Cantonal Differences in Health Care Premium Subsidies in Switzerland

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Abstract

We study health care premium subsidies in the Swiss cantons in order to understand the reasons behind the substantial cross-cantonal variation in households' premium load, i.e., the share of disposable income that is spent on premiums after the subsidy. Cantons' financial situation is of particular interest in this regard, because the premium subsidies aim at reducing the premium load for lower income groups in order to ensure universal access to health care at affordable costs. Thus, variation in premium load is meant to reflect underlying differences between cantons in health care and overall living costs, or different preferences of the electorate with regards to social policy, but not budgetary considerations of cantons. We develop a premium subsidy calculation model based on cantonal regulations and apply it to households in the Swiss Household Panel to assess the effect of cantonal budget tightness on households' premium load from 2004-2012. Our analysis is based on panel regression methods and a difference-in-differences model in order to take into account unobserved heterogeneity and simultaneity concerns. The results indicate that there is a significant and negative relationship between the budget of a canton and the premium load of households.

JEL-Classification: H51, H72, H75, I14, I18

Keywords: Health care premium subsidies, equity, health care financing, fiscal federalism, budget constraint, Switzerland

1 Introduction

Switzerland's health care system is characterized by its high quality and high cost, most of which is covered through individual payments towards the mandatory health insurance scheme (Gerritzen and Kirchgässner, 2011). Insurance payments are not income-based but financed through per capita premiums, thereby putting disproportionate financial pressure on low-income households. Health care premium subsidies are thus essential to ease the financial burden for low- and middle-income households in order to ensure universal access to health care for all citizens at affordable costs, a core aim stipulated in the Swiss Health Insurance Act KVG (BAG, 2013a). With 2.32 million recipients in 2010 (29.8 percent of the Swiss population), premium subsidies have by now become an integral part of the Swiss health care system (Kägi et al., 2012). Due to steadily increasing health care costs, premium expenses nevertheless constitute an increasing economic burden for a large part of the Swiss population (see Bolgiani et al., 2006, for a discussion). Despite the subsidy scheme being in place, 366,000 people were sued by health insurers in 2010 for not paying their health insurance premiums. Furthermore, funds available for premium subsidies have increased at a lower rate than health insurance costs and hence also premiums, thus making it considerably more difficult for cantons to offset increasing expenses (OECD/WHO, 2011).

Individual premium subsidies differ widely across the country due to the large cantonal autonomy in designing health care policies (Gerritzen and Kirchgässner, 2012; Kocher, 2010). At the same time, there is also considerable cross-cantonal variation in health care premiums and tax schemes. Thus, when comparing the generosity of the premium subsidy schemes across cantons, it is important to focus on the remaining premium load, i.e., the share of disposable household income that is spent on health care premiums after the subsidy, rather than the amount of premium subsidies itself. Based on cantonal tax and health care regulations, we model premium subsidies and premium load for various household types (one-parent and two-parent households with up to eight children, and single retirees living alone) at all income levels (ESTV, 2012; GDK, 2012). We find substantial cross-cantonal variation in premium load for otherwise identical households. Our model captures the years 2004, 2007, 2010 and 2012 and indicates that, while premium load has increased over time as a result of increasing health care premiums, the variation between cantons nevertheless remains more important than the variation within cantons over time.

Despite being substantial, the cross-cantonal variation in health care premium load need not be problematic in a federal system as long as the core goal associated with the premium subsidies, i.e., universal access to health care at affordable costs, can be fulfilled, and as long as variation in premium load reflects reasonable underlying differences between cantons. Such differences could be variation in health care and

overall living costs, or different preferences of the electorate with regards to social policy, but not budgetary considerations of cantons.

In order to derive a better understanding of the determinants of households' health care premium load in the Swiss cantons, we apply our premium subsidy calculation model to households in the Swiss Household Panel from 2004-2012. In the empirical analysis, particular consideration is given to the financial situation of cantons that these households live in, while controlling for cross-cantonal differences in, for example, health care costs. We use panel regression methods and a difference-in-differences approach, exploiting the variation in cantonal budgets due to the introduction of the new fiscal equalization scheme NFA (*Neugestaltung des Finanzausgleichs*). To a certain extent, the variation in the premium load across cantons for households in the SHP data can be explained by differences in overall cantonal health care costs and other household- and canton-specific features and preferences. However, we also find significant evidence that cantons restrict financial support due to budgetary tightness.

This paper aims at contributing to the empirical literature on equity concerns in the Swiss health care system.[1] Previous studies in this field, most of which perform decomposition analysis, have found Swiss health-care financing to be particularly regressive, i.e., lower-income individuals proportionally pay significantly more than higher-income individuals. Bilger (2008) and Wagstaff et al. (1999) study regressivity at the national level, whereas Crivelli and Salari (2014) use cantonal data from the Swiss Household Budget Survey (HBS) (previously referred to as the Swiss Household Income and Expenditure Survey SHIES) for their analysis. We add to this discussion by assessing not only net premiums, but by also explicitly modeling premium subsidies. Further, we advance the existing literature by analyzing the link between inequity in Swiss health care financing and cantonal budget tightness, thereby exploring the determinants of the observed inequity. We also add a highly relevant time dimension to this debate by using panel data over a time period that covers the introduction of the new fiscal equalization scheme.

There are several policy papers that address and model cross-cantonal differences in premium subsidies (see, for example, Balthasar et al., 2005, 2008; Kägi et al., 2012). However, previous contributions have typically followed a purely descriptive approach, focusing on a few model-types.[2] Using a detailed, automated model for the calculation of the premium subsidies, we are able to add a substantial number of model cases at various income levels in all Swiss cantons, and to further apply the subsidy calculations to existing household data. This allows us to analyze the generosity of subsidies across the whole income distribution, rather than for some predetermined income levels only. As the regression analysis carried out in this project combines panel data methods with a difference-in-differences strategy, this project is the first study of health care premium subsidies in Switzerland that explicitly addresses endogeneity in order

to detect causal links between the situation of cantonal public finances and the generosity of the subsidy scheme.

The paper proceeds as follows: Section 2 provides an introduction to the health care system and premium subsidy system in Switzerland, Section 3 describes our premium subsidy calculation model, as well as a graphic depiction of the results regarding cross-cantonal variation. Section 4 explains the application of the model to the Swiss Household Panel SHP data, together with summary statistics. Section 5 discusses the methodology and estimation strategy for the panel regression and difference-in-differences estimations and presents the results of these estimations (Section 5.3). Section 6 concludes.

2 Institutional setting

2.1 Compulsory health insurance and the subsidy system

Health care in Switzerland is regulated under the Federal Health Insurance Act (*Krankenversicherungsgesetz*, KVG), which was introduced in 1996. Participation in the basic health insurance scheme is compulsory for any person residing in Switzerland for longer than three months. In turn each insurer has a legal obligation to insure anyone applying for insurance. This guarantees that all residents are covered by basic health insurance. Insurance is financed through per capita premiums and each member of the family is insured individually. People are free to choose their insurance and deductibles (*Franchise*) for a legally pre-defined service package. The services covered by the basic health insurance are regulated under the KVG and are the same regardless of the insurer and the canton of residence. There is a large number of insurers who differ with respect to the premiums they charge for this basic package.[3] In addition, premiums differ not only across insurers, but also across cantons.

The health insurance market is regulated by the Federal Office of Public Health (*Bundesamt für Gesundheit*, BAG). Each year, premiums of each insurer have to be approved by the BAG. The insurers hand in the suggested premiums along with information on the number of insured persons and the projected cost development. The primary goal of the BAG in this regard is to approve of premiums which cover the costs and guarantee the financial security of the insurers on the cantonal and national level. The BAG bases its decision on the cost projections, comparisons between insurers and previous experience. Thereby, general and individual risks of each insurer are taken into account, e.g., the number of insured persons, the risk structure, the cost development, the risk balance and the current financial situation (BAG, 2013b). The general cost development within a canton is typically projected based on canton-specific factors driving the cost of health care such as hospital bed density, physician density, pharmacy density, and the population

share of retirees (Bilger and Chaze, 2008; Rüefli and Vatter, 2001). As a result, premiums differ across cantons, reflecting existing cantonal (and regional) cost differences. In this regard, it seems relevant to note that the BAG and the cantons have (potentially) opposing interests. The cantons benefit from low health insurance premiums, incurring lower social spending, while the BAG has an interest in keeping the insurance system financially healthy and solvent by making sure that the premiums cover all the costs.

Insurance is financed through per capita premiums, which differ for children, young adults up to 25 and adults, but are equal for all income groups. Therefore, health insurance costs put a disproportionate financial burden on low income households. In 2004, the premium load acounted for 3.4 percent of household income for the highest income quartile and for 11.8 percent of household income for the lowest income quartile (OECD/WHO, 2011). In order to ease inequities related to the financing of health insurance premiums, premium subsidies were introduced under the KVG in 1996 (Bolgiani et al., 2006). In the discussions preceding the introduction of the statutory health insurance scheme, which also marked the introduction of premium subsidies, the Federal Council wanted to fix the maximum burden implied by the health insurance premiums at eight percent of taxable income (which corresponds to approximately six percent of disposable income). The Swiss Parliament, however, decided to grant more freedom to the cantons in order to adequately take into account cantonal differences in the tax and social security systems. Consequently, there is no legal national target parameter with respect to the maximum premium load, although the six-to-eight-percent goal has remained a reference point in political discussions.

The remaining premium load is calculated as the ratio of the net health care premium over the net-of-tax income; cantonal differences in health insurance premiums as well as in tax laws are therefore taken into account (Balthasar et al., 2008):

$$PL = \frac{IP - PS}{NI - T} \tag{1}$$

where PL = premium load in percent of disposable income; IP = health insurance premium; PS = premium subsidy; NI = net income; T = taxes.

Because health care premiums, tax schemes and premium subsidies differ between cantons, the remaining premium load after subsidies differs for otherwise identical households (Balthasar et al., 2008). In 2012, for example, the annual tax load for a family with two children and a modest annual gross income of CHF 70,000 ranged from CHF 171 to CHF 15,662 across cantons, gross health care premiums ranged from CHF 8,678 to CHF 14,935, and premium subsidies ranged from CHF 1,193 to CHF 6,104.[4] With our premium subsidy calculation model, explained in more detail in the next section, we are able to provide an overview

on the considerable range of taxes, health care premiums and subsidies in the Swiss cantons.

3 Modelling premium subsidies across cantons in Switzerland

3.1 Description and results of premium subsidy calculation model

To date, micro-data on the premium subsidies paid out to individuals by the cantons is not available in Switzerland. Prior to this research project, the only source making the premium subsidies comparable across cantons were the Monitoring Studies of the Socio-Economic Effectiveness of the Premium Subsidies (from now on referred to as Monitoring Studies). These studies, carried out by policy consulting agencies (Balthasar et al., 2005, 2008; Kägi et al., 2012), were released by the BAG for the years 1998, 2000, 2002, 2004, 2007 and 2010. For these studies, cantons were asked to report the premium subsidies for four reference households with a predetermined yearly gross income: (i) a retired person with a gross income of CHF 45,000, (ii) a single mother with two children and CHF 60,000 income, (iii) a middle-income family with two children and CHF 70,000 income, and (iv) a large family with four children and CHF 85,000 gross income; all children being under the age of 18.[5] From 2007 onward, the subsidies as reported by the cantons were double-checked by the consulting agencies, who based their calculations on the cantonal laws and decrees regulating the premium subsidies.

While in principle the data from these Monitoring Studies could be used for our analysis, there are two drawbacks to such an approach. First, the gross income for each beneficiary type is fixed, so it is not possible to analyze the generosity of the systems along the income distribution. Namely, for each year, there is only one "observation" per canton and type. Second, these income levels were changed substantially from the 2007 Monitoring Studies onward, in order to avoid the inclusion of model households who would in fact be eligible for means-tested social welfare benefits (*Sozialhilfe*) or means-tested supplementary pension benefits (*Ergänzungsleistungen*, called EL) (Balthasar et al., 2008). Health insurance premiums of these beneficiaries are always fully subsidized and do not fall under the regular subsidy calculation procedure. However, changing the gross incomes while observing only one point in the income distribution makes comparison over time difficult.

To overcome these two issues, we model the subsidy calculation for all cantons for the years 2004, 2007, 2010 and 2012. Like the Monitoring Studies of the later years, we also base our calculations on cantonal laws and decrees regulating premium reductions in the cantons (ESTV, 2012; GDK, 2012). However, the code behind our model is formulated generally enough in order to calculate premium subsidies for all types of households (namely retirees, one-parent and two-parent households, with up to eight children under the

age of 18) and for any gross income level. This allows us to compare the generosity of the subsidy system across cantons for different household types along the income distribution.

Point of departure for our model calculations is the yearly gross household income (note that "household" corresponds to a tax unit). Contributions to social insurance schemes are deducted from this income and family allowances are added to it, leading to the so-called annual net income of the household, i.e., net of social contributions, but not net of taxes. Based on cantonal and federal tax laws, we calculate taxable income and taxes for the different household types (ESTV, 2012). As tax rates in Switzerland vary across cantons and municipalities, we use the municipality tax of the cantonal capital for our model cases. Our model then uses this information to calculate the premium reduction which, for most cantons, depends on taxable income (on this, see also the discussion on the income definition in Section 3.2). Furthermore, the subsidy schemes in the cantons allow for different deductions depending on the size and income of the household (GDK, 2012). We use the *average* health care premium that a certain type of household would pay in a given canton (as premium subsidies are only relevant for the basic health insurance package, we abstain from including additional voluntary health insurance). With respect to both premium subsidies and taxes, the actual age of the children is not relevant as long as they are below the age of 18. This is because all premium subsidy schemes only distinguish between children below and above age 18, whereby the latter pay higher premiums and therefore also receive higher subsidies.

The results from our model are equivalent to the simulations of the Monitoring Studies, except for a few cases where we employ different assumptions and/or deductions. For example, in some years, the Monitoring Studies did not add family allowances (*Famlienzulagen*) when computing net income, whereas we do so in all years. Furthermore, we assume that in families with four or more children, the principal earner is between 35 and 44 years old, which implies that the income deduction to compute contributions to the second pillar of the Swiss pension system, BVG, corresponds to ten percent of gross income of these households. The Monitoring studies, however, assume that the principal earner is below the age of 35, regardless of the number of children that a family has, which results in a deduction of seven percent.

Figures 1, 2, 3, 5, 6 and 7 depict the results from our model for three model cases which represent the most common household types in the Swiss population relevant for the subsidy scheme. Namely, these are (i) a single parent with one child under the age of 18, (ii) a two-parent household with two children under the age of 18, and (iii) a retiree. For all types, the income range considered in the figures goes from CHF 20,000 to 200,000. Thus, the types are comparable across cantons because each of them has been assigned the same gross income, and the remaining variation in the graphs is due to cantonal differences in taxes and premium subsidies. In line with the Monitoring Studies from 2007 onward, we abstain from assigning

any assets to the households, but rather focus on income. Provided that the premium subsidy scheme is means-tested, wealthier households' earnings would typically be too high in order for them to be eligible anyways. Nevertheless, we have included property taxation regulations in our model's code, so in principle we could also model premium subsidies for households with positive wealth.

Figures 5, 6 and 7 in the appendix show premium subsidies as a continuous function of gross income for the three model cases single parent, two-parent household and retiree. The vertical lines mark the first, second and third quartile of the actual income distribution for each respective type of household in the Swiss population (derived from the nationally representative data from the Swiss Household Panel). The graphs suggest that there is considerable variation across cantons. The variation within cantons over time reflects, for example, policy changes and the general increase in health insurance premiums between 2004 and 2012.

Figures 1, 2 and 3 depict the remaining premium load (after premium subsidies) as a share of disposable income for the three model cases single parent, two-parent household and retiree in 2004 and 2012. The share of income spent on health care is above six percent of disposable income in most cantons, thus above the threshold originally defined by the Federal Council (marked by the horizontal red line in the graphs). As can be seen in the graphs, only in a few cantons the six percent goal has been reached - this holds especially when considering two-parent families and retirees. Furthermore, in the majority of cantons, the premium load has increased over time, as the 2012 curve lies further to the right than the 2004 curve. When interpreting this development, it has to be kept in mind that the premium load measure takes into account cantonal differences in taxes and premiums. Therefore, given the implicit policy goal of a net premium load around six percent, we would expect this measure to be stable or on a decreasing path, since already in 2004 many cantons did not reach the six percent threshold.

The fact that the premium load has been increasing over time suggests that the public funds available for premium subsidies are not sufficient in order to offset increases in health care premiums. The degree to which this worrisome development is related to overall health care costs and/or public budgets is assessed in the following sections, using data from the Swiss Household Panel.

Figure 1: Premium load (in percent of disposable income) for a single parent with one child, at different income levels, by canton

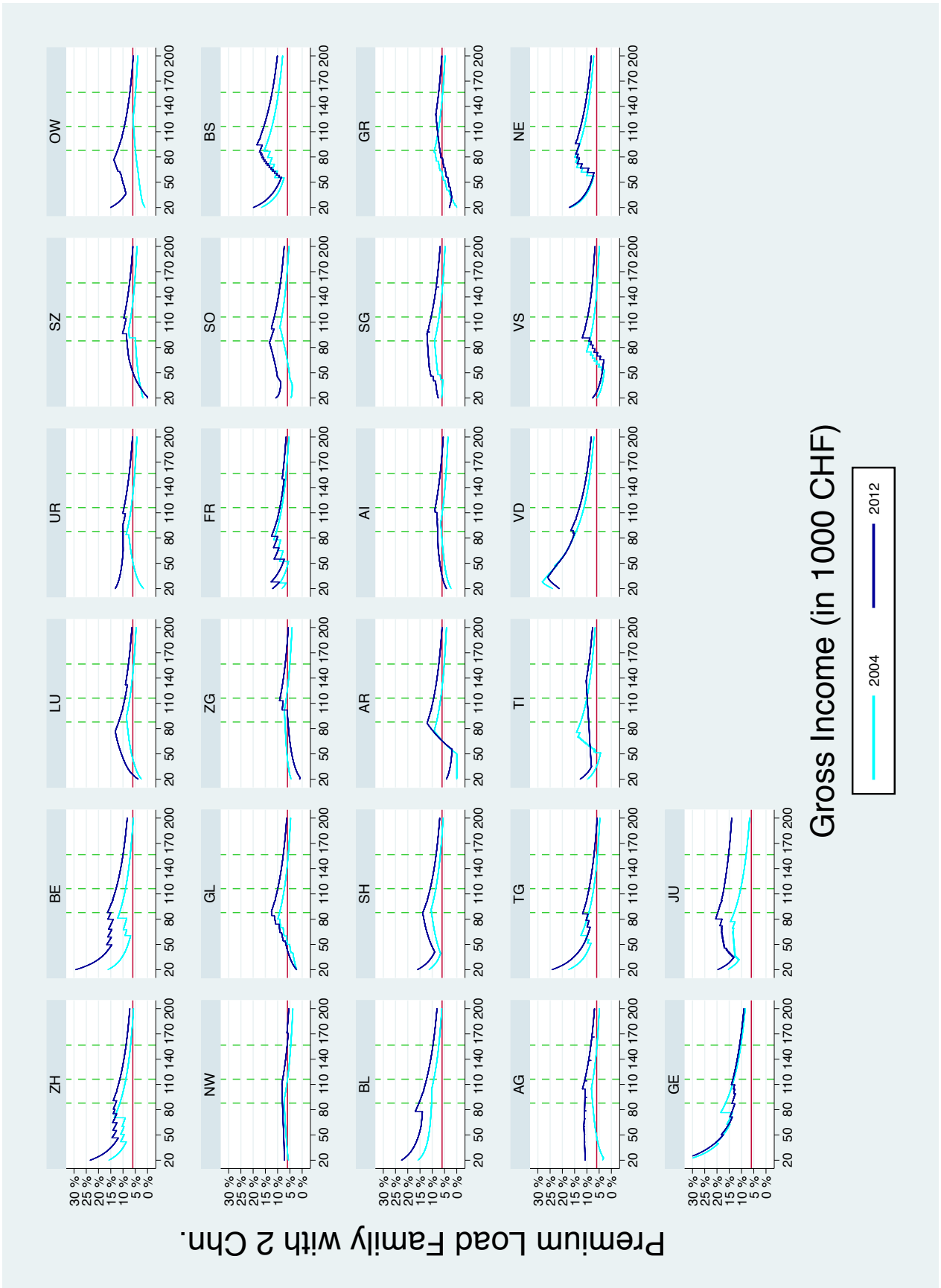

Figure 2: Premium load (in percent of disposable income) for a two-parent family with two children, at different income levels, by canton

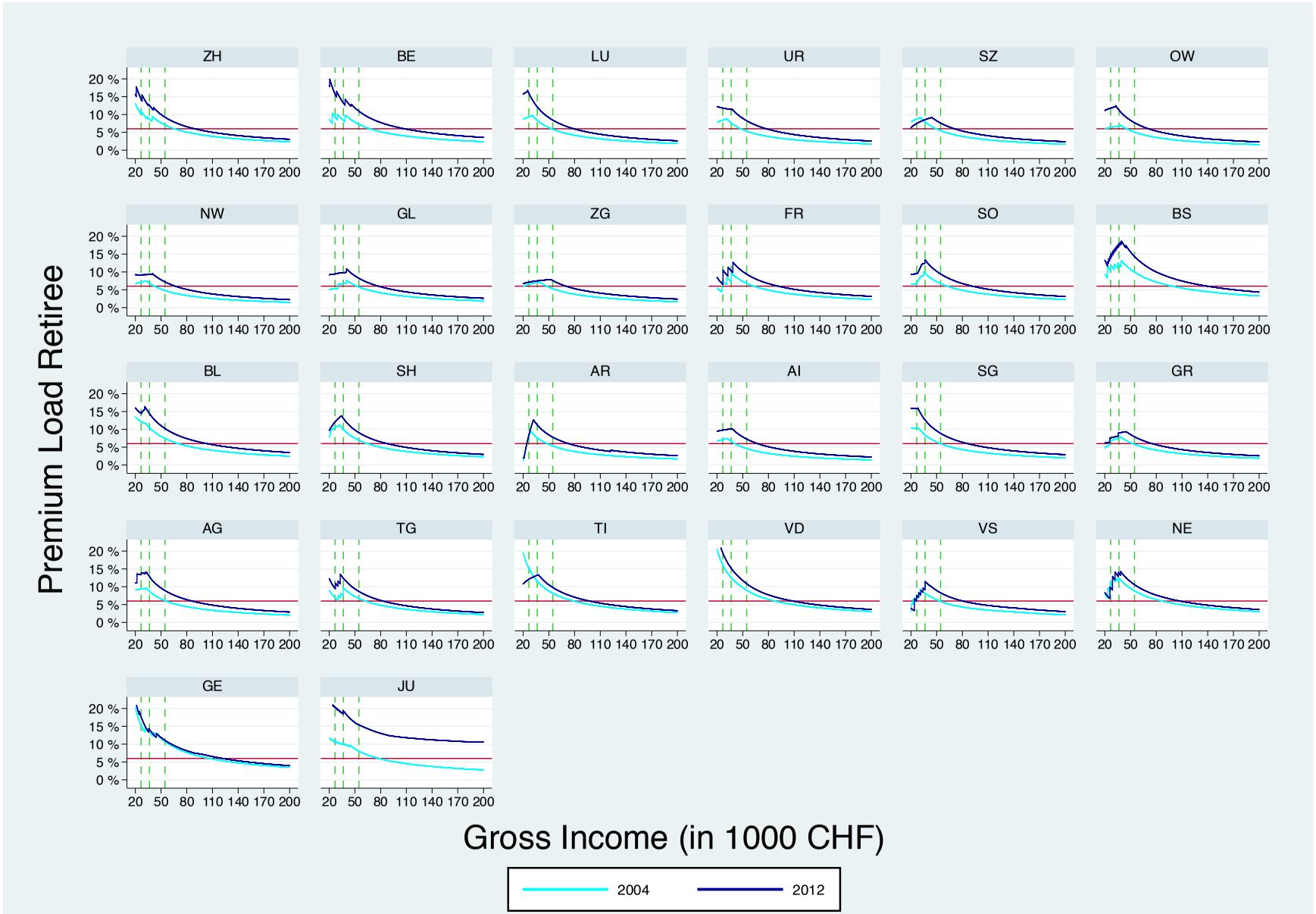

Figure 3: Premium load (in percent of disposable income) for a single retiree living alone, at different income levels, by canton

3.2 Possible causes for the large cantonal differences

As can be see from Figures 1, 2 and 3, premium subsidies and the remaining premium load differ widely across cantons, thereby reflecting the extensive autonomy of Swiss cantons with respect to the design of the cantonal health care systems. The inconsistency of premium subsidy systems and the resulting differences in the remaining premium load have been repeatedly criticized by the OECD as a major source of inequity in the Swiss health care system (OECD/WHO, 2006, 2011).

Regarding the underlying reasons behind the large cantonal differences, there are at least four factors which may account for the variation: (i) actual premiums differ between cantons, forcing cantons to adjust subsidies accordingly; (ii) differences in subsidies reflect differences in wages and in overall living costs, as well as general preferences of the cantonal electorate; (iii) subsidies differ due to different designs of the subsidy systems; (iv) financial support could be subject to budget tightness of cantons.

Differences in health care costs and premiums. The OECD Health Report 2006 shows that there is a positive (but weak) correlation between health care premiums and premium subsidies, a finding which is confirmed by our data. The premiums in turn are determined - among other things - by health care costs, which differ between cantons (for a detailed description of the process of premium approval by the BAG, see also Section 2). According to Bilger and Chaze (2008) and Rüefli and Vatter (2001), health care cost developments in the cantons are driven by both supply and demand for health care. On the supply side, physician density and physician specialization, the general provision of medical services and especially the hospital financing regime in place influence health care costs. Hospital costs account for a large share of public expenditure, and the relation of acute to long-term hospital stays is a critical parameter of cantonal health care costs (Rüefli and Vatter, 2001). On the demand side, the degree of urbanization, the number of elderly, the number of unemployed, and weak social networks influence health care costs. In general, Rüefli and Vatter (2001) find that a high degree of state intervention tends to drive up public health expenditure, while more market-oriented cantons have lower public health expenditures.

Differences in wages, living costs and preferences for redistribution. Wages and living costs differ between cantons. For example, according to the Swiss Federal Statistical Office, median salaries ranged from CHF 5,076 (canton Jura) to CHF 6,349 (canton Zurich) in 2010. Although not explicitly, wage differences are taken into account when cantons determine the amount of subsidies, as they are based on net income or taxable income. Similarly, living expenditures are not explicitly considered in subsidy calculations, however, inquiries with cantonal officials suggest that cantons consider household expenditures when they determine premium subsidies.[6] Finally, cantons differ with respect to the electorate's preferences for social spending,

which can be observed in national referendums on issues related to redistribution and the relative share of political parties in the cantons. While not wanting to neglect the importance of cross-cantonal variation in preferences, these differences alone cannot account for the observed differences in the outcome. In addition, preferences for redistribution appear to be relatively stable in the short to medium term, which is also well reflected by voting shares in the cantons over time. For example, the national popular vote on a single national health insurance in 2007 (*Volksinitiative für eine soziale Einheitskrankenkasse*) and the national referendum on managed care in 2012 (*Abstimmung über die integrierte Versorgung*) resulted in comparable voting shares in the cantons. Namely, cantons with a higher yes share in the 2007 referendum (which was mainly supported by the political left) also had a higher no share in the 2012 referendum (which would have reduced the generosity of the health care system) (BFS, 2013; Gerritzen and Kirchgässner, 2013). As this study is using data from 2004-2012, preferences of the electorate can be expected to be more or less stable over this time period. Nevertheless, attempting to measure such differences in cantonal preferences represents an exciting area for future research.[7]

Different designs of the subsidy systems. The basic mechanism of the subsidy designs can be described as follows. Eligibility is based on the income definitions laid out by cantonal tax laws, often combined with deductions specific to the premium subsidy system and including a percentage of taxable wealth. Each canton defines an income threshold, below which individuals are eligible for a subsidy - which in turn again differs in generosity from canton to canton.

(i) The subsidy scheme. In practice, the subsidy schemes in place across cantons can be divided into two different types (with the exception of a few cantons who use a combination of these two schemes). The first group of cantons uses so-called "percentage models", where citizens become eligible for premium subsidies as soon as health care expenditures exceed a pre-determined income share. The reference expenditures in this regard are not the actual health costs of a tax unit but the so-called reference premium in the canton. The subsidy is then the difference between this threshold and the actual burden. The applicable percentage thresholds again differ across cantons. The second group of cantons relies on so-called "step models", where, depending on household composition, different income brackets are defined and a fixed amount of subsidies corresponds to each bracket. The step models have the advantage that calculation is easy and they imply less administrative effort, as adjustments in the subsidies are only necessary when the income around the thresholds changes. However, there have been concerns among policy-makers about socially sub-optimal behavioral responses, as households have an incentive to bunch at kink points (Canton of Bern, 2010, 2009). Additionally, fairness of the step models has been questioned, which lead to an increased adoption of percentage models. By 2010, 16 cantons had a percentage model and two cantons used a combination of

the two, leaving only 8 cantons with a step model.

(ii) The income definition. There is no uniform income definition in place to determine eligibility. The majority of cantons relies on cantonal taxable income, which is again calculated differently in each canton as each canton has its own tax code. Most cantons allow further deductions from taxable income to determine the reference income for the health premium subsidies. Some cantons use cantonal net income plus a fixed amount of wealth, and finally the canton of Thurgau uses the "simple tax" as eligibility criterion.[8]

(iii) Procedural modalities. Cantons also differ with respect to procedural modalities. In some cantons, residents need to apply for premium subsidies after being informed about eligibility based on their tax return. In other cantons, residents need to apply without being personally informed about their eligibility. In a third set of cantons people automatically receive the subsidies with no need to apply if they are eligible according to their income reported in their tax return (Balthasar et al., 2008).

Responses to budget tightness. Anecdotal evidence suggests that the amount of subsidies paid out to low-income households is influenced by the financial situation of the canton, i.e., that funds for the health insurance premium subsidies are restricted due to cantonal budget tightness. For example, in August 2013, the canton of St. Gallen decided to cut cantonal contributions to the premium subsidy scheme by CHF 6.5 million as part of an austerity package (St. Galler Tagblatt, 2013, August 23). In response to the tight financial situation of the canton of Bern, the cantonal parliament reduced the subsidies for all income groups in 2013 (Canton of Bern, 2012). The cantonal executive has enacted further cuts for the future, explicitly admitting that the social goal set by the Federal Council is not met (Canton of Bern, 2013). Further, the canton of Glarus is currently considering reductions in premium subsidies as one among several measures in order to dampen the effect of radical tax cuts introduced in 2011, which have reduced yearly tax revenue by CHF 20 million (Tagesanzeiger, 2014, March 27).

If a canton faces tighter budget constraints and wants to confront this by reducing health care premium subsidies, it can do so by choosing one or several of the following approaches:

- Reduce the overall premium load by trying to reduce cantonal health care costs, which will ultimately determine health care premiums set by insurers in a given canton. An example for such a measure would be the cantonal licensing practice for new doctors and specialized physicians. This cost-reducing strategy would allow to fulfill the social target with lower subsidies.
- Cut premium subsidies, while leaving the income thresholds - and thereby the number of beneficiaries - unchanged.
- Reduce the number of beneficiaries by changing the subsidy system, i.e., reducing income thresholds,

changing the income definition or adjusting the allowable deductions.

- Take "hidden measures" by changing the procedural modalities with the goal to reduce the the actual number of subsidized households.

All these changes are decided upon by the cantonal parliaments and executives. This means that, in theory, politicians and political parties could be held responsible for unpopular adjustments and cuts. However, the extent to which such punishing takes places will depend on the visibility of the measure itself. From a political perspective, the first measure is difficult to take due to the complexity of the public health care system and the general limitations a canton faces to influence the determinants of health care costs. As pointed out by Bolgiani et al. (2006) and Crivelli et al. (2006), the complexity of the Swiss health care system, the pronounced federal characteristics of the system and the importance of direct democracy make reforms of the Swiss health care system very difficult. The second measure is comparatively easier to implement, however, there is bound to be opposition from political parties.

The third and forth measures seem to be the easiest ways for politicians and administrations to respond to a tighter financial situation. A canton can quite easily change its procedural modalities or calculation method in order to reduce the number of beneficiaries and the subsidy paid out to each beneficiary. As these measures are less transparent than simple cuts, they could reflect some sort of hidden budget constraint. The aforementioned cuts in the canton of Bern for example have been achieved through a combination of lowering the income thresholds and reducing the subsidy for each income bracket. Also, using a percentage instead of a step model is likely to reduce the amount of subsidies received by some of the beneficiaries. The actual choice of the procedural modality could be used to influence the number of recipients as well. It is likely that in cantons where people need to apply for subsidies, fewer people receive subsidies as some people might miss the deadline or simply forget to apply. This would enable cantons to reduce overall costs - or give them the option of distributing higher subsidies to those who do apply. This is even more likely in cantons where people need to actively find out whether they are eligible for subsidies because they are not personally informed about eligibility.[9] A closer look into cantonal political discourses supports this view. In the canton of Bern, for example, several cantonal parliamentary requests proposed to switch from the current system, where the subsidy is paid out automatically to anyone eligible, to one where the subsidy is paid out only after applying for it. The overall effect on public budgets, however, is ambiguous: If inhabitants need to apply for the subsidy, this might reduce subsidy claims, but at the same time it it also incurs higher administrative costs (Canton of Bern, 2009).

It is however, relatively challenging to classify changes in the procedural modalities accordingly, and often classification appears to be somewhat arbitrary and not necessarily able to capture all the subtle

cantonal nuances in regulatory differences. In order to avoid basing conclusions on potentially arbitrary classifications of such "hidden measures", we have decided to focus on the actual amount of premium subsidies that households receive based on cantonal decrees and premium subsidy legislation, rather than "hidden measures". Thus, in our analysis, a significant effect of budget tightness on the premium load of households can be seen as a lower bound of the actual effect. In other words, in the presence of "hidden measures" in addition to a reduction in the amount, the overall effect of budget tightness on the canton's generosity, measured in terms of both subsidy level and number of recipients, would be even more pronounced.

4 Applying the premium subsidy model to the Swiss Household Panel

As aforementioned, our model is formulated generally enough in order to calculate premium subsidies and taxes for all types of households with up to eight children under the age of 18, and for all income levels. It is therefore possible to link our subsidy calculation model to existing micro-data sets such as the Swiss Household Panel (SHP). This section motivates our choice of this dataset and explains its relevant features when applying our model calculations to the data, followed by descriptive statistics.

4.1 The Swiss Household Panel data set

In order to apply our premium subsidy calculation model to real-world data, we use the 2004, 2007, 2010, and 2012 waves of the Swiss Household Panel (SHP). The SHP is a yearly panel study following a random sample of households in Switzerland over time, interviewing all household members, thereby constituting a unique longitudinal database for Switzerland.[10]

From the SHP data, we use information on household composition (i.e., the household type as defined by the number of children and adults living in the household), canton of residence, net household income and tax payments. The net income in the SHP includes incomes from work of all household participants (net of social security contributions), plus family allowances, plus social public transfer income, income from old age or invalidity pensions and informal transfer income.

In order to compute our premium load measure described in Section 2, we require information on households' premium subsidies, disposable income (net income minus taxes), and health care premiums. Based on the net income from the SHP, we compute taxable income, which is the basis for the premium subsidy in most cantons. We then apply our premium subsidy calculation model to the SHP data and compute the amount of premium subsidies that each household in the sample would receive in the years

2004, 2007, 2010 and 2012. To compute disposable income, which requires the actual tax amount rather than taxable income, we rely on the information from the SHP. The reason behind using the actual tax amount from the SHP rather than our model's prediction is that the tax computation in our model is based on the multipliers for the capital of the canton and would therefore lead to an incorrect prediction if a household lives in a municipality with a different tax multiplier. The taxable income, however, which is used to calculate the premium subsidy, varies only across cantons, but not across municipalities within a canton.

The final element which is needed to compute the premium load are health care premiums. As the SHP does not contain information on the households' health care expenditures, we use the average health care premium in the canton for adults and children, respectively, as enacted in the yearly decrees of the Federal Department of Home Affairs (EDI) and published in the OKP statistics of the compulsory health insurance (BAG, 2012). Needless to say, this is a simplification, but alternative datasets which would include measures on households' health care expenditures, such as, for example, the Swiss Household Budget Survey (HBS), are not necessarily suitable in this context: First, the HBS data only contains self-reported information on net premiums, which might be biased in cantons where the premium subsidy is paid directly to the insurer.[11] Second, and more importantly, the HBS data does not offer a panel dimension. Third, the HBS data is not representative on the cantonal level, but only for seven major regions of Switzerland.[12] Since the purpose of our study is to better understand the impact of cantons' budgetary tightness on premium load over time, we require data for households in each canton and premium subsidy measures that are as accurate as possible. Provided that our premium subsidy calculation model rigorously takes into account both cantonal and federal legislation, it can be expected to be considerably more reliable to combine average health care premiums with modeled premium subsidies than self-reported net premiums.

We use all households from the abovementioned four waves except households who are social welfare recipients, as for these households premiums are generally fully subsidized. In order to avoid cases of misreporting due to stigma associated with receiving welfare benefits, we exclude not only households who reported in the survey that they receive social welfare benefits, but also drop all households with a yearly gross income below CHF 15,000 CHF.[13] We further exclude 34 households who moved from one canton to another during the survey period. T-tests suggest that the excluded households do not differ from the rest of the sample with respect to premium subsidies and premium load. However, with respect to income, the t-tests suggest that households that move to a different canton have significantly higher net income than those who stay in the same canton. This is in line with previous studies on geographic mobility which suggest that mobility increases with income (Kirchgässner and Pommerehne, 1996; Liebig et al., 2007;

Schmidheiny, 2006). As we are studying determinants of a means-tested subsidy scheme, excluding these households should not bias our results. As expected, performing the estimations including households that move to a different canton leads to comparable coefficient estimates.[14].

We further drop households with one or more children above age 18 who are still living in the household. This is due to the fact that our premium subsidy model includes only cantonal regulations for children under age 18, and also because if we were to include young adults, we would have to make several assumptions regarding their own income, schooling and so on. For example, in some cantons premium subsidy eligibility for young adults depends on the school fees that they pay, or whether the education institution includes boarding, and so on. Since the SHP data does not contain this information, we focus on families where all children are under the age of 18. Further, we only include retirees that are living in a one-person household, i.e., we exclude retirees where both partners are still alive and living together. This is partly because our model focuses on lone retirees, but also because this group is more relevant from the viewpoint of social policy, as also reflected by the inclusion of the single retiree type in the Monitoring Studies.

In this regard, it seems also relevant to note that the observations in the SHP data contain weights which can be used in order for the sample to be representative of the Swiss population. Provided that we are using a restricted sample, despite employing these weights we cannot aim at deriving conclusions that are valid for the Swiss population overall. Rather, we are interested in deriving conclusions that are valid for the household types in the Swiss population which are target groups for the premium subsidy scheme.

Detailed information on the assets of households is only available in the 2011 and 2012 waves of the SHP. There are, however, variables in the SHP data capturing whether the participants are homeowners or tenants, and if they have savings in the third pillar of the Swiss retirement savings scheme. As this third pillar is voluntary, but contributions to it can be deducted from taxable income, it is predominantly used by wealthier parts of the population. Therefore, dummy variables on home ownership and savings are included in the estimations to control for assets.

4.2 Descriptive statistics

Table 1 shows descriptive statistics of the resulting premium subsidy and further household characteristics when applying our subsidy calculation model to the Swiss Household Data SHP. Detailed information on data sources and variable descriptions are provided in Table A.1 in the appendix. The upper part of Table 1 depicts summary statistics for all household types jointly, whereas the lower part shows statistics for retirees, two-parent and one-parent households, respectively. The average remaining premium load after the subsidy is for all households significantly higher than the six percent threshold. The premium load

after the subsidy is highest among the retirees (10.269 percent), and lowest among single parents (7.605 percent). There is also considerable variation in disposable income, with the retirees having an average disposable income of CHF 42,038 compared to an average of CHF 107,000 among two-parent households with children.

Finally, the bottom part of Table 1 contains canton-specific data. As our main interest is in the relationship between budget tightness and premium subsidies, we include canton-specific data on the net financial result (*Finanzierungsergebnis*), i.e., total cantonal revenues minus total cantonal expenditures (including extraordinary expenditures), in CHF per capita (EFV, 2012). The higher this measure, the better the financial situation of the canton. We use the first and second lag of this variable, which are both positive on average, although with a mean value of CHF 143.80 per resident, the second lag of the financial result is higher than the first lagged value of CHF 75.40.

Table 1 further depicts summary statistics on factors influencing health care cost development in a canton. Based on the literature (Bilger and Chaze, 2008; Rüefli and Vatter, 2001), but also on the factors that are considered by insurance providers and the BAG when deciding on and approving of premiums, the most important canton-specific factors driving the cost of health care are the following: hospital bed density, physician and pharmacy density (i.e., number of hospital beds, specialized physicians in outpatient care and pharmacies per 100,000 inhabitants of a canton), as well as the population share of retirees (i.e., residents in the canton above age 65) (BFS, 2012a,b,c). The general macroeconomic climate in a canton is meant to be reflected by the cantonal unemployment rate, which was on average 2.96 percent over the survey period (SECO, 2012).

Table 2 provides summary statistics on the share of subsidy recipients by canton (based on the OKP statistics of the compulsory health insurance, BAG, 2012) and the resulting premium load of SHP households in the 26 cantons (based on our model calculations). Over the survey period, the percentage of resident population receiving premium subsidies was highest in canton Obwalden (46.32 percent), and lowest in canton Vaud (22.82 percent). However, the premium load, i.e., the net premium after the subsidy in percent of disposable household income, was highest in canton Jura (12.35 percent) and lowest in canton Zug (5.73 percent).

Detailed results on the premium load by household type and canton can be found in Table A.2 in the appendix.

Table 1: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Household-specific variables, all households					
Premium load	4,446	9.644	3.481	0	28.755
Health care premium	4,446	7,733.69	3,094.52	2,040.00	17,860.80
Premium subsidy	4,446	698.79	1,388.52	0	10,848.00
Gross income	4,446	106,000.00	120,000.00	15,000.00	3,320,000.00
Disposable income	4,446	83,033.16	83,004.21	14,498.00	2,270,000.00
Children in household	4,446	1.239	1.078	0	8
Homeowner	4,445	0.478	0.5	0	1
Savings third pillar	4,422	0.57	0.495	0	1
Summary statistics by household type: retiree					
Premium load	1,376	10.269	4.026	0	28.755
Health care premium	1,376	4,165.94	729.46	2,040.00	6,004.80
Premium subsidy	1,376	411.85	662.49	0	3,828.00
Gross income	1,376	46,648.26	32,112.74	15,000.00	568,000.00
Disposable income	1,376	42,038.76	23,962.71	14,498.00	377,000.00
Children in household	1,376	0	0	0	0
Homeowner	1,376	0.393	0.489	0	1
Savings third pillar	1,370	0.187	0.39	0	1
Summary statistics by household type: two-parent family					
Premium load	2,794	9.483	3.152	0.503	26.005
Health care premium	2,794	9,865.40	1,842.81	4,735.00	17,860.80
Premium subsidy	2,794	817.01	1,639.16	0	10,848.00
Gross income	2,794	140,000.00	141,000.00	22,000.00	3,320,000.00
Disposable income	2,794	107,000.00	96,783.27	22,000.00	2,270,000.00
Children in household	2,794	1.893	0.77	1	8
Homeowner	2,793	0.539	0.499	0	1
Savings third pillar	2,777	0.785	0.411	0	1
Summary statistics by household type: single parent					
Premium load	276	7.605	2.163	1.224	14.859
Health care premium	276	5,708.28	1,093.24	2,820.00	8,385.60
Premium subsidy	276	1,133.43	1,308.10	0	5,385.60
Gross income	276	76,664.09	31,196.27	19,600.00	188,000.00
Disposable income	276	62,119.83	22,211.29	16,200.00	137,000.00
Children in household	276	1.51	0.61	1	4
Homeowner	276	0.313	0.465	0	1
Savings third pillar	275	0.505	0.501	0	1
Canton-specific variables					
Net financial result, lag	104	75.442	644.028	-2,767.95	2,283.95
Net financial result, lag2	104	143.823	550.625	-1,935.49	1,641.49
Hospital bed density, lag2	104	514.024	224.741	188.81	1,294.94
Physician density, lag2	104	123.315	62.088	25.41	336.77
Pharmacy density, lag2	104	19.383	12.99	4.97	56.99
Share of retirees, lag2	104	16.582	1.88	12.92	20.78
Unemployment rate, lag2	104	2.961	1.318	0.77	6.97

Note: Average values based on data from 2004, 2007, 2010, 2012. Household-specific data stems from the Swiss Household Panel SHP and own calculations based on cantonal regulations (ESTV, 2012; GDK, 2012), summary statistics were generated using probability weights as provided by the SHP in order to create a sample that is representative of the types of households in the Swiss population, which are target groups for the premium subsidy scheme. Data is on retirees, two-parent and single parent families with children under the age of 18, respectively. Canton-specific data has been obtained from the federal authorities (BFS, 2012a,b,c; EFV, 2012; SECO, 2012).

Table 2: Summary statistics premium subsidy recipients and premium load, by canton

	PS recipient share	*Premium load (Net premium in % of disposable income)*					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Canton	% population	Obs	Mean	Std. Dev.	Min	Max	Weight SHP
ZH	30.565	707	9.153	2.832	0.594	19.651	525,127.84
BE	29.906	572	10.972	3.13	2.335	19.322	371,357.71
LU	37.118	200	9.021	2.623	2.668	16.546	130,418.71
UR	41.590	12	8.239	1.395	6.452	10.255	5,956.63
SZ	26.939	73	7.353	1.75	1.379	10.62	40,418.74
OW	46.318	21	7.624	2.809	3.821	13.668	12,584.16
NW	42.598	16	7.642	0.995	4.406	9.217	12,462.49
GL	26.143	15	8.539	1.379	5.307	10.79	11,638.61
ZG	28.626	66	5.73	1.457	2.985	7.742	60,561.30
FR	31.833	202	8.494	1.919	3.248	13.889	123,820.11
SO	27.601	167	8.378	2.267	1.257	12.805	103,076.86
BS	27.955	82	10.992	2.56	3.186	15.932	55,579.00
BL	26.679	165	9.225	3.285	2.08	15.784	108,091.79
SH	32.431	37	8.19	2.136	4.394	12.935	30,866.09
AR	25.182	25	5.87	3.219	0	11.891	21,052.32
AI	44.387	2	7.134	2.018	5.816	8.678	1,262.00
SG	32.055	248	8.848	2.903	1.787	15.569	198,186.42
GR	31.895	109	6.904	1.433	2.289	9.268	74,221.30
AG	26.253	322	8.297	2.377	1.224	13.809	238,818.04
TG	39.033	106	8.719	2.287	0.724	15.188	81,100.19
TI	32.514	206	10.892	4.286	2.523	22.941	168,561.80
VD	22.821	492	12.291	4.414	4.311	28.755	360,429.52
VS	29.762	146	6.914	2.218	2.016	11.59	86,100.80
NE	27.773	243	10.39	2.22	4.332	15.102	158,333.48
GE	30.027	190	11.499	4.444	0.503	27.676	151,348.24
JU	34.182	22	12.346	1.984	8.477	17.615	17,205.99

Note: Average values based on data from 2004, 2007, 2010, 2012. Column 1 displays the share of premium subsidy recipients in percent of the cantonal resident population (BAG, 2012). Columns 2-7 show the canton-specific average premium load of households in the Swiss Household Panel SHP, where premium load has been predicted according to our own premium subsidy calculation model based on cantonal information regarding eligbility schemes. Summary statistics were generated using probability weights as provided by the SHP in order to create a sample that is representative of the types of households in the Swiss population, which are target groups for the premium subsidy scheme. Data is on retirees, married couples with children and single parents with children under the age of 18, respectively.

5 Investigating responses to cantonal budget tightness

This section describes our estimation strategy and results from investigating the relationship between the premium subsidies that households from the SHP dataset receive (based on our model calculations) and the financial situation of the households' canton of residence. First, we use panel data methods in a regression of households' premium load on cantonal budget tightness (as measured by the cantons' net financial result) and a set of household- and canton-specific control variables. Second, we employ a difference-in-differences approach using the exogenous changes in cantonal budgets associated with the introduction of the new fiscal equalization scheme NFA in January 2008.

5.1 Panel regressions of premium load on budget tightness

Within the panel regression framework, we regress the premium load of households in the SHP (i.e., the share of disposable income spent on net health insurance premiums after the subsidy) on a measure of cantonal budget tightness and a set of control variables:

$$PL_{ijt} = \alpha + NFR_{jt-1}\beta_1 + \mathbf{x}'_{ijt}\beta_2 + \eta_i + \lambda_t + \lambda_{tj} + \varepsilon_{ijt} \tag{1}$$

where PL_{ijt} is the remaining premium load of household i in canton j in a given year t, NFR_{jt-1} denotes the lagged net financial result of canton j, and X_{ijt} is a set of household- and canton-specific control variables. In addition, we employ household-specific fixed effects η_i , time dummies λ_t, and (in some specifications) canton-specific time dummies λ_{tj}. The fixed effects are meant to capture household- and canton-specific unobserved heterogeneity, as long as it is time-constant (**?**; Wooldridge, 2002, p. 248). As we have restricted dynamic behavior of households over time by, e.g., only including households with children under the age of 18, it can reasonably be assumed that unobservable factors affecting health care preferences of these households are not subject to major shifts over the time period concerned. As discussed above, cantonal preferences regarding, e.g., redistributive policies, appear to be relatively stable over time as well, thereby supporting the use of fixed effects as well. To the extent that the impact of increases in the costs of health care have affected all cantons equally, these changes can be expected to be adequately captured by the time trend included in the equation (**?**). Furthermore, we estimate several specifications using canton-specific time trends. Parameter tests clearly support (at all significance levels) the use of time dummies and canton-specific time trends, thereby making a specification which includes all these controls our preferred specification. We also conduct a Hausman (1978), a Breusch-Pagan Lagrange multiplier test (1980), and a poolability test, based on an F-Test, which all clearly indicate the use of panel data methods,

namely fixed effects regressions (detailed results of these tests can be found in the lower part of Table 3 in the results section).

We use standard errors that are robust to clustering and serial correlation. Standard errors are clustered by household as observations in a given household over time can be assumed to be correlated. Further, we test for serial correlation and find significant evidence for it in the data. Therefore, we use cluster-robust standard errors that take into account serial correlation as well as clustering (Wooldridge, 2002, p. 274-276).

As aforementioned, our measure of budget tightness is the net financial result, defined as cantonal revenues minus cantonal expenses in CHF per capita. We include the lag of the budget constraint measure, as (i) the budget might affect the premium subsidies with a lag; (ii) doing so might alleviate potential endogeneity issues. Namely, if cantons simultaneously decide on tax rates and expenses on health care and social security, choosing the right timing of the variables becomes crucial in order to account for potential reverse causality (**?**). In particular, we would expect the generosity of health care premium subsidy schemes in period $t-1$ to affect the cantonal budget in period t, rather than the other way around.

The full set of control variables includes canton-specific cost drivers in health care and the cantonal unemployment rate. The reasons for choosing these variables are described in Section 4.2. It seems relevant to point out that we avoid including the actual average health care premium in a canton as it might be a bad control in the sense of **?**, but rather we include variables (such as the physician density) which are expected to determine health care premiums. As aforementioned, the timing of cantonal decision-making matters in order to avoid bad controls. We address this by using the second lag of, e.g., the cost drivers in health care which will then in turn be less likely to be affected by cantonal spending in the period thereafter. The household-specific controls we include are the number of children, as well as dummy variables on homeownership and savings in the third pillar of the Swiss retirement savings scheme. As the SHP questionnaire asks respondents about, e.g., their net income in the previous year, household-specific variables represent lagged values as well.

We have also considered taking into account a canton's hidden budget constraint as discussed in Section 3.2, by including a dummy for the procedural modality and a dummy indicating whether a canton uses a percentage model. Further, one could also control for the overall number of premium subsidy beneficiaries in a canton as this contributes to the budget constraint as well. However, these variables can be interpreted as outcomes of a canton's financial situation, rather than as controls, and are therefore bad controls as well (**?**). Namely, a variable such as procedural modality could be the dependent variable in a regression of its own and is likely to be influenced by the same factors as the premium load. We therefore abstain from including these variables in the main regression. However, doing so does not qualitatively change the

coefficient estimates on the net financial result.[15]

5.2 Difference-in-differences approach using the NFA as an exogenous source of variation

The panel regression framework laid out above captures the effect of unobservable canton- and household-specific characteristics and events on the premium load, as long as these characteristics are time-constant (in which case they will be captured by the fixed effects) or identical for all households within a canton (in which case they will be captured by the canton-specific time trend). We have further tried to alleviate potential simultaneity bias with respect to taxation, budgeting, and premium subsidy decisions of the cantons by paying particular attention to timing, e.g., by using the second lag of cost drivers in health care. Nevertheless, it is not entirely possible to rule out endogeneity and simultaneity concerns when analyzing the effect of budget tightness on premium subsidies.

An ideal experiment in order to analyze the effect of budget tightness on premium subsidies would be represented by a randomly assigned shock to cantonal budgets. If we wanted to mimic such an ideal experiment in order to address the potential endogeneity between cantonal budgets and premium subsidies, we would need an exogenous change to cantonal budgets. The reform of the Swiss fiscal equalization scheme NFA, a system of revenue equalization between the federal state and the cantons, represents such an exogenous source of variation.

The *Neugestaltung des Finanzausgleichs* (NFA) was introduced on 1 January 2008, following a public referendum on 28 November 2004, as a means to even out intercantonal inequities and to increase efficiency. Under the former fiscal equalization scheme, federal contributions towards the cantonal expenses for health premium subsidies depended on the financial strength of the canton, as well as population size and average health care premiums in Switzerland. Cantonal financial strength was measured by a financial strength index (*Finanzkraftindex*, FKI), which was not an entirely objective, resource-based measure, but rather, it was to a certain extent possible for cantons to influence the index measure by, e.g., increasing cantonal taxes and public debt, thereby ranking lower on the index and qualifying for higher contributions from the fiscal equalization scheme. In the course of the reform, this index was replaced by a more incentive-compatible resource-based index (*Ressourcenindex*).[16]

With the introduction of the NFA, the federal share of premium subsidy payments is no longer dependent on the cantons' financial strength, but only on cantonal population size and the nationwide average of health care costs. Under the new system, the federal authorities commit to financing 25 percent of gross health care premiums for 30 percent of the Swiss population. In addition, since the reform, the funds that cantons receive from the federal government for premium subsidies are no longer earmarked and can also be spent

on other matters. This changes the incentives for cantons who are financially relatively weak: prior to the reform, these cantons had an incentive to pay higher premium subsidies as a large part of the subsidies was financed by the central government. Now, if cantons pay higher subsidies, they have to cover these expenses themselves. Taken together, financially weak cantons now have an incentive to be less generous with respect to premium subsidies than prior to the NFA reform.

Our identification strategy therefore rests on the notion that while the NFA substantially changed incentives for cantons who are financially relatively weak, for relatively strong cantons the incentives regarding premium subsidies remain more or less unchanged. If anything, the latter group now receives more federal money for subsidies (and other policy matters, as the funds are not earmarked) than prior to the reform. The former group can thus be used as a treatment group and the latter as a control group. We define the threshold value for belonging to the treatment group at an FKI index equal to or lower than 90 in 2002/2003, which corresponds to the average value of the FKI among the Swiss cantons.[17] Provided that the referendum on the NFA was accepted in November 2004, we can assume that cantons were well aware of the changes associated with the NFA when they were definining tax and premium subsidy schemes for the year 2007. In other words, we consider 2004 as the observed period prior to the policy change, and 2007, 2010 and 2012 as the observed periods after the policy change. Alternatively, one could also assume that treatment took place in 2008, i.e., 2007 would also be considered as a period prior to the policy change. Estimating the model under this assumption leads to very similar difference-in-differences estimates.[18]

For this setting to fulfill the conditions of a quasi-experiment, the groups have to remain stable after treatment, i.e., the relative financial strength of cantons should not change over time. An analysis of the variance of cantons' resource and financial strength indexes over time indicates that this is the case: The between variation in both indexes is much larger than the within variation. Namely, when decomposing the standard deviation of the financial strength index FKI into between and within components, the between standard deviation is 46.02, whereas the within standard deviation is 4.12. For the resource index, the respective values are 38.18 and 4.44, which allows us to conclude that the relative position of cantons is stable over time.

A second condition that needs to be fulfilled is the common trend assumption of the two groups. Figure 4.4 shows the premium load of households in the treatment and control group cantons over time. Between 2004 and 2007, the two groups appear to have moved in parallel, although households in treated cantons (i.e., those with a lower FKI index) had a relatively higher premium load. The higher level of the premium load in the treated cantons potentially also reflects the financial weakness of these cantons. Between 2007 and 2010, the premium load increased less for households in the untreated cantons than in the treated

cantons, i.e., the curve in the former has flattened, thereby supporting the use of a difference-in-differences strategy. Following 2010, we again observe an increase. This can be seen as evidence that the groups which - despite differences in the level of premium load - followed a common trend prior to the NFA reform, now follow a different pattern over time.[19]

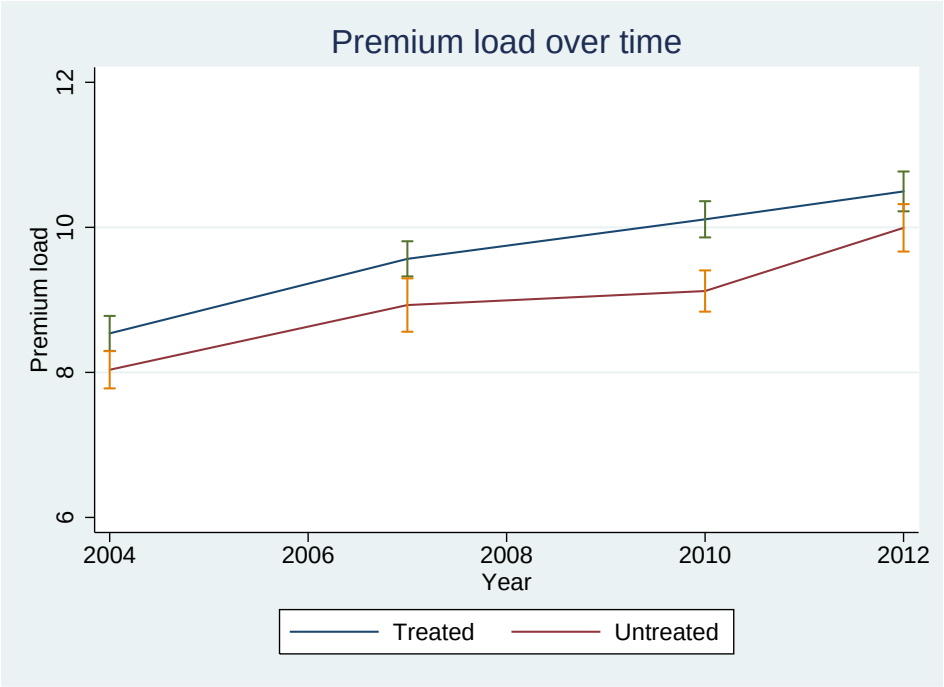

Figure 4: Premium load over time, treatment and control group

Following the notation by **?**, p. 233 and Hansen (2007), the difference-in-differences model we estimate can be described as follows:

$$PL_{ijt} = \alpha + \gamma T_{ij} + \lambda d_t + (T_{ij} d_t)\delta + \mathbf{x}'_{ijt}\beta + \eta_i + \lambda_t + \lambda_{tj} + \varepsilon_{ijt} \tag{2}$$

where PL_{ijt} is the remaining premium load of household i in canton j at time t, T_{ij} indicates treated cantons, d_t is a dummy that takes the value one following the introduction of the NFA, and δ is our difference-in-differences coefficient of interest. The household-specific fixed effects η_i, unobserved canton/time effects λ_t, λ_{tj}, and the controls at the cantonal and household level, X'_{ijt}, that we include are the same as in the panel regressions described above.

As before, we use household-level panel data from the years 2004, 2007, 2010 and 2012. As we use several years of data on the households in our sample, the errors in our difference-in-differences model are potentially subject to clustering and serial correlation. We therefore correct for this by using cluster-robust standard errors (see Bertrand et al., 2004, for a detailed discussion of serial correlation in DiD estimation and possible correction methods). Following Bertrand et al. (2004), we also pool all pre- and post treatment

periods, i.e., we use collapsed data in order to avoid potential bias due to serial correlation.

Provided that we only have data for one period prior to the reform, we cannot conduct a placebo test to analyze whether coefficients would change if we assumed that the treatment had taken place in 2004. Theoretically, it would be possible to extend our premium calculation model to yet another period, for example 2002. However, doing so would significantly reduce the sample size. This is because we are restricting the households we include from the SHP to only those households with children under age 18. Doing so while studying families over a decade, implies that a very high share of households would need to be dropped as most families will at some point have at least one child that is older than 18. Given this tradeoff between extending the time period and drastically reducing sample size, it seems that relying on Figure 4.4 in order to assess the common trend assumption, is preferable to extending the premium subsidy model to another year in order to conduct a placebo test.

5.3 Results panel regressions

Table 3 shows results from our panel regression of premium loads of households in the SHP on cantons' financial results and a set of household- and canton-specific control variables.

According to the theoretical considerations in Section 3.2, we would expect budget tightness to have a negative effect on the amount of premium subsidies received, thus increasing the premium load households face. A higher net financial result indicates that a canton is doing relatively well. Ceteris paribus, such a canton would also find it easier to alleviate the premium load of households in need. In other words, in our regression, we would expect the coefficient on the lagged financial result to be negative. This is indeed what we find in the data, where across all specifications and also for the second lag of the financial result, the estimated coefficient on the net financial result is significant and negative. Thus, the results in Table 3 support the hypothesis that financially solid cantons can succesfully dampen the premium load of households, whereas in cantons that are facing a tight budget constraint, the premium load in the following period(s) increases.

Columns 1 and 2 in Table 3 depict the estimation results including controls for time-varying and time-invariant household- and canton-specific characteristics and a national time trend. Columns 3 and 4 in Table 3 additionally include canton-specific time trends, which is our preferred specification according to the parameter tests described in Section 5.1. The coefficient estimates in Columns 3 and 4 suggest that the premium load for households in the SHP was 0.002 and 0.001 percentage points lower for each CHF increase in the net financial result of the canton that the households live in (for the lag and second lag of the financial result, respectively). When interpreting this effect, it has to be kept in mind that the average

premium load of households in the SHP data set is 9.64 percent, and the lagged financial result in CHF per capita ranges from CHF -2,767.955 to CHF 2,283.95 over all cantons over the whole period.

The coefficient estimates of the control variables are in line with theoretical predictions. Namely, the results from our preferred specification in Columns 3 and 4 in Table 3 suggest that supply side factors such as the density of specialists and pharmacies (potentially through supply-induced demand), together with demand side factors such as the share of retirees, increase health care costs and ultimately the premium load of households. Hospital bed density is an exception in this regard, as the estimated coefficient is negative. However, this effect is likely to be offset by the other cost drivers whose coefficents are significantly larger and positive. With respect to household-specific controls, homeowners appear to have a significantly lower premium load, which is most likely due to the correlation of income and assets at the household level.

Furthermore, we perform Wald tests in order to assess the joint signifance of the different groups of regressors. The test results show that the canton-specific variables are jointly significant at all conventional levels ($F(5, 1359) = 47.90$), whereas the household-specific variables are jointly significant at the ten percent level ($F(3, 1359) = 2.18$) . When analyzing the joint significance for all variables included in the regressions, the Wald test is again significant at all conventional levels ($F(9, 1359) = 29.75$).

In order to be able to compare the impact of cantonal budget changes on the premium load of different types of households, we further estimate one equation for each type of beneficiary, i.e., retirees, single parents, and two-parent families in the SHP. Results are provided in Table A.3 in the appendix. The estimated coefficients are highly similar to the baseline estimation in Table 3, except for the single parent when the lagged net financial result is used as a regressor, where the coefficient changes the sign and becomes positive. This could reflect different preferences of cantons with respect to different family types. However, as we only have data on 113 single-parent households with children under age 18, compared to 890 two-parent households and 411 retirees, the result is most likely due to insufficient sample size. When the second lag of the financial result is used as a regressor, the coefficient estimate for the single parents again becomes negative and remains significant.

As already mentioned in Section 5.1, parameter tests clearly indicate the importance of using a combination of time dummies and canton-specific time trends. Employing household-specific fixed effects involves the assumption that household-specific unobserved heterogeneity is time-constant. However, this assumption must not necessarily hold, especially when studying families with children whose health care needs and expenses might substantially change and evolve over time. To a certain extent, we restrict such effects by focusing on households where all children are under the age of 18. Nevertheless, in order to investigate such tendencies, we re-estimate the panel regressions for the time periods 2004-2007 and 2010-2012,

separately (columns 5 and 6 in Table 3). The results from the later two time periods are highly similar to the main estimations using all years. However, the regressions based on the earlier two years lead to an insignificant coefficient estimate of the net financial result. Thus, the results suggest that the effect of cantonal budget tightness on households' premium load was more pronounced during later periods. Besides household-specific changes, this could also be due to policy changes, one of which we will investigate in the next section, the introduction of the new fiscal equalization scheme NFA in 2008.

5.4 Results difference-in-differences estimation

Table 4 shows the results from the difference-in-differences regressions of the remaining premium load on the effect of the NFA and a set of household- and canton-specific controls, using data from the Swiss Household Panel SHP for the years 2004, 2007, 2010 and 2012.

As abovementioned, treatment is assumed to have taken in place in 2007 when cantons where planning their budgets for 2008, i.e., the year of the introduction of the NFA and the ensued changes in the financing of the premium subsidy scheme. However, estimating the model under the assumption that treatment took place in 2008, i.e., considering 2007 as a period prior to the policy change, does not qualitatively change the results.[20]

The first three columns of Table 4 show the coefficient estimates when we assume that the effect of the new policy was identical in all years after the treatment (i.e., the policy change). For the estimation depicted in column 4 of Table 4, we allow the effect of the policy to vary over time. Across all specifications, we find a positive and significant impact, although the effect appears to have been most pronounced in 2010. In all specifications, we employ household-specific fixed effects and a national time trend. In addition, the specification in column 3 further employs a canton-specific time trend. In column 5 and 6 of Table 4, we re-estimate the model using collapsed data, i.e., after pooling data from all pre- and post treatment periods, in order to avoid potential bias due to serial correlation (Bertrand et al., 2004). The difference-in-difference estimate remains positive and highly significant.

Overall, the positive and significant difference-in-differences estimates suggest that households who live in treated cantons, i.e., cantons that had a relatively low financial strength index prior to the reform, have experienced a significant increase in premium load. In other words, following the introduction of the NFA, the share of disposable income that households need to spend on health insurance payments (after the subsidy) has increased more substantially in cantons that rank low on the FKI index than in cantons that were less affected by the reform. The exogenously induced budget tightness due to the NFA thus appears to significantly increase the premium load of households in the treated cantons.

Regarding the control variables, we again find a positive and significant relationship between the canton-specific cost drivers in health care and the premium load of the households. The only exception in this regard is the hospital bed density in column 3. As before, however, this negative effect is likely to be offset by the relatively large and significant positive coefficients on the other cost drivers, namely physician density and the share of retirees. With respect to the household-specific controls, we find a negative and significant association between premium load and home ownership and savings, which can be assumed to reflect wealth effects.

As mentioned in Section 4.1, we exclude 34 households that moved to a different canton during the survey period. If these cantons moved to a canton where they would receive a higher premium subsidy, this could affect the validity of our treatment definition. However, this type of behavior is rather unlikely for two reasons: first, as abovementioned, t-tests show that households who move have significantly higher income than those who stay, i.e., mobility at the top of the income distribution appears to be higher than at the bottom. Mobility decisions of wealthier households can be assumed to be more influenced by cantonal differences in, for example, tax schemes, rather than premium subsidies. Second, with respect to the amount of premium subsidies and the remaining premium load, we do not find significant differences between households that moved and those that stayed. Nevertheless, as a robustness check we re-estimate the difference-in-differences model including the households that moved to a different canton, which leads to very similar coefficient estimates, both with respect to sign, size and significance. Detailed results are provided in Table B.3 in the appendix.

6 Conclusions

This paper studies cantonal differences in health care premium subsidies in Switzerland. As the Swiss public health system is characterized by high costs borne by individuals, premium subsidies are an important tool to ease the financial burden of the mandatory health insurance for low- and middle-income households, in order to ensure universal access to health care for all citizens at affordable costs, a core aim stipulated in the Swiss Health Insurance Act KVG (BAG, 2013a). Health care premiums, subsidies, and tax schemes differ widely across cantons due to the cantons' strong federal autonomy. Based on cantonal tax and health care regulations, we model health care premium subsidies and premium load at all income levels and find significant variation in the resulting share of health care costs in disposable income for otherwise identical households in different cantons.

In addition to relying on model type data, we also combine our premium subsidy calculation model with data from the Swiss Household Panel (SHP). Both our model and the application of the latter to the Swiss

Household Panel data show that health care premium load in Switzerland is above six percent of disposable income of households in many cantons. This suggests that designing and funding effective premium subsidy schemes in the face of increasing health care costs appears to be a challenge for most, if not all, Swiss cantons. However, it has to be kept in mind that the premium load threshold of six percent has been stipulated more than 18 years ago (Bolgiani et al., 2006). Over this time period, real income per capita in Switzerland has increased, and it is quite likely that with rising income, the willingness to pay for health care goods has increased as well (assuming that health care is a normal good). To a certain extent, the increasing share of health care spending in percent of GDP can be seen as evidence for this (Gerritzen and Kirchgässner, 2013). Nevertheless, provided that over the past decades income has increased significantly less at the lower end of the income distribution than in the upper half of the income distribution (Asensio et al., 2013), the validity of this argument might be limited regarding the type of households typically eligible for premium subsidies.

As explained in the introduction, cross-cantonal variation in health care premium load need not be problematic in a federal system as long as the core goal associated with the premium subsidies, i.e., universal access to health care at affordable costs, can be fulfilled, and as long as variation in premium load reflects reasonable underlying differences between cantons. Such differences could be variation in health care and overall living costs, or different preferences of the electorate with regards to social policy, but not budgetary considerations of cantons. We therefore investigate the determinants of the substantial cross-cantonal differences in households' premium load in the Swiss Household Panel (SHP). The empirical analysis uses fixed effects regression models and difference-in-differences estimations, relying on the introduction of the new fiscal equalization scheme NFA as a source of exogenous variation of the financial situation of the cantons. Based on our results, we find support for the hypothesis that limited cantonal funding resources have negative repercussions on premium subsidies in Switzerland. Namely, in the panel regressions, the first (and second) lag of the net financial result of cantons is significantly negatively related to the premium load. The difference-in-differences estimates suggest that in cantons where premium subsidy budgets were more affected by the NFA, households face a significantly higher premium load after the reform. Therefore, the tighter a canton's budget, the more challenging it seems to be for this canton to effectively reduce households' premium load.

When interpreting the finding that budgetary considerations affect households' premium load in a canton, it has to be kept in mind that cantons' budgets might again be determined by canton-specific preferences of the electorate. Using panel data methods and a difference-in-differences model, we have tried to address pontential endogeneity concerns in this regard, for example by including fixed effects and canton-

specific time trends to capture canton-specific preferences with respect to health care consumption and redistribution, which tend to be relatively stable over time. Nevertheless, it is possible that the significant negative relationship between the situation of cantonal public finances and premium load reflects local preferences, since cantonal budgets available for redistributive policies to a certain extent depend on the electorate's willingness to accept a more progressive tax schedule.

With respect to other determinants, we find evidence that health care costs, which again differ across cantons, increase households' health care premium load. Since health care expenses are not only determined by supply and demand side factors (reflected by canton-specific health care cost drivers in our model), but also by cantonal differences in preferences with respect to health care consumption, our model includes fixed effects and canton-specific time trends. The fixed effects and canton-specific time trends can further be expected to capture canton-specific preferences with respect to redistribution. The general macro-economic climate, reflected by cantonal unemployment rates, is significantly, and in most specifications negatively, related to premium load. At the household level, asset ownership is negatively associated with premium load, thus reflecting that wealthier households find it less challenging to cope with health care expenditures. The estimated coefficient on the number of children is insignificant in most specifications. To the extent that household-specific preferences regarding health care are time-invariant, they are captured by the household fixed effects.

To sum it up it can be said that although the variation in the net premium load can, to a certain extent, be explained by differences in overall cantonal health care costs and other household- and canton-specific features and preferences, we find significant evidence that cantons restrict financial support due to budgetary tightness. The present study is limited to the households in the Swiss Household Panel and uses premium subsidy calculations from a model we developed based on cantonal tax and premium subsidy regulations. From a data perspective, it would be preferable to have canton-specific household data on actual premium subsidy payments. If this type of data was made available by the Swiss cantons, replicating this type of analysis with anonymized household data would be an interesting extension of our study. Further, besides the fixed effects regressions and difference-in-differences models employed in this analysis, exploring other methods to address the potential endogeneity with respect to preferences, budgets, and premium subsidies at the cantonal level constitutes an exciting opportunity for future research.

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NOTES

1. A theoretical analysis of the welfare effects of premium subsidy schemes is provided by Kifmann and Roeder (2011).

2. Bieri and Köchli (2013) and Dusheiko et al. (2012) study premium subsidies across the whole income distribution, however the analysis is restricted to very few cantons, namely Bern, Neuchatel, and Vaud.

3. As of 2014, there are 61 insurers in the market; since 2001, when there were 99 insurers, the number of insurers has been declining steadily (BAG, 2013c).

4. According to the Swiss Federal Statistical Office, the median income in the same year was CHF 78,000.

5. Up to 2004, the retiree was assigned CHF 35,000, the single parent CHF 40,000, and the middle-income family and the large family CHF 70,000 each. In the old definition, the middle income family and the large family additionally had savings of CHF 100,000.

6. This was confirmed in a telephone interview with the head of the social department in Basel Stadt on April 2, 2013.

7. Options include comparing cantonal voting and election outcomes and political parties' respective attitudes towards health care policy, or comparing generosity of health care policies with other social policies like family policies.

8. In the Swiss tax system, the simple tax is set differently in each canton and is then multiplied by a cantonal and a municipality tax multiplier.

9. The federal law in fact only requires the cantons to regularly inform citizens about the existence of premium subsidies (Art. 65 Abs. 2 KVG).

10. Further information on sampling and methodology can be found on the website of the Swiss Household Panel, http://www.swisspanel.ch/

11. Namely, in the HBS survey, participants were asked to report their monthly expenditures on health care premiums and the amount of premium subsidies which they receive. However, in cantons where the subsidy is paid directly towards the insurer, the insured often (wrongly) state that they are not receiving the subsidy, thereby reporting the net premium instead of the gross premium. This is not necessarily a problem if one is only interested in the net premium anyway (for a more detailed description, see, e.g., Crivelli and Salari, 2014).

12. By pooling data across several years, it is possible to use the HBS data to construct measures that are representative on the cantonal level. In other words, if one is willing to give up the time dimension, one can also use this data to study the between-variation across cantons, as it is done by, e.g., Crivelli and Salari (2014). The purpose of our study, however, is to better understand the impact of cantons' budgetary tightness on premium load over time, thus making it imperative to study not only between-, but also within-variation.

13. The thresholds for eligibility for social welfare vary across cantons as well. Yearly gross earnings of CHF 15,000 can thus be seen as a nationwide minimum and the affected households also reflect outliers in the SHP dataset.

14. Results can be found in Table B.2 and B.3 in the appendix

15. Results are available from the authors on request.

16. A detailed overview on the new fiscal equalization scheme is provided on the website of the Federal Finance Administration: http://www.efv.admin.ch/broschueren/NFA-Broschuere.pdf

17. Choosing a different threshold value, e.g, 95 or 85, leads to qualitatively similar results.

18. Results are provided in the appendix in Table B.1.

19. To a certain extent, however, the increase might also reflect a catch-up effect or the effect of non-earmarked federal contributions.

20. Detailed results are available in the appendix in Table B.1.

Figure 5: Premium subsidy (in CHF per year) for a single parent with one child, at different income levels, by canton

Figure 6: Premium subsidy (in CHF per year) for a two-parent family with two children, at different income levels, by canton

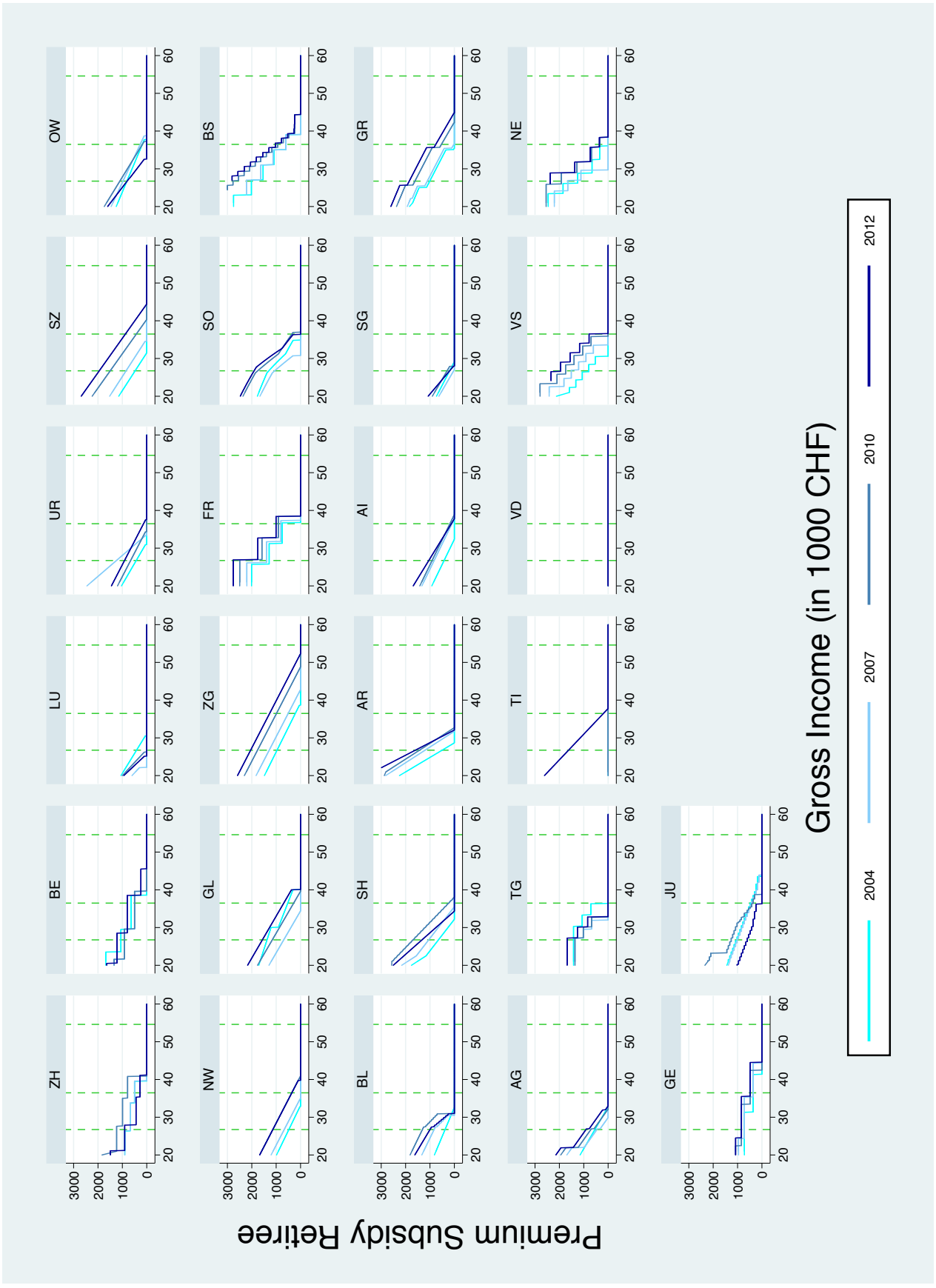

Figure 7: Premium subsidy (in CHF per year) for a single retiree living alone, at different income levels, by canton

Table 3: Effect of lagged net financial result on premium load, fixed effects panel regressions

	2004-2012				2004-2007	2010-2012
Premium load	(1)	(2)	(3)	(4)	(5)	(6)
Canton-specific controls						
Net financial result, lag	-0.001***		-0.002***		0.000	-0.001**
	(0.000)		(0.000)		(0.000)	(0.001)
Net financial result, lag2		-0.000***		-0.001***		
		(0.000)		(0.000)		
Hospital bed density, lag2	0.006***	0.007***	-0.004**	-0.008***	0.004***	-0.004
	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)	(0.004)
Physician density, lag2	-0.001	0.001	-0.005	0.011*	0.019*	-0.003
	(0.007)	(0.007)	(0.006)	(0.007)	(0.010)	(0.019)
Pharmacy density, lag2	0.001	0.005	0.046***	0.062***	0.030**	0.453***
	(0.011)	(0.011)	(0.013)	(0.013)	(0.013)	(0.163)
Share of retirees, lag2	0.049	-0.080	1.634***	1.531***	-0.226	0.757**
	(0.171)	(0.178)	(0.255)	(0.256)	(0.436)	(0.374)
Unemployment rate, lag2	-0.363***	-0.569***	0.474***	-0.282*	-1.093***	0.565
	(0.116)	(0.123)	(0.130)	(0.157)	(0.299)	(0.549)
Household-specific controls						
Children in household	0.081	0.096	0.104	0.104	0.137	0.013
	(0.146)	(0.142)	(0.125)	(0.125)	(0.242)	(0.313)
Homeowner	-0.292	-0.233	-0.394**	-0.394**	-0.055	0.084
	(0.209)	(0.221)	(0.187)	(0.187)	(0.305)	(0.323)
Savings third pillar	-0.311*	-0.328**	-0.199	-0.199	-0.690***	0.221
	(0.160)	(0.161)	(0.155)	(0.155)	(0.233)	(0.299)
Observations	3,651	3,651	3,651	3,651	1,934	1,717
Households	1,360	1,360	1,360	1,360	1,125	1,029
R2 Within	0.197	0.168	0.347	0.347	0.389	0.171
R2 Between	0.0297	0.0133	0.0186	0.0146	0.0332	0.0330
R2 Overall	0.0551	0.0299	0.0394	0.0349	0.0508	0.0281
Breusch-Pagan (p-value)	0	0	0	0	0	0
Poolability test (p-value)	0	0	0	0	0	0
Hausman-test (p-value)	0	0	0.003	0.019	0.004	1
Household fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time trend	Yes	Yes	Yes	Yes	Yes	Yes
Canton-specific time trend	No	No	Yes	Yes	Yes	Yes

Note: Estimation of premium load (share of disposable income that households spend on net health care premium, i.e., after the premium subsidy) using data on retirees, single parent and two-parent households from the Swiss Household Panel from 2004-2012 (columns 5 and 6 for 2004-2007 and 2010-2012, respectively). The table displays coefficients from a fixed effects regression with (canton-specific) time trends. Estimation controls for the lagged net financial result of the canton, canton-specific features of health care infrastructure which influence health care premiums (e.g., physician density and share of retirees in the population), as well as the general macroeconomic conditions at the cantonal level (unemployment). Household-specific controls include the number of children, home ownership and savings in the third pillar in the pension scheme in order to control for wealth effects. Estimation with a constant and probability weights in order to create a sample that is representative of the Swiss premium subsidy target population. Robust standard errors are indicated in parentheses. Level of significance is denoted by * ($\leq$10%), **($\leq$5%), ***($\leq$1%).

Table 4: Difference-in-differences estimation with panel and collapsed data

	Panel data				Collapsed	
Premium load	(1)	(2)	(3)	(4)	(5)	(6)
Difference-in-differences estimates						
DiD estimate	1.069***	1.039***	5.307***		1.001***	0.877***
	(0.192)	(0.189)	(0.817)		(0.183)	(0.190)
DiD estimate 07				0.827***		
				(0.183)		
DiD estimate 10				1.545***		
				(0.241)		
DiD estimate 12				0.730**		
				(0.295)		
Treated (FKI <= 90)	0.758	1.165	2.958***	1.033	1.214	0.639
	(2.107)	(2.243)	(0.704)	(2.231)	(2.551)	(2.694)
Period (year >= 07)	1.240***	0.872**	-5.566***	0.563	0.581***	1.633***
	(0.173)	(0.426)	(0.695)	(0.481)	(0.141)	(0.456)
Canton-specific controls						
Hospital bed density, lag2		0.006***	-0.014***	0.006***		0.006***
		(0.002)	(0.002)	(0.002)		(0.002)
Physician density, lag2		0.011	0.079***	0.011		-0.011
		(0.007)	(0.012)	(0.008)		(0.010)
Pharmacy density, lag2		0.010	0.050***	0.005		0.007
		(0.011)	(0.013)	(0.011)		(0.012)
Share of retirees, lag2		0.078	1.006***	0.127		0.304
		(0.175)	(0.226)	(0.178)		(0.212)
Unemployment rate, lag2		-0.515***	-2.212***	-0.589***		-0.608***
		(0.120)	(0.300)	(0.122)		(0.221)
Household-specific controls						
Children in household		0.095	0.104	0.095		-0.073
		(0.144)	(0.125)	(0.145)		(0.232)
Homeowner		-0.170	-0.394**	-0.209		0.247
		(0.215)	(0.187)	(0.217)		(0.345)
Savings third pillar		-0.341**	-0.199	-0.339**		-0.577**
		(0.162)	(0.155)	(0.161)		(0.244)
Observations	3,674	3,651	3,651	3,651	2,115	2,097
Households	1,363	1,360	1,360	1,360	1,175	1,171
Adjusted R2	0.153	0.174	0.331	0.183	0.181	0.214
Household fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time trend	Yes	Yes	Yes	Yes	No	No
Canton-specific time trend	No	No	Yes	No	No	No

Note: Estimation of premium load using data from the Swiss Household Panel from 2004-2012. The table displays coefficients from a difference-in-differences estimation using panel data (columns 1-4) and collapsed data (columns 5-6). Cantons are assumed to be treated if their financial strength index FKI was below or equal to 90 in 2003, as these cantons are more likely to have faced financial constraints following the introduction of the new fiscal equalization scheme NFA. As the NFA was introduced in 2008 (following a referendum in November 2004), the treatment period is 2007, when cantons were already planning their budgets for the following year. Estimation controls for canton-specific cost drivers in health care (e.g., physician density and share of retirees in the population), as well as general macroeconomic conditions (cantonal unemployment). Household-specific controls include the number of children, home ownership and savings in the third pillar in the pension scheme. Estimation with a constant and probability weights in order to create a sample that is representative of the Swiss premium subsidy target population. Robust standard errors are indicated in parentheses. Level of significance is denoted by * ($\leq$10%), **($\leq$5%), ***($\leq$1%).

APPENDIX A

Table A.1: *Variable descriptions*

Variable name	Description	Type	Source
Dependent variable			
Premium load	Premium load in percent of disposable income, in percent (share of after-tax income that households spend on healthcare premiums after the subsidy has been paid)	Continuous [0,100]	Own calculations based on cantonal regulations (ESTV, 2012; GDK, 2012)
Canton-specific variables			
Net financial result, lag	Net financial result canton (previous year, in CHF per inhabitant)	Continuous	EFV *Finanzierungsrechnung Kantone*
Net financial result, lag2	Net financial result canton (two years ago, in CHF per inhabitant)	Continuous	EFV *Finanzierungsrechnung Kantone*
Hospital bed density, lag2	Hospital beds (total: basic and specialized) per 100,000 inhabitants, previous year	Continuous	BFS *Krankenhausstatistik und Medizinische Statistik*
Physician density, lag2	Specialist physicians (non-stationary care) per 100,000 inhabitants, previous year	Continuous	BFS *Bestand und Dichte der Ärzte, Zahnärzte und Apotheken nach Kanton*
Pharmacy density, lag2	Number of pharmacies per 100,000 inhabitants, previous year	Continuous	BFS *Bestand und Dichte der Ärzte, Zahnärzte und Apotheken nach Kanton*
Share of retirees, lag2	Share of retirees in the cantonal population, in percent, previous year	Continuous [0,100]	BFS *Bevölkerungsstatistik, Demographische Komponenten*
Unemployment rate, lag2	Cantonal unemployment rate, previous year	Continuous [0,100]	SECO *Arbeitsmarktstatistik: Arbeitslosenquote nach Kantonen*
Household-specific variables			
Health care premium	Total health care premium per year, in CHF per household	Continuous	BAG *OKP Statistik der obligatorischen Krankenversicherung*
Premium subsidy	Health care premium subsidy per year, in CHF per household	Continuous	Own calculations based on cantonal regulations (ESTV, 2012; GDK, 2012)
Gross income	Gross household income, in CHF per year	Continuous	Swiss Household Panel
Disposable income	Disposable household income (net income - taxes), in CHF per year	Continuous	Swiss Household Panel and own calculations
Children in household	Number children in household younger than age 18	Continuous	Swiss Household Panel
Homeowner	Accommodation: Tenant (0) or owner (1)	Dummy	Swiss Household Panel
Savings third pillar	Savings into third pillar of Swiss retirement savings scheme (1 yes, 0 no)	Dummy	Swiss Household Panel

Table A.2: Summary statistics premium load, by canton and type

Premium load (Net health care premium as a share of disposable income)									
	Retiree			*Two-parent family*			*Single parent*		
Canton	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
ZH	220	9.369	3.198	439	9.271	2.649	48	6.954	1.415
BE	207	10.495	3.317	331	11.569	2.926	34	8.525	1.545
LU	57	10.403	3.158	139	8.287	1.956	4	8.787	2.007
UR	0	(na)	(na)	12	8.239	1.395	0	(na)	(na)
SZ	16	6.604	1.376	57	7.62	1.802	0	(na)	(na)
OW	3	5.822	0.753	16	8.021	3.115	2	7.971	1.157
NW	6	8.139	0.82	8	7.346	0.842	2	5.733	1.769
GL	7	9.013	1.376	5	8.581	1.501	3	7.497	0.875
ZG	14	6.49	1.081	48	5.534	1.537	4	5.021	0.253
FR	48	7.873	1.753	139	8.97	1.791	15	6.148	1.146
SO	45	8.555	2.228	118	8.339	2.248	4	6.362	3.92
BS	54	10.892	2.418	24	11.522	2.73	4	8.388	3.121
BL	44	9.648	3.813	115	9.084	3.092	6	8.652	2.641
SH	10	9.876	2.31	22	8.179	1.747	5	6.168	0.732
AR	10	5.161	3.337	15	6.523	3.105	0	(na)	(na)
AI	0	(na)	(na)	2	7.134	2.018	0	(na)	(na)
SG	68	9.482	3.624	170	8.647	2.51	10	6.966	1.127
GR	29	6.076	1.285	80	7.255	1.353	0	(na)	(na)
AG	81	8.31	3.179	220	8.366	2.094	21	7.198	1.795
TG	39	9.261	2.306	63	8.452	2.218	4	6.192	0.446
TI	80	12.794	4.812	116	9.577	2.85	10	5.747	1.572
VD	164	13.395	4.787	291	11.856	4.16	37	9.706	2.029
VS	37	6.626	1.856	95	7.501	2.216	14	4.654	1.687
NE	70	10.065	2.163	151	10.814	2.103	22	7.997	1.719
GE	59	13.635	4.598	104	10.673	4.279	27	9.556	1.641
JU	8	12.5	2.683	14	12.209	1.242	0	(na)	(na)

Note: Average values based on data from 2004, 2007, 2010, 2012. Predictions of premium load for different income levels according to own premium subsidy calculation model based on cantonal information regarding eligbility schemes. Household-specific income data is based on the Swiss Household Panel SHP, summary statistics were generated using probability weights as provided by the SHP in order to create a sample that is representative of the Swiss premium subsidy target population. Data on retirees, married couples with children and single parents with children under the age of 18, respectively.

Table A.3: Effect of lagged net financial result on premium load, fixed effects panel regressions, by household type

	Retiree		*Two parents*		*Single parent*	
Premium load	(1)	(2)	(3)	(4)	(5)	(6)
Canton-specific controls						
Net financial result, lag	-0.001***		-0.002***		0.001***	
	(0.000)		(0.000)		(0.000)	
Net financial result, lag2		-0.001*		-0.001***		-0.002***
		(0.000)		(0.000)		(0.001)
Hospital bed density, lag2	-0.016***	0.007**	-0.005***	-0.009***	-0.012***	-0.001
	(0.006)	(0.003)	(0.002)	(0.002)	(0.004)	(0.004)
Physician density, lag2	0.062***	0.038***	-0.015**	0.003	-0.131***	-0.141***
	(0.015)	(0.009)	(0.008)	(0.007)	(0.033)	(0.032)
Pharmacy density, lag2	0.062*	0.042	0.046***	0.063***	0.036***	0.065***
	(0.033)	(0.035)	(0.013)	(0.014)	(0.009)	(0.014)
Share of retirees, lag2	1.618***	0.470*	2.168***	2.065***	-0.038	1.058***
	(0.602)	(0.254)	(0.287)	(0.288)	(0.286)	(0.325)
Unemployment rate, lag2	0.822***	-0.187	0.653***	-0.171	-1.811***	-0.941**
	(0.291)	(0.283)	(0.131)	(0.171)	(0.495)	(0.459)
Household-specific controls						
Children in household	-0.233	-0.233	-0.144	-0.144	-1.160*	-1.160*
	(0.278)	(0.278)	(0.211)	(0.211)	(0.586)	(0.586)
Homeowner	-0.107	-0.107	-0.298	-0.298	-1.028	-1.028
	(0.244)	(0.244)	(0.200)	(0.200)	(0.782)	(0.782)
Savings third pillar			0.336***	0.336***	0.165	0.165
			(0.129)	(0.129)	(0.680)	(0.680)
Observations	1,065	1,065	2,360	2,360	226	226
Households	411	411	890	890	113	113
R2 Within	0.443	0.443	0.410	0.410	0.573	0.573
R2 Between	0.107	0.069	0.007	0.007	0.138	0.118
R2 Overall	0.147	0.099	0.020	0.022	0.131	0.108
Household fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time trend	Yes	Yes	Yes	Yes	Yes	Yes
Canton-specific time trend	Yes	Yes	Yes	Yes	Yes	Yes

Note: Estimation of premium load (share of disposable income that households spend on net health care premium, i.e., after the premium subsidy) using data from the Swiss Household Panel from 2004-2012. The table displays coefficients from a fixed effects regression with (canton-specific) time trends. Estimation controls for the lagged net financial result of the canton, canton-specific features of health care infrastructure which influence health care premiums (e.g., physician density and share of retirees in the population), as well as the general macroeconomic conditions at the cantonal level (unemployment). Household-specific controls include the number of children, home ownership and savings in the third pillar in the pension scheme in order to control for wealth effects. Estimation with a constant and probability weights in order to create a sample that is representative of the Swiss premium subsidy target population. Robust standard errors are indicated in parentheses. Level of significance is denoted by * ($\leq$10%), **($\leq$5%), ***($\leq$1%).

APPENDIX B

Table B.1: Difference-in-differences estimation with panel data, assuming treatment took place in 2008

Premium load	(1)	(2)	(3)	(4)
Difference-in-differences estimates				
DiD estimate	0.732***	0.917***	-0.219	
	(0.185)	(0.208)	(0.682)	
DiD estimate 10				1.174***
				(0.203)
DiD estimate 12				0.368
				(0.264)
Treated (FKI <= 90)	1.000	1.225	3.157***	1.156
	(2.075)	(2.100)	(0.714)	(2.196)
Period (year > 07)	0.942***	0.725	-2.035***	0.739
	(0.158)	(0.468)	(0.720)	(0.466)
Canton-specific controls				
Hospital bed density, lag2		0.005***	-0.006***	0.006***
		(0.002)	(0.002)	(0.002)
Physician density, lag2		0.016**	0.043***	0.011
		(0.007)	(0.010)	(0.007)
Pharmacy density, lag2		-0.002	0.044***	-0.003
		(0.011)	(0.013)	(0.011)
Share of retirees, lag2		0.083	0.467*	0.116
		(0.176)	(0.262)	(0.176)
Unemployment rate, lag2		-0.704***	-0.233	-0.695***
		(0.125)	(0.261)	(0.125)
Household-specific controls				
Children in household		0.098	0.104	0.098
		(0.144)	(0.125)	(0.144)
Homeowner		-0.186	-0.394**	-0.217
		(0.218)	(0.187)	(0.219)
Savings third pillar		-0.357**	-0.199	-0.355**
		(0.162)	(0.155)	(0.161)
Observations	3,674	3,651	3,651	3,651
Households	1,363	1,360	1,360	1,360
Adjusted R2	0.144	0.169	0.331	0.175
Household fixed effects	Yes	Yes	Yes	Yes
Time trend	Yes	Yes	Yes	Yes
Canton-specific time trend	No	No	Yes	No

Note: Estimation of premium load using data from the Swiss Household Panel for 2004, 2007, 2010 and 2012. The table displays coefficients from a difference-in-differences estimation using panel data, assuming treatment took place *after* 2007. Cantons are considered as treated if their financial strength index FKI was below or equal to 90 in 2003, as these cantons are more likely to have faced financial constraints following the introduction of the new fiscal equalization scheme NFA. For this estimation, we assume that there was no anticipation effect, i.e., cantons did not adapt their behavior prior to the introduction of the NFA in 2008. Thus, the treatment period is 2008 (2010 in our data). Estimation controls for canton-specific features of health care infrastructure which influence health care premiums (e.g., physician density and share of retirees in the population), as well as the general macroeconomic conditions at the cantonal level (unemployment). Household-specific controls include the number of children, home ownership and savings in the third pillar in the pension scheme in order to control for wealth effects. Estimation with a constant and probability weights in order to create a sample that is representative of the Swiss premium subsidy target population. Robust standard errors are indicated in parentheses. Level of significance is denoted by * ($\leq$10%), **($\leq$5%), ***($\leq$1%).

Table B.2: Effect of lagged net financial result on premium load, fixed effects panel regressions, including households who moved

All household types Swiss Household Panel, incl. households who moved				
	2004-2012 data			
Premium load	(1)	(2)	(3)	(4)
Canton-specific controls				
Net financial result, lag	-0.001***		-0.002*	
	(0.000)		(0.001)	
Net financial result, lag2		-0.000***		-0.001**
		(0.000)		(0.000)
Hospital bed density, lag2	0.007***	0.008***	0.004	0.002
	(0.002)	(0.002)	(0.006)	(0.008)
Physician density, lag2	0.005	0.007	0.004	0.009
	(0.006)	(0.005)	(0.019)	(0.025)
Pharmacy density, lag2	-0.017	-0.013	0.039***	0.046***
	(0.017)	(0.016)	(0.012)	(0.015)
Share of retirees, lag2	-0.161	-0.229	0.020	-0.146
	(0.189)	(0.188)	(0.338)	(0.350)
Unemployment rate, lag2	-0.426***	-0.598***	0.273	-0.034
	(0.121)	(0.125)	(0.455)	(0.869)
Household-specific controls				
Children in household	0.062	0.084	0.132	0.132
	(0.143)	(0.140)	(0.130)	(0.130)
Homeowner	-0.276	-0.235	-0.390**	-0.390**
	(0.202)	(0.213)	(0.183)	(0.183)
Savings third pillar	-0.339**	-0.363**	-0.169	-0.169
	(0.157)	(0.158)	(0.162)	(0.162)
Observations	3,742	3,742	3,742	3,742
Households	1,394	1,394	1,394	1,394
R2 Within	0.196	0.168	0.345	0.345
R2 Between	0.023	0.013	0.096	0.091
R2 Overall	0.043	0.025	0.108	0.103
Breusch-Pagan (p-value)	0	0	0	0
Poolability test (p-value)	0	0	0	0
Hausman-test (p-value)	0	0	0.026	0.020
Household fixed effects	Yes	Yes	Yes	Yes
Time trend	Yes	Yes	Yes	Yes
Canton-specific time trend	No	No	Yes	Yes

Note: Estimation of premium load (share of disposable income that households spend on net health care premium, i.e., after the premium subsidy) using data from the Swiss Household Panel from 2004-2012, without excluding households that moved to a different canton. The table displays coefficients from a fixed effects regression with (canton-specific) time trends. Estimation controls for the lagged net financial result of the canton, canton-specific features of health care infrastructure which influence health care premiums (e.g., physician density and share of retirees in the population), as well as the general macroeconomic conditions at the cantonal level (unemployment). Household-specific controls include the number of children, home ownership and savings in the third pillar in the pension scheme in order to control for wealth effects. Estimation with a constant and probability weights in order to create a sample that is representative of the Swiss premium subsidy target population. Robust standard errors are indicated in parentheses. Level of significance is denoted by * ($\leq$10%), **($\leq$5%), ***($\leq$1%).

Table B.3: Difference-in-differences estimation with panel data, including households who moved

Premium load	(1)	(2)	(3)	(4)
Difference-in-differences estimates				
DiD estimate	1.070***	1.001***	0.843	
	(0.192)	(0.186)	(0.746)	
DiD estimate 07				0.751***
				(0.184)
DiD estimate 10				1.535***
				(0.236)
DiD estimate 12				0.750**
				(0.293)
Treated (FKI <= 90)	-1.677	-1.239	0.549	-1.282
	(1.642)	(1.305)	(1.429)	(1.268)
Period (year >= 07)	1.218***	1.134***	-1.621***	0.849**
	(0.173)	(0.342)	(0.380)	(0.395)
Canton-specific controls				
Hospital bed density, lag2		0.006***	0.010*	0.007***
		(0.001)	(0.006)	(0.002)
Physician density, lag2		0.010*	0.054***	0.010
		(0.005)	(0.014)	(0.006)
Pharmacy density, lag2		-0.012	0.025*	-0.017
		(0.016)	(0.013)	(0.016)
Share of retirees, lag2		-0.105	-1.965***	-0.065
		(0.149)	(0.581)	(0.150)
Unemployment rate, lag2		-0.585***	-1.149***	-0.669***
		(0.120)	(0.349)	(0.128)
Household-specific controls				
Children in household		0.069	0.132	0.072
		(0.140)	(0.130)	(0.140)
Homeowner		-0.179	-0.390**	-0.221
		(0.208)	(0.183)	(0.210)
Savings third pillar		-0.370**	-0.169	-0.358**
		(0.160)	(0.162)	(0.159)
Observations	3,765	3,742	3,742	3,742
Households	1,397	1,394	1,394	1,394
Adjusted R2	0.144	0.173	0.327	0.182
Household fixed effects	Yes	Yes	Yes	Yes
Time trend	Yes	Yes	Yes	Yes
Canton-specific time trend	No	No	Yes	No

Note: Estimation of premium load using data from the Swiss Household Panel from 2004-2012, including households who moved to a different canton. The table displays coefficients from a difference-in-differences estimation using panel data. Cantons are assumed to be treated if their financial strength index FKI was below or equal to 90 in 2003, as these cantons are more likely to have faced financial constraints following the introduction of the new fiscal equalization scheme NFA. As the NFA was introduced in 2008, the treatment period is 2007, when cantons were already planning their budgets for the following year. Estimation controls for canton-specific cost drivers in health care (e.g., physician density), as well as macroeconomic conditions (unemployment). Household-specific controls include the number of children, home ownership and savings in the third pillar in the pension scheme. Estimation with a constant and probability weights in order to create a sample that is representative of the Swiss premium subsidy target population. Robust standard errors are indicated in parentheses. Level of significance is denoted by * ($\leq$10%), **($\leq$5%), ***($\leq$1%).