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On the Association between Insurance Deductibles and Prevention Behaviour: Evidence from the Swiss Health System

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Abstract: Many studies have attempted to investigate the drivers of preventive behaviour. This study contributes to this strand of literature by examining the association between higher insurance deductibles in the Swiss health system and preventive behaviour that allows for maintaining a good diet, exercising and limiting/abstaining from smoking and alcohol consumption. To conduct our study, we made use of the 2017 Swiss Health Survey and employed an ordered probit model with each prevention aspect as a dependant variable. Our results show that, except for alcohol consumption, higher insurance deductibles were significantly associated with higher behavioural prevention. Our study also highlighted how numerous other factors influenced prevention and offered some guidance for public policies to further incentivise prevention decisions.

Keywords: health insurance; insurance deductibles; moral hazard; health behaviour

JEL Classification: I12; I18

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1. Introduction

Ex-ante moral hazard refers to the disincentives to perform preventive activities due to insurance (Zweifel and Manning 2000). Hence, individuals with more insurance would tend to undertake fewer preventive activities as they do not receive all the benefits of prevention since the potential loss is already covered by insurance. Some argue that in health insurance, such phenomena hardly exist, as the loss of health due to less prevention is not fully compensated by insurance, only medical care expenses are (e.g., Cutler and Zeckhauzer 2000). Empirical evidence is rather scant and offers mixed support for the presence of ex-ante moral hazard in health insurance. Our work contributes to this empirical literature by considering the specific changes in the level of health insurance through different levels of deductibles to allow for considering various levels of coverage. We focused on Switzerland, as it is one of the few countries where mandatory basic health insurance is dominantly based on deductibles. Our aim was to investigate the effect of higher deductibles in the Swiss health system on the decision to engage in healthy behaviours, i.e., having a good diet, exercising and limiting/abstaining from smoking and alcohol consumption.

When studying ex-ante moral hazard, two forms of changes in insurance are usually considered, taking into account the institutional aspects of insurance. The first one is being enrolled in a public health insurance scheme. In that respect, various studies on ex-ante moral hazard consider the granting of Medicare at the age of 65 as a change of insurance leading to mixed results. For instance, Card et al. (2008) did not find any evidence of an effect on smoking due to enrolment to Medicare, while Dave and Kaestner (2009) and de Preux (2011) showed that Medicare reduces prevention and increases unhealthy behaviours, such as smoking, drinking and low exercise levels. The second form of change of insurance is the purchase of private health insurance, which usually complements the public system by offering higher reimbursement, access to more personalised care and a

shorter waiting list. For instance, the RAND Health Insurance Experiment in the United States showed that more generous private health insurance does not significantly affect habits such as smoking, drinking and exercise (). This was also confirmed by Lee (2018) by showing that in the United States, the presence or absence of health insurance does not affect young adults' smoking and drinking behaviours, nor their access to preventive care. Yet, Courbage and de Coulon (2004) found a rather positive association between having private health insurance and higher exercise and less smoking in the United Kingdom. Recently, Aistov et al. (2021) found supportive and somehow mixed results for Russia. Their study shows that individuals with voluntary health insurance are less inclined to smoke, have greater engagement in physical activity and are more likely to consume more alcohol compared to individuals with no insurance.

In this study, we considered a different aspect of insurance that truly reflects changes in the level of risk coverage through a change in the level of deductibles, and therefore, allows for considering changes in the level of insurance coverage. We also complement previous work by considering dietary changes that represent one of the main behavioural factors linked to health (WHO 2013). To perform our analysis, we considered the basic mandatory Swiss health scheme under which people have different levels of deductibles. To the best of our knowledge, the issue of ex-ante moral hazard has never been addressed within the basic mandatory Swiss health scheme.

Various elements need to be taken into account when addressing the relationship between insurance coverage and prevention decisions, with the first being the direction of the relationship between these two variables (Chiappori and Salanié 2000). Indeed, higher insurance coverage, i.e., lower deductibles, can induce lower prevention, which corresponds to an ex-ante moral hazard. However, at the same time, more risky individuals, i.e., those performing fewer preventive activities, may choose higher insurance coverage and then lower deductibles. The causality effect should be clearly distinguished from the selection effect. A second element that might drive the relationship between insurance coverage and prevention decisions is the role of the personal doctor in guiding preventive behaviour. Indeed, insurance reduces the cost of consulting doctors who could encourage a healthy lifestyle and thereby offset the direct effect of insurance on prevention, i.e., the true ex-ante moral hazard according to Dave and Kaestner (2009). A third element concerns the role of risk aversion in explaining both the choice of deductible and prevention (Courbage and de Coulon 2004).

This study thus aimed to investigate the association between deductibles and the decision to engage in healthy behaviour. To conduct our empirical study, we made use of the 2017 Swiss Health Survey. We employed an ordered probit model and alternatively estimated our data using instrumental variable analysis to control for causality and selection effects, as outlined by Chiappori and Salanié (2000). To further investigate how deductibles affect prevention behaviour in general, we performed principal component analysis and used the first factor to produce a broad index of prevention. This allowed us to consider a holistic approach to individuals' preventive attitudes. We also considered the role of personal doctors in encouraging healthier lifestyles and included doctor visits in our analysis, as in Dave and Kaestner (2009). Moreover, we controlled for risk aversion behaviours in the spirit of Courbage and de Coulon (2004). We found that, except for alcohol consumption, higher insurance deductibles were significantly associated with higher behavioural prevention. Our study also highlighted how numerous other factors influenced prevention.

This study thus contributes to the literature in several ways. First, we provided a better understanding of the importance of insurance deductibles in driving prevention behaviour. Second, we identified and provided an in-depth analysis of the main factors that boost prevention among Swiss individuals and the factors that deter this behaviour. Third, we separately highlighted the effect of deductibles on four different prevention aspects. Fourth, we also considered prevention behaviour as a whole and included an index to assess the impact of health deductibles on general prevention behaviour. Fifth, our

paper provides a prelude to promising research in this field, especially after the outbreak of the coronavirus disease 2019 (COVID-19) pandemic, which has altered the scope of interest in research towards the importance of prevention and the scopes of insurance coverage.

The article is organised as follows. In Section 2, we briefly present the Swiss health system. Section 3 describes the database, the variables used and the econometric analysis. The results are presented in Section 4. Section 5 consists of robustness checks of the results of Section 4. The final section offers a conclusion.

2. The Swiss Health System

Since 1996, all Swiss residents have access to health care via a system of mandatory health insurance. Unlike most European health systems, the Swiss confederation does not provide any free health services but does provide subsidies for individuals whose income is not enough to cover their premiums (about one-third of the population). Thus, all residents are insured under Swiss Federal Law. However, mandatory health insurance cannot be profit-making. Cost-sharing in Switzerland, particularly in the form of deductibles, is high by international standards.

The standard insurance benefits package is regulated by federal legislation and includes most general practitioner (GP) and specialist services, as well as inpatient care and services provided by other health professionals if prescribed by a physician (De Pietro et al. 2015). Individuals can also obtain supplementary health coverage for services that are not included in the basic package. This supplemental coverage enables them to access private rooms, their doctor's choice in hospital and services outside their canton, as well as extra benefits, such as dental coverage (Leu et al. 2009).

All mandatory health insurance packages have deductibles and a 10% co-payment rate, which applies to all services. Enrolees may opt for a higher deductible and obtain a reduced premium. The minimum annual deductible is CHF 300 for adults, while the maximum deductible is CHF 2500. The total user charges (deductible plus co-payment) are capped at CHF 1000 or CHF 3200, depending on the size of the deductible chosen. This high disparity between the existing levels of deductibles renders the Swiss health system very interesting when it comes to exploring the effect of deductibles on individual prevention schemes.

3. Sample, Variables and Methodology

3.1. Sample

In this study, we extracted our data from the sixth and most recent wave of the Swiss Health Survey (SHS), which was conducted in 2017. This survey has been performed every five years since 1992. It encompasses a wide range of questions concerning the health status of individuals, health behaviour and the use of health services. The SHS is conducted using telephone interviews assisted by a computer, which is followed by a written questionnaire. It is carried out in French, German and Italian for individuals aged 15 and above living in a private household. The survey was carried out throughout 2017 in order to take into account the effect of seasonal variations on responses.

Initially, 43,769 individuals were randomly selected to participate in the survey. The participation rate was 51% such that there was a total of 22,134 respondents, among which, 11,671 were women and 10,463 were men. A total of 17,277 individuals were Swiss and 4857 were foreigners residing in Switzerland.

The SHS is based on a global and dynamic health model. As defined by the World Health Organization (WHO 1946), health is not only the absence of a disease but is a state of physical, mental and social well-being.

3.2. Variables

3.2.1. Dependent Variables

Table A1 presents all the variables employed in this study. We used four variables as proxies for preventive activities. We believe that prevention is not adequately portrayed

by using dummy variables since this type of behaviour corresponds more to levels of prevention. Hence, we attempted to use ordinal variables to measure the prevention variables as much as our data allowed us.

The choice of prevention variables was based on covering all aspects of prevention behaviour as much as possible. First, we employed the variable physical_activity, which controlled for the number of days of physical exercise per week. This variable was an ordinal variable that took the value of 1 for no physical activity, 2 for one to two days per week and 3 for three or more days per week. Next, we accounted for the variable diet using the number of fruits and/or vegetables consumed per day. This variable was scaled from 1 to 4 with 1 being the nonconsumption of fruits/vegetables every day to 4 being consuming 5 or more fruits/vegetables per day. To control for tobacco consumption, we used the variable tobacco, which took the value of 1 for a daily smoker, 2 for an occasional smoker and 3 for a nonsmoker. Finally, the ordinal variable alcohol accounted for daily alcohol consumption and scaled from 1 to 4, with 1 being the highest percentile of consumption to 4 being the lowest. We constructed all variables in the same sense of scaling, in other words, an increase in each level for each variable was associated with higher prevention.

3.2.2. Independent Variables

The main explanatory variable in this study was the amount of the insurance deductible in the basic mandatory health scheme. The variable deductible ranged from 300 CHF, the lowest level of deductible, to 2500 CHF, the highest level of deductible in Switzerland. We wished to assess to what extent ex-ante moral hazard influenced prevention behaviour whereby individuals' prevention increased with the increase in the level of insurance deductibles. The higher the amount of out-of-pocket health care spending individuals would have to bear in the case of a negative shock on their health, the more likely they were to be involved in preventive activities to reduce such a risk on their health. Thus, a positive sign was expected for this variable.

We followed the literature to control for other factors that might influence prevention choices. As in all behavioural studies, we started by controlling for socioeconomic factors. The vector socioeco contained a set of nine variables that controlled for all demographic, social and economic characteristics of individuals, which are detailed below. Age controlled for the individual's age, as prevention schemes might highly vary with age. The variable in our sample ranged between 15 and 98 years of age. Gender was a dummy variable equal to 1 if the subject is a male and 0 for a female. Education was an ordinal variable ranging from 1 for no compulsory school education to 20 for the highest level of graduate degree. As individuals living alone might be less motivated to engage in preventive activities, we controlled for whether the household was a single-person household using a dummy variable single_household, which was equal to 1 for a single-member household and 0 for more than one member. Since around a quarter of the Swiss population is constituted of foreigners, we controlled for the nationality of the individual using the variable nationality. This variable took the value of 1 if the individual was Swiss by birth, 2 if Swiss by naturalisation and 3 for a foreigner. As prevention can be partly explained by cultural habits, we expected this variable to have a significant effect on the prevention levels. Additionally, since Switzerland encompasses three linguistic regions that are associated with three official languages, we included the following three dummy variables that controlled for the mother tongue of the subject interviewed, namely, German, French or Italian. We wished to establish whether significant differences existed between the prevention behaviour of individuals in different linguistic areas. To assess how employment status might influence prevention behaviour, we added the dummy variable employed, which took the value of 1 if the subject was currently employed or 0 otherwise.

We included a dummy variable doctor_visit to control for whether the individual had visited the doctor during the last year. Indeed, insurance reduces the cost of consulting doctors who could encourage a healthy lifestyle and thereby could offset the direct effect of insurance on prevention, i.e., the true ex-ante moral hazard (Dave and Kaestner 2009).

To measure the subject's general risk aversion, which could influence both insurance and prevention, we made use of a lottery question that asked individuals whether they have ever played the lottery. Thus, lottery was a variable that took the value of 1 for "yes" as an answer and 0 otherwise. Individuals who are more risk averse tend to avoid the lottery and perform more preventive activities.

Finally, to account for traits of character that might influence prevention choices, we included a vector of personal individual traits containing two variables. First, we included a dummy variable, altruistic, which took the value of 1 if the individual considers themself altruistic and 0 otherwise. Second, we added an ordinal variable, pessimistic, which ranged from as low as 1 for never being pessimistic to 4 representing being pessimistic almost every day.

3.3. Model and Methodology

To estimate our data, we employ the following models one to four where every equation serves to estimate each prevention aspect:

$$\text{physical activity} = \gamma_0 + \gamma_1 \text{deductible} + \sum_{f=1}^{9} \beta_f \text{socioeco} + \gamma_2 \text{doctor}_{\text{visit}} + \gamma_3 \text{lottery} + \sum_{h=1}^{2} \mu_h \text{traits} + \varepsilon, \quad (1)$$

$$\text{diet} = \gamma_0 + \gamma_1 \text{deductible} + \sum_{f=1}^{9} \beta_f \text{socioeco} + \gamma_2 \text{doctor}_{\text{visit}} + \gamma_3 \text{lottery} + \sum_{h=1}^{2} \mu_h \text{traits} + \varepsilon, \quad (2)$$

$$\text{tobacco} = \gamma_0 + \gamma_1 \text{deductible} + \sum_{f=1}^{9} \beta_f \text{socioeco} + \gamma_2 \text{doctor}_{\text{visit}} + \gamma_3 \text{lottery} + \sum_{h=1}^{2} \mu_h \text{traits} + \varepsilon, \quad (3)$$

$$\text{alcohol} = \gamma_0 + \gamma_1 \text{deductible} + \sum_{f=1}^{9} \beta_f \text{socioeco} + \gamma_2 \text{doctor}_{\text{visit}} + \gamma_3 \text{lottery} + \sum_{h=1}^{2} \mu_h \text{traits} + \varepsilon. \quad (4)$$

In the basic regression analysis, we employed an ordered probit model to estimate the above models. The choice of this model relied on the fact that our dependent variables were ordinal variables, which took discrete values, with higher values being associated with higher prevention.

Moreover, in the further analysis section, we used instrumental variables to deal with potential inverse causality. Indeed, the relationship between insurance and prevention could be explained by inverse causality or selection effects (Chiappori and Salanié 2000). To control for this phenomenon, we employed an ordered instrumental variable probit model. To estimate our model, we made use of conditional mixed-process modelling (CMP). Using this modelling process allowed us to obtain a consistent estimator for recursive systems, where all the endogenous variables are shown on the right-hand side of the equation.

4. Results

4.1. Summary Statistics

Table 1 presents the descriptive statistics of the full sample. Furthermore, we display in Table 2 the descriptive statistics of the prevention variables according to the level of health insurance deductibles. Insurance deductibles ranged from level 1, representing an insurance deductible of 300 Swiss Francs, to level 6, representing the highest deductible level of 2500 Swiss Francs.

Table 3 displays the correlation matrix. No major correlations existed between the independent variables, which implied that our regression did not suffer from possible multicollinearity issues. We also calculated the variance inflation factor (VIF) to further confirm this. We obtain a mean VIF that was considerably lower than 10, which further verified the lack of multicollinearity issues.

Table 1. Descriptive statistics.

Variable	N	Mean	Std. Dev.	Min	Max
physical_activity	21,158	1.976	0.788	1	3
diet	21,108	2.68	0.92	1	4
tobacoo	22,132	2.561	0.782	1	3
alcohol	15,730	2.495	1.114	1	4
deductible	16,381	3.014	2.069	1	6
age	18,832	49.36	18.667	15	98
education	19,412	9.996	5.369	1	20
single_household	22,134	0.156	0.363	0	1
gender	18,832	0.469	0.499	0	1
nationality	22,097	1.566	0.828	1	3
employed	22,134	0.652	0.476	0	1
German	22,134	0.663	0.473	0	1
French	22,134	0.264	0.441	0	1
Italian	22,134	0.072	0.259	0	1
doctor_visit	19,479	0.823	0.382	0	1
lottery	18,435	0.281	0.45	0	1
pessimism	18,507	1.468	0.709	1	4
altruism	19,483	0.348	0.476	0	1

This table displays the descriptive statistics for all variables. The definitions of all the variables are provided in Table A1 in Appendix A.

Table 2. Descriptive statistics of the prevention variables by deductible levels.

Deductible Level in CHF					
Entire Sample					
Prevention Variables	***N***	**Mean**	**Std. Dev.**	**Min**	**Max**
physical_activity	4834	2.047	0.802	1	3
diet	4801	2.59	0.946	1	4
tobacoo	5752	2.515	0.809	1	3
alcohol	3149	2.5	1.129	1	4
300					
physical_activity	6501	1.829	0.8	1	3
diet	6492	2.702	0.909	1	4
tobacoo	6527	2.578	0.781	1	3
alcohol	4649	2.514	1.134	1	4
500					
physical_activity	2294	1.874	0.786	1	3
diet	2290	2.717	0.903	1	4
tobacoo	2307	2.534	0.81	1	3
alcohol	1674	2.502	1.145	1	4
1000					
physical_activity	897	1.965	0.768	1	3
diet	893	2.704	0.912	1	4
tobacco	899	2.519	0.808	1	3
alcohol	723	2.549	1.091	1	4
1500					
physical_activity	1808	2.046	0.762	1	3
diet	1808	2.663	0.912	1	4
tobacco	1812	2.591	0.76	1	3
alcohol	1448	2.539	1.086	1	4
2000					
physical_activity	727	2.089	0.734	1	3
diet	728	2.663	0.886	1	4
tobacco	728	2.511	0.804	1	3
alcohol	619	2.381	1.102	1	4
2500					
physical_activity	4097	2.135	0.727	1	3
diet	4096	2.732	0.919	1	4
tobacco	4107	2.618	0.72	1	3
alcohol	3468	2.454	1.073	1	4

This table displays the descriptive statistics for the prevention variables according to the different levels of deductibles. The definitions of all the variables are provided in Table A1 in Appendix A.

Table 3. Correlation matrix.

Variables	Deductible	Age	Education	Single_ Household	Gender	Nationality	Employed	German	French	Italian	Altruism	Doctor_ Visit	Lottery	Pessimism	Physical_ Activity	Diet	Tobacco	Alcohol
deductible	1.000																	
age	−0.339	1.000																
education	0.292	−0.190	1.000															
single_household	−0.027	0.032	−0.045	1.000														
gender	0.071	−0.069	0.143	−0.067	1.000													
nationality	0.074	−0.126	0.097	0.027	0.058	1.000												
employed	0.246	−0.559	0.242	−0.020	0.142	0.073	1.000											
German	0.007	0.017	0.006	−0.072	−0.036	−0.174	0.089	1.000										
French	−0.020	−0.020	−0.017	0.083	0.024	0.130	−0.080	−0.864	1.000									
Italian	0.023	0.005	0.019	−0.014	0.027	0.100	−0.026	−0.353	−0.165	1.000								
altruism	−0.065	0.024	0.085	0.018	−0.195	−0.037	0.032	0.064	−0.043	−0.046	1.000							
doctor_visit	−0.200	0.198	−0.103	0.036	−0.105	−0.027	−0.201	−0.021	0.067	−0.084	0.031	1.000						
lottery	0.065	−0.167	0.001	−0.008	−0.002	−0.235	0.149	0.067	−0.036	−0.064	0.006	−0.003	1.000					
pessimism	−0.080	−0.046	−0.003	0.136	0.011	0.014	0.074	−0.110	0.049	0.124	0.001	0.052	0.021	1.000				
physical_activity	0.076	−0.034	0.115	−0.027	−0.008	−0.026	−0.001	0.154	−0.132	−0.057	0.015	0.042	0.013	−0.161	1.000			
diet	0.030	−0.009	0.102	−0.014	−0.272	−0.024	−0.011	−0.036	0.047	−0.016	0.101	0.044	−0.013	−0.021	0.198	1.000		
tobacco	−0.062	−0.090	−0.131	0.178	0.018	0.055	−0.029	−0.043	−0.014	0.110	−0.046	−0.045	−0.149	0.097	−0.072	−0.135	1.000	
alcohol	−0.076	0.085	−0.042	0.021	0.275	−0.072	−0.076	−0.115	0.094	0.052	−0.066	−0.036	0.057	0.064	−0.028	−0.170	0.103	1.000

In what follows, we start by presenting the results of our baseline regression using models 1 to 4 in Section 4.2. In the following section, we discuss further analysis, which involved adopting alternative strategies to allow for a more tailored in-depth analysis of the association between deductibles and prevention behaviour. For this purpose, we first employed an alternative estimation technique to make sure that our results were robust to different estimation methods (Section 4.3.1). Next, we looked at the association between the deductibles and prevention behaviour from a holistic perspective by analysing all prevention aspects simultaneously. To do so, we made use of principal component analysis, as presented in Section 4.3.2. As the last step, we added a variable controlling for doctor visits to our model. Indeed, visiting the doctor more frequently was expected to influence prevention choices as individuals became more alert of the importance of prevention behaviour. Section 4.3.3 sheds light on this issue.

4.2. Baseline Regression Results

The results of the baseline regression are presented in Table 4. The results show that for all prevention variables (physical_activity, diet and alcohol) except alcohol, the deductibles were significant at the 1% confidence level. More specifically, the results showed that a higher deductible level was associated with a higher level of prevention. In contrast, for alcohol, the effect of the deductibles was not statistically significant. Furthermore, alcohol has an addiction dimension, which made its association with prevention more complicated and less comparable to the remaining dimensions of prevention that were displayed by the other variables.

We found that age had different effects on prevention behaviour, depending on the type of prevention.

As expected, more educated individuals reverted more to preventive activities, as displayed by the positive sign of all prevention variables, except alcohol, i.e., higher education levels were not associated with lower alcohol consumption.

A household made up of one individual had a significant negative effect on all prevention variables, except alcohol, which was not statistically significant. Individuals not living alone might be pushed by other household members into maintaining some prevention behaviour, such as a woman motivating her husband to do physical activity or a mother pushing her children to eat fruits or vegetables.

Gender exhibited a significant negative effect on all prevention variables, except for the positive effect on physical activity. In other words, males tended to do less in terms of prevention, except for physical activity, which seemed to be higher among male individuals.

The status of being employed differently affected the prevention variables; it did not seem to have any influence on physical activity, while it seemed to be associated with lower alcohol consumption but higher tobacco intake. Furthermore, employed individuals, compared to unemployed ones, seemed to do less in terms of diet-based prevention. It can be argued that unemployed individuals have more time and can thus put more effort and attention into maintaining a healthier diet.

Individuals from the German-speaking region of Switzerland seemed to do much more in terms of prevention compared to Italian and French areas, as displayed by the positive significant sign of the German dummy variable. It is worth noting that this applied to all four aspects of prevention. As for the variable nationality, individuals who were foreign nationals tended to do less physical exercise and smoke more compared to Swiss individuals. In contrast, alcohol consumption was higher among Swiss.

As for the variable doctor_visit, a significant positive effect was observed only for tobacco consumption. Visiting a doctor more frequently seemed to be associated with less smoking but did not have any positive effect on other prevention aspects.

The lottery variable was included to control for risk-taking attitudes. Although not a perfect measure of risk-taking, this was the only variable the survey contained that could control for the risk appetite of the individual to a certain extent. The results show that risk

attitudes had no influence on either physical activity or diet. In contrast, risk-taking seemed to have significant effect on smoking and alcohol consumption. For tobacco consumption, the effect was positive, whereby a risk-taker seemed to smoke less. However, risk-taking was associated with higher alcohol consumption.

Finally, we found that pessimism significantly reduced all aspects of prevention, while altruism was associated with higher prevention in terms of diet and physical activity.

Overall, it is worth noting that alcohol seemed to be affected differently by most independent variables as compared to the remaining prevention variables.

Table 4. Baseline regression.

	(1)	(2)	(3)	(4)
Prevention Behaviour	**Physical_Activity**	**Diet**	**Tobacco**	**Alcohol**
deductible	0.0400 ***	0.0154 ***	0.0400 ***	−0.00260
	(7.79)	(3.10)	(6.39)	(−0.46)
age	−0.0120 ***	0.00349 ***	0.0142 ***	−0.00192 **
	(−16.18)	(4.94)	(16.11)	(−2.33)
education	0.0175 ***	0.0278 ***	0.0294 ***	−0.00581 ***
	(9.00)	(14.85)	(12.33)	(−2.71)
single_household	−0.0512 **	−0.125 ***	−0.249 ***	0.0255
	(−2.03)	(−5.24)	(−8.39)	(0.92)
gender	0.131 ***	−0.619 ***	−0.237 ***	−0.806 ***
	(6.57)	(−32.02)	(−9.85)	(−36.53)
nationality	−0.0711 ***	−0.0126	−0.0375 **	0.0487 ***
	(−5.43)	(−1.01)	(−2.44)	(3.32)
employed	0.00620	−0.0899 ***	−0.123 ***	0.127 ***
	(0.25)	(−3.75)	(−4.05)	(4.54)
German	0.228 ***	0.0873 **	0.150 ***	0.237 ***
	(6.07)	(2.47)	(3.46)	(5.72)
French	0.00632	0.271 ***	0.120 ***	0.0923 **
	(0.16)	(7.16)	(2.59)	(2.09)
Italian	0	0	0	0
	(.)	(.)	(.)	(.)
doctor_visit	0.0408	−0.00843	0.0854 ***	−0.0290
	(1.55)	(−0.33)	(2.74)	(−1.02)
lottery	−0.00792	−0.00530	0.0910 ***	−0.0801 ***
	(−0.36)	(−0.25)	(3.37)	(−3.37)
pessimism	−0.149 ***	−0.0838 ***	−0.119 ***	−0.0453 ***
	(−10.23)	(−6.09)	(−7.07)	(−2.75)
altruism	0.123 ***	0.119 ***	−0.0167	0.0269
	(6.17)	(6.21)	(−0.69)	(1.23)
cut1				
_cons	−0.826 ***	−1.269 ***	−0.0585	−1.078 ***
	(−10.09)	(−16.16)	(−0.61)	(−11.74)
cut2				
_cons	0.247 ***	−0.0251	0.208 **	−0.331 ***
	(3.02)	(−0.32)	(2.17)	(−3.61)
cut3				
_cons		0.982 ***		0.415 ***
		(12.57)		(4.54)
N	13,988	13,979	14,032	10,828

This table displays the results of the main regressions using an ordered probit model for the four different models. The dependent variables are measures of prevention behaviour. Reported beneath each coefficient estimate in parenthesis is the t statistic. **, and *** indicate statistical significance at the 5%, and 1% levels, respectively. The definitions of all the variables are provided in Table A1 in Appendix A.

4.3. Further Investigation and Robustness Checks

4.3.1. Alternative Estimation Using Conditional Mixed-Process Modelling

In the insurance literature, the association between insurance and prevention can be explained by causality or selection effects (Chiappori and Salanié 2000). Indeed, higher

insurance coverage, i.e., lower deductibles, can induce lower prevention. However, at the same time, more risky people may choose higher insurance coverage and lower deductibles. To control for this phenomenon, we employ an ordered instrumental variable probit model. We used the declared level of income as an instrumental variable to deal with inverse causality. The reason for choosing this variable as an instrument was because we suspected that the level of income might influence the choice of deductible without directly influencing prevention and healthy lifestyle choices.

To estimate our model, we made use of CMP. Using a system of seemingly unrelated regressions (SUR) is adequate since the equations seemed unrelated in the sense that the dependent variables appeared on the right-hand side of the remaining equations while the errors could be correlated, thus sharing a multidimensional distribution (Roodman 2011). Hence, taking account of those correlations is more efficient than those derived from single-equation regressions. The estimates are thus equivalent to those derived from the full information maximum likelihood (FIML) method, assuming multivariate normal errors. The CMP modelling framework is equivalent to considering seemingly unrelated regressions, with the advantage that it allows for the inclusion of noncontinuous variables. In the case of our data, the dependent variable was an ordered discrete variable.

The results obtained using the CMP methodology are displayed in Table 5. The results confirmed the robustness of our main regression findings, whereby all prevention variables, except for alcohol, were significantly affected by deductibles at the 1% confidence level. It is worth noting that an income effect was evident for alcohol consumption since the results showed that alcohol consumption was positively affected (lower prevention) by higher levels of deductibles when income was used as an instrument, unlike in the main regression where deductibles showed no significant effect on alcohol consumption.

Table 5. Conditional mixed-process modelling.

	(1)	(2)	(3)	(4)
Prevention Behaviour	**Physical_Activity**	**Diet**	**Tobacco**	**Alcohol**
deductible	0.383 ***	0.366 ***	0.385 ***	−0.356 ***
	(96.45)	(97.45)	(80.34)	(−85.99)
age	−0.0000539	0.0133 ***	0.0207 ***	−0.0137 ***
	(−0.07)	(19.16)	(25.63)	(−17.14)
education	−0.00915 ***	0.000109	−0.00422 *	0.0186 ***
	(−4.84)	(0.06)	(−1.95)	(8.94)
single_household	−0.0597 **	−0.130 ***	−0.222 ***	0.0307
	(−2.44)	(−5.51)	(−8.09)	(1.13)
gender	0.0155	−0.650 ***	−0.297 ***	−0.638 ***
	(0.80)	(−34.06)	(−13.52)	(−29.46)
nationality	−0.0271 **	0.0205 *	0.00691	0.0190
	(−2.12)	(1.66)	(0.48)	(1.33)
employed	−0.157 ***	−0.249 ***	−0.360 ***	0.256 ***
	(−6.37)	(−10.49)	(−12.73)	(9.33)
German	0.230 ***	0.120 ***	0.155 ***	0.161 ***
	(6.33)	(3.42)	(3.84)	(3.97)
French	0.0528	0.291 ***	0.128 ***	0.0236
	(1.36)	(7.77)	(2.96)	(0.55)
doctor_visit	0.331 ***	0.291 ***	0.369 ***	−0.326 ***
	(12.93)	(11.75)	(13.00)	(−11.82)
lottery	−0.0809 ***	−0.0811 ***	−0.0159	−0.00244
	(−3.73)	(−3.85)	(−0.65)	(−0.10)
pessimism	−0.0365 **	0.0173	0.0114	−0.126 ***
	(−2.57)	(1.27)	(0.73)	(−7.86)
altruism	0.148 ***	0.145 ***	0.0275	−0.0259
	(7.56)	(7.65)	(1.24)	(−1.21)
N	13,988	13,979	14,032	10,828

This table displays the results found using the conditional mixed-process modelling (CMP) methodology for the four different models. The instrument employed in all regressions was the self-declared level of annual income. Reported beneath each coefficient estimate in parenthesis is the t statistic. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The definitions of all the variables are provided in Table A1 in Appendix A.

4.3.2. General Prevention Behaviour: Principal Component Analysis

To further investigate how deductibles affected prevention behaviour in general, we performed principal component analysis (PCA) and used the first factor to produce a broad index of prevention called PREVENT. PCA allowed us to analyse all prevention aspects simultaneously since one might argue that such behaviours are hard to dissociate and are better considered at the same time. However, there was the possibility that including all prevention variables at the same time could lead to bias estimates due to important correlations between the prevention variables. The factor loadings were as follows: 0.4 for physical activity, 0.6 for diet, 0.5 for alcohol consumption and 0.5 for tobacco intake. We reran our main regression using PREVENT as the dependent variable. The results of the PCA analysis are displayed in Table 6. The results show a positive significant sign for deductibles at the 1% confidence level. The findings confirmed that deductibles significantly boosted prevention behaviour, regardless of whether specific aspects of prevention were considered or all aspects were considered simultaneously.

Table 6. Principal component analysis.

	PREVENT
deductible	0.0323 ***
	(6.23)
age	0.00120
	(1.58)
education	0.0264 ***
	(13.27)
single_household	−0.153 ***
	(−5.95)
gender	−0.682 ***
	(−33.15)
nationality	−0.0125
	(−0.93)
employed	−0.0512 **
	(−1.99)
German	0.262 ***
	(6.88)
French	0.211 ***
	(5.21)
doctor_visit	0.0356
	(1.36)
lottery	−0.00424
	(−0.19)
pessimism	−0.138 ***
	(−9.05)
altruism	0.0893 ***
	(4.42)
N	10,763

This table displays the results of the regression with the principal component indicator as the dependent variable. Reported beneath each coefficient estimate in parenthesis is the t statistic. **, and *** indicate statistical significance at the 5%, and 1% levels, respectively. The definitions of all the variables are provided in Table A1 in Appendix A.

4.3.3. Controlling for Doctor Visits

Finally, we reran our regression by removing the variable controlling for doctor visits. Since visiting the doctor more frequently might influence prevention choices, we aimed to examine whether our main results were altered when this variable was omitted. The results are presented in Table 7. The findings remained the same and confirmed the robustness of our main findings.

Table 7. Removing doctor visits.

	(1)	(2)	(3)	(4)
Prevention Behaviour	**Physical_Activity**	**Diet**	**Tobacco**	**Alcohol**
deductible	0.379 ***	0.363 ***	0.381 ***	−0.352 ***
	(95.97)	(97.02)	(79.89)	(−85.57)
age	0.000568	0.0138 ***	0.0213 ***	−0.0143 ***
	(0.79)	(19.99)	(26.46)	(−17.92)
education	−0.00846 ***	0.000781	−0.00352	0.0179 ***
	(−4.48)	(0.43)	(−1.63)	(8.58)
single_household	−0.0669 ***	−0.137 ***	−0.230 ***	0.0416
	(−2.73)	(−5.80)	(−8.38)	(1.53)
gender	−0.0187	−0.681 ***	−0.335 ***	−0.601 ***
	(−0.97)	(−35.87)	(−15.35)	(−27.96)
nationality	−0.0269 **	0.0202	0.00685	0.0200
	(−2.11)	(1.63)	(0.48)	(1.40)
employed	−0.173 ***	−0.263 ***	−0.377 ***	0.274 ***
	(−7.03)	(−11.12)	(−13.35)	(10.00)
German	0.234 ***	0.122 ***	0.158 ***	0.159 ***
	(6.42)	(3.50)	(3.93)	(3.93)
French	0.0632	0.300 ***	0.138 ***	0.0160
	(1.63)	(8.01)	(3.21)	(0.37)
lottery	−0.0796 ***	−0.0808 ***	−0.0152	−0.00346
	(−3.68)	(−3.84)	(−0.62)	(−0.15)
pessimism	−0.0224	0.0304 **	0.0269 *	−0.140 ***
	(−1.59)	(2.24)	(1.72)	(−8.74)
altruism	0.145 ***	0.141 ***	0.0230	−0.0209
	(7.39)	(7.45)	(1.04)	(−0.98)
N	13,991	13,982	14,035	10,831

This table displays the results after excluding the variable controlling for doctor visits for the four different models. Reported beneath each coefficient estimate in parenthesis is the t statistic. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

5. Conclusions

This study investigated the relationship between insurance deductibles and prevention behaviour in Switzerland using the 2017 Swiss Health Survey. It also focused on analysing the main socioeconomic factors that boost or deter prevention.

For this purpose, an ordered probit model was employed using different prevention aspects as dependent variables and the level of insurance deductible as the main independent variable. We also included a comprehensive set of sociodemographic covariates and other behavioural variables that we deemed might influence the prevention behaviour. Moreover, we used instrumental variable analysis to control for causality and selection effects, as stressed by Chiappori and Salanié (2000). To further investigate how deductibles affected the prevention behaviour in general, we performed principal component analysis and used the first factor to produce a broad index of prevention. This allowed us to consider a holistic approach to individuals' preventive attitudes. We also considered the role of personal doctors in encouraging healthier lifestyles and, thus, included doctor visits in our analysis, as in Dave and Kaestner (2009). Finally, we controlled for risk aversion behaviour, as in Courbage and de Coulon (2004), as risk aversion could explain both insurance and prevention decisions.

Our findings provide evidence of a significant positive link between insurance deductibles and behavioural prevention in terms of diet, physical activity and smoking, supporting the ex-ante moral hazard assumption. Our results are in line with Dave and Kaestner (2009) and de Preux (2011) for Medicare, and Aistov et al. (2021) for Russia, all of which provide evidence that health insurance deters prevention behaviour. While these previous studies considered behavioural changes in terms of physical activity, smoking and alcohol consumption, we complemented their analysis by also considering changes in diet, which represents one of the main behavioural factors linked to health (WHO 2013). Our

work also complemented previous works by investigating how a change in the level of insurance coverage through a change in deductibles influenced health behaviours of insured individuals rather than how the introduction of insurance modified health behaviours.

As for the other determinants of prevention, we found that, except for alcohol, more-educated individuals tended to revert more to preventive activities. As for gender, males tended to do less in terms of prevention, except for physical activity, which was higher among male individuals. Living alone had a significant negative effect on all prevention variables, except alcohol. Individuals from the German-speaking region of Switzerland were more likely to engage in prevention activities than Italian-speaking and French-speaking areas, pointing out to a cultural gradient. In general, our findings confirmed that alcohol consumption seemed to be differently affected by different elements compared to other aspects of prevention. Finally, a broader look showed that the positive significant effect of deductibles on prevention also held when prevention was measured as a whole using principal component analysis.

A deductible is a form of co-payment under which the care user bears a proportion of his/her health care expenses. If higher deductibles reduce insurance premiums, they also increase out-of-pocket payment and, as such, can be criticized on equity grounds (Crivelli and Salari 2014). Our results contribute to this discussion by showing that, in Switzerland, higher deductibles led to healthier behaviour, which is likely to benefit the Swiss health system and the general health of individuals.

We acknowledge some limitations related to our work. First, this study lacked a time dimension given that the survey used was only administered once. However, we believe that prevention is a habit-based behaviour and thus varies slightly over time. At the same time, exploring whether prevention behaviour has evolved nowadays compared to previous generations and whether people have realised its importance could be of high interest in further understanding prevention behaviour evolution. Second, the analysis in this study was limited to Switzerland only. It might be interesting to expand the scope of analysis to include more countries around the world that employ deductible-based health insurance systems. Third, while our study addresses the issue of inverse causality or selection effects in the relation between insurance deductibles and prevention by considering specific instrumental variables, other instruments could also be investigated, though the main challenge remains in finding variables that highly correlate with insurance propensity without being correlated with risk aversion. Fourth, studying aspects of prevention other than the ones included in this study might be another future dimension of interest to explore as well. For example, exploring the role played by insured prevention behaviour, such as skin testing, cervical examinations and breast screening, can also be considered an interesting extension for this paper. Finally, extending our analysis to include preventive behaviour in the era of the COVID-19 pandemic remains the most promising field of research.

Overall, our work constitutes the first approach towards a better understanding of the importance of insurance deductibles in prevention behaviour and may also provide a prelude for further research in this important field.

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List of Abbreviations

CMP	Conditional mixed-process modelling
COVID19	Coronavirus disease 2019
FIML	Full information maximum likelihood
GP	General practitioner
PCA	Principal component analysis
SHS	Swiss Health Survey
SUR	Seemingly unrelated regressions
VIF	Variance inflation factor
WHO	World Health Organization

Appendix A

Table A1. Definition of the variables.

Variable	Description	Details
Physical_activity	Physical activity	1 for none, 2 for 1–2 days per week and 3 for more than 3 days per week
diet	Diet based on the number of fruits/vegetables intake per day	1 for less than 5 portions per week, 2 for 0–2 portions per day, 3 for 3–4 portions per day and 4 for 5 or more portions per day
tobacco	Tobacco consumption	1 for a daily smoker, 2 for an occasional smoker and 3 for a nonsmoker
alcohol	Categorical daily alcohol consumption in grams, which was calculated on a whole-sample percentile basis	1 for more than 14.5 g 2 for 7 g < consumption < 14.5 g 3 for 3.66 g < consumption < 7 g 4 for less than 3.66 g
deductible	Answer to the following question: What is your personal annual deductible?	1 for CHF 300 to <500 2 for CHF 500 to <1000 3 for CHF 1000 to <1500 4 for CHF 1500 to <2000 5 for CHF 2000 to <2500 6 for CHF 2500 or more
age	Age in number of years	18–99
education	Education level	1 for have not finished obligatory school to 20 for having a Doctorate degree or equivalent
single_household	Dummy for a single household	1 if the household is composed of a single individual and 0 otherwise
gender	Male or female	1 for male, 0 for female
nationality	Nationality	1 for born Swiss, 2 for Swiss by naturalisation and 3 for another nationality
employed	Employment dummy	1 if employed, 0 otherwise
German	Dummy for German-speaking	1 if German speaking, 0 otherwise
French	Dummy for French-speaking	1 if French speaking, 0 otherwise
Italian	Dummy for Italian-speaking	1 if Italian speaking, 0 otherwise
doctor_visit	Dummy for visiting a doctor	1 for having visited a doctor within the last 12 months, 0 otherwise
lottery	Answer to the following question: Have you ever played the lottery?	1 for answering yes, 0 otherwise
pessimism	Answer to the following question: To what extent you consider yourself pessimistic?	1 for never 2 for somedays 3 for more than 50% of the time 4 for almost every day
altruism	Answer to the following question: Do you consider yourself altruistic?	1 for answering yes, 0 otherwise

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