

Magnitude and Social Correlates of Poor Decisions in Health Insurance*

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Abstract

This study investigates consumer choice in health insurance markets. Despite theoretical expectations, empirical evidence challenges the assumption that the provision of consumer choice enhances consumer welfare. Analyzing Swiss mandatory health insurance, with six deductible plans and standardized services, we identify social characteristics associated with suboptimal decision-making. Results indicate significant financial losses for a substantial number of consumers. While economically disadvantaged populations with lower incomes and less education tend to choose higher coverage plans, this is, on average, not optimal, emphasizing the need for a nuanced understanding of the relationship between consumer choice, social factors, and financial outcomes in health insurance.

JEL codes: D81, D91, I13, I18.

Keywords: health insurance, decision models, choice quality

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1 Introduction

Choice architecture is a highly relevant issue in many domains of financial decision-making, involving savings and debt decisions and insurance choices. The prospect of choice lies in the ability to enhance consumer and social welfare through improved alignment with individually heterogeneous preferences (Dixit and Stiglitz 1977). However, the degree to which consumer and social welfare is truly improved through choice provisions relies heavily on consumers’ ability to make individually optimal decisions and whether individually optimal decisions are also socially optimal. To evaluate choice architectures, it is crucial to explore choice quality, both collectively and in relation to relevant social characteristics. The existing literature identifies various obstacles that lead to suboptimal choices, including limited literacy (Abaluck and Gruber 2011), consumer inertia (Saltzman, Swanson, and Polsky 2021; Handel 2013), liquidity constraints (Ericson and Sydnor 2022; Finkelstein, Hendren, and Luttmer 2019), default effects (Brot-Goldberg et al. 2023), and inattention (Brown and Jeon 2023; Andersen et al. 2020). The ability to make optimal decisions is influenced by these obstacles, which are likely correlated with social demographics. Consequently, the welfare implications of consumer choice are potentially conditional on the interrelation between social characteristics and decision-making obstacles.

In this study, we focus on an area of financial decision making that is highly relevant to everyone and has a potentially severe impact on the basic need to access healthcare: health insurance. Research has broadly documented healthcare inequality¹ and recently Liu and Sydnor (2022) and Handel et al. (2024) suggested that suboptimal choice in health insurance maybe widespread instead of being a minor issue. However, the empirical literature lacks a sufficient understanding of the systematic variation in choice quality of health insurance decisions that determine access. In fact, along with Handel et al. (2024), this paper presents surprisingly homogeneous empirical evidence regarding the distribution of choice quality in two large but independent population-representative data sets, however, from a different institutional setting with higher levels of choice heterogeneity. While Handel et al. (2024) solely focus on the extensive margin of market participants choosing optimally or not, we also provide an intensive margin perspective by estimating the size of the financial consequences stemming from poor decision-making.

Our empirical context is the Swiss mandatory health insurance market, a heavily regulated

¹Chetty et al. (2016) use big data to show the large gap in life expectancy between the rich and poor in the US; Bor, Cohen, and Galea (2017) examine the impact of rising income inequality on health outcomes in the US; Mackenbach et al. (2008) present a comparative study of health inequalities in multiple European countries.

industry with cleanly identifiable optimal and non-optimal contracts. The health insurance mandate extends to the entire Swiss population. Premiums are determined through a community rating system in which every insured individual pays an equal premium regardless of their age, gender, or other health-related indicators. The primary choice individuals face is the level of deductible that determines health insurance premiums. Notably, all covered services, including access to particular provider networks, are standardized across different plans. This standardization enables us to isolate and examine choices based solely on deductibles. While private insurance companies offer plans in a managed competition market, the attributes of these plans are consistent across companies, ensuring uniformity in offerings.

We begin our analysis by assessing the available health insurance plans in the market. To accomplish this, we utilize various normative and descriptive theoretical models to provide insights into the conditions that render certain plans optimal. We calibrate these models using detailed specifications of existing health insurance plans, precise real-world health cost data, and a wide range of preference parameters. These parameters encompass not only standard risk preferences, as in expected utility theory (EUT), but also extend to behavioral characteristics such as probability weighting under rank-dependent utility and reference points under reference-dependent utility.² The outcomes of this modeling exercise consistently indicate that, with reasonable parameter specifications, only two of the six plans can be optimal. These plans are either the highest deductible plan with a CHF 2,500 (USD 2,783) deductible or the lowest deductible plan with a CHF 300 (USD 334) deductible.³

Our results show stark disparities between documented choices in this market and theoretical predictions. Within the population, 36 percent select non-optimal intermediate deductible plans, while 13 out of the 44 percent who opt for the CHF 300 deductible plan have health costs too low to justify their choices within our theoretical framework. Consequently and in line with Liu and Sydnor (2022), roughly 49 percent of adult Swiss citizens opt for non-welfare-maximizing plans, resulting in significant foregone savings. On average, these foregone savings amount to between CHF 382 to CHF 457 per year, which is approximately equal to one month worth of premium payments for the high coverage deductible plan. The magnitude of these estimates, combined with their considerable variation, serves as the primary motivation for our research, which concentrates on the distribution of and social correlates of foregone savings and choice quality.

Health risk (i.e., expected health costs) should be the primary component determining

²In this study, we do not model individuals' potential liquidity constraints. However, in a related study, we show that liquidity constraints are unlikely to affect plan optimality (Biener and Zou 2024).

³CHF 1 was on average worth USD 1.113 in 2023.

deductible choice in our normative theoretical framework. Our empirical findings emphasize expected health costs as the most important determinant of deductible choice. When individuals experience a CHF 1,000 increase in health costs, they tend to choose an insurance contract that provides an incrementally higher level of coverage, with a 0.14 increase in plan actuarial value. However, the impact of health costs on selecting plans optimally is multifaceted. We demonstrate that 58 percent of consumers would benefit from choosing a higher deductible plan based on their health risk. Our results unveil a complex relationship between health risk and choice optimality, including the positive association between health costs and optimal choice among low-income households.

Individual characteristics such as wealth and education are known to influence financial decision-making ([Calvet, Campbell, and Sodini 2007](#); [Ruggeri et al. 2023](#)). Our empirical results echo this point by illustrating income and education as significant predictors of insurance demand. Increases in income and educational attainment are associated with lower insurance demand, showing that high coverage plans are predominantly chosen by individuals with lower income and lower education levels. However, on average, these higher coverage levels are not optimal, resulting in a higher share of non-optimal deductible plans and higher financial losses among those with limited resources. Furthermore, the effects of income on choice optimality and financial losses are conditional on health risk. Particularly, increases in health costs have a greater impact on individuals with lower incomes and their optimal deductible plan selection. Notably, educational attainment emerges as a plausible protective factor against non-optimal choices and the resultant financial losses.

Overall, our analysis unveils the complex role of social correlates in deductible choice and choice quality in particular. We demonstrate that a broad spectrum of factors beyond the traditional frictionless insurance choice model not only exists but also exerts substantial influence on individuals' decisions. Our results substantiate the notion that individuals with higher incomes and higher educational attainment incur lower health costs, therefore demanding less insurance and exhibiting more optimal decision-making and lower financial losses.

This paper contributes to various strands of literature. Firstly, it adds to the existing body of research on insurance choice with frictions such as financial literacy (e.g., [Abaluck and Gruber 2011](#); [Loewenstein et al. 2013](#); [Handel and Kolstad 2015](#); [Bhargava, Loewenstein, and Sydnor 2017](#)), complexity of choice menus (e.g., [Schram and Sonnemans 2011](#); [Frank and Lamiraud 2009](#); [Besedeš et al. 2012](#)), consumer inertia (e.g., [Saltzman, Swanson, and Polsky 2021](#); [Handel 2013](#)), liquidity constraints (e.g., [Ericson and Sydnor 2022](#); [Finkelstein, Hendren, and Luttmer 2019](#)), default effects (e.g., [Brot-Goldberg et al. 2023](#)),

inattention (e.g., [Brown and Jeon 2023](#); [Andersen et al. 2020](#)), and other factors (e.g., [Abaluck and Gruber 2022](#); [Bertko et al. 2021](#)). Our study of the different factors influencing poor decision-making contributes to the literature by highlighting the systematic variation in choice quality based on observable characteristics. Our work is closely related to [Handel et al. \(2024\)](#), who examine choice quality using data from the Dutch health insurance market. Though both studies share numerous similarities, our study diverges in several aspects. In the Dutch system, the overwhelmingly preferred coverage is the default option. In contrast, our empirical context displays a higher disparity of deductible choices, with over 40 percent of the population opting for an alternative to the lowest deductible plan. This more diverse choice landscape enhances the understanding of choice patterns in health insurance markets. Furthermore, due to the specific architecture of the Dutch system, [Handel et al. \(2024\)](#) primarily emphasize an extensive perspective on deductible choices. While we also provide insights into deductible choice patterns, our study offers new insights due to the Swiss market’s unique deductible options architecture that include clearly optimal and non-optimal deductible plans, which also allows us to provide an intensive margin perspective by estimating the size of the financial consequences stemming from poor decision-making.

Secondly, we contribute to discussions on the role of selection in insurance demand both conditional on risk and income. While [Handel \(2013\)](#), [Spinnewijn \(2017\)](#), [Handel, Kolstad, and Spinnewijn \(2019\)](#), [Polyakova \(2016\)](#) and [Marone and Sabety \(2022\)](#) all show that health insurance markets are plagued by adverse selection, which is in line with our data, evidence for selection based on income is mixed. [Geruso et al. \(2023\)](#) identify a positive association between income and insurance coverage in the US Virginia market. In contrast, [Handel et al. \(2024\)](#) find a negative correlation in the Dutch market, with higher incomes exhibiting lower insurance coverage. Adding further empirical evidence to this ongoing debate from a different market, our study not only uncovers a negative association similar to [Handel et al. \(2024\)](#) but also shows that income is positively associated with optimal decision making.

Thirdly, our paper adds to the literature on vertical choice (i.e., offering choice over coverage levels) in health insurance. [Marone and Sabety \(2022\)](#) show that vertical choice is efficient only if consumers with higher willingness to pay have a higher efficient level of coverage, and that this condition is unlikely to hold in practice. They show empirically that the positive correlation condition in fact does not hold in a sample of public school employees in Oregon. Other papers find mixed effects of vertical choice, depending on the data and methods. We find that the Swiss market also fails to meet this condition, as consumers who are willing to pay more for health insurance do not necessarily have higher optimal levels of coverage, thus reinforcing that vertical choice may not be a desirable feature of health

Table 1: Deductible menu

Deductible	Co-insurance rate	Cap co-insurance	Premium (in CHF)
CHF 300	10%	CHF 700	4,960
CHF 500	10%	CHF 700	$4,960 - (500 - 300) \times 70\% = 4,820$
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	$4,960 - (2,500 - 300) \times 70\% = 3,429$

insurance markets.

The remainder of this paper proceeds as follows. Section 2 provides an introduction to the institutional background of the Swiss mandatory health insurance market. In Section 3, we perform a theoretical analysis of the six deductible plans available to consumers. Section 4 outlines our sample and presents the empirical framework. The empirical results are discussed in Section 5, while Section 6 concludes.

2 Institutional background

We leverage the unique consumer choice environment of the Swiss health insurance market and establish a connection between administrative data on health insurance decisions and data from the Swiss Health Survey. The Swiss health insurance system provides an ideal setting in which to examine consumer decision-making due to several key factors. Firstly, the mandatory nature of health insurance in Switzerland eliminates potentially systematic selection biases that commonly affect other empirical studies. Secondly, the community rating scheme ensures that all adult Swiss citizens encounter an identical array of health insurance plans, regardless of gender, age, health status, income, and wealth. Thirdly, the variations among the available plans primarily pertain to cost-sharing attributes, while covered services remain constant across all options. This simplifies the process of comparing consumer choices.

Switzerland provides its adult citizens with a range of insurance plan options, allowing them to choose from six different deductible levels. These options are divided vertically and cater to individuals aged 26 and above. The deductible options, outlined in [Table 1](#), include deductible levels of CHF 300, CHF 500, CHF 1,000, CHF 1,500, CHF 2,000, and CHF 2,500.⁴ A coinsurance rate of 10 percent is applicable for health expenditures exceeding the

⁴Children up to the age of 18 pay lower premiums and have a different set of deductibles. People with

deductible. However, the maximum coinsurance amount is limited to CHF 700. The premium difference between the default plan (i.e., CHF 300 deductible) and plans with higher deductibles is capped by the regulator at 70 percent. If, for example, an individual selects the CHF 1,000 deductible plan, the maximum premium rebate compared to the CHF 300 deductible plan is $70\% \times (\text{CHF } 1,000 - \text{CHF } 300) = \text{CHF } 490$. Actual market data reveals that, on average, insurance companies apply a scheme of linear premium rebates amounting to 70% (i.e., rebates are the same for every level of deductible), which is remarkably homogeneous across providers. Each year, insurance firms submit premiums for the default deductible plan (i.e., CHF 300) to cantonal regulators⁵. Once approved, all other deductible plan premiums are determined according to the linear premium rebate shown in [Table 1](#). This ensures that relative differences in premiums as depicted in [Figure 1](#) remain consistent for all insurance providers in all cantons of Switzerland.

While premiums for the different deductible plans differ slightly between insurance firms, covered health services are the same. In 2021, the Swiss market included 52 registered insurance companies. The average number of insurers operating in each price region is 37. Each insurer operating in the Swiss market can but does not necessarily offer all six deductible plans. However, almost all health insurance companies offer all six deductible plans. For example, only 1 out of 35 insurers offering health insurance in 2022 did not offer all six deductible plans in the premium region 1 of the canton of St. Gallen, and only 2 out of 36 in the premium region 1 of the canton of Zurich did not.

[Figure 1](#) illustrates the mapping between total incurred health costs and costs borne by the insured conditional on deductible plan for the average plan menu in 2019 in the canton of St. Gallen. This example facilitates comparison of the financial implications of varying levels of health costs based on the corresponding deductible plan. Notably, we observe a distinct advantage for both the CHF 300 deductible plan (i.e., for health costs below approximately CHF 2,000) and the CHF 2,500 deductible plan (i.e., for health costs exceeding approximately CHF 2,000). The focus of this paper is on individuals aged 26 or older for whom the deductible schemes described here apply.

The average monthly premium for the base deductible contract with a CHF 300 deductible averages to CHF 383 (approximately 421 US dollar). The selection of health insurance plans by consumers takes place annually within a set period before the end of November, with

low incomes may be entitled to a premium subsidy, see Zou ([2022](#)) for more details. Adults aged between 19 and 26 are offered educational discounts.

⁵Cantonal regulators approve premiums to ensure that the premium income is sufficient to cover expected claims and costs for a particular insurer in a particular premium region.

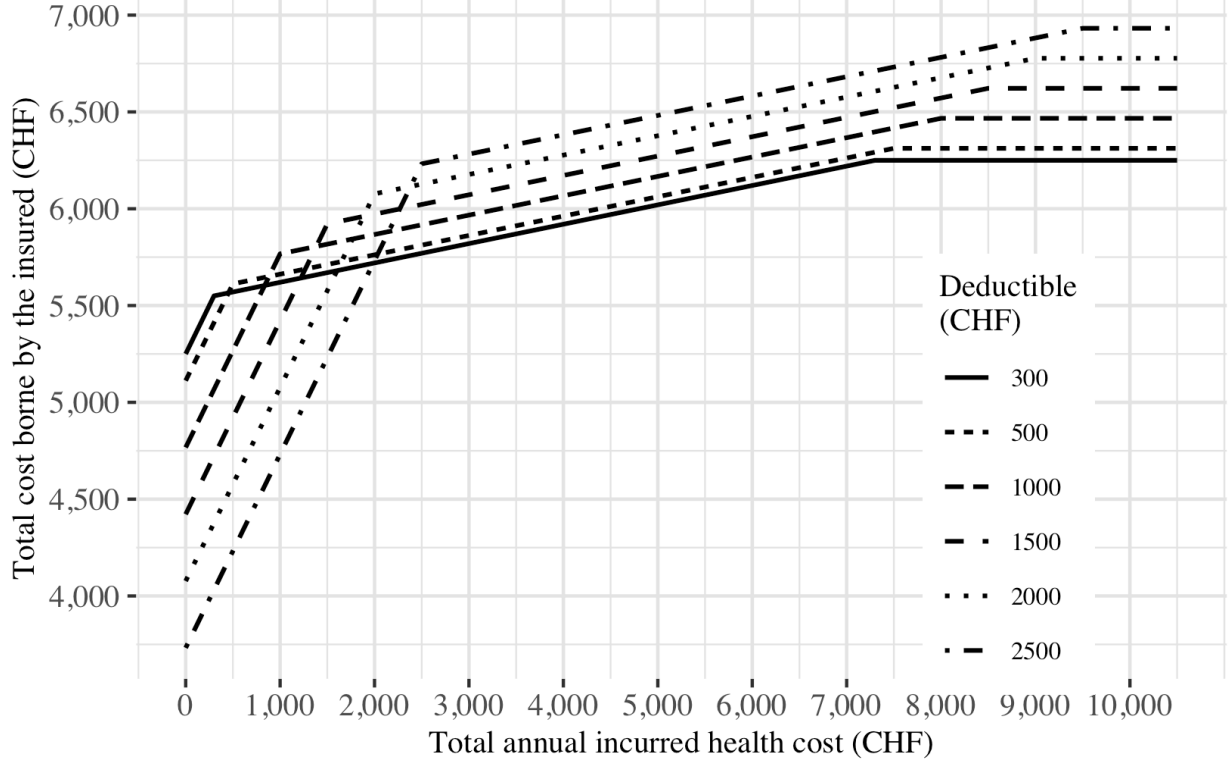


Figure 1: Mapping of total incurred health cost to cost borne by the insured

Note: The figure depicts the correlation between the total annual health costs incurred by an individual and the out-of-pocket costs borne by the insured under various deductible plan options. Each line represents a distinct deductible plan.

automatic renewal taking place in the case of no action.⁶ Each household member is insured individually with an individually assigned deductible.

3 Optimality of plan choice

3.1 Model without frictions

We study a choice environment in which each individual is subject to a compulsory deductible choice d , and is free to choose the deductible level at corresponding premium m_d from the choice menu. An individual draws her expectation of health cost x from an individual-specific distribution $F_i(x)$. Depending on the deductible d , this health cost translates into an out-

⁶In one of the datasets used in this study (i.e., Statistics on Income and Living Conditions), we observe 2,390 individuals' deductible choices for two consecutive years. The share of individuals changing their deductible from 2018 to 2019 is 5.3 percent, which is in line with publications of the Swiss Federal Office of Public Health reporting 5.5 percent for this period ([Federal Office of Public Health 2021](#)).

of-pocket expense $G_i(x, d)$, which is derived from the health cost distribution $F_i(x)$ and the deductible choice d . W_i represents the initial wealth of individual i before any health cost and premium payment. We define the expected utility of an individual as:

$$EU_{i,d} = \int u_i(W_i - m_d - G_i(x, d)) \times F_i(x) dx.$$

Using this framework, we can estimate expected utility for each deductible d and derive the optimal deductible contract for each individual.

In order to identify the optimal deductible contracts for people with different levels of health risk, we vary the health cost distribution, ranging from low to high-risk types. For this, we obtained cost data from the Federal Office of Public Health. Figure 2 presents the distribution of health costs conditional on age and gender. Each distribution is highly skewed, with about 19 percent of individuals exhibiting zero health costs, while for more than 10 percent of individuals, expenditures exceed CHF 10,000. We restrict attention to all individuals who are at least 26 years old in the year they decide on their health insurance contract. In the following analysis, we use age and gender as proxies for different risk profiles.

Expected utility theory (EUT) is the canonical decision framework under risk, providing an indication of normatively optimal behavior. Under this framework, optimal decisions can be inferred conditional on risk profile and the propensity to bear risk, with individuals trading risk (i.e., variance of wealth) against expected wealth.

We rely on constant relative risk aversion (CRRA) as the functional form of $u_i(\cdot)$. Under the assumption of CRRA, individuals' risk preferences vary with changes in wealth. We further validate our analysis using constant absolute risk aversion (CARA), and the results align with those obtained under the CRRA model, as demonstrated in Biener and Zou (2024). Here, we present the results based on CRRA with $u_i(w) = w^{1-\rho}/(1-\rho)$ and risk aversion parameter ρ . $F_i(x)$ is the distribution function representing the individual-specific expected health costs. For the underlying risk profiles (i.e., distribution of health costs conditional on age and gender), we rely on population statistics that have been provided by the Swiss Federal Office of Public Health (see Figure 2).

Figure 3 shows the optimal deductible contracts under the CRRA framework. In our simulation, we assume initial wealth to be CHF 10,000, representing the threshold level of wealth for the lower 10 percent of the population.⁷ The simulation results make apparent

⁷We also vary this initial wealth level (e.g., using CHF 100,000, the median population wealth in Switzerland) with results not being qualitatively affected.

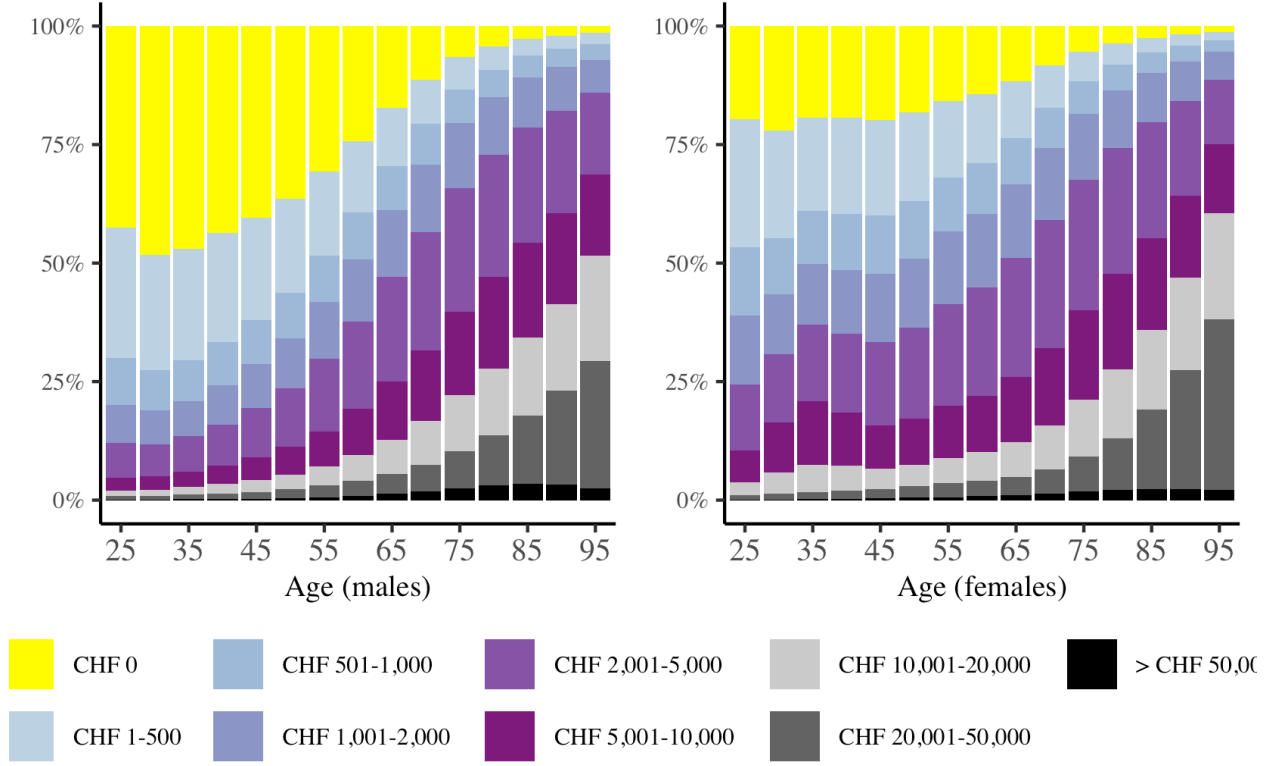


Figure 2: Health cost distribution conditional on age and gender

Note: The figures show the distribution of health cost conditional on age and gender according to the Swiss Federal Statistics 2017.

that none of the “middle” deductible contracts (i.e., CHF 500, CHF 1,000, CHF 1,500, CHF 2,000) can be rationalized for a meaningful level of risk aversion. Only with a CRRA preference parameter of $\rho = 5$ the middle deductible plans begin to play a material role in terms of becoming a preferred option for some types of individuals. To provide an intuition into what this level of risk aversion implies, consider the following example. Assume an individual with CHF 100,000 initial wealth (i.e., median population wealth in Switzerland) and exposure to health costs in line with a Swiss male between 31 and 35 years of age.⁸ The risk premium an individual with this profile would be willing to pay for full insurance if he had $\rho = 5$ is CHF 7,884 for an expected health cost exposure of CHF 2,885. The willingness to pay thus is roughly 2.7 times the expected loss.

⁸The simplified probability distribution over total incurred health costs for males between 31 and 35 years is categorically defined as follows: (i) CHF 0 with 47.0%, (ii) CHF 500 with 23.0%, (iii) CHF 2,000 with 16.0%, (iv) CHF 5,000 with 7.0%, (v) CHF 10,000 with 3.5%, and (vi) CHF 50,000 with 3.5%.

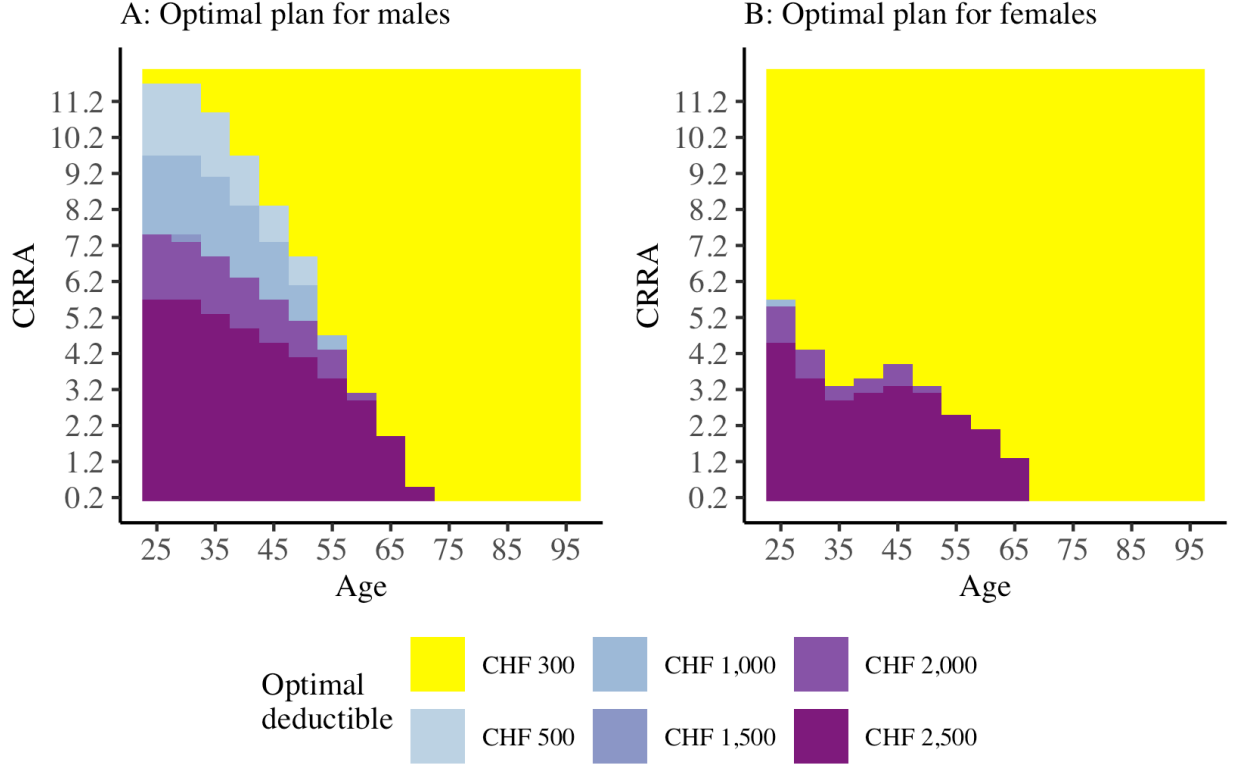


Figure 3: Optimal deductible under EUT for males and females

Note: The figures present the first-ranking deductible options conditional on age and risk aversion under CRRA EUT (Panel A for males and Panel B for females). The underlying risk profiles (i.e., distribution of health costs conditional on age and gender) have been provided by the Swiss Federal Office of Public Health.

3.2 Choice barriers

EUT decision-makers select the contract that maximizes their expected utility. In our context, this generally corresponds to the selection of the two boundary deductible options. However, we often observe that individuals tend to disproportionately overweight potentially severe health shocks. To address this behavioral pattern and understand consequential deductible plan optimality, we employ rank-dependent utility (RDU), which accentuates the propensity of individuals to overstate the likelihood of high health costs. Notwithstanding this modification, our results affirm that the two boundary deductible options (i.e., CHF 300 and CHF 2,500) consistently emerge as the optimal choice for RDU maximizers. Thus, probability weighting in RDU does not provide a rationale (though descriptively) for individuals choosing middle deductible plans.

In a context where health insurance is mandatory, individuals are required to purchase at least the minimum insurance coverage, represented by the CHF 2,500 deductible contract.

Individuals then assess the trade-off between additional premiums and extended coverage and potential out-of-pocket health expenses. This framing gives rise to reference-dependent ideas of decision making, with cumulative prospect theory (CPT) being one of the most prominent models in this domain. Our simulation results based on CPT mirror those from EUT and RDU models—boundary deductible plans remain the optimal choice. Thus, reference dependence in CPT does not provide a rationale (though descriptively) for individuals choosing middle deductible plans. A detailed discussion of RDU and CPT as well as their corresponding simulation results can be found in Appendix A.1.

As we extend our analysis from the normative EUT to the descriptive RDU and CPT models, our analysis cannot conclusively explain the selection of middle deductible options. Further factors such as liquidity constraints could play a role in explaining middle deductible plan optimality; however, the Swiss context provides mitigating factors here. In particular, individuals below a specific income threshold are entitled to premium subsidies, and those unable to cover co-payments receive assistance from social programs. Notably, approximately 20% of the adult population in Switzerland benefit from these subsidies. We’re not focusing on this low-income population receiving subsidies in this study and the Statistics on Income and Living Conditions (SILC) from 2019 survey data indicates that an overwhelming 93% of individuals not receiving premium subsidies report the capability to manage a CHF 2,500 expenditure shock. Hence, while acknowledging the potential relevance of liquidity constraints, the contextual factors in Switzerland offer significant alleviation of these concerns. In a related study, we also show theoretically that liquidity constraints are unlikely to affect plan optimality ([Biener and Zou 2024](#)).

4 Data and methodology

4.1 Data

This study utilizes two sets of data: the Swiss Health Survey (SGB) from 2017 and the Statistics on Income and Living Conditions (SILC) from 2018 and 2019. The SGB data, obtained from the Swiss Federal Office of Public Health, provides a rich collection of information on individuals’ health insurance choices, health status, and socio-demographic factors. With a sample size of 10,531 individuals, this study covers a wide range of variables, including income, education, language, and other demographic characteristics. To ensure consistency, our analysis excludes adults who receive health insurance subsidies.

In addition, the SILC data offers valuable administrative data on registered household

income and realized health expenditure. Our sample size of 9,848 observations⁹ complements the SGB data by providing detailed insights into health expenditures. While the SILC and SGB data cover different individuals, they share a similar sample composition, as highlighted in Table 2. This similarity enhances the comparability and generalizability of our findings across the two sets of data.

By leveraging the unique strengths of both the SILC and SGB data, we can effectively explore a wide range of social correlates related to health outcomes. The SILC data’s focus on realized health expenditure, combined with the SGB data’s comprehensive coverage of health conditions, allows us to examine the interplay between socio-economic factors and health outcomes from multiple angles. Moreover, employing the SGB data as a cross-check enables us to validate and corroborate our findings based on the SILC data, enhancing reliability.

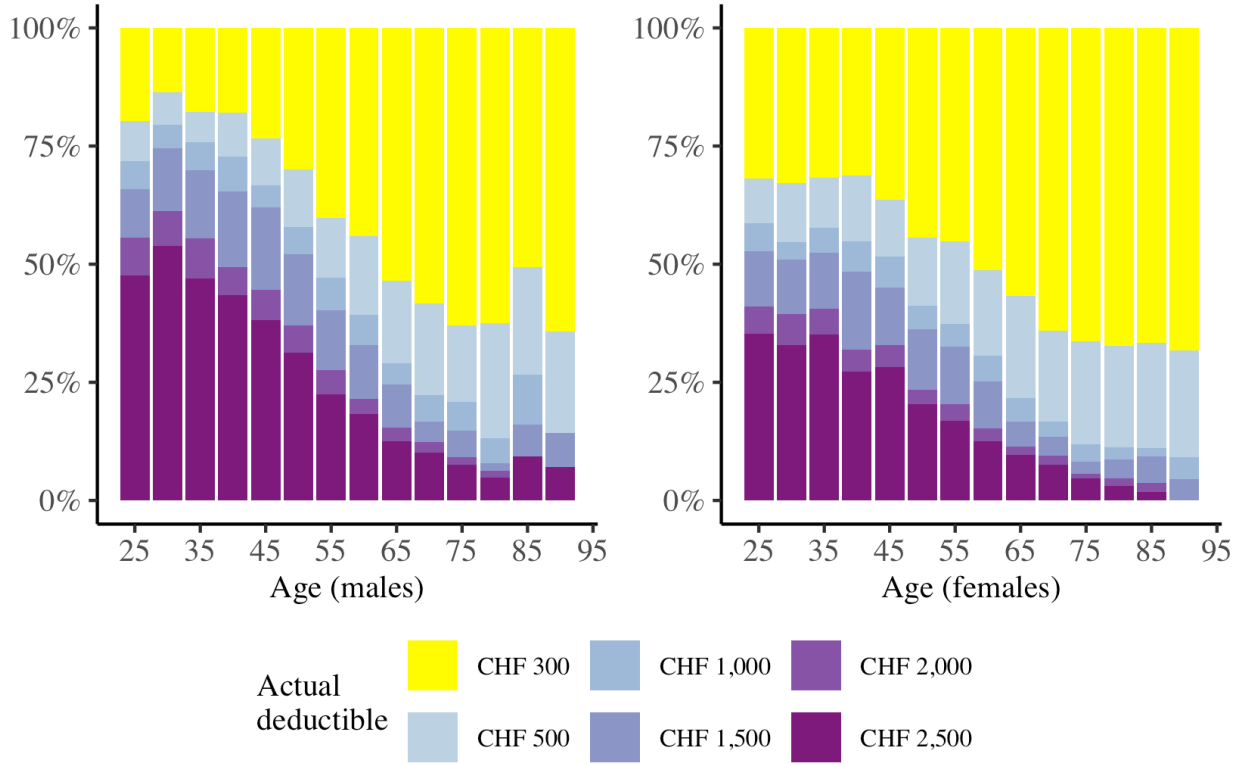


Figure 4: Actual deductible choices in 2017

Note: The figures show deductible choices of 15,485 individuals taken from a representative population sample (Swiss Health Survey 2017) by age and gender.

In this tightly regulated market, Swiss insurance companies are prohibited from selectively

⁹It is important to note that we limit our sample to those individuals not receiving premium subsidies.

choosing customers based on observable traits. To address the potential clustering of high-risk individuals in specific firms and prevent incentives for attracting low-risk individuals (i.e., cream-skimming), the Swiss Financial Market Supervisory Authority (FINMA) has implemented a risk compensation scheme. This scheme relies on four factors—age, gender, the presence of any of the 69 listed chronic diseases listed by the Swiss Federal Office of Public Health, and whether the individual has spent a night in hospital during the previous year. By employing the methodology of this risk compensation scheme, we can aggregate the extensive data and generate an index of expected health costs in the SGB data. It’s worth noting that average costs vary significantly among different groups. For instance, a 60- to 65-year-old man on average incurs health costs roughly 4.31 times greater than that of a 25- to 30-year-old man (CHF 5,323 versus CHF 1,235). Moreover, we can directly observe realized health expenditures based on register data in the SILC data, in which we observe average health expenditures of CHF 5,386.

Individuals are free to select from the deductible levels CHF 300, CHF 500, CHF 1,000, CHF 1,500, CHF 2,000, and CHF 2,500.¹⁰ Higher deductibles lead to lower premium payments. In Figure 4, we show the empirical deductible choice patterns among the Swiss adult population. All six plans have positive uptake in all age- and gender-groups. Increases in age and subsequently average expected health costs are associated with an increase in insurance coverage (i.e., decrease in deductible). Notably, around 40 percent of adults choose one of the intermediate deductible plans, which are hard to rationalize as we have shown previously.

Table 2 presents a comprehensive overview of the key variables in the two sets of data. The SILC sample consists of 9,848 individuals, and the SGB sample consists of 10,531 individuals. The average age of the participants is 56 years in the SILC data and 52 years in the SGB data. Health expenditure shows substantial variation, with average annual costs of CHF 5,386 in the SILC data and CHF 4,465 in the SGB data. The smaller standard deviation of health costs in the SGB data arises mainly due to the fact that SGB health costs are approximated based on the risk factors applied by the risk-compensation scheme of the Swiss Federal Office of Public Health, whereas SILC health costs are realized values based on register data.

Average annual household income (SILC data) is CHF 350,148 and average annual personal net income (SGB data) is CHF 110,876. Notably, more than 20 percent of the participants in the two samples possess a university degree. Gender distribution is balanced, with 55 percent female participants in the SILC data and 52 percent in the SGB data. Regarding

¹⁰While this deductible menu has been in place since 2005, the premium levels have increased significantly. However, the relative premium differences between the deductible plans remained unchanged.

Table 2: Summary statistics

	Data SILC		Data SGB		<i>p</i> -value
	Mean	SD	Mean	SD	
Age	55.88	15.09	51.98	16.90	0.000
Female	54.99	49.75	53.17	49.90	0.0043
Deductible (%)					
CHF 300	46.81	49.90	39.84	48.96	0.000
CHF 500	12.88	33.49	14.08	34.79	0.0053
CHF 1,000	3.19	17.57	5.49	22.79	0.000
CHF 1,500	7.88	26.94	11.06	31.37	0.000
CHF 2,000	2.29	14.97	4.44	20.61	0.000
CHF 2,500	26.95	44.37	25.07	43.34	0.0008
Health expenditure	5,385.94	11,449.39	4,464.59	5,894.90	0.000
Income (household)	350,148.12	850,671.75			
Income (individual)			110,875.88	282,083.58	
University degree	22.80	41.96	22.32	41.64	0.324
Chronic disease (%)	42.65	49.46	34.49	47.53	0.000
Overnight hospital stay (%)	8.12	27.32			
Doctor visit times			1.83	3.45	
Observations	9,848		10,531		

Note: The table shows the summary statistics for the SILC and SGB data separately, with SD denoting the standard deviation. In the SILC data, the health expenditure is the incurred health cost; in the SGB data, the health expenditure is projected following the risk adjustment scheme. This scheme relies on four factors: age, gender, presence of any 69 listed chronic diseases, and whether the individual has spent a night in hospital during the previous year.

health-related factors, 42 percent of participants in the SILC data (and 34 percent in the SGB data) report having a chronic disease. Furthermore, 8 percent of participants have stayed overnight in a hospital in the previous year, while the average number of doctor visits is 1.83. The selected deductible options cover the whole range from CHF 300 to CHF 2,500, with varying enrollment percentages.

4.2 Empirical approach

In this study, we aim to unveil two characteristics of insurance demand: coverage patterns and choice quality. For both of these characteristics we’re interested in understanding average patterns across the population but also heterogeneity within the population. We begin to examine coverage patterns by estimating the association between deductible choices and health risk proxied by healthcare costs, as this is an important empirical relationship also investigated elsewhere (see, e.g., [Handel et al. 2024](#)). By scrutinizing this correlation, we provide insights into how individuals evaluate and respond to their perceived health risks regarding their deductible choices. We segment our sample into ten equally-sized groups based on their levels of health expenditure. Within each group, we show the prevalence of deductible plans, thereby illuminating the interplay between health risk and deductible choice. Second, we estimate the association between individual social characteristics and

deductible choices. Here, we encounter correlations between a range of variables, specifically between income, health costs, and educational level. To account for these complex relationships, we introduce the concept of actuarial value (AV) to represent insurance coverage under a given deductible plan as it provides a single, comprehensive measure of the share of total health expenditures that a plan would cover. Transforming deductible levels into AV s effectively encapsulates the complex interplay between cost and deductible levels. By doing so, we enable a focused study on how income, educational level, and other social characteristics independently correlate with insurance demand without the confounding influence of their relationships with cost.

The AV of a certain insurance contract is calculated by dividing the health expenditure covered by the health insurance plan by total health expenditure. The AV provides a measure of the financial protection offered by each deductible plan. A higher AV indicates a more generous contract. For example, an AV of 0.70 suggests that the insurance plan covers 70 percent of an insured person's health expenditures. For individual i , the AV_i of a deductible plan is calculated as:

$$AV_i = \frac{\text{Health expenditure covered by insurance plan}_i}{\text{Total health expenditure}_i}.$$

To analyze choice quality, we estimate the financial impact (i.e., financial loss) resulting from deductible choices. For individual i , the financial loss FL_i is defined as:

$$FL_i = \text{Total Cost}_i^* - \text{Total Cost}_i,$$

where Total Cost_i represents the sum of premium payments and out-of-pocket expenses under the selected contract, and Total Cost_i^* denotes the sum of premium payments and out-of-pocket expenses under the optimal contract. FL_i thus provides a measure of the monetary consequences of not selecting deductible plans optimally.

To study the social correlates of insurance demand and choice optimality, we estimate models of the following form:

$$Y_i = \alpha + \beta_1 X_i + \beta_2 \text{Control}_i + \epsilon_i,$$

where Y_i is either be the AV of the respective deductible plan chosen by individual i or a binary variable indicating whether the optimal deductible plan was selected (i.e., $Y_i = 1$) or

not (i.e., $Y_i = 0$). X_i is an independent variable of interest, which can either be $\log(Cost_i)$ ¹¹, $\log(Income_i)$, or an interaction of the two, $Education_i$, or a range of risk characteristics, depending on the specific analysis. A critical aspect of this methodology involves possible correlations between our independent variables. To control for any time-varying factors that might affect insurance choices in the SILC data that includes two years of data in an unbalanced panel, we include a year 2019 dummy variable in the regression.

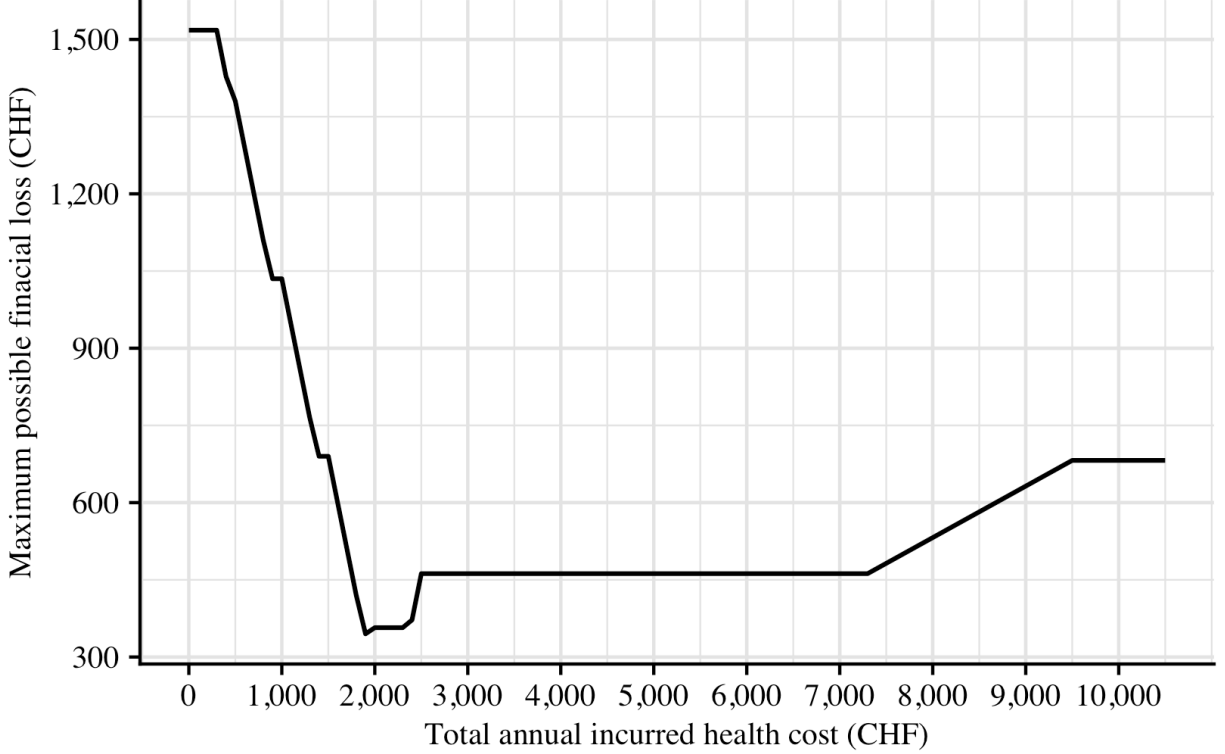


Figure 5: Maximum possible financial losses conditional on total incurred health cost

Note: The figure shows the maximum possible financial losses conditional on total incurred health cost (in CHF) as the difference of total cost borne by the insured (in CHF) between the highest and lowest cost plan.

In addition to insurance demand and the probability of choosing optimally, with financial losses we would expect a non-linear relationship between health costs and financial losses because of the structure and pricing of the different deductible plans. Based on Figure 1, we can estimate the maximum possible financial loss from non-optimal choice as the difference of total cost borne by the insured (in CHF) between the highest and lowest cost

¹¹ $\log(Cost_i)$ represents either the natural logarithm of the approximated health cost following the approach used under the risk adjustment scheme (for the SGB data) or the natural logarithm of the realized health costs from register data (for the SILC data).

plan conditional on total incurred health cost (in CHF). The result of this analysis is shown in Figure 5, substantiating the non-linear relationship between health cost and financial losses. The regression models with the dependent variable being the financial loss incurred by individual i due to suboptimal deductible selection thus also include the square of logged health cost.

5 Empirical analysis

The findings are categorized into four distinct sections. The initial section delves into the correlation between health costs and deductible choice. Subsequently, the second section sheds light on social characteristics influencing the demand for insurance. The third section investigates factors crucial to decision quality. Finally, the fourth section scrutinizes the financial repercussions stemming from suboptimal decision-making.

5.1 The role of health costs in deductible choice

Figure 6 plots the distribution of deductible choice conditional on (deciles of) health costs and by that illustrates the correlation between these two variables. Three notable findings emerge. Firstly, in accordance with theoretical expectations, individuals in good health tend to opt for higher deductibles. This behavior aligns with the concept of (rational) adverse selection, under which healthier individuals bear more risk (i.e., opt for higher deductibles) while paying lower premiums. Secondly, the relationship between health risk and deductible choice appears to be less pronounced than anticipated under the standard normative model. On average, we find that approximately 48 percent of insureds would optimally have chosen the CHF 2,500 deductible plan based on health risk, while only about 21 percent actually did so (based on the SILC data). Thirdly, for those who select intermediate options, no clear association between anticipated health cost and deductible choice emerges. Specifically, approximately 25 percent of individuals opt for suboptimal intermediate plans regardless of their health risk. This observation suggests that factors other than health risk might influence deductible choice.

Figure 7 shows the relationship between the average per person total spending and deductible plan AVs. Individuals are grouped by their chosen plan and each dot represents one of the six deductible plans. The size of each dot indicates the number of individuals and the dashed line indicates the linear relationship between the plans' AVs and average health costs of those selecting a particular plan. Here, an increase of CHF 1,000 in average health costs

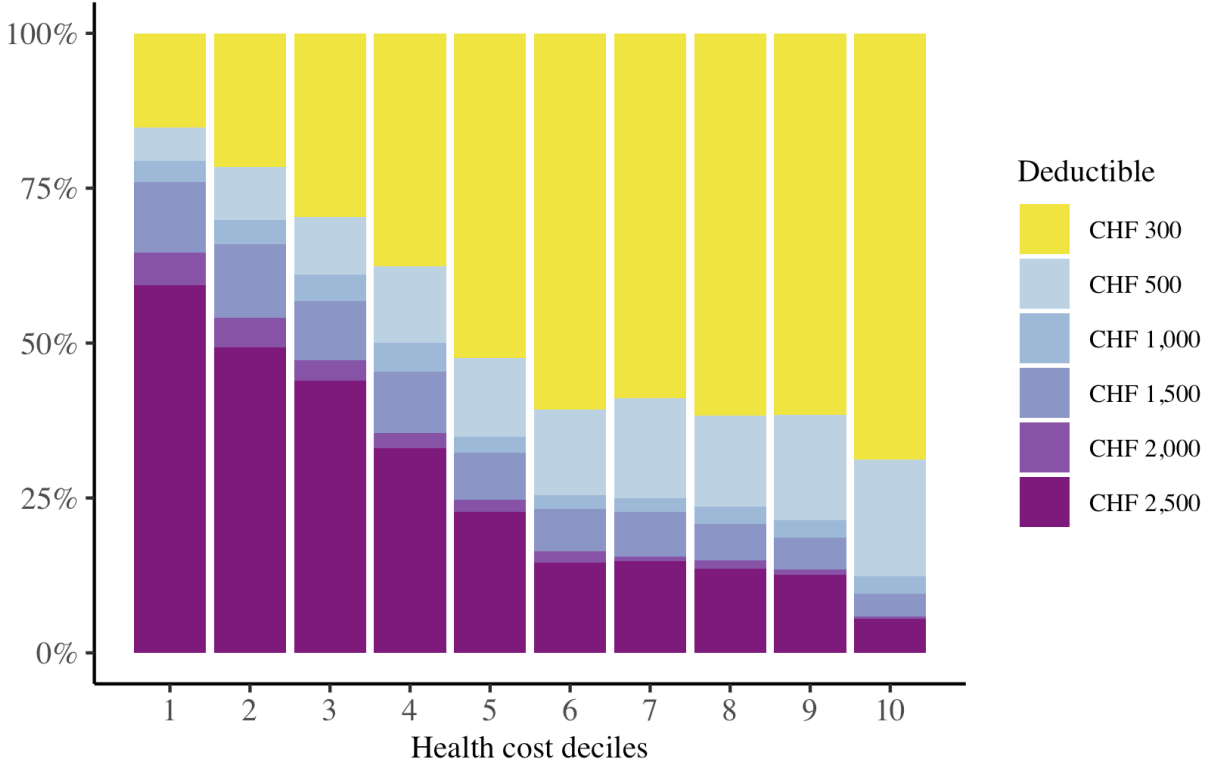


Figure 6: Deductible choice patterns conditional on expected health costs

Note: The figure plots the distribution of deductible choices conditional on health costs based on the SILC data. The health cost deciles are as follows: 1 refers to health costs of CHF 0; 2 refers to health costs between CHF 0 and CHF 75; 3 refers to health costs between CHF 75 and CHF 342; 4 refers to health costs between CHF 342 and CHF 748; 5 refers to health costs between CHF 748 and CHF 1,355; 6 refers to health costs between CHF 1,355 and CHF 2,228; 7 refers to health costs between CHF 2,228 and CHF 3,454; 8 refers to health costs between CHF 3,454 and CHF 5,575; 9 refers to health costs between CHF 5,575 and CHF 10,711; 10 refers to health costs between CHF 10,711 and CHF 280,891.

is associated with an AV-increase of 0.014 (p -value ≤ 0.001).¹² This simple analysis suggests (rational) adverse selection behavior on average; insureds anticipating higher health costs are more likely to opt for plans with higher AVs, effectively seeking more generous insurance coverage. For example, those choosing a CHF 300 deductible plan on average have CHF 5,214 higher health costs than those individuals opting for the CHF 2,500 deductible plan (i.e., CHF 7,240 versus CHF 2,026).

¹²A simple linear regression model is employed to understand the relationship between the AV of deductible plans and average health costs of insured under a respective plan. The regression result is presented in Appendix A.2.

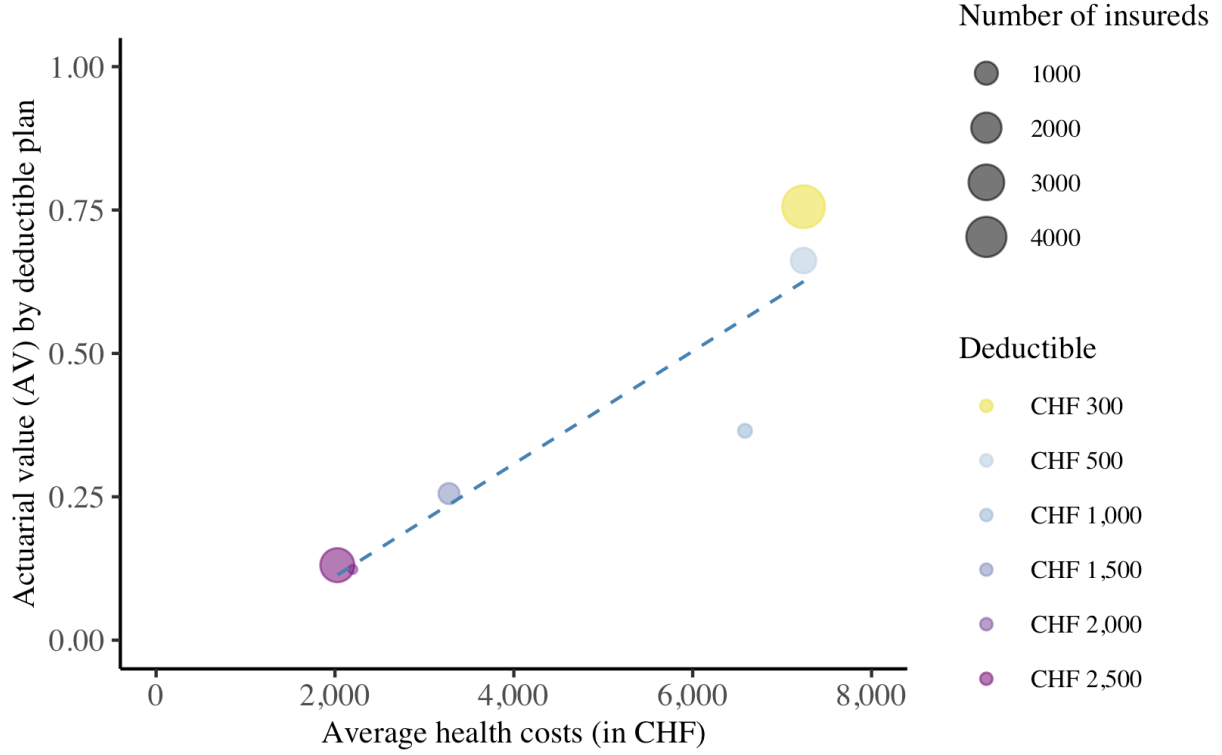


Figure 7: Association of AVs and health expenditures

Note: The figure shows the relationship between average per person total health costs and plan AV. Individuals are grouped by their chosen deductible plan, and each dot represents one of the six deductible plans. The size of each dot indicates the number of individuals. The best-fitting linear association is presented as a dashed line. The regression result is presented in full in Appendix A.2.

5.2 Social correlates of insurance coverage

Table 3 displays the relationship between insurance plan AV (Column 1) or deductible (Columns 2 and 3) and socioeconomic characteristics. We employ two different approaches to proxy insurance demand (i.e., AVs and deductible choice) to illustrate the robustness of the identified relationships across the two sets of data. While we can estimate AVs in the SILC data based on administrative data, including net and gross health costs, those cost variables can only be proxied in the SGB data with high levels of noise. Thus, we also include deductible levels as indicators of insurance demand that we have in both the SILC and SGB data. The two dependent variables represent opposing directions, i.e., higher deductibles imply lower AVs. We observe highly consistent results between the two sets of data and the two approaches to measure insurance demand.

In all regression specifications, income is negatively associated with insurance coverage,

Table 3: Relationship between plan AV or deductible and socioeconomic characteristics

	<i>Dependent variable:</i>		
	AV	Deductible	
	SILC	SILC	SGB
	(1)	(2)	(3)
Income (log)	−0.019*** (0.004)	0.085*** (0.021)	0.105*** (0.020)
University degree	−0.021** (0.010)	0.496*** (0.058)	0.614*** (0.043)
Female	0.072*** (0.007)	−0.328*** (0.040)	−0.471*** (0.038)
Age	0.007*** (0.0003)	−0.038*** (0.002)	−0.029*** (0.002)
Household size	−0.028*** (0.004)	0.104*** (0.022)	
Chronic disease	0.170*** (0.007)	−0.787*** (0.041)	
Overnight hospital stays	0.170*** (0.012)	−0.463*** (0.079)	
Constant	0.274*** (0.050)		
Year FEs	Yes	Yes	No
Canton FEs	Yes	Yes	Yes
Marital status	Yes	Yes	Yes
Insurance model	Yes	Yes	No
Observations	9,848	9,848	10,531
R ²	0.259		
Adjusted R ²	0.256		

Notes: The table shows regression results with the dependent variable being AV (Column 1) that we can estimate only in the SILC data using OLS and with the dependent variable being the level of deductible (Columns 2 and 3) with higher levels implying lower coverage using an ordered logistic model. Data on deductible choice are available for both SILC and SGB data. Standard errors are presented in parentheses below the coefficients. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels respectively.

with a one-unit increase in the natural logarithm of income being associated with a 0.019 decrease in plan AV (p -value ≤ 0.001). In line with this, a one-unit increase in the natural logarithm of income leads to an increase in the log of odds of having a higher deductible level by 0.085 (p -value ≤ 0.001) in the SILC data and by 0.105 (p -value ≤ 0.001) in the SGB data. This result suggests that higher-income individuals are more likely to opt for lower insurance coverage by selecting higher-deductible plans.

Similarly, holding a university degree is strongly associated with a preference for lower coverage, with a 0.021 percent decrease in plan AV when going from no university degree to university degree (p -value ≤ 0.05). Again in line with the previous result, achieving a university degree implies the log of odds of having a higher deductible level to increase by 0.496 (p -value ≤ 0.001) in the SILC data and by 0.614 (p -value ≤ 0.001) in the SGB data.

Females exhibit higher AVs (+0.072, p -value ≤ 0.001) and lower deductibles (-0.328 in SILC and -0.471 in SGB, both p -values ≤ 0.001) and as individuals get older, they tend to choose plans with higher coverage with an increase in AV of 0.007 (p -value ≤ 0.001) per year of age and lower deductibles (-0.038 in SILC and -0.029 in SGB, both p -values ≤ 0.001). Household size is negatively associated with insurance coverage with an additional household member implying a reduction in AVs by 0.028 (p -value ≤ 0.001) and higher deductibles (+0.104, p -values ≤ 0.001).

As expected and in line with normative theory, the presence of health conditions impacting health costs is associated with higher insurance coverage. In particular, increases in AV are observed as conditional on the presence of any chronic diseases (+0.17, p -value ≤ 0.001) and overnight hospital stays in the past year (+0.16, p -value ≤ 0.001). The results on deductible choice again mirror these findings.

5.3 Social correlates of choice quality

Our preceding theoretical analysis indicates that insurance plans with the lowest (i.e., CHF 300) or highest (i.e., CHF 2,500) deductibles are the most optimal for individuals, with the optimal choice dependent on their specific health-risk profile. Building upon this finding, we determine the optimal deductible plan at the individual level based on realized (SILC) and estimated (SGB) health costs. Our analysis reveals that only 5,189 individuals out of 9,848 (i.e., 55 percent) from the SILC sample have selected deductible plans optimally. The SGB data indicates that only 44 percent of individuals (4,039 out of 10,531) make optimal plan choices. The differences between the two samples could potentially be attributed to a discrepancy in health cost estimates. While the SILC data includes public register data

on realized health costs, in the SGB data we proxy health costs based on the risk factors applied by the risk compensation scheme of the Swiss Federal Office of Public Health.

Table 4: Relationship between socioeconomic characteristics and optimal choice

	<i>Dependent variable:</i>	
	Optimal choice	
	SILC	SGB
	(1)	(2)
Cost (log)	0.310*** (0.044)	0.367*** (0.077)
Income (log)	0.109*** (0.028)	0.256*** (0.055)
Cost (log) $\times$ Income (log)	-0.017*** (0.004)	-0.033*** (0.007)
University degree	-0.022 (0.017)	0.031*** (0.011)
Constant	-1.888*** (0.344)	-2.446*** (0.607)
Year FEs	Yes	No
Canton FEs	Yes	Yes
Gender	Yes	Yes
Age	Yes	Yes
Marital status	Yes	Yes
Observations	6,234	10,531
R ²	0.156	0.011
Adjusted R ²	0.152	0.008

Notes: The table shows OLS regression results with the dependent variable being a dummy variable indicating choice of optimal deductible plan in the SILC data (Column 1) and the SGB data (Column 2). Standard errors are presented in parentheses below the coefficients. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels respectively.

Table 4 presents the outcomes of regression models investigating the relationship between socioeconomic characteristics and optimal deductible plan choices. The analysis considering the two distinct sets of data, SILC and SGB, shows highly consistent results.

Health cost consistently shows a significant positive association with the likelihood of making an optimal choice across both sets of data. In the SILC data, a one-unit increase in the logarithm of health cost is linked to a 31.0 percent increase in the probability of selecting the optimal deductible (p -value ≤ 0.001). Similarly, in the SGB data, this effect is observed with an increase in choice optimality of 36.7 percent associated with a one-unit increase in the logarithm of health cost (p -value ≤ 0.001). The findings suggest that higher health costs, and potentially the greater salience of health issues, are associated with a greater inclination towards optimal choices.

Income emerges as another influential factor in healthcare plan choice. An increase in the logarithm of income is associated with a higher likelihood of opting into an optimal deductible plan. The SILC data shows that a one-unit rise in the log of income corresponds

to a 10.9 percent increase in the likelihood of choice optimality (p -value ≤ 0.001), while in the SGB data, the effect is comparable with an increase of 25.6 percent (p -value ≤ 0.001). These results imply that individuals with higher incomes are more likely to make optimal choices, and this relationship holds consistently across datasets.

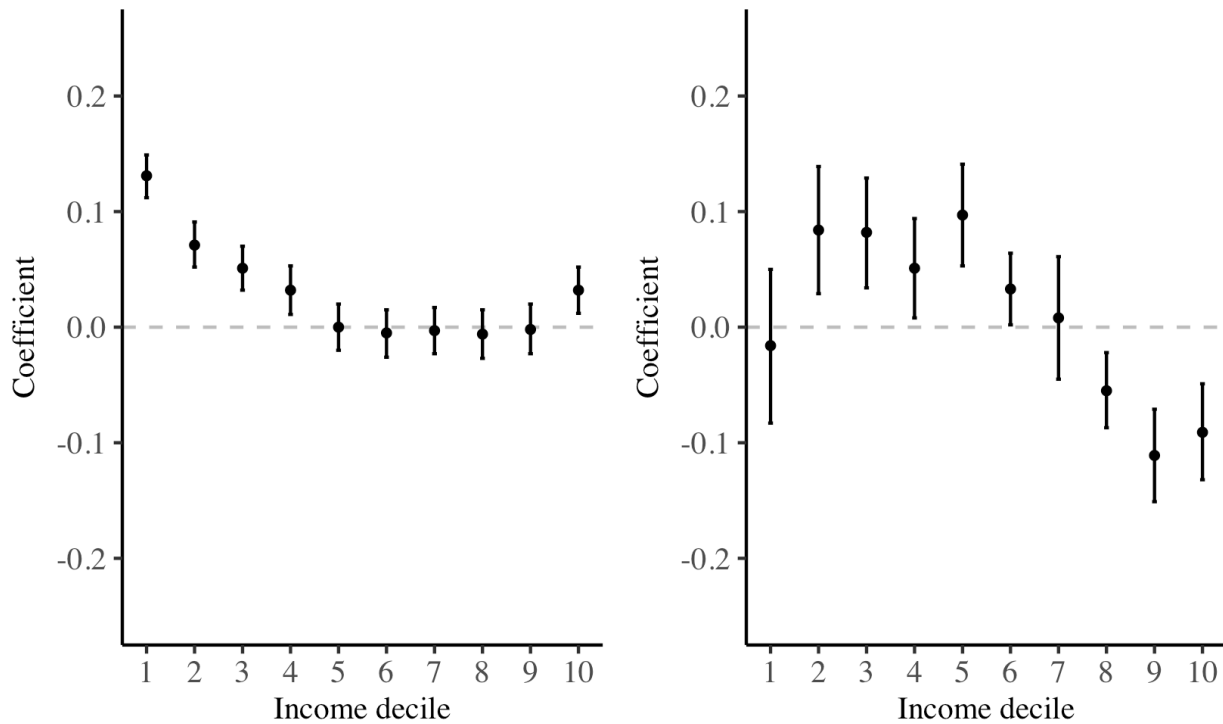


Figure 8: Interaction effects of income and health cost on optimal deductible choice

Note: The figures display regression results for income decile subsamples. The binary dependent variable in these regressions is, whether individuals have selected their individually optimal deductible plan, while the independent variable is health costs. Results based on SILC data are presented in the left panel and results based on SGB data are presented in the right panel.

Ex ante, we expect the effect of health costs to be conditional on income, because increases in health costs are more detrimental to more financially constrained individuals. The negative coefficients (i.e., -0.017 in SILC and -0.033 in SGB, both p -value ≤ 0.001) indicate that the relationship between cost and optimal choice is indeed moderated by income levels. To further elaborate on this conditionality, Figure 8 shows the impact of health cost on optimal choice conditional on income levels. The results based on the SILC data show that, when household income levels are below CHF 144,329 (i.e., household income decile 5), increases in health expenditures are positively correlated with selecting deductible plans optimally. The SGB data shows highly consistent results, indicating that, when individual income is below

CHF 74,400 (i.e., individual income decile 7), increases in health expenditures are positively correlative with optimal plan selection. These results suggest that, when health expenses are more significant (in terms of individuals' share of income), higher health expenditures are associated with better choices.

Possessing a university degree is another potential predictor of selecting deductible plans optimally; however, the effect is only significant in the SGB data (+0.031, $p \leq 0.01$). As income and the possession of a university degree are highly correlated, we take the overall results as evidence for more optimal deductible plan choices among the economically advantaged population with high income and/or high levels of education.

5.4 Financial consequences

The previous results generally demonstrate the association of various social characteristics with insurance demand and decision quality. In this section, we analyze the resulting financial losses from non-optimal deductible choice conditional on these social characteristics.

A focus beyond the fraction of optimal choices is important because lower average financial losses among a particular demographic may not automatically follow from higher fractions of optimal choices and vice versa. While the latter is a potential indicator of higher welfare, it is unclear whether lower financial losses would arise in the aggregate, because the remaining individuals not selecting optimal deductibles may select deductible plans with higher financial losses on average. Thus, the distribution of individuals in a particular demographic across all deductible plans is relevant.

Overall, we find that, among those choosing non-optimal plans, the average financial losses amount to CHF 457 in the SILC sample and to CHF 382 in the SGB sample.¹³ The distribution of financial losses is shown in full in Figure 9. To put this into perspective, average financial losses in the SILC data amount to 9 percent of the total costs from accessing health services (including health insurance premiums) of CHF 5,263. Figure 10 shows, how the distribution of total health expenses (i.e., premiums plus deductible and co-payment) would change as a result of switching from the selected deductible (i.e., left boxplots in black) plan to the individually-optimal plan (i.e., right boxplots in purple) conditional on the selected deductible plan. This analysis mirrors the analysis of average financial losses by showing that, on average, the total health expense distribution under the optimal deductible plan exhibits lower mean, median, first and third quartile values, so altogether lower total

¹³If we consider the entire sample (i.e., also including those choosing optimally), the average financial loss is CHF 257 in the SILC data and CHF 235 in the SGB data.

health expenses. Additionally, we learn that particularly individuals in the five high-coverage plans with low deductibles (i.e., CHF 300, CHF 500, CHF 1,000, CHF 1,500, CHF 2,000) would benefit from switching to a different deductible plan, with no potential for improvement among insureds that selected the high-deductible plan with a deductible of CHF 2,500.

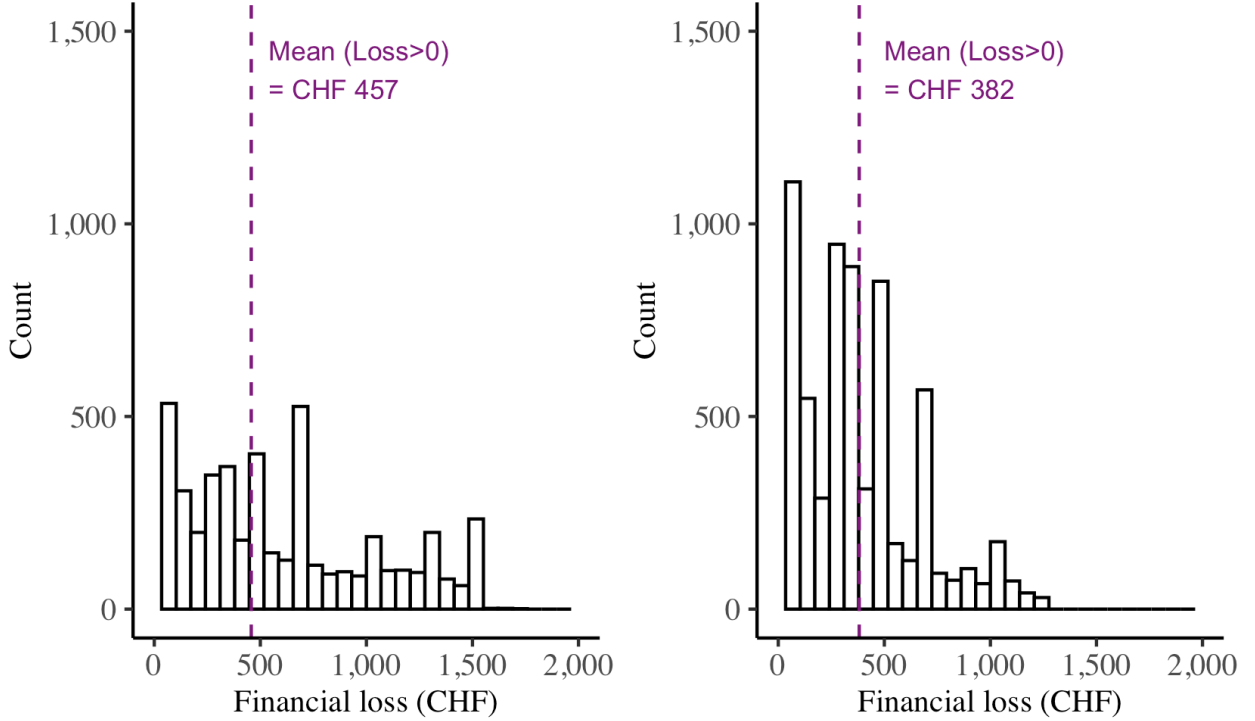


Figure 9: Distribution of financial losses

Note: The figures show the empirical distribution of financial losses, estimated from the two datasets. Results based on SILC data are presented in the left panel and results based on SGB data are presented in the right panel.

To analyze sample heterogeneity in terms of financial losses, we regress social characteristics on financial losses (i.e., the difference between total costs borne by the insured under the chosen deductible plan and under the optimal deductible plan) as defined in Section 4.2. Table 5 presents the outcomes of regression models investigating the relationship between socioeconomic characteristics and financial losses resulting from non-optimal deductible plan choices.

As outlined in Section 4.2, we expect a non-linear relationship between health costs and financial losses because of the structure and pricing of the different deductible plans. This is why we include a squared logged health cost term in the regression models presented in Table 5. The analysis on the two distinct sets of data – SILC and SGB – again shows highly

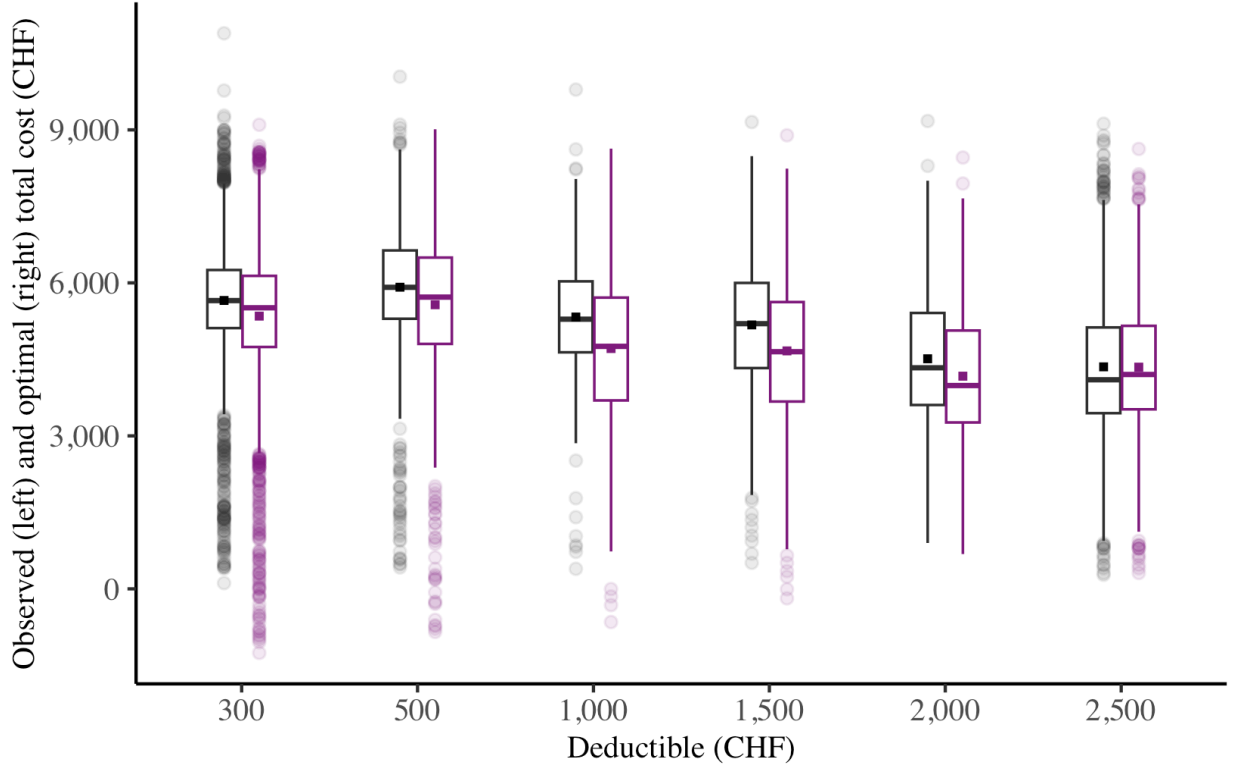


Figure 10: Health expenditure distribution conditional on choice optimality

Note: The figure shows a boxplot of the distribution of total health expenses (i.e., premiums plus deductible and co-payment) choices conditional on deductible choice as observed (i.e., left side) and as would have been optimal (i.e., right side) in the SILC data. Lower and upper ends of the boxes correspond to the first and third quartiles, lines dissecting the boxes represent the median, and the squares show the mean.

consistent results.

The results presented in Table 5 confirm the anticipated non-linear relationship between health costs and financial losses, suggesting that financial losses are particularly high for individuals with lower health costs for whom mistakes are most costly. With a one-unit increase in logged health cost, financial losses decrease by CHF 251 ($p\text{-value} \leq 0.001$) in the SILC sample and to CHF 1,098 ($p\text{-value} \leq 0.001$) in the SGB sample. The quadratic logged health cost term is CHF 5 ($p\text{-value} \leq 0.001$) in the SILC sample and to CHF 50 ($p\text{-value} \leq 0.001$) in the SGB sample, implying that financial losses decrease as health costs increase. Thus, we find consistent evidence not only that health costs are positively linked to a higher likelihood of making optimal deductible choices, but that this also translates into lower financial losses.

Table 5: Relationship between socioeconomic characteristics and financial losses

	<i>Dependent variable:</i>	
	Financial loss	
	SILC (1)	SGB (2)
Cost (log)	−251.104*** (45.488)	−1,097.802*** (75.102)
Income (log)	−43.522* (24.195)	−175.539*** (29.953)
Cost (log) × Income (log)	6.766** (3.122)	21.302*** (3.805)
Cost (log) ²	5.252*** (1.348)	49.651*** (3.731)
University degree	−62.478*** (14.195)	−29.532*** (6.076)
Constant	1,728.790*** (311.573)	6,020.482*** (412.769)
Year FEs	Yes	No
Canton FEs	Yes	Yes
Gender	Yes	Yes
Age	Yes	Yes
Marital status	Yes	Yes
Observations	8,063	10,531
R ²	0.108	0.146
Adjusted R ²	0.104	0.143

Notes: The table shows OLS regression results with the dependent variable being financial losses in CHF from non-optimal choice in the SILC data (Column 1) and the SGB data (Column 2). Standard errors are presented in parentheses below the coefficients. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels respectively.

Next, income might be negatively associated with financial losses. A one-unit increase in logged income results in a decrease of approximately CHF 44 ($p\text{-value} \leq 0.1$) in financial losses in the SILC data and an increase of approximately CHF 176 ($p\text{-value} \leq 0.01$) in financial losses in the SGB data. This result, which seems consistent (but not equal in magnitude and significance) between the two sets of data suggests that individuals with higher incomes tend to exhibit marginally lower financial losses. However, the effects of both health cost and income on financial losses seem to be conditional on each other as indicated by the significant interaction term (7 with $p\text{-value} \leq 0.05$ in the SILC data and 21 with $p\text{-value} \leq 0.01$ in the SGB data).

Lastly, the SILC data shows that individuals with a university degree experience a decrease of approximately CHF 62 ($p\text{-value} \leq 0.01$) in financial losses, and the SGB data shows decrease of approximately CHF 30 ($p\text{-value} \leq 0.01$) in financial losses in the SGB data compared to those without a university degree. This negative association demonstrates the importance of education in enhancing decision-making capabilities and reducing financial losses.

6 Conclusion

Extensive research has consistently highlighted disparities in healthcare access. In this study, we address a noticeable gap in this empirical literature that aims at a more comprehensive understanding of the systematic variations in the quality of individual choices made in health insurance. In particular, we document the distribution of choice quality regarding important social characteristic within the Swiss population and provide estimates of financial losses from sub-optimal decision-making based on a comprehensive theoretical assessment of the choice environment.

Our theoretical analysis shows that neither expected utility nor reference-dependent and rank-dependent utility adequately account for the observed patterns in deductible choices in the market. Our findings thus suggest that subjective distortions of objective probabilities and the incorporation of reference points are not the primary behavioral factors explaining deviations from the standard model.

Our empirical analysis reveals that individuals with higher health risks, limited financial capacity, and lower education are more inclined to choose higher insurance coverage. Notably, high-income individuals tend to opt for lower coverage. We observe that consumers struggle to make optimal choices when presented with options, resulting in an average financial loss equivalent to one month worth of premium payments for the highest coverage plan.

An examination of the factors most predictive of sub-optimal decision-making indicates that high-income individuals and those individuals with higher (i.e., more salient) health costs are more likely to make optimal decisions and that these characteristics interact with each other. Importantly, individuals with lower incomes and lower levels of educational attainment experience larger financial losses due to sub-optimal choices. This suggests that, while a mandatory health insurance scheme with uniform premiums is expected to benefit the economically disadvantaged population due to the absence of risk selection by insurance firms, having choices in this context actually disadvantages this population. These results thus highlight the challenges associated with uniform pricing.

Despite the highly regulated uniform pricing policy aiming to reduce selection, our study reveals that individuals struggle to make financially optimal decisions, raising concerns about equity considerations within a uniform premium policy scheme. Future research could explore policies that strike a balance between consumer selection and market selection behavior. In general, more research is necessary to understand consumers' decision-making processes to design optimal choice menus that account for the observed choice frictions.

A Appendix

A.1 Descriptive decision theory

A.1.1 Rank-dependent utility

Behavioral violations of expected utility theory have been documented widely in the literature. Alternative models that incorporate, for example, probability weighting, such as rank-dependent utility (RDU), are proposed to solve some of these violations (Quiggin (1982)). Bernard et al. (2015) provide evidence that RDU can explain insurance demand for small losses better than EUT.

In our setting, we expect individuals to weight consequences differently, therefore, we believe that RDU could be a proper alternative to explain insurance decisions. The idea is that decision weights are used instead of objective probabilities, allowing for systematic distortions of objective probabilities. The decision weights associated to an outcome depend on its probability and on its ranking relative to other outcomes. As a consequence, extreme outcomes (because of extreme stakes or very low probabilities) are particularly affected by the introduction of decision weights. Empirical data suggests an inverse S-shaped relationship between objective probabilities and decision weights, implicating an over-weighting of low-ranked and high-ranked outcomes and under-weighting of medium-ranked outcomes. RDU is different from EUT because it simultaneously features standard risk aversion and probability weighting in evaluating options.

We assume N possible states of final wealth ordered from the lowest to the highest outcomes. Every outcome is assigned a decision weight π_i . The decision maker maximizes the following function:

$$V_{rdu} = \int u_i(W_i - m_d - G_i(x, d)) \times \pi(x_i) dx, \quad (3)$$

where $u_i(W_i - m_d - G_i(x, d))$ denotes utility of wealth and x represents different levels of health cost. In general, $u_i(\cdot)$ is simply an increasing and continuous function; however, we follow Polkovnichenko (2005) and use the CRRA specification $u_i(w) = w^{1-\rho}/(1-\rho)$ with risk aversion parameter ρ .

The decision weights π_i are constructed using a strictly increasing and differentiable function $g(p)$. The function $g(F_i(x_i))$ is the cumulative distribution function of the probability of outcomes. In particular, we calculate the weights as:

$$\begin{cases} \pi_1 &= g(F_i(x_1)) \\ \pi_i &= g(F_i(x_i)) - g(F_i(x_{i-1})) \text{ for } i = 2, \dots, N-1, \\ \pi_n &= 1 - g(F_i(x_{n-1})) \end{cases} \quad (4)$$

The functional form of $g(\cdot)$ determines how the decision maker transforms objective probabilities into subjective decision weights and captures probability-dependent risk attitudes. The previous literature used field data and experimental data to identify the shape of this relationship with an inverse-S shape being a common finding. In our setting, we follow Barseghyan et al. (2013) and Tversky and Kahneman (1992) to apply the following transformation functional:

$$g(p) = \frac{p^\gamma}{(p^\gamma + (1-p)^\gamma)^{\frac{1}{\gamma}}}, \quad (5)$$

for which Tversky and Kahneman (1992) find γ to be 0.61 for gains and 0.69 for losses.

Barseghyan et al. (2013) used field auto and home insurance data to estimate the range of risk preference and probability distortion parameters, finding the weighting function parameter to be $\gamma = [0.56, 0.74]$ and the risk aversion parameter to be $\rho = [0.32, 0.88]$. For our simulations, we allow a wider range of $\gamma = [0.1, 1]$ and $\alpha = [0, 10]$. As mentioned earlier, as γ declines, the decision-weighting function is more distorted and assumes an inverted-S shaped form. This induces risk-seeking for low-probability favourable events but maintains risk-averse behaviour for low-probability unfavourable outcomes. More specifically, we assume that an individual in good health and thus low risk is more risk averse to high health costs compared to the standard model and thus prefers lower deductibles.

Figure A1 shows the optimal deductible contract under RDU for males (Panel A) and females (Panel B), respectively. In each panel, from left to right, we plot different levels of probability distortions $\gamma = \{0.1, 0.6, 0.9\}$. When γ is close to 1, the probability distortion can be ignored, i.e., decision weights get close to the objective probabilities. When γ equals 0.1, all objective probabilities other than 1 receive weights close to 0, indicating that individuals only care about the most likely outcome. In our setting, the most likely outcome for much of the population involves health costs below CHF 2,000, thus RDU estimates the highest deductible plan as the first-ranking optimal choice when probabilities are highly distorted (i.e., $\gamma = 0.1$). For $\gamma = 0.6$, a realistic estimate, individuals overweight probabilities less than approximately 30 percent and underweight probabilities larger than approximately 30 percent and thus pay more attention to less-likely outcomes. Therefore, under RDU, these individuals are more likely to choose the lowest deductible plan.

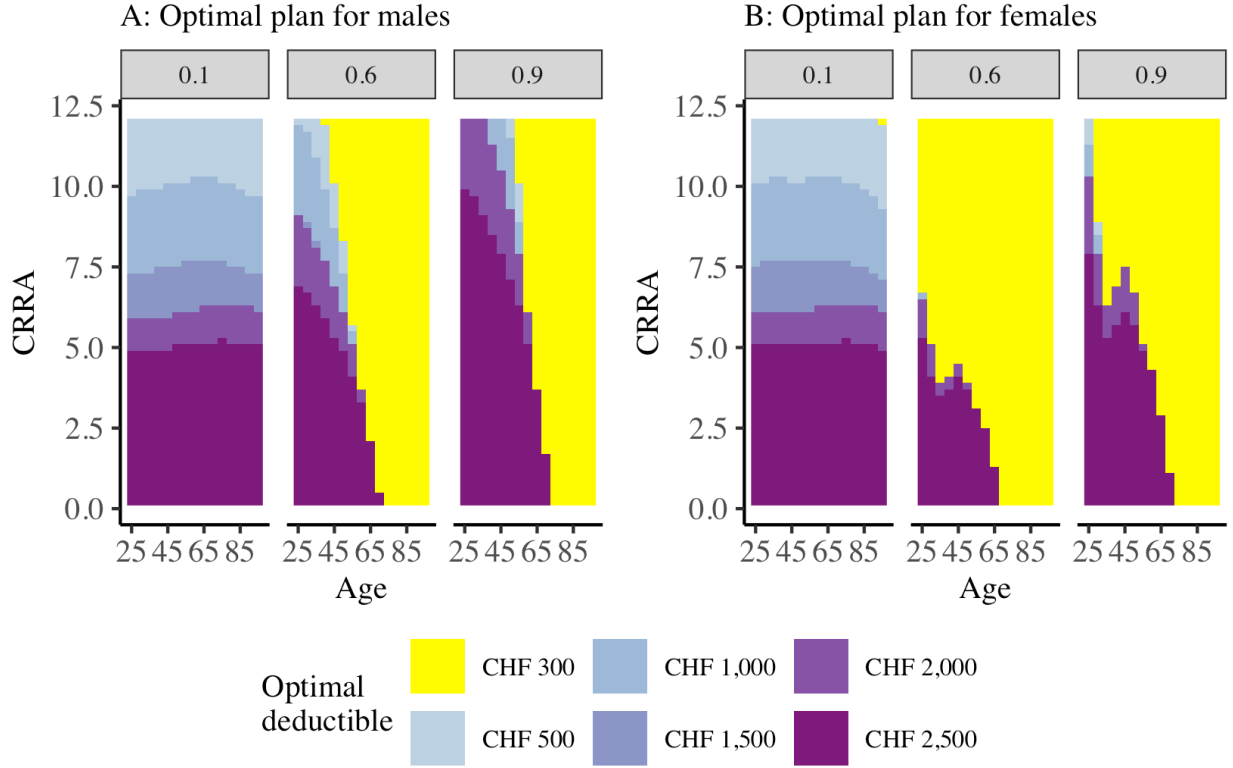


Figure A1: Optimal deductible under RDU for males and females

Note: The figures present the first-ranking deductible options conditional on age, risk aversion, and weighting distortions under RDU. Panel A shows the optimal plan for males, while Panel B shows the optimal plan for females. In each panel, from the left-hand side to right-hand side, the probability weighting parameter γ increases from 0.1 to 0.6, and 0.9.

Nevertheless, even though we add an empirically observed behavioral pattern to modelling deductible decisions in the Swiss mandatory health insurance, we only see the lowest and highest deductible plans as the first-ranking plans.

A.1.2 Cumulative prospect theory

To explain empirically observed violations of the predictions of standard economic models, cumulative prospect theory (CPT) introduces a reference point into the evaluation of prospects jointly with the probability distortions common in RDU. What CPT adds in our context is thus the separate evaluation of losses and gains relative to a predefined reference point.

In our setting, we consider CPT as an alternative model to explain the individual deductible decisions for two main reasons. First, probability weighting has been shown to be a significant

factor driving insurance decisions (see, e.g., Barseghyan et al. (2013)). Second, the reference point offers a potential way to take framing of the insurance decision into account. In our core model, we assume that individuals regard expected health expenditures as a reference point. Thus, if one expects high (low) health costs, the lower (higher) deductible plans are optimal. The difference between expected health costs and total out-of-pocket expense is the key factor in this decision. Because health insurance is mandatory, we also look at CHF 3,732 (i.e., the premium for the highest deductible plan) and CHF 5,250 (i.e., the premium for the lowest deductible plan) as respective reference points.

Determining the optimal contract under CPT requires choosing functional forms and parameters for the value function V and the probability weighting functions $g+$ and $g-$. Under our CPT framework an individual maximizes the following functional:

$$PT(f) = \int V(x) \times g(x) \times F(x) dx, \quad (6)$$

where $V(x)$ represents the value function, $g(x)$ represents the probability weighting function (defined above in equation (5)), and $F(x)$ represents the cumulative distribution function of health costs.

To estimate the model for different contracts, we apply a standard value function suggested by Tversky and Kahneman (1992) and thus follow a common approach in the literature (e.g., Kairies-Schwarz et al. 2017). The value function depends on the sign of x and is related to the reference point in the following way:

$$V(x) = \begin{cases} x^\rho & \text{if } x > 0 \\ 0 & \text{if } x = 0 \\ -\lambda \times (-x)^\rho & \text{if } x < 0 \end{cases}, \quad (7)$$

where λ denotes the loss-aversion parameter and ρ the risk aversion parameter, which were estimated to be 0.88 and 2.25, respectively in the original paper of Tversky and Kahneman (1992). In our simulation, we use a broader range of loss-aversion parameters $\lambda = [0.33, 3.33]$ and a broader range of risk-aversion parameters $\rho = [0, 10]$.¹⁴

Figure A2 shows the optimal deductible contracts under CPT for males and females respec-

¹⁴However, empirical evidence finds risk preference parameters in CPT smaller than those under EUT and RDU theory. More specifically, Tversky and Kahneman (1992) find $\rho = 0.88$ and Camerer and Ho (1994) estimate $\rho = 0.32$.

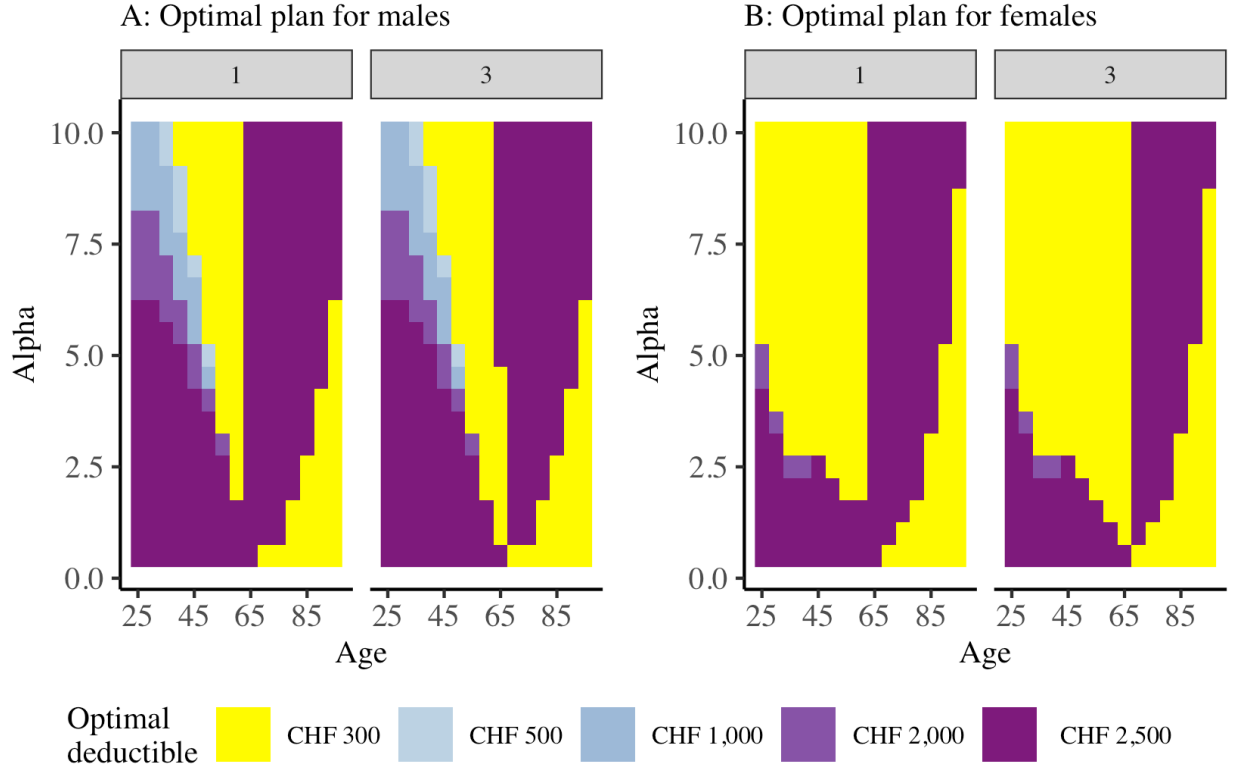


Figure A2: Optimal deductible plan choice under CPT for males and females

Note: The figures present the first-ranking deductible options conditional on age and risk aversion, and loss aversion under CPT. Panel A plots optimal contracts for females under the condition of different scale of loss aversion, while Panel B plots for males under the condition of different scale of loss aversion. In each panel, from left-hand side to the right-hand side, the loss aversion varies from 1.0 to 3.0. The underlying risk profiles (i.e., distribution of health costs conditional on age and gender) have been provided by the Swiss Federal Office of Public Health.

tively. In each figure, from left to right, we vary the loss aversion parameter from 1.0 to 3.0. Setting the parameter of γ equal to 0.61 (in the gain domain) and 0.68 (in the loss domain) as in Tversky and Kahneman (1992)¹⁵, we find that, while for $\lambda \geq 1$ individuals should switch from the high deductible plan to the low deductible plan around the age of 65, for $\lambda < 1$ the high deductible plans is more attractive to those of younger age.

Based on the fact that health insurance is mandatory and individuals need to choose one of the various plans offered, we also look at CHF 3,732 (i.e., the premium for the highest deductible plan) and CHF 5,250 (i.e., the premium for the lowest deductible plan – also

¹⁵We also extend the probability-weighting distortion range to a maximum of $\gamma = 0.91$, finding no significant difference in result. In order to increase the clarity of results, we present the condition that only γ equals 0.61 (in the gain domain) and 0.68 (in the loss domain) as in Tversky and Kahneman (1992).

referred to as the base deductible) as the respective reference points. For both of these reference points, we find that only the two boundary deductible plans (i.e., CHF 300 and CHF 2,500) are optimal for a reasonable range of risk-aversion parameters.

This section thoroughly considers the optimality of deductible options on the choice menu in the mandatory Swiss health insurance system. These results suggest that different specifications of weighting and utility function and reference points, to a large extent, are not relevant behavioral deviations from the standard rational model that would explain wildly different choices as observed in the market. Taken together, we find that neither standard expected utility nor reference-dependent and rank-dependent utility can sufficiently provide a rationale for selecting the middle deductibles. The optimal choices in line with all theories are the two boundary deductibles (either the CHF 300 deductible plan or the CHF 2,500 deductible plan). However, the exercise makes evident that expected health costs should be the sufficient determinant for whether one is better off selecting the highest (i.e., CHF 2,500) or the lowest (i.e., CHF 300) deductible plan. As we describe in the next section, it is fairly straightforward to assess whether a given individual is better off under the high or the low deductible plan.

Figure [A3](#) presents the optimal deductible contract under the CPT for males and females while assuming the reference as the out-of-pocket expense if one selects the CHF 2,500 contract.

Figure [A4](#) presents the optimal deductible contract under the CPT for males and females while assuming the reference as the out-of-pocket expense if one selects the CHF 300 contract.

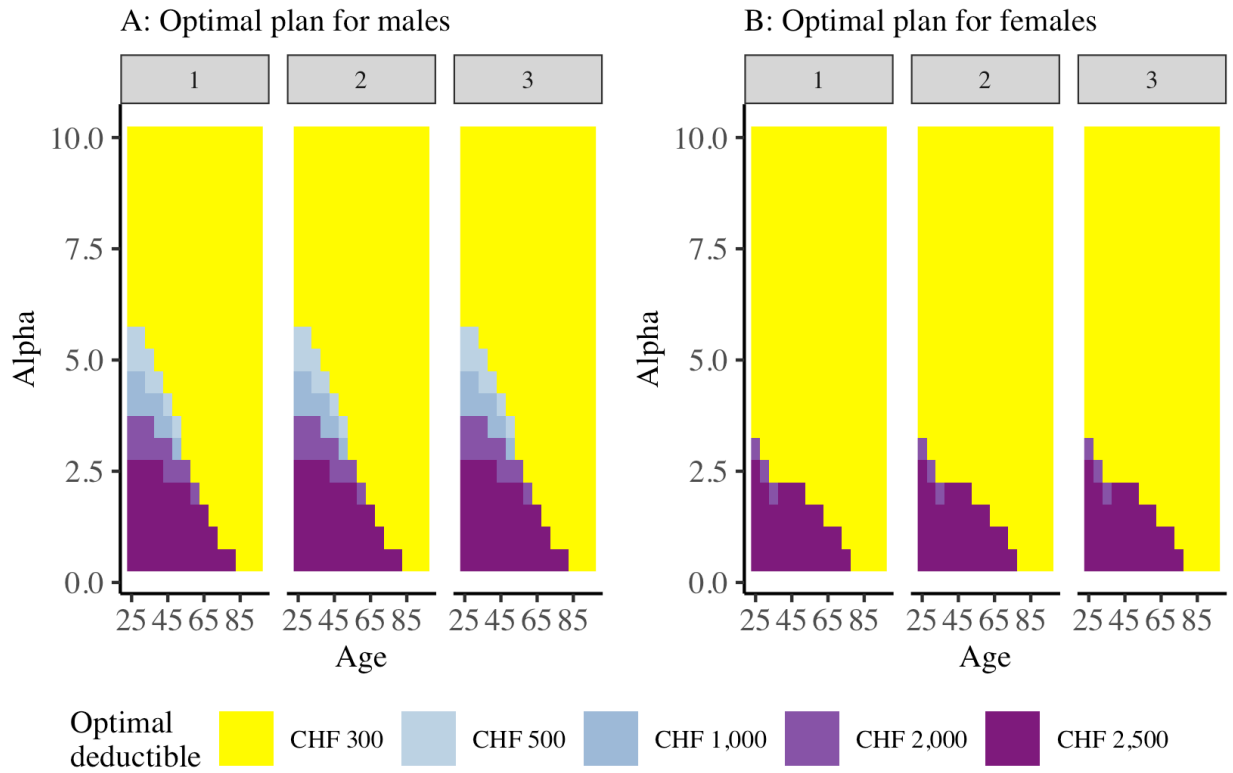


Figure A3: Optimal deductible under CPT for males and females

Note: The figures present the first-ranking deductible options conditional on age and risk aversion, and loss aversion under CPT. Panel A plots optimal contracts for females under the condition of different scale of loss aversion, while Panel B plots for male under condition of different scale of loss aversion. In each panel, from left-hand side to right-hand side, the loss aversion varies from 0.2, 1.0 to 2.0. The underlying risk profiles (i.e., distribution of health costs conditional on age and gender) have been provided by the Swiss Federal Office of Public Health.

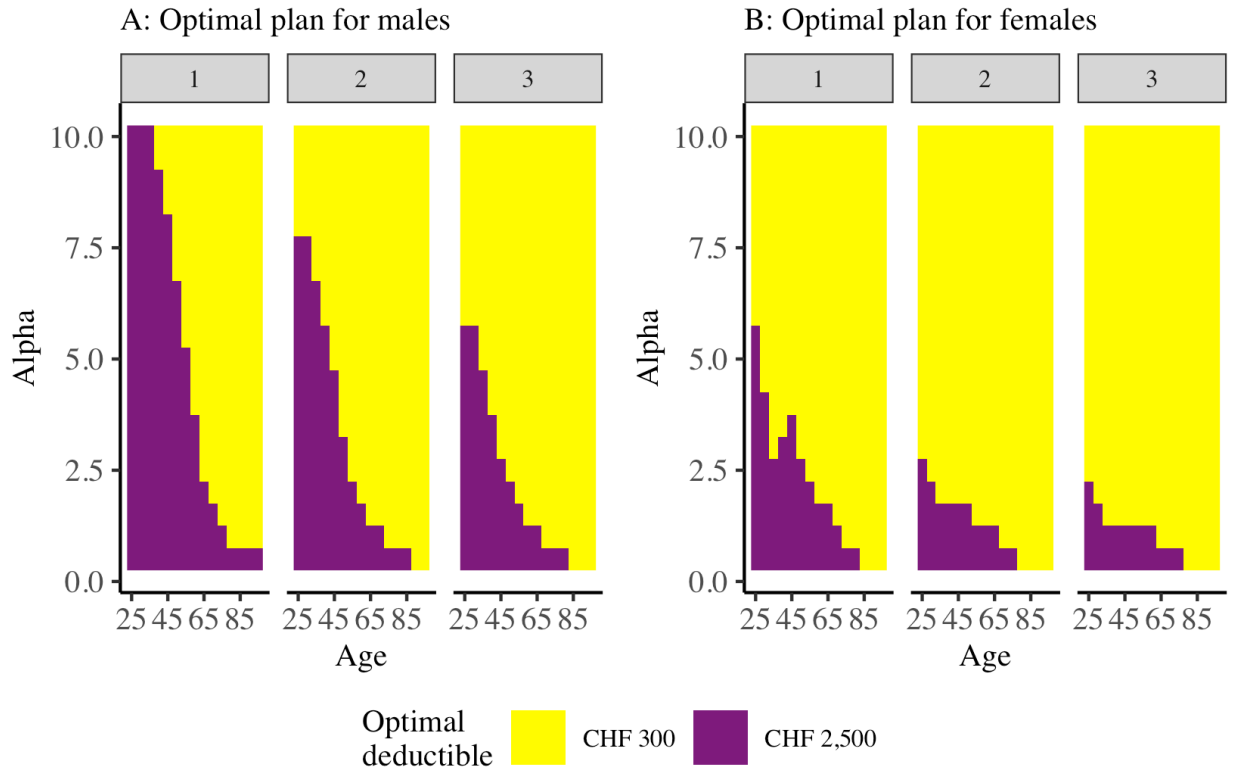


Figure A4: Optimal deductible under CPT for males and females

Note: The figures present the first-ranking deductible options conditional on age, risk aversion, and loss aversion under CPT. Panel A plots optimal contracts for females under the condition of different scales of loss aversion, while Panel B plots for males under the condition of different scale of loss aversion. In each panel, from the left-hand side to the right-hand side, the loss aversion values are 0.2, 1.0, and 2.0. The underlying risk profiles (i.e., distribution of health costs conditional on age and gender) have been provided by the Swiss Federal Office of Public Health.

A.2 Regression on actuarial values

Table A1: The impact of health costs on AVs

<i>Dependent variable:</i>	
Actuarial value (AV)	
Cost	0.00001*** (0.00000)
Constant	−0.007 (0.007)
Constant	0.438*** (0.005)
Observations	9,848
R ²	0.171
Adjusted R ²	0.171
<i>Note:</i> *p<0.1; **p<0.05; ***p<0.01	

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