The impact of subsidies on deductible choice in health insurance

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Abstract

Premium subsidies increase insurance coverage through two main channels: the income effect, which increases disposable income and subsequently increases insurance coverage, and the substitution effect, which changes the relative price of insurance, making more generous insurance plans more attractive. Previous literature assumes that the income effect is small, but this paper shows that the income effect is substantial and consequential. Subsidies increase insurance coverage by 20 percentage points, with 40% of this increase attributable to the income effect. Additionally, the increased coverage leads to higher healthcare expenditures among recipients, as marginal enrollees increase their medical spending from CHF 1,109 (1255 USD) to CHF 5,687 (6436 USD). These findings indicate that price change direction, in addition to price differences, plays a critical role when applying price elasticity in welfare evaluations.

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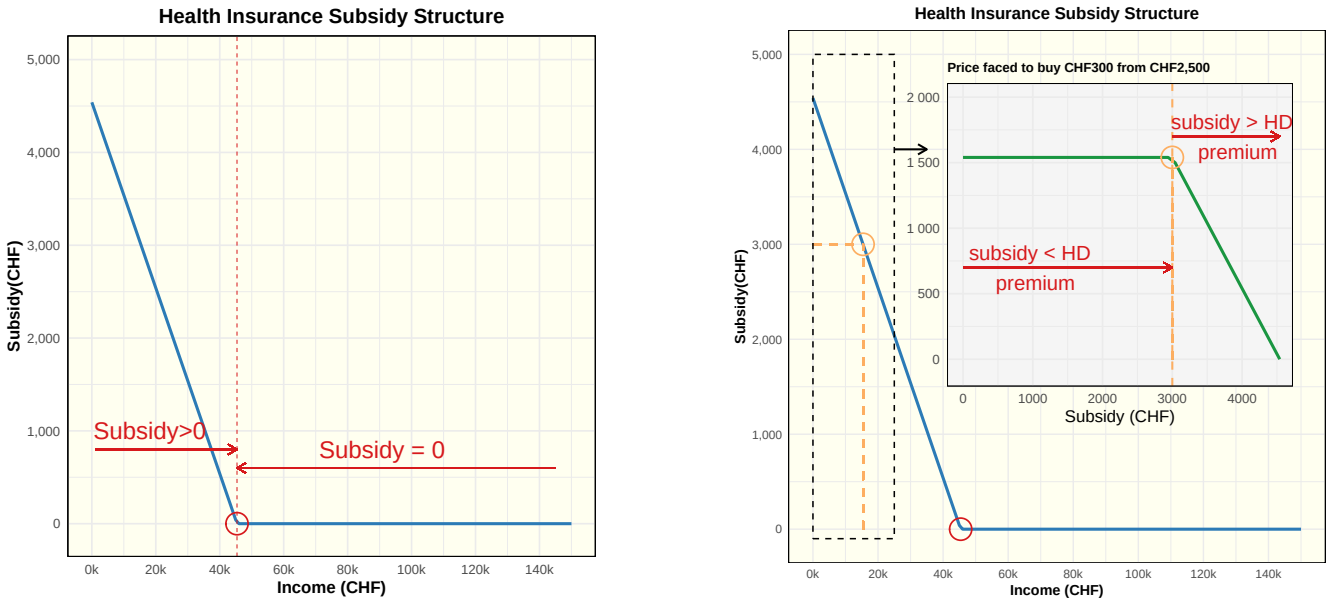
1 Introduction

The income effect is an important parameter in subsidized health insurance demand with respect to the size of the subsidy, in addition to the well-documented demand elasticity (substitution effect), for two reasons. First, while substitution effects capture how relative price changes shift demand, the income effect reflects changes in disposable income that influence demand asymmetrically. When prices decrease, subsidies increase disposable income, amplifying insurance uptake. Conversely, price increases constrain disposable income, reducing demand. These asymmetries suggest that demand responses to higher subsidies cannot be directly interpreted as (income-constant) willingness-to-pay (WTP). For instance, to reduce the number of uninsured individuals, governments can either subsidize insurance or impose penalties for lacking coverage, as seen in CommCare (Finkelstein et al. (2019b)). These interventions may have equivalent impacts on relative prices but differ in their effects on disposable income. Subsidizing high-coverage plans increases disposable income and insurance uptake, whereas penalizing low-coverage plans reduces disposable income and uptake. Second, if the income effect is substantial, subsidizing general health insurance products could lead to larger-than-expected increases in coverage and healthcare utilization under traditional elasticity estimates (Einav et al. (2010);Handel (2013);Tebaldi (2024)). This, in turn, may drive up market prices due to strategic insurer behavior, imposing higher premiums on unsubsidized individuals and creating broader societal burdens (Jaffe and Shepard (2020); Einav et al. (2019)).

Existing literature often assumes a minimal or negligible income effect (Finkelstein et al. (2019b); Adams et al. (2022)). This assumption is based on two main reasons: first, subsidies are generally small relative to overall income levels, and in theory, the income effects of subsidies should be distributed across all consumption options and the life cycle, not just insurance. Second, subsidies are typically tied to income levels. Empirical literature often estimates the price elasticity following Einav et al. (2010), where subsidies are used as instruments to shift demand and plot the demand curve, with price thresholds contingent on various income levels. These estimates rely on the assumption of a minimal income effect, making them effectively income-constant measures of willingness-to-pay(WTP). For example, Finkelstein et al. (2019b) employ price discontinuity points to estimate the willingness-to-pay for health insurance.

This paper challenges this prevailing assumption by providing empirical evidence that the income effect is substantial in the context of health insurance, using data from the Swiss mandated basic health insurance market. First, individuals are mandated to hold a basic coverage plan, known as the high deductible (HD) plan. This is similar to a uniform tax that has to be paid by individuals residing in Switzerland. The relevant insurance choice individuals face is whether to enhance coverage by opting into a lower deductible (LD) plan; this is similar as buying a top-up insurance. This decision depends on an individual's disposable income (initial wealth minus the premium for the HD

plan) and the fixed price of upgrading to a lower deductible (LD) plan.[1] Second, when individuals have income below the eligibility threshold, they receive a subsidy (see Figure 1). Subsidy is a function of income. When the subsidy is small, it increases disposable income after covering the cost of the basic insurance (HD) plan. As the subsidy increases further, it eventually fully offsets the HD plan premium, reducing its price to zero. Beyond this point, any additional subsidy directly lowers the cost of upgrading to a lower deductible (LD) plan.



(a) Subsidy and Income

(b) Subsidy and price for top-up insurance

Figure 1: The data sample in Panels C and D is the entire subsidy recipients group.

This market encapsulates two specific discontinuities in the subsidy design in Figure 1, each helping to address a unique effect. The first discontinuity arises when income falls below the income threshold. Once the subsidy is activated, it increases the disposable income. Essentially, any changes in consumer behavior at this point can be directly attributed to changes in the income effect. The extent of any such income effect may depend on the degree to which individuals make decisions with narrow mental budgets for health insurance (Hastings and Shapiro (2013)). The second discontinuity occurs when the HD plan reaches zero price, where I refer to as "zero-price" point. Any subsidy increase after this HD zero-price point progressively decreases the price for the top-up option. Prior to the HD zero-price point, consumers' response to subsidies is influenced solely by the income effect. However, upon crossing the zero-price point, the response to a subsidy arises at the intersection of the income effect and the substitution effect. The transit of consumer choice around this zero-price point can be attributed to the substitution effect.

[1]Existing literature documents that the market is heavily regulated, ensuring uniformity in other contract features, such as covered networks, facilitating the evaluation of insurance coverage decisions. Individuals have the option to purchase supplemental insurance in addition to their basic health coverage. However, supplemental insurance is separate from basic insurance, and decisions regarding supplemental coverage do not impact choices related to basic insurance.

First, I document a substantial positive income effect. Subsidized individuals increased their take-up rate for the most generous plan by 20 percentage points compared to the unsubsidized group. Using regression kink discontinuity (RKD) analysis, I find that a CHF 100 subsidy increases the likelihood that consumers will select the most generous plan by 1.5 percentage points. This is attributable to the pure income effect. Since subsidy eligibility is determined by an administratively set cutoff point, individuals just above and below this threshold are effectively identical in all respects, including their take-up trends along income levels. The RKD approach specifically tests the change in the slope of the take-up rate around the cutoff. Without the policy intervention, the treated group would have followed the same take-up pattern as the control group. Thus, any difference in take-up rates between the two groups is driven solely by the income effect induced by the subsidy.

Second, the results also indicate a strong substitution effect. Examining the reaction of demand to subsidy increases at the zero-price threshold for HD, I find that a CHF 100 increase in the subsidy leads to a 2.58 percentage point increase in LD plan take-up. This estimate is comparable to the estimates from other markets. Tebaldi (2024) finds a 2-4 percent decrease in enrollment for a $100 premium increase in the California ACA exchange.[2] Finkelstein et al. (2019b) suggest a 5.3 percent decrease in take-up for a $100 premium increase.[3] The differences between my findings and those in these studies can be attributed to two main factors. First, while both studies focus on increasing insurance coverage among the uninsured, my study examines individuals already insured with basic coverage, focusing on the extensive margin of upgrading to higher coverage. Second, in the Swiss context, over 50% of the subsidized population already select the high coverage plan, leading to a lower potential sensitivity to premium changes in my results.

Combining the point estimates from the two RKD estimates, I find that roughly 40 percent of the marginal effect of subsidy benefits on insurance coverage is due to the income effect. I derived the demand model; this estimate implies that the income effect plays a positive and significant marginal effect of the subsidy on the insurance demand. An important indication is that while designing the subsidy policy, economists and policymakers should consider the role of the income effect and design the subsidy policy for the target purpose. A direct application is that penalizing the uninsured will have different policy outcomes compared to subsidizing the insured when applying the elasticity estimates in Finkelstein et al. (2019b). This is consistent with the findings from Iizuka and Shigeoka (2023), who study Japanese child healthcare and find that when coinsurance increases from 0% to 30%, the demand response is more than twice that to a price decrease from 30% to 0%.

Additionally, the existence of an income effect suggests that the "labeling" of subsidies may play a crucial role in consumers' insurance deductible choices. Intuitively, the subsidy increase on the insurance coverage plan via the income effect is indifferent to the income effect from other resources,

[2] Tebaldi (2024) estimates a 2-4 percent decline in enrollment for an across-the-board $100 annual premium increase for subsidized enrollees without children.

[3] Finkelstein et al. (2019b)find that a $40 increase in monthly premiums (equivalent to $468 annually) leads to a 25% decrease in insurance take-up, which scales to a 5.3% decrease for a $100 annual increase.

such as the salary increase's impact on the insurance decision. If so, consumers will allocate these subsidy increases in income to other consumptions in a utility-maximizing way. However, I document subsidy recipients with high disposable income (via subsidy) will spend more on health insurance. This study provides no direct evidence of mental accounting. However, this piece of evidence is consistent with the concept of mental accounting. Gruber et al. (2024) demonstrate that consumers' decisions regarding insurance are influenced by the source of funds, indicating that they do not treat all income as fungible. This indicates that transferring the subsidy directly to the firm will have different results versus transferring directly to the individual general account. In the Swiss market, Kaufmann et al. (2017) find that transferring the subsidy directly to the insurance firm (in-kind transfer) will increase insurance coverage compared to transferring the subsidy directly to the consumer (in-cash transfer).

At the zero-price point, where the basic coverage plan (HD plan) becomes zero price, the enrollment in the HD plan increases from 25% to 50%, resulting in a significant average health expenditure decrease from CHF 3,992 to CHF 3,302. This cost reduction is attributed to 25% of individuals being enticed by the zero-price effect, leading them to switch from the LD to the HD plan. Notably, these individuals exhibit lower health utilization when selecting the HD plan over the LD plan, consuming CHF 1,109 compared to CHF 5,687, respectively. This substantial cost drop suggests moral hazard behavior. [4]

This paper complements the literature that studies low-income individual's response to subsidies (Chan and Gruber (2010); Krueger and Kuziemko (2013); Chandra et al. (2014); McGuire (2014); Marquis et al. (2004)). These studies examine how subsidies affect health insurance decisions (Kaufmann et al. (2017); Tebaldi (2024); Finkelstein et al. (2019b)) and health care utilization (Adams et al. (2022);Ghosh et al. (2019)) and use these estimates to evaluate the efficiency of these social programs (Finkelstein et al. (2019a); Hendren (2021)). For instance, Frean et al. (2017) show that subsidies and mandates increase insurance coverage. Prior literature assumes a limited role of income effect due to limited empirical evidence; this paper contributes to the literature in two ways. First, this paper provides evidence of positive income effect, indicating the asymmetry in policy implication - subsidizing the insurance product will result in higher insurance uptake as compared to penalizing the uninsured. Moreover, this work shows that the income effect is sizable. Among the extant studies, the most influential work is Finkelstein et al. (2019b), who find that, given the generous subsidies, low-income adults demonstrated a modest willingness to pay for health insurance compared to their cost. This paper finds a similar relation, and when people receive more resources, they increase the insurance coverage take-ups. These findings inform the policy that more insurance will be taken up when receiving more subsidies.

[4]The zero-price point is when the HD plan reaches the zero-price at the cheapest insurance firm in the market; therefore, insured persons at the first zero-price point could be relatively healthier individuals.

2 Institutional background

This paper examines the Swiss health insurance system, in which basic insurance is mandatory for all citizens. Each contract offers standardized services and covers an identical scope of benefits. The insured are offered six vertically differentiated insurance options. These options differ only in terms of the insurance provider and the deductible level. The six deductible levels begin at the default of CHF 300 and increase to CHF 500, CHF 1,000, CHF 1,500, CHF 2,000, and finally CHF 2,500. A co-insurance rate of 10 percent applies to all costs exceeding the respective deductible, while the out-of-pocket co-insurance amount is capped at CHF 700. The difference in premiums between the default insurance product (CHF 300 deductible plan) and the contract with the extra deductible is fixed at a maximum of 70 percent.[5] Insurance companies bid competitively for the premiums of the default CHF 300 deductible plan, and all premiums for the other plans are fixed according to the premium difference regulated by the government. Consumer selection of health-care plans takes place yearly within a set period before the end of November. Insurance is financed through per capita premiums, and each family member is individually insured. Table 1 illustrates all attributes of these plans.

Health premiums are community-rated for the same age groups within each canton. There are three main age groups: children under 18[6], young adults between ages 18 and 26, and adults aged 26 and older. For the main interest group, the uniform premium pricing system is highly regulated, implying the availability of a full sample of men and women, young and old, sick and healthy, rich and poor, all of whom are offered the same menu of insurance options within one canton.

Table 1: Deductible choice menu

Deductible	Co-insurance rate	Cap co-insurance	Premium (CHF)
CHF 300	10%	CHF 700	4,960
CHF 500	10%	CHF 700	$4,960-(500-300)\times 70\% = 4,829$
CHF 1,000	10%	CHF 700	$4,960-(1,000-300)\times 70\% = 4,479$
CHF 1,500	10%	CHF 700	$4,960-(1,500-300)\times 70\% = 4,129$
CHF 2,000	10%	CHF 700	$4,960-(2,000-300)\times 70\% = 3,779$
CHF 2,500	10%	CHF 700	$4,960-(2,500-300)\times 70\% = 3,429$

Notes: The table shows one pricing example for a certain insurance model. Insurance firms set the price for the CHF 300 deductible plan; all the other plans are automatically priced following the rules. More specifically, for unemployed individuals, the percentage of 70% in the table is specifically at 69.6%. For employed individuals, the percentage is 64.8%.

Price variation across markets Switzerland has 26 cantons. A universally mandated health insurance package with a list of distinct options is offered across each canton. Each canton has the

[5]More specifically, for unemployed individuals, the percentage is 69.6 percent; for employed individuals, the rate is 64.8 percent.

[6]The premium levels vary in accordance with different age groups within cantons. For children 18 and under, the options structure is different in that it is divided into seven deductible levels: CHF 0, CHF 100, CHF 200, CHF 300, CHF 400, CHF 500, and CHF 600.

decisive power to regulate the indicative premiums on the default contract (CHF 300 deductible level) based on the supply side of the health cost, the administrative cost, the cost of living, wages, and other factors, such as physician density. The costs vary among cantons.

Health insurance premium subsidies To ensure low-income individuals' access to health insurance, the federal and cantonal government provide financial aid for health insurance to the insured with modest economic conditions. Cantons have the decisive power to regulate subsidy design for their insured population. Two main subsidy schemes are implemented across the 26 cantons, either in an income-linear subsidy or a step-wise[7] decreasing function with reference to income. 8 cantons apply the step-wise method (similar to the ACA in the US market), while the remaining 18 cantons[8] implement an income-linear subsidy.

The linear subsidy form ensures that subsidies are a proportion of prior household income. Cantons define a premium load threshold and pay the difference between this threshold and the indicative premium. For example, in the canton of Nidwalden (NW), where the premium load should not exceed 10 percent of household income, a 30-year-old single male with a taxable income of CHF 40,000 in 2017 and an indicative premium of CHF 4,500 would receive a subsidy of CHF $4500 - 40,000 \times 10\% = 500$.

Two factors determine the entitled subsidy: the indicative premium regulated by the canton government and the premium load which is the percentage of the net premium based on household taxable income. For administrative reasons, the household taxable income used to determine eligibility is taken from the tax declaration made two years prior. This taxable income is adjusted for the type of household, including marital status and the number of children.

Premium subsidies are fixed coupons Across all cantons except Neuchatel, the subsidy amount is calculated based on the indicative premium of the most generous plan (default CHF 300 deductible plan). Therefore, it is a fixed coupon regardless of the plan being selected by the subsidy recipients. The canton of Neuchatel, however, regulates the subsidy received, which varies with the choice of deductible.

Furthermore, since 2014, all 26 cantons have been required by federal law to apply an in-kind transfer, which transfer the subsidy directly to the insurance firms. In 2014, 9 of the 26 cantons transitioned from cash (to consumers) to in-kind transfers (to insurers). Kaufmann et al. (2017) examine this regional reform, particularly focusing on the impact on health insurance deductible choices. Their findings indicate that in-kind transfers result in a 4 percentage point increase in the uptake of LD contracts compared to cash transfers. However, they observed that this increase in

[7]Detailed information on step-wise subsidy design can be found in Appendix A.2

[8]The following cantons specify their subsidy model as a mix of step-wise subsidy and the income-linear subsidy. These cantons are: the Canton of Lucerne, Obwalden, Glarus, Fribourg, Solothurn, Appenzell I.Rh, St Gallen, Graubuenden, Ticino, and Vaud. In essence, these cantons implement income-linear subsidy within the specific household types.

insurance coverage does not affect healthcare utilization. The absence of moral hazard behavior contrasts with other works studying the Swiss market (Boes and Gerfin (2016); Gerfin et al. (2015); Trottmann et al. (2012)). Subsidies are generally paid out on a monthly basis. Each Swiss resident is insured individually, even within a household; however, the subsidy is calculated by family unit and distributed evenly to all adult household members.

3 Data and methodology

3.1 Data and variables

This paper relies on two datasets. The first is the individual administrative data (from the Federal Office of Public Health) that covers all individuals in Switzerland from 2019 to 2022. The data includes basic socio-demographic data (age,gender), region of residence, deductible choice, annual medical expenditure, premiums, and subsidies. The second dataset is a sub-sample of the administrative data linked with registered household survey data, which includes registered income information.

I use the following cleaning steps to to restrict the data. First, I restrict my attention to all adults aged 26 and up who face the same choice set. Second, based on the subsidy information, I divide the population into two groups: subsidized and unsubsidized. In the entire population sample, subsidized group represents individuals who receive the premium; the unsubsidized are indivdiduals who do not receive the subsidy. In the representative survey sample, I used the registered income information to define the income threshold for subsidy eligibility, and the subsidized population are people who should be entitled to subsidy. Among which, 90% of representative sample who are eligible for subsidy are receiving the subsidy. This will make my estimates using the survey sample a conservative lower bound on individuals' response to subsidy.

Table 2 presents the summary statistics of the two data sets. 57% of subsidized individuals choose LD plan compared to 40% of the unsubsidized group. Notably, 36% of subsidized recipients report difficulties handling unexpected health expenditure shocks of CHF 2,500. This could contribute to the high share of recipients select the LD plan. For subsidized recipients, average annual premium is CHF 2,027 covers less than 34 percent of their average medical cost (CHF 6,081). Unsusidized pay CHF 4,026 as annual premium, which covers around around 99-100 percent of their medical cost (CHF 4,061).

Subsidized individuals are more likely to choose LD plans and incur lower health expenditures compared to those without subsidies. Specifically, 57% of subsidized individuals choose LD plan compared to 40% of the unsubsidized group. Additionally, subsidized individuals have lower annual health expenditures, averaging CHF 4,061, versus CHF 6,081 for those without subsidies. The subsidized group also report systematically worse health belief compared to the unsubsidized group.

On average, the unsubsidized group has a household income of CHF 155,000, which is about

60% higher than the CHF 93,799 average for the subsidized group. For the unsubsidized group, the premium is around 5- 6 percent of the equivalent income. For subsidized recipients, the post-subsidy premium is also around 5 percent of their income. The income threshold is roughly CHF 126,710 for a two-person adult.

3.2 Research design

To identify the effect of the subsidy on deductible choice, I use the kinks in the subsidy schedule following a sharp RKD design. The empirical challenge in identification lies in two assumptions. First, the assignment variable (income) distribution should be smooth at the kink. Second, the social demographic characteristics should evolve smoothly with the assignment variable at the kink.

The local smooth assignment condition seems credible in this context. More specifically, the subsidy is calculated based on two main factors: (1) taxable income two years ago and (2) the indicative premium published by the cantonal government each year, which cannot be predicted by people. To be able to perfectly manipulate one's position in the schedule of subsidy benefit ex ante, it is necessary to know the precise indicative premium published by the government, which is not possible for people to predict. In the next section, I provide further empirical evidence in support of the RKD assumptions.

Following Card et al. (2015), the RKD estimation only relies on the estimation of the change in the slope of the conditional expectation function of the outcome given the assignment variable at the kink. This can be done by running parametric polynomial models of the form:

$$E_i = \mu_o + \left[\sum_{p=1}^{\overline{p}} \gamma_p \ (w_i - k_i)^p + \rho_i \nu_p (w_i - k_i)^p\right] \tag{1}$$

where w_i is the assignment variable, which is household income level; ρ_i is a dummy indicator for being above the kink threshold when $w \geq k$; and the change in the slope of the conditional expectation function is given by ν_p.

The subsidy amount differs depending on household types, including marital status, number of children under 18, and number of dependent children under 26. The premium and subsidy levels differ across cantons. To evaluate the impact of subsidy, I cluster the cantons by transferring the subsidy amount relative to the corresponding household income threshold. For instance, an individual has a subsidy scale equal to 0.9, indicating that his household income is 90% of the corresponding income threshold.

4 Empirical Analysis

In this section, I present empirical evidence that illuminates the impact of subsidies across varying levels on deductible choices and health expenditure. First, I employ a regression discontinuity design to examine the effects of even modest subsidies on deductible choices. Second, I investigate the zero-price effect, delving into consumer choice and healthcare utilization upon this point.

4.1 Regression kink discontinuity

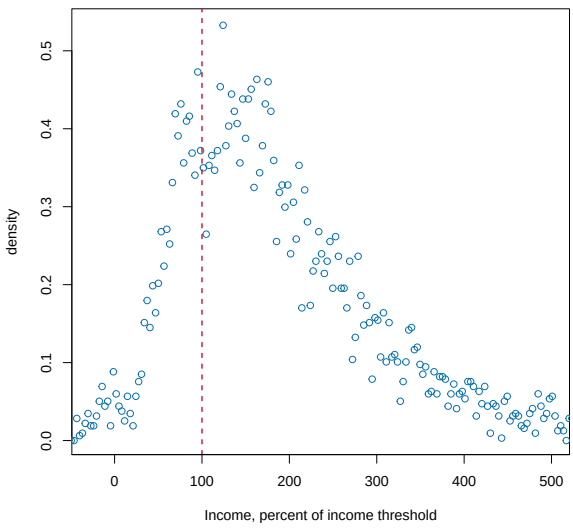
In this section, I present the RKD result. The first kink analysis is based on the representative sample, as it contains the income information. The second kink - zero-price analysis is based on all subsidy recipients.

Validation of RKD Figure 2 shows that the validity of the RKD assumptions. The running variable is the household income relative to the income threshold. Subsidies are available when the income is below the threshold. When income is smaller than zero, individuals receive the maximum subsidy and some additional social aid, known as the supplementary social aid program.

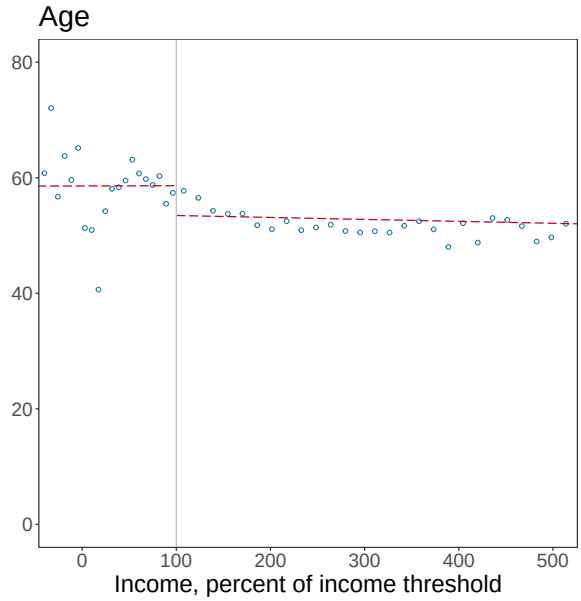
First, Figure 2a shows that the eligible population size is smooth through the income threshold at which subsidy eligibility changes. I also perform McCrary tests, with estimates ($p = 0.2488$) aligned with the empirical result, indicating no manipulation behavior. Two reasons for minimal evidence of any manipulation: first, the cantonal government publishes the indicative premium annually, hindering individuals' ability to accurately predict it; second, the income base for calculating the subsidy is from two years prior.

Second, Figure 2 suggests that the covariates evolve smoothly at the kink, indicating that two groups around the kink are otherwise comparable with observable characteristics. Thus, the difference in the choice pattern reflects the effect of subsidy. The subsidy recipients are overall older than the non-eligible ones, as shown in panel (a), and females are slightly more likely to be eligible for subsidies (see panel (b)). High education could increase income level and be more resistant to financial shocks, and therefore, less likely to receive government aid (Panel (c)).

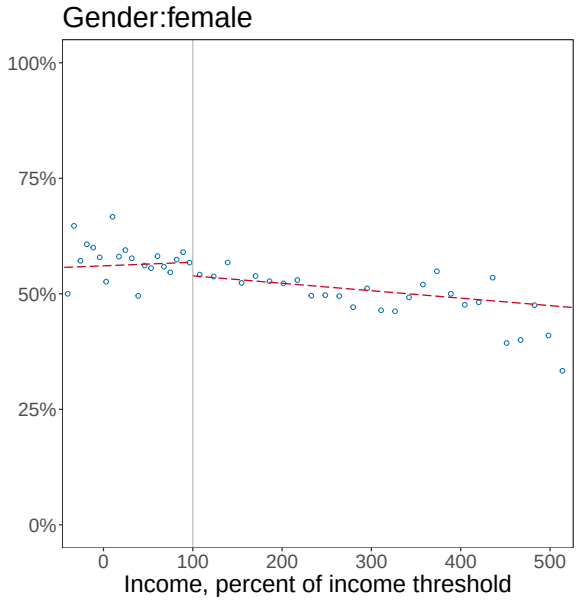
Size of income effect Figure 3 reveals a notable choice pattern for the uptake of the LD plan (CHF 300 deductible contracts) (in Figure 3a) and HD plan (CHF 2,500 deductible contracts) (in Figure 3b). A distinct change in slope is seen in the relationship between deductible choice and the assignment variable at the kink of the subsidy schedule, with a coefficient estimate of -0.886 ($p = 0.057$). This indicates an average semi-elasticity of -0.0015, where a CHF 100 increase in the subsidy raises the take-up of CHF 300 deductible contracts by 1.5 percentage points. The semi-elasticity is derived by first considering $e = \frac{\frac{\Delta q}{q}}{\frac{\Delta p}{p}}$, where p is the net-premium after the subsidy, and q is the take-up rate of the LD plan. Within the cut-off window (subsidy ranges from 90% to 100% of income threshold), the average $q = 0.516$ and the average $p = 4,418$. Let $\frac{\frac{\partial q}{\partial p}}{\frac{p}{p}} = \nu_p$, where



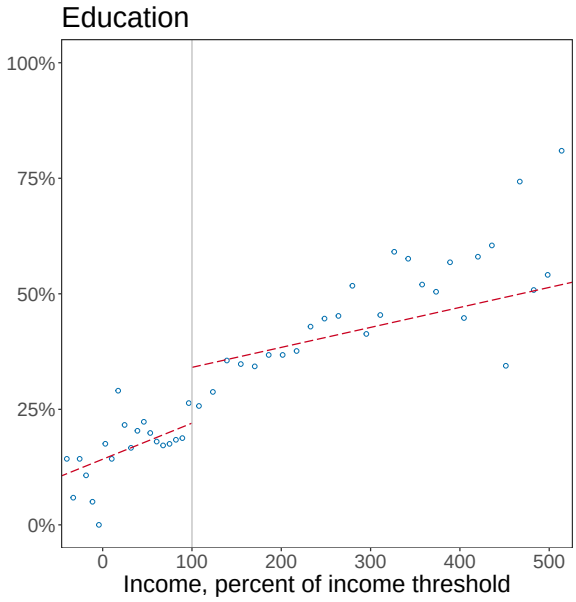
(a) Mccrary test



(b) Smooth test: age



(c) Smooth test: female



(d) Smooth test: university degree

Figure 2: RKD smoothness test: Panel A presents the income distribution; Panel B and Panel C, and Panel D present the smoothness test for different variants, from age, gender and education. The running variable is household income corresponding to the relative income threshold. Subsidies are available when the running variable is smaller than the poverty line. When income is smaller than zero, individuals receive the maximum subsidy and additional social aid for co-payment and health insurance. Subsidies are available when the running variable is smaller than 100.

the estimated $\nu_p = -0.34$, consequently, $e = \frac{\frac{\Delta q}{q}}{\frac{\Delta p}{p}} = \frac{-0.34}{0.516} = -0.668$. Therefore, a CHF 100 increase in the subsidy affects the take up as follows: $\frac{\Delta q}{q} = e \times \frac{\Delta p}{p} = -0.668 \times -100/4418 = 0.015$.

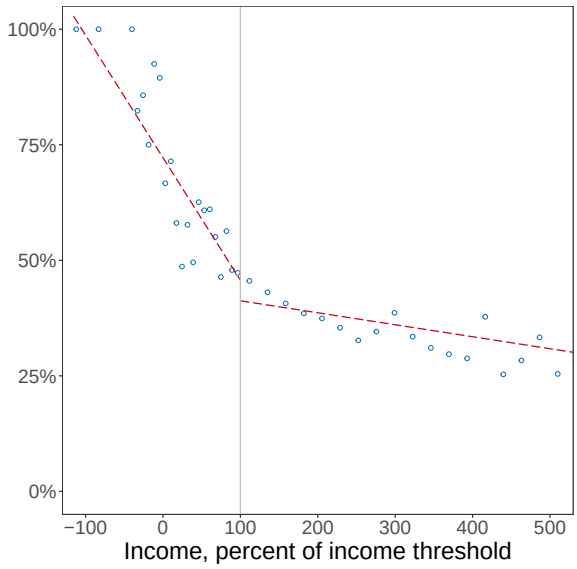
Figure 3a also reveals a negative correlation between income and demand for LD plans. Without controlling other covariates, every CHF 10,000 increase in income will decrease 0.2 percentage points of the take-up of the LD plan. This estimate is roughly of similar magnitudes of 2.2 percentage points in the absence of liquidity constraints compared to those under the liquidity constraints in the Netherlands market (Handel et al. (2024)). As noted from Ericson and Sydnor (2022), liquidity constraints could either increase the insurance demand to avoid financial shocks or reduce the insurance demand to avoid the premium. This finding is consistent with the prior one. This is also consistent with the theory that predicts that people who possess more wealth/and or resources demand less insurance coverage (Gropper and Kuhnen (2024)).

The take-up rate of the HD plan in the Figure 3b shows a peak among subsidy recipients. This peak represents the take-up rate of the HD plan when a sub-group of subsidy recipients experience the HD zero-price point even in the representative survey sample.

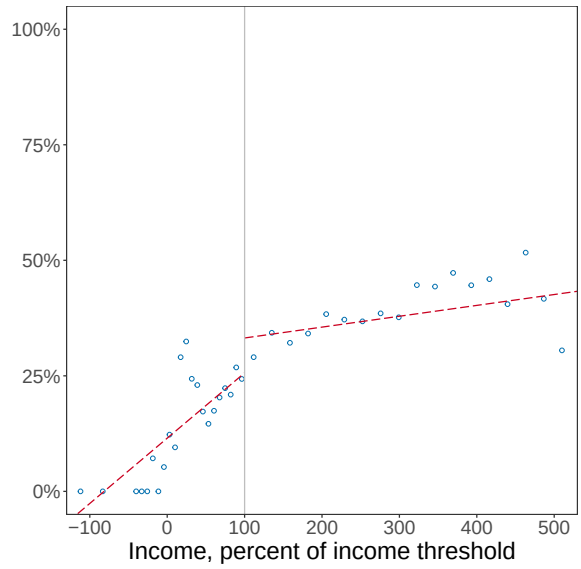
Size of substitution effect Figure 3c and Figure 3d present the take-up rates of the CHF 300 deductible plan (LD plan) and the CHF 2,500 deductible plan (HD plan) across different subsidy levels. The x-axis presents subsidy − premium for the CHF 2,500 deductible contract. The 0 signifies the subsidy level at which the CHF 2,500 deductible (HD) plan becomes zero dollars. Cantons differ in subsidy scales and market price. I align the cantons based on the zero dollar point. Insurance firms have different pricing levels, so I select the cheapest HD plan within each market. Therefore, the kink documents the first zero price point people face within each market.

Figure 3c illustrates that as subsidies increase, the take-up rate for the LD plan rises gradually but at a modest pace. This relatively slow growth can be attributed to the fact that higher subsidies are offset by a reduction in disposable income. Although subsidies have a positive income effect, they are accompanied by a decrease in income levels. As a result, the impact of increasing subsidies on the take-up rate for the LD plan remains relatively flat. However, once the zero-price point is surpassed, the take-up rate for the LD plan experiences a sharp rise, approaching nearly 90%.

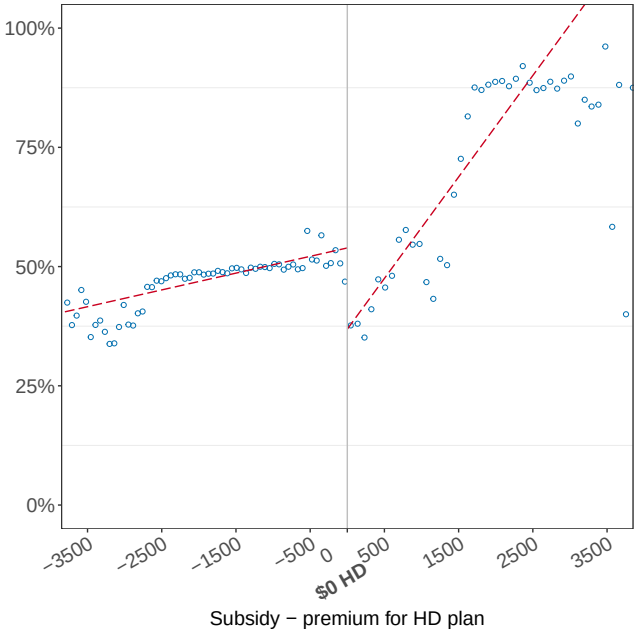
I use the following steps to construct the take-up rate of LD plan for estimating the size of the substitution effect and the marginal effect of income effect. The significant decrease in the take-up rate at the zero-price point could potentially exaggerate the size of the substitution effect, as it increases the likelihood of opting for the zero-price plan after the cut-off point. To address this, I employ both interpolation and extrapolation techniques. First, I interpolate the take-up rate of the LD plan for subsidies above the HD zero-price point, within the range of [0, 1540]. Next, I extrapolate the take-up rate of the LD plan within the same range, assuming only the income effect. The interpolation result is then used to measure the size of the substitution effect, providing an upper-bound estimate. Subsequently, the extrapolation result is used to estimate the marginal



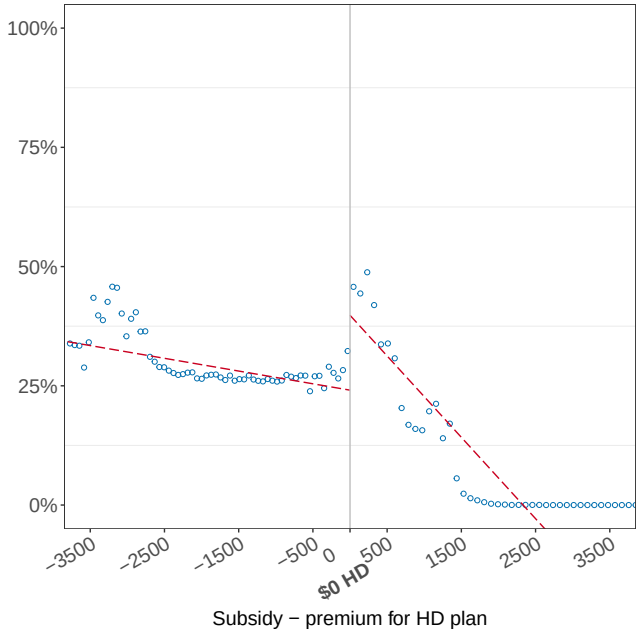
(a) Take-up of **LD plan - CHF 300**



(b) Take-up of **HD plan - CHF 2,500**



(c) Take-up of **LD plan - CHF 300**



(d) Take-up of **HD plan - CHF 2,500**

Figure 3: Panels A and B present the take-up rate of insurance contracts across the kink where people start to receive subsidies; Panels C and D present the take-up rate of insurance contracts across the kink where the HD plan becomes zero premium. The running variable in Panels A and B is household income corresponding to the income threshold, and the running variable in Panels C and D is the subsidy amount. The data in Panels A and B are the representative sample in Table 2. The data sample in Panels C and D is the entire subsidy recipients group.

income effect on the overall take-up rate.

Utilizing RKD analysis with this interpolated data yields a coefficient of 0.051 (p = 0.000, bandwidth = 176). Transferring this coefficient to the elasticity suggests that a CHF 100 subsidy increase will increase the take-up rate by 2.58 percentage points due to the substitution effect. This estimate is roughly comparable to, though on the lower bound of, estimates from other markets. Tebaldi (2024) finds a 2-4 percent decrease in enrollment for a $100 premium increase in the California ACA exchange.[9] Finkelstein et al. (2019b) suggest a 5.3 percent decrease in take-up for a $100 premium increase.[10] The differences between my findings and those in these studies can be attributed to two main factors. First, while both studies focus on increasing insurance coverage among the uninsured, my study examines individuals already insured with basic coverage, focusing on the extensive margin of upgrading to higher coverage. Second, in the Swiss context, over 50% of the subsidized population already selects the high coverage plan, leading to a lower potential sensitivity to premium changes in my results.

Marginal effect of income effect Following the model of Chetty (2008), I develop a framework (detailed in the Appendix) to simulate the marginal effect of the income effect. The take-up of the LD plan increases by approximately 25.74 percentage points after the zero-price point, reflecting a combination of income and substitution effects. Based on the extrapolation estimates, the income effect alone is responsible for a 10.44 percentage points increase in the take-up rate. This suggests that around 40% of the increase in insurance coverage due to the subsidy can be attributed to the income effect.

Take-up under counterfactual policies These results imply asymmetric implications for different subsidy policies. These estimates have implications for understanding enrollment in the CommCare market. For instance, Finkelstein et al. (2019b) find that a $40 increase in monthly premiums, equivalent to $468 annually, results in a 25% decrease in insurance take-up, which corresponds to a 5.3% decrease in take-up for every $100 increase in annual premiums. My estimates indicate that 40% of the 5.3% decrease (approximately 2.12 percentage points) is due to the income effect, while the remaining 60% (approximately 3.18 percentage points) is attributable to the substitution effect. In contrast, my estimates further suggest that penalizing individuals the same amount will only lead to a 1.06% increase in the take-up rate (3.18% - 2.12%).

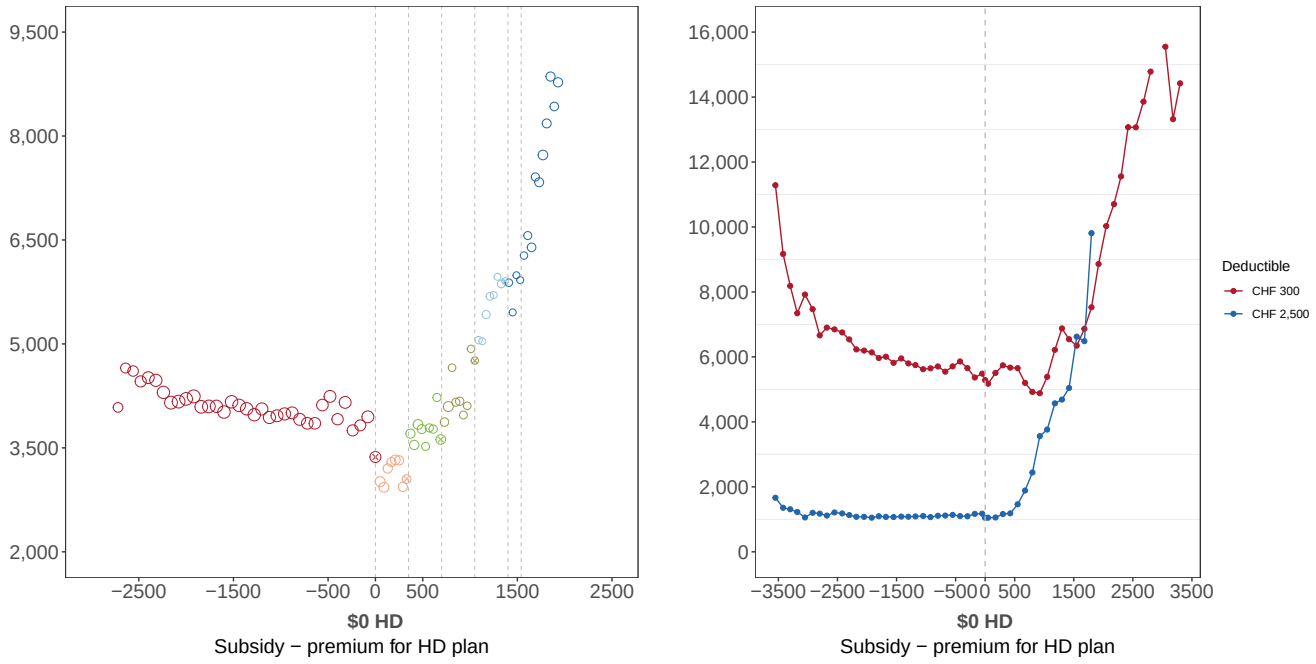
4.1.1 Utilization impacts

How does the subsidy affect the health expenditure utilization? Figure 4a examines the overall health expenditure across subsidy levels, including all plans; Figure 4b scrutinizes the health expenditure

[9] Tebaldi (2024) estimates a 2-4 percent decline in enrollment for an across-the-board $100 annual premium increase for subsidized enrollees without children.

[10] Finkelstein et al. (2019b)find that a $40 increase in monthly premiums (equivalent to $468 annually) leads to a 25% decrease in insurance take-up, which scales to a 5.3% decrease for a $100 annual increase.

across varying subsidy levels by plans.



(a) Average cost at different subsidy levels

(b) Average cost by deductible plan

Figure 4: The two figures show the average cost at different subsidy levels (panel A) and by different deductible plans (panel B), with vertical dashed lines indicating when the various contracts become zero-price plans subsequently, starting from the cheapest plan on the left.

Figure 4a presents the health expenditure by the subsidy levels. Health expenditure by subsidy level remains stable at around CHF 3,992 per enrollee (standard error = CHF 129) until the subsidy reaches the HD zero-price point, where it notably decreases to CHF 3,302. The cost reduction is primarily driven by 25 percent of individuals enticed by the zero-priced HD plan. This is further supported by Figure 4b, which reveals that individuals who select the HD plan at the zero-price point exhibit similar risk levels to those who chose it prior to this point. This consistency suggests that the observed reduction in cost is not due to a change in the risk profile of enrollees but rather their response to the plan's pricing, highlighting moral hazard behavior through which individuals insured under the LD plan incur higher health expenditures. In particular, individuals in the LD plan incur higher health expenditures, with the average cost for LD plan enrollees being CHF 5,687 (standard deviation = 189), compared to CHF 1,109 (standard deviation = 35) for HD plan enrollees. This substantial cost reduction highlights the moral hazard behavior induced by the subsidy.

5 Conclusion

While the extant research largely assumes the absence of the income effect, this paper provides the first empirical evidence delineating the distinct roles played by income and substitution effects. I identify strong and sizeable income effects. This result has important implications for future

research. The presence of income effects necessitates adjustments to accurately gauge WTP across different income levels. This insight directly informs the interpretation of demand-response as WTP, as seen in the work of Finkelstein et al. (2019b), among others. Ignoring income effects could lead to overestimations or underestimations of consumer valuation, thereby affecting policy recommendations and welfare assessments.

In addition, while the evidence on the "tagging" or "labeling" of subsidies is indirect in this work, it suggests that mental accounting may play a role in how subsidies are utilized. The potential for individuals to allocate subsidy dollars in ways that deviate from utility-maximizing behavior is an area ripe for further investigation. If the mental accounting is true, it would indicate that subsidy design needs to account for behavioral biases, ensuring that subsidies achieve their intended effects.

A Appendix

A.1 Summary statistics

A.2 Institutional background

A.2.0.1 Step-wise subsidy scheme The step-wise decreasing function form (see Figure 5) for subsidies is similar to the subsidy rules applied in the US Affordable Care Act (ACA) market (see Finkelstein et al. (2019b) for more details). Subsidy amount is dependent on income level and the different groups to which the insured are assigned according to their household type. The main rationale for implementing a proportional subsidy is to ensure that health insurance is affordable to low-income individuals, while the step-wise subsidy scheme saves on administrative costs when distributing subsidies.

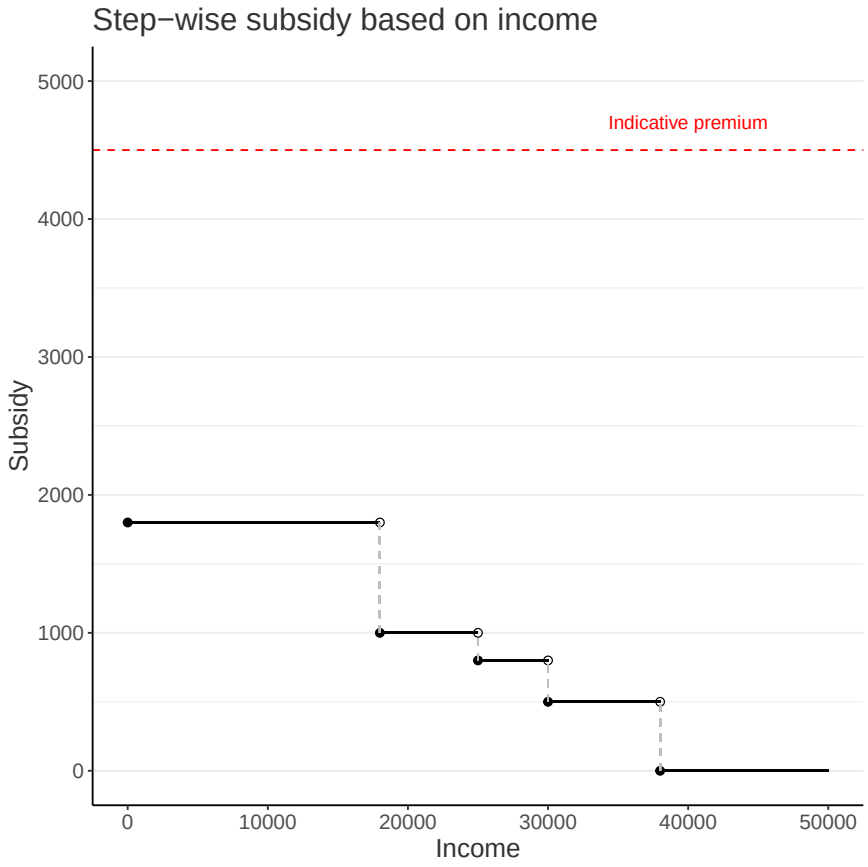


Figure 5: Step-wise subsidy schemes: the x-axis shows the taxable income two years ago

The subsidy distribution mechanism differs vastly across cantons. Six out of eight cantons implementing a step-wise subsidy scheme automatically transfer the subsidy.[11] For the most cantons[12] implementing the income-linear subsidy, eligible citizens receive notification via mail in

[11]The six cantons are: BE, VS,NE,GE, JU. Canton of TG and ZH require individual application for subsidy.
[12]Canton of AI implements the income-linear subsidy, but they automatically distribute the subsidy amount.

Table 2: Descriptive statistics

	Entire Swiss		Representative sample	
	Unsubsidized	Subsidized	Unsubsidized	Subsidized
Dependent variable				
CHF 300	0.398	0.569	0.395	0.521
CHF 500	0.110	0.114	0.107	0.120
CHF 1,000	0.034	0.027	0.039	0.030
CHF 1,500	0.076	0.048	0.088	0.070
CHF 2,000	0.023	0.014	0.023	0.013
CHF 2,500	0.359	0.228	0.347	0.246
Premium				
Premium	4,026	4,501	4,362	4,693
Net premium	4,026	2,027	4,360	2,187
Subsidy	0	2,474	0	2,506
Health cost				
Total health cost	4,061	6,081	4,319	6,066
Cost shared by insured	618	631	698	649
Cost shared by insurer	3,443	5,450	3,621	5,417
Risk factors (*share*)				
Overnight hospital stay	0.062	0.102	0.062	0.090
Drug cost ($>$ 5,000)	0.025	0.044		
PCG (*69 listed chronic disease*)	0.207	0.269		
Insurance model(*share*)				
Base	0.248	0.275	0.243	0.216
DIV (*Telmed*)	0.194	0.172	0.199	0.215
Family doctor model	0.495	0.494	0.498	0.523
HMO (*Limited network*)	0.063	0.059	0.061	0.046
Social background				
Female	0.495	0.562	0.520	0.563
Age 26 − 45	0.375	0.477	0.312	0.427
Age 45 − 64	0.392	0.305	0.420	0.289
Age 65 +	0.233	0.218	0.250	0.215
Work = 1	0.421	0.584	0.462	0.587
Highest education: with university degree			0.370	0.213
Self−report health condition				
General health condition				
Good health			0.841	0.734
Bad health			0.025	0.074
Chronic disease			0.365	0.429
Unmet need for medical			0.035	0.057
Reason: too expensive			0.166	0.429
Financial condition				
Gross household income			155,887	95,296
Disposable household income			107,710	67,648
Equivalent household size			2	2
Happy with financial situation			0.822	0.473
Improved financial condition			0.110	0.114
Deteriorate financial condition			0.063	0.121
Able to handle unexpected CHF 2,500 expenditure shock			0.923	0.615
Arrears in health insurance			0.027	0.098
Observations	21,875,182	5,388,979	12,211	2,504
Shares	80.2%	19.8 %	83.0 %	17.0 %

Notes: The entire adult sample covers data from year 2019 to 2022. The representative sample covers data from 2019. The equivalised household size assigns a value of 1 to one adult, 0.5 to a young adult who is still dependent and aged 14, and 0.3 for children aged below 14. The DIV insurance model, known as Telmed, requires patients to call a medical center before visiting a doctor; the family doctor insurance model requires visiting a family physician, who acts as a gatekeeper, before accessing a hospital center; the HMO insurance model is another type of mandatory basic model in which a physician from the medical network serves as the initial contact before seeking treatment at a formal care center.

June, and they then must file the application for the subsidy themselves in the regulated time. The effective time for filing the application varies across cantons from one month to twelve months. For instance, the canton of St. Gallen has a three-month application period, and the canton of Basel-Landeschaft offers 12 months to respond to the letter. The final subsidy amount would be noticed before the annual health insurance decision is made each year in November.[13]

A.3 Smooth distribution of subsidy levels

Smooth distribution of subsidy levels To assess the assumption of randomness, in Figure 6, I plot a histogram of the subsidy levels in the spirit of the density test of McCrary (2008). The x-axis presents the subsidy levels but is normalized, with the 0 mark signifying the subsidy level at which the CHF 2,500 deductible plan (HD plan) becomes zero-priced. A primary challenge lies in the heterogeneous nature of subsidies across cantons. Not only do cantons differ in their subsidy scales, but also the exact subsidy amount varies, which makes the CHF 2,500 deductible zero-price. Thus, in the main analysis, I align the cantons based on when the zero-price point for CHF 2,500 becomes available. Different insurance firms have different pricing strategies for HD plans, so I selected the cheapest HD plan on the market. Importantly, the distribution of subsidy levels appears to be relatively smooth across the discontinuity point. In some cantons, the distribution is not smooth around the first kink, but when all cantons are pooled together, the distribution is smooth.

[13]For the eighteen cantons implementing the 'income-linear' subsidy, eligible citizens residing in the canton of Basel (BS) are reliable to check the subsidy regulation and file applications for the subsidy themselves. For the rest cantons, eligible adults receive a notification letter, and they have limited time to apply for the subsidies.

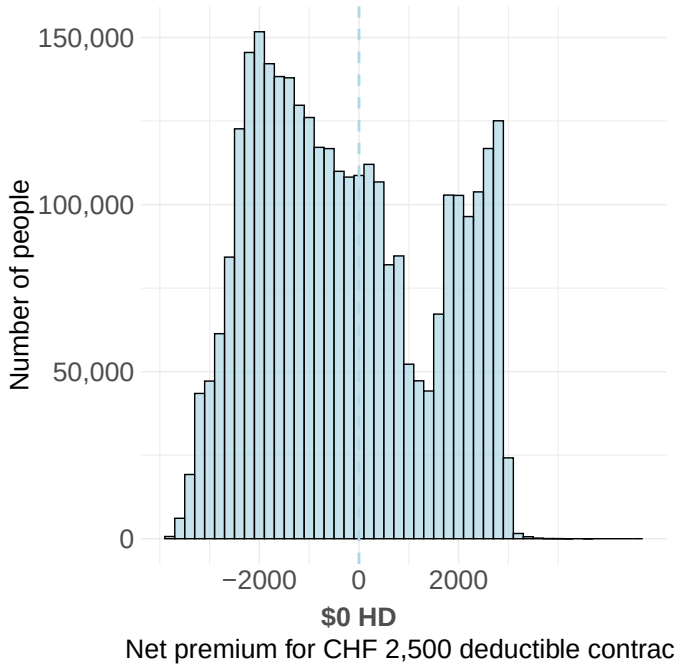


Figure 6: Subsidy distribution smoothness test: The x-axis depicts subsidy levels - premium for the CHF 2,500 deductible contract. The point '0' corresponds to the subsidy amount where the CHF 2,500 deductible plan becomes free (market rate is $0). This normalization is used to align different cantons based on their specific subsidy schedules and market rates. This figure shows the distribution of subsidy levels for all subsidy recipients in all cantons implementing the income-linear subsidy in 2019. In a few cantons, the distribution is not smooth around the zero-price kink, but when all cantons are pooled together, the distribution is smooth. The distribution figure will vary due to a few cantons using different bandwidths, but the main result of this paper is still the same. I also present the same analysis using specific cantons, such as the Argau. The analysis and result hold and are presented in the Appendix.

A.4 Robust test for RKD using different bandwidth

A.4.0.1 RKD estimates using different bandwidth This subsection presents the sensitivity analysis conducted to assess the robustness of the Regression Kink Design (RKD) results. To address the possibility of the non-linear relationship presented in the main result in Figure 3, the following analysis presents the RKD result using different cutoff points using different bandwidths.

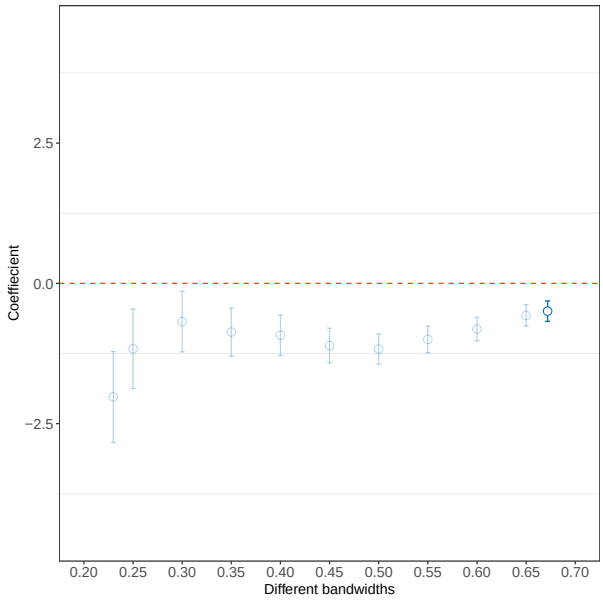
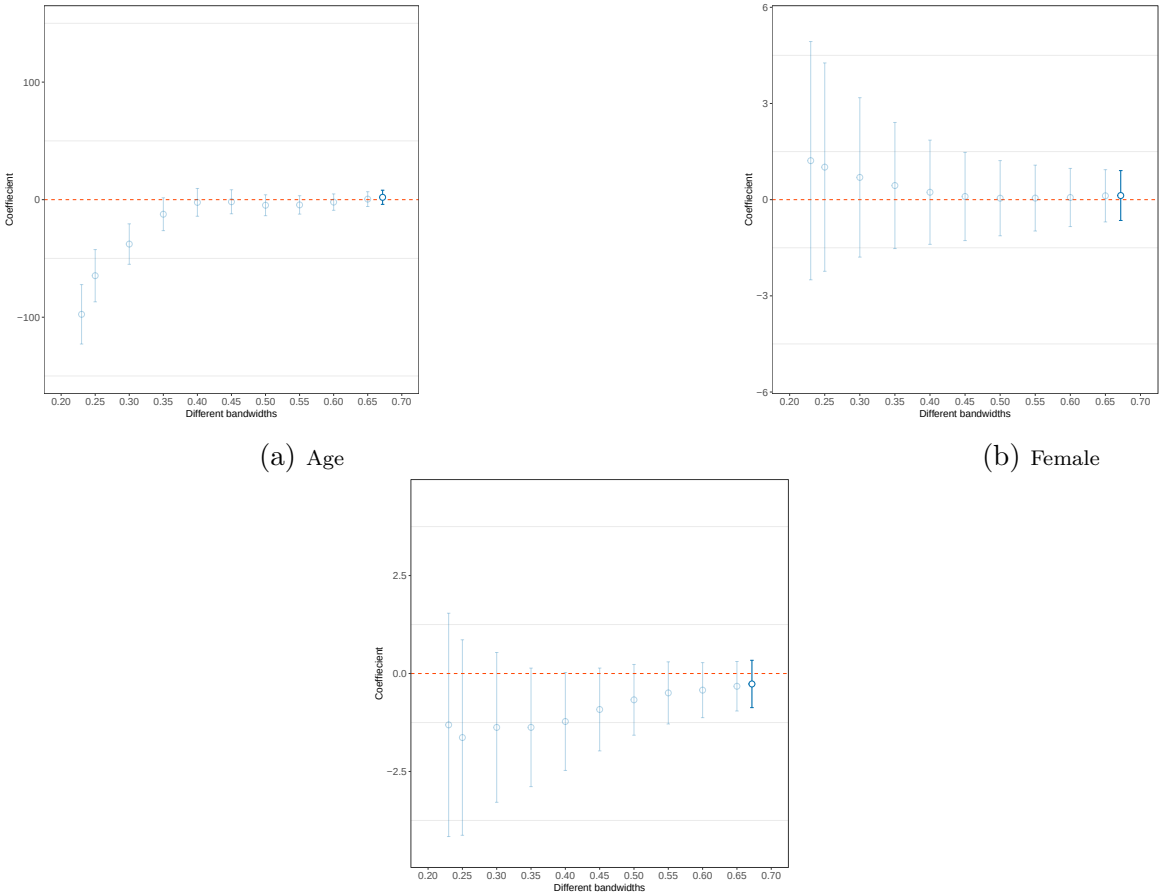


Figure 7: Coefficients for RKD main result using different bandwidths

Note: This figure shows the coefficients from RKD regression using different bandwidths. The result from optimal bind-width is highlighted.



(a) Age

(b) Female

(c) University degree

Figure 8: Coefficients for RKD assumption using different bandwidths

Note: Figures show the coefficients from RKD assumption test using different bandwidths. The result from optimal bind-width is highlighted.

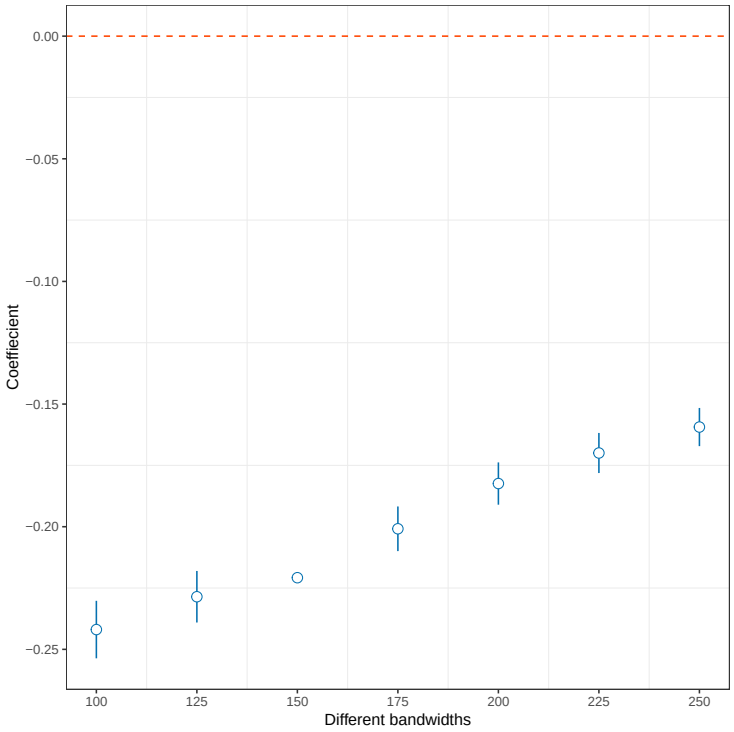


Figure 9: Figures show the coefficient from RKD regression using different bins.

A.5 Model

A.6 model

In this section, I used a simplified model in the spirit of Chetty (2008). This model shows the choice of buying the top-up option can be decomposed into two parts: income effect and substitution effect. Without considering the income effect, demand response to an increase in the subsidy for the top-up option only gives us a demand curve with respect to the price that is inclusive of the income effect, i.e., it is not reflective of income-constant WTP.

Agent's Problem Consider an individual who has an initial budget w_0. After paying for the basic coverage deductible plan p_{basic}, the remaining budget for considering the purchase of the top-up option is w. Assume the consumer faces a health risk, denoted by the random variable θ, which occurs with probability $p(\theta)$. The individual faces the option to buy full coverage for this risk by paying p_0 for the top-up insurance. In this model, the top-up insurance is simplified as a full insurance product that covers the entire risk θ.

Value Function for Different Conditions The value function for not purchasing the top-up option is defined as V:

$$V = V(w + y(s) - \theta) \tag{2}$$

The value function for choosing the top-up option is defined as U:

$$U = U(w - p_0 + p(s)) \tag{3}$$

Agent Decision Individuals decide to purchase a $(1 - x)$ share of the top-up option, where x represents the proportion of risk the individual decides to retain. They select x to maximize the expected value function $J(x)$:

$$J(x) = \mathbb{E}[xU + (1 - x)V - h(x)] \tag{4}$$

Here, $h(x)$ represents the cost associated with the decision-making process, which may increase as the individual retains more risk (x). This cost can capture factors like the mental burden or stress of retaining risk, known as the peace of mind effect, or the difficulty in making decisions when faced with complex choices such as insurance coverage levels.

Subsidy's Impact on Decision-Making: The influence of a subsidy s on an individual's decision-making unfolds through two primary channels, depending on its application and magnitude. When the subsidy does not directly affect relative prices, its role is more pronounced through the income channel. In this case, the subsidy s enhances the individual's available budget w, after accounting for the basic health insurance plan. This increased budgetary allowance makes the top-up

option more accessible. On the other hand, if the subsidy s leads to a reduction in the price of the top-up option, its effect is exerted through the price channel. Here, the direct lowering of the top-up insurance cost alters the individual's decision-making calculus in the function $J(x)$, making the additional coverage more financially attractive and likely to be chosen.

The optimal decision on whether to buy the top-up option is determined by the first-order condition:

$$h'(x) = \mathbb{E}[U - V]$$

This condition indicates that the observed demand response to an increase in the subsidy for the top-up option is a combination of both the income effect and the substitution effect.

Decomposition of the Subsidy's Impact: The effect of an increase in the subsidy s for the top-up option on the take-up of the top-up option can be decomposed into two distinct effects:

1. **Income Effect**: The subsidy s effectively increases the individual's available budget w by $y(s)$. This additional income makes the top-up option more affordable, even if the relative price p_0 does not change. This effect is reflected in the value function for not purchasing the top-up option:

   $$V = V(w + y(s) - \theta)$$

   Here, the increase in $w + y(s)$ due to $y(s)$ represents the income effect.

2. **Substitution Effect**: The subsidy s may also reduce the effective price p_0 of the top-up insurance by Δp_0, making the top-up insurance relatively cheaper compared to other spending options. This effect is reflected in the value function for choosing the top-up option:

   $$U = U(w - (p_0 - \Delta p_0) + p(s))$$

   Here, the decrease in p_0 by Δp_0 represents the substitution effect.

Consequently, the derived demand curve with respect to the price is inclusive of the income effect, meaning it does not represent an income-constant willingness to pay (WTP).

A.7 Extrapolation for take-up rate

Table 3: Price effect regression result

	CHF 300 deductible contract	
	Pre-Kink	Post-Kink
Coefficient	0.00009***	0.00066***
	(0.0000)	(0.0000)
Intercept	0.1014***	-0.4005***
	(0.0019)	(0.0022)
Marginal Effect	0.0000***	0.0002***
	(0.0000)	(0.0000)
AIC	2559870	1380445
Observations	1,852,814	1,330,601

Note: The dependent variable is a binary variable indicating the choice of a low deductible plan (CHF 300). The key independent variable is subsidy level. Coefficients represent the change in the latent propensity to choose the CHF 300 deductible plan, and the marginal effects indicate the change in probability of choosing the LD plan for a CHF increase in subsidy levels. The models can be represented by the equation $\Pr(\text{CHF300}=1) = \Phi(\alpha_0 + \beta_1 \times \text{subsidy levels}_i)$ where Φ is the cumulative distribution function of the standard normal distribution. AIC represents the Akaike Information Criterion. Standard errors presented in parentheses below the coefficients. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels respectively.

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