instrumental variable approach the two groups look rather similar. If anything health care expenditures are higher for individuals with the higher deductible. After differing by gender, we find significant increases in health care costs for males with higher deductibles, while for women higher deductibles seem to decrease expenditures. A possible explanation for this finding is health neglect and high health care expenditures, due to underinvestments in health and delays of doctor visits incentivized by a high deductible. This is in line with many other studies that observe that men are far less likely to go to the doctor than women (see for instance Winkelmann, 2004). While part of this can be explained by differing

needs, there is also evidence for behavioral differences (Springer and Mouzon, 2011; Addis and Mahalik, 2003). This is also supported by Kozhimannil et al. (2013) who find that men with higher deductibles reduce emergency department visits at all severity levels and thus forgo needed care.

This result is robust to several robustness checks. First, we suspect that death occurrences might at least partly drive the results. Therefore we exclude all individuals who leave our sample over the 5 year observation period from 2003 to 2007 – mostly due to change of health insurer or death. However, after this exercise results become even stronger. In a second step we look at later years where the cost difference between the two groups weakens. This reduction in later years can be explained by health investments reducing costs in later years and a learning effect of individuals who underinvest in their health.

In terms of limitations it should be mentioned that due to our instrumental variable strategy we are estimating a local average treatment effect. More specifically we estimate the treatment effect on the population of compliers and thus the external validity of the results reported here remains unclear.

Summing up, our results reveal that after a certain level the spending elasticity to a higher deductible is close to zero. In terms of policy, deductibles in general are useful to increase cost awareness of the insured, however, after a certain level this result seems to wash out, or might even create incentives to avoid doctor visits and thereby lead to higher health care expenditures.

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