Risk equalization and voluntary deductibles: a complex interaction

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ZORA URL: https://doi.org/10.5167/uzh-123584

Originally published at:
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A complex interaction

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Voluntary Deductibles and Risk Equalization: A complex interaction

Vrijwillige eigen risico’s en risicoverevening: Een complexe interactie

Proefschrift

ter verkrijging van de graad van doctor aan de
Erasmus Universiteit Rotterdam
op gezag van de
rector magnificus

Prof.dr. S.W.J. Lamberts

evergens besluit van het College voor Promoties.
De openbare verdediging zal plaatsvinden op
vrijdag 6 februari 2009 om 13.30 uur

door

Richard Cornelis van Kleef

geboren te Delft
2.1 Introduction

In Switzerland and the Netherlands residents are obliged to obtain basic health insurance. In both countries a risk equalization system has been implemented to realize cross subsidies from low-risk to high-risk individuals. In addition, insurers must accept every eligible applicant for a community-rated premium. Another common aspect is that the insured may opt for a deductible, which means that they can choose to pay expenditures up to a certain amount out-of-pocket in return for a premium rebate. The presence of a deductible option raises two important questions regarding the respective risk equalization systems.

The first question is: ‘What are the effects of equalizing different types of expenditures?’ In a situation where all insured have the same coverage, differences in risk and health can be adjusted for by simply equalizing the net insurance claims. This implies that the insurer’s equalization payment for insured $i$ equals the average net claims in $i$’s risk group minus the overall average net claims. If the payment is positive, the insurer receives it; if it is negative, the insurer must pay it into the risk equalization fund. In a situation where some insured choose a deductible and others do not, variation in net claims is not only attributable to differences in health and risk, but also to differences in out-of-pocket expenditures and moral hazard (reduction). If just the net claims are equalized, as is currently (2006) the case in Switzerland, then out-of-pocket expenditures and moral hazard reductions are totally neglected. An option would be to equalize the latter two components as well. The first purpose of this paper is to clarify the implications of equalizing different types of expenditures.

The second question is ‘What are the consequences of self selection?’. Self selection occurs because healthy insured have a greater incentive to opt for a deductible than unhealthy insured. As a result, expenditure differences between these groups are (partly) due to differences in health and risk. In the absence of risk equalization, competing insurers are forced to incorporate these expenditure differences into the premium rebate. In the presence of risk equalization, the effect of self selection on the premium rebate will be smaller since these differences are adjusted for via the equalization payments. However, it is unlikely that the current (2006) Swiss and Dutch equalization systems do fully adjust for self selection. Part of the differences in health status may still be incorporated into the premium structure, resulting in a reduction of cross subsidization between the healthy and the unhealthy compared to a situation without a deductible option. The second purpose of this paper is to indicate the extent to which the current Swiss and Dutch equalization systems adjust for the effect of self selection.

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1 I.e. risk adjustment.
2 The net insurance claims are defined as the expenditures that are actually reimbursed. Henceforth, these expenditures are referred to as ‘net claims’.
3 In the Netherlands the risk equalization payment equals the average annual insurance claims in $i$’s risk group minus a fixed amount that does not necessarily equal the overall average insurance claims. However, this detail is not relevant for the analyses and conclusions in this paper.
Before these questions are discussed, section 2.2 provides a brief description of the Swiss and Dutch basic health insurance schemes and their risk equalization systems. Section 2.3 is concerned with the first question and theoretically considers the consequences of equalizing different types of expenditures. After that, the paper focuses on the second question and reports on an empirical study aimed at examining the extent to which the current Swiss and Dutch equalization systems adjust for self selection. Finally, section 2.8 summarizes and discusses the conclusions.

2.2 Risk equalization in Switzerland and The Netherlands

The Dutch and Swiss basic health insurance schemes have many similarities. However, there are important differences with respect to funding, user charges and risk equalization. Hence, we briefly describe the relevant aspects of both systems in 2006.

2.2.1 Switzerland

Since the Revised Health Insurance Law came into force in January 1996, all Swiss residents must obtain individual basic health insurance. There is open enrollment, which means that insurers are obliged to accept every eligible applicant. Among others, the ‘basic’ package includes inpatient and outpatient care, physician services, physiotherapy, laboratory analyses, health care at home, nursing home care, technical aids, medicaments from pharmacy and physicians, and alternative and complementary benefits. On average about 85 percent of the total expenditures is financed by the insurance premium and 15 percent is financed by user charges. The insurance premium is community-rated per insurer, region and age group (0-18, 19-25 and >25) and is paid to the insurer.

In return for a premium rebate, insured can opt for a deductible starting from a mandatory minimum. The federal government has put upper limits on the premium rebate in order to protect cross subsidies from healthy to unhealthy individuals. Children (under 18 years of age) are exempted from mandatory deductibles and their voluntary deductible options are all lower then the options for adults. In addition to these deductibles there is a coinsurance of 10 percent up to a maximum of CHF 600 per person per year for all medical expenditures on top of the (total) deductible. During inpatient care those from single-occupant households must pay hotel-type expenses of CHF 10 per day. During the years for which we have data (1998-2003) the mandatory deductible was CHF 230 and the voluntary deductibles on top of that were CHF 170, 370, 970 and 1,270 per person per year.
Every region has its own risk equalization system, which equalizes the net insurance claims and takes into account (only) two characteristics, i.e. age and gender. The insurer’s risk equalization payment for insured $i$ equals the average actual net claims in $i$’s age/gender-group (in $i$’s region of residence) minus the overall average actual net claims (in $i$’s region of residence) (Beck et al., 2003).

### 2.2.2 The Netherlands

In the Netherlands all residents are obliged to have basic health insurance since the Health Insurance Law came into force on 1 January 2006. Similar to the Swiss scheme, the Dutch basic insurance is based on the principle of individual insurance and the insurers are obliged to accept every eligible applicant. In general terms, the ‘basic’ package includes hospital care, care provided by general practitioners and specialists, prescription drugs, maternity care, obstetrics, technical aids and dental care for children. On average, 50 percent of the total expenditures is financed by income-related contributions. These contributions are paid into the Risk Equalization Fund (REF), out of which the insurers receive equalization payments. About 45 percent of total expenditures is financed through insurance premiums. These premiums are paid directly to the insurer and are community-rated per province\(^4\) for all insured with the same type of insurance policy\(^5\) provided by the same insurance company. Government finances medical care for children up to the age of 18 (into the REF) since children are exempted from paying insurance premiums.

Individuals (older than 17) who have no insurance claim in a certain year get a no-claim refund of €255. If the total insurance claim is between €0 and €255 then the no-claim refund equals €255 minus the actual claims. This applies to all medical benefits in the basic package except for care provided by the general practitioner, obstetrics and maternity care. On top of the no-claim refund the insured may choose a deductible of €0, €100, €200, €300, €400 or €500 per person per year.

The risk equalization model for 2006 is based on expenditure information of the year 2003. The following risk factors are included in the model: age interacted with gender, region, source of income, pharmacy-based cost groups (PCGs), and diagnostic-based cost groups (DCGs). For a detailed description of the use and the construction of PCGs and DCGs in the Netherlands we refer to Lamers (1999a) and Lamers (1998, 1999b), respectively. In general terms, the insurer’s equalization payment for insured $i$ is calculated as the expected (average) medical expenditures in $i$’s risk group minus a fixed amount which is the same for all the insured. The payment can be either positive or negative. As insurers are not able to

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\(^4\) The Netherlands is divided into 12 provinces.

\(^5\) In the Netherlands insurers can offer preferred-provider policies, policies with full freedom of choice and policies that are a mixture of these two.
control all types of expenditures to the same extent, there is also a system of ex-post risk sharing between the insurers and the REF. We will not discuss this in further detail since risk sharing is irrelevant for this paper.

2.2.3 A simplified risk equalization model

To answer the two questions raised in Section 2.1 we consider a general risk equalization model in which the insurer’s equalization payment for individual $i$ is calculated as the average expenditures to be equalized in $i$’s risk group minus the average expenditures to be equalized in the entire population of insured. In principle, this mechanism is consistent with that in Switzerland and the Netherlands.

2.3 The effects of equalizing different types of expenditures

If insured have the same level of coverage, variation in net insurance claims can be totally attributed to differences in risk and health. In the presence of voluntary deductibles, this variation is also attributable to differences in out-of-pocket expenditures and differences in moral hazard. Consequently, equalizing the net claims is expected to have different outcomes in situations with and without a deductible option. This section theoretically considers the effects of equalizing different types of expenditures.

2.3.1 A conceptual framework

Figure 2.1 shows a scenario with just two risk types regarding medical expenditures: low-risk individuals (group A) and high-risk individuals (group B). There is no consumer information surplus and for each insurer 50 percent of the insured belongs to group A and 50 percent belongs to group B. All insured have full coverage for medical expenditures and both insurers and the insured know to which risk group an individual belongs. The average insurance claims equal € 1,000 in risk group A and € 2,000 in risk group B. In a competitive health insurance market without risk equalization insurers are forced to ask different premiums. If we assume the premium to equal the (expected) insurance claims then it will be € 1,000 for the insured in risk group A and € 2,000 for the insured in risk group B.

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6 The Dutch risk equalization system distinguishes between three components of health care costs, which are treated differently: production-dependent hospital costs plus costs of specialist care, production-independent hospital costs, and costs of other care. These components have varying degrees of ex-ante risk equalization and ex-post risk sharing, since insurers are not able to influence these costs to the same extent. The Dutch government aims to increase the risk equalization part and to decrease the risk sharing part for all appropriate types of health care in the near future.
At a certain moment, risk equalization is introduced in order to realize cross subsidies between the low risks and the high risks. Insurers receive a positive payment for each insured in risk group B and a negative payment for each insured in risk group A. Equalization payment $R_j$ for an insured in risk group $j$ is calculated as the average insurance claims in risk group $j$ minus the overall average insurance claims. Accordingly, $R_B$ equals € 500 ($= \€ 2,000 - \€ 1,500$) and $R_A$ equals € -500 ($= \€ 1,000 - \€ 1,500$). As a result, the average sums of insurance claims and equalization payments are equal for both risk groups, thus removing incentives for premium differentiation.

![Figure 2.1 Equalizing the net claims when insured have the same level of coverage](image)

Figure 2.1 Equalizing the net claims when insured have the same level of coverage

At a later moment the option to take a voluntary deductible is introduced, together with the regulation that premiums must be the same for all insured with the same deductible. Notice that this regulation is found in Switzerland and the Netherlands (in 2006). We assume that all insured in risk group A take the deductible and all insured in risk group B do not. On average the insured with a deductible pay € 300 themselves and have expenditure savings due to a moral hazard reduction of € 200. Consequently, their average net claims drop to € 500. As shown in figure 2.2, the overall average net claims drop from € 1,500 to € 1,250. If risk equalization is (still) based on the net claims then $R_B$ increases to € 750 ($= \€ 2,000 - \€ 1,250$) and $R_A$ decreases to € -750 ($= \€ 500 - \€ 1,250$).

When the insurer has learned about this, the premium will equal € 1,250 ($\€ 500 - \€ -750$) for insured who choose a deductible, which is lower than in a situation without the deductible option (figure 2.1). However, the premium for insured who do not choose the deductible will also equal € 1,250 ($\€ 2,000 - \€ 750$), implying a premium rebate of € 0. This probably results in none of the insured opting for a deductible and no moral hazard reduction in later years.

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7 Thus, premiums can be differentiated only according to the level of deductible (i.e. yes/no deductible).
To enable insurers to include out-of-pocket expenditures and moral hazard reductions in the premium rebate, these two types of expenditures must be equalized as well. To do so, information is needed about the expenditures that insured pay themselves. In addition, accurate information is needed to estimate the moral hazard reduction due to the deductible. In this example we assume this information to be available. Figure 2.3 shows that the average expenditures to be equalized equal €1,500 if the three types of expenditures are included. Similar to a situation without ‘a deductible option’ (figure 2.1), $R_B$ equals €500 ($= €2,000 - €1,500$) and $R_A$ equals €-500 ($= €1,000 - €1,500$). When the insurer has learned about this, the premium for an insurance policy without a deductible will equal €1,500 and the premium for a policy with a deductible will equal €1,000, implying a premium rebate of €500.

Figure 2.2 Equalizing the net claims in a situation with a deductible option

Figure 2.3 Equalizing the net claims, out-of-pocket expenditures and moral hazard reduction in a situation with a deductible option
2.3.2 Three types of expenditures

Thus, in the presence of a deductible option three types of expenditures can be equalized: the net insurance claims $\text{NET}_j$, the out-of-pocket expenditures $\text{OOPE}_j$ and moral hazard reduction $\text{RMH}_j$. If all three types are included then risk equalization payment $R$ for individuals in risk group $j$ equals:

$$R_j = (\text{NET}_j + \text{OOPE}_j + \text{RMH}_j) - (\text{NET} + \text{OOPE} + \text{RMH})$$

where the first term represents the averages in risk group $j$ and the second term represents the overall averages. In fact, each type of expenditure can be seen as a separate element in risk equalization, as demonstrated in equation (2.2).

$$R_j = (\text{NET}_j - \text{NET}) + (\text{OOPE}_j - \text{OOPE}) + (\text{RMH}_j - \text{RMH})$$

Applying equation (2.2) to the situation of figure 2.3 shows that the total equalization payment of € -500 for individuals in risk group A is composed of € -750 ($\text{NET}_A - \text{NET}$), € 150 ($\text{OOPE}_A - \text{OOPE}$) and € 100 ($\text{RMH}_A - \text{RMH}$). The total equalization payment of € 500 for individuals in risk group B is composed of € 750, € -150 and € -100, respectively.

2.3.3 Incentives for cream skimming

In the scenario of section 2.3.1 the risk equalization model perfectly explains the variance in choice of deductible, i.e. all insured in group A choose a deductible and all insured in group B do not. In practice this is unrealistic, except when the level of deductible is included as a risk factor in the equalization system. We consider a second scenario to demonstrate the consequences of equalizing different types of expenditures in a situation where this is not the case. In this scenario, which is shown in figure 2.4, equalizing just the net claims has a second effect (next to the effect discussed in Section 2.3.1), which is that insurers will be confronted with incentives for cream skimming.

If 50 percent of the insured in group A and none of the insured in group B choose a deductible and just the net claims are equalized then $R_A$ equals € -625 (€ 750 - € 1,375) and $R_B$ equals € 625 (€ 2,000 - € 1,375). The sum of net claims and equalization payments equal € 1,625 (€ 1,000 - € -625) for insured in risk group A without a deductible, € 1,125 (€ 500 - € -625) for insured in risk group A with a deductible, and € 1,375 (€ 2,000 - € 625) for insured in risk group B. Because of the ban on premium differentiation the insurer is forced to ask a premium of € 1,458 ($1/3 \times € 1,625 + 2/3 \times € 1,375$) to the insured.

\[\text{In the group of insured without a deductible } 1/3 \text{ is of risk type A and } 2/3 \text{ of is of risk type B.}\]
without a deductible and € 1,125 to the insured with a deductible. Consequently, the insured in risk group B are profitable for insurers since their premium exceeds the net claims plus equalization payment. The opposite holds for insured in risk group A without a deductible, which implies an incentive for cream skimming. These incentives will not occur when out-of-pocket expenditures and moral hazard reductions are equalized as well.

![Figure 2.4 Equalizing the net claims when the risk equalization model explains some of the variance in choice of deductible](image)

Notice that the premium rebate equals € 333 (€ 1,458 - € 1,125). Thus, the degree to which out-of-pocket expenditures and moral hazard reductions can be incorporated into the premium rebate decreases when the risk equalization model explains more of the variance in choice of deductible.

### 2.3.4 An exceptional situation

Theoretically, there is an exceptional situation in which the average out-of-pocket expenditures and reductions in moral hazard are the same in all risk groups distinguished in the risk equalization system. An example is shown in figure 2.5. In this scenario the proportion of insured choosing a deductible is the same for A and B and in both groups insured with a deductible pay on average € 300 themselves and have expenditure savings due to less moral hazard of € 200. If just the net claims are equalized then $R_A$ equals € -500 (€ 750 - € 1,250) and $R_B$ equals € 500 (€ 1,750 - € 1,250). Consequently, the net claims plus equalization payments equal € 1,500 for insured without a deductible (€ 1,000 - € -500 in group A and € 2,000 - € 500 in group B) and € 1,000 for insured with a deductible (€ 500 - € -500 in group A and € 1,500 - € 500 in group B). When the insurer has learned about this, the premium will equal € 1,500 for insured without a deductible and € 1,000 for insured with a deductible, which means a rebate of € 500 (€ 1,500 - € 1,000). In this scenario, equalizing the out-of-pocket expenditures and moral hazard reductions would have no effect on the total equalization payment $R_j$ since $OOPE_j - OOPE = 0$ and $RMH_j - RMH = 0$ for both risk groups.
Risk equalization and voluntary deductibles

Figure 2.5 Equalizing the net claims in an exceptional situation where the average out-of-pocket expenditures and moral hazard reduction are the same in all risk groups distinguished in the equalization system.

2.3.5 Conclusion

We conclude that in the presence of voluntary deductibles three types of expenditures can be equalized, which are the net insurance claims, out-of-pocket expenditures and expenditure savings due to less moral hazard. The consequences of equalizing different types of expenditures are different for three scenarios.

In the first scenario risk equalization explains 100 percent of the variance in choice of deductible, which will be the case if the level of deductible is included as a risk factor in the equalization model. If just the net insurance claims are equalized then out-of-pocket expenditures and moral hazard reductions due to a deductible cannot be included in the premium rebate. The opposite holds if these two types of expenditures are equalized as well.

In the second scenario risk equalization explains some of the variance in choice of deductible. This scenario is most likely to occur in practice as long as the level of deductible is not included as a risk factor in the equalization model. If just the net insurance claims are equalized then the insurers will be confronted with incentives for cream skimming and insurers cannot (fully) incorporate out-of-pocket expenditures and moral hazard reductions into the premium rebate. These consequences will not occur if out-of-pocket expenditures and moral hazard reductions are equalized as well.

Theoretically, there is a third (exceptional) scenario in which the average out-of-pocket expenditures and moral hazard reductions are the same for all risk groups distinguished in the risk equalization system. In this situation, which might occur just by chance, there is no difference between equalizing and not equalizing out-of-pocket expenditures and moral hazard reductions.
2.4 Implications of self selection

Hence, the paper is concerned with the consequences of self selection. Self selection occurs because within each premium-risk group healthy insured have a greater incentive to opt for a deductible than unhealthy insured. Many studies have found evidence of self selection within the health insurance market (e.g., Browne, 1992; Gardiol et al., 2006; Beck, 2004). In this section the consequences of self selection are discussed for situations with risk equalization and without risk equalization.

2.4.1 Without risk equalization

The premium rebate in return for a voluntary deductible in unregulated health insurance markets consists of four components (Bakker et al., 2000). A first component is the insured's out-of-pocket expenditures. Since the insured pays expenditures up to the deductible amount himself the insurer has to reimburse less compared to full coverage.

A second component is the moral hazard reduction. Many studies have found evidence of a positive correlation between insurance coverage and medical consumption controlling for health status. The RAND-experiment showed that those with a catastrophic insurance plan, i.e. a 95-percent coinsurance rate with a high cap on out-of-pocket expenses, had on average 31 percent lower medical expenditures than those with a full-coverage plan (Manning et al., 1987; Keeler et al., 1988; Newhouse, 1993). Studies based on data from Switzerland and the Netherlands, which controlled for methodological problems (such as adverse selection) in a non-experimental setting, confirmed the effects of user charges on moral hazard. Van Vliet (2004) shows that a deductible of € 800 in the Dutch private health insurance of 1996 led on average to 14 percent lower medical expenditures than full coverage. Gardiol et al. (2006) have found that deductibles of CHF 970 (€ 580, 2006) and CHF 1,270 (€ 760, 2006) in the Swiss basic health insurance resulted in expenditure reductions of about 17 percent.

A third component is a reduction in administration costs. Some insured do not send their bills to the insurer before their total expenditures exceed the deductible, i.e. before they will get any reimbursement. Consequently, the insurer does not have to deal with these bills, which might reduce his administration costs. In the Swiss and Dutch basic health insurance this component will not be substantial since a large part of the bills is settled between the provider of care and the insurer, even if insured have a deductible. For that reason we do not take into account this component in our analyses.

A fourth component is the effect of self selection. If self selection occurs, the average medical expenditures of the insured with a voluntary deductible will be lower than that of those without a voluntary deductible. In an unregulated market this leads to market
segmentation, since the insurer is forced by competition to incorporate these expenditure differences into the premium structure. Consequently, differences in (ex-ante) health status will be reflected in the premium rebate for a voluntary deductible.

2.4.2 **With risk equalization**

The effect of self selection on the premium structure will be smaller in the presence of risk equalization. If the equalization payments do perfectly adjust for differences in health and risk, the premium rebate can be based only on the out-of-pocket expenditures (cost sharing) and moral hazard reduction. If not, then the rebate can also be based on differences in health status, resulting in lower cross subsidies from healthy to unhealthy individuals compared to a situation without a deductible option. The following sections report on an empirical analysis, which was aimed at indicating the remaining effect of self selection after risk equalization in both Switzerland and the Netherlands.

2.5 Data

The data were taken from an administrative database of a Swiss sickness fund and include medical expenditures and background information of insured older than 26 years in 1996. These insured were continuously enrolled during the period 1998-2003, starting with \( n = 197,120 \) and ending up with \( n = 134,758 \). The main reasons for drop-out were leaving to another region or leaving the country, switching to another insurance company and deaths.

The data distinguish between gross insurance claims, i.e. all expenditures known to the insurer, and the net insurance claims, i.e. the expenditures on top of the deductible. The gross insurance claims are divided into 11 categories of medical care, which are physician services, drugs from physicians, drugs from pharmacies, physiotherapy, laboratory analyses, inpatient hospital care, outpatient hospital care, health care at home, nursing home care, technical aids, and other. Available background information includes age, gender, region of residence, level of deductible and premiums, among others.

The analysis was based on the year 2003. In order to make the benefit package comparable to that in the Dutch basic health insurance, expenditures for nursing home care were not taken into account. Table 2.1 shows the percentage of insured with voluntary deductible in 2003. Notice that the voluntary deductibles of CHF 170, 370, 970 and 1,270 came on top of the mandatory deductible of CHF 230. Accordingly, the total deductible levels in 2003 were CHF 230, 400, 600, 1,200 and 1,500. Row I shows the average gross claims and row II shows the average net claims per deductible. Row III shows the average out-of-pocket expenditures

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9 Under the assumption that the risk equalization system equalizes all three types of expenditures considered in Section 2.3.
known to the insurer. Differences in gross claims between the insured with and without a voluntary deductible can be attributed to self-selection, differences in moral hazard and differences in unfiled claims. Unfiled claims occur when insured with a deductible do not send their bills to the insurance company when they expect no reimbursement.

Table 2.1 Descriptive results (currency = CHF, CHF 1 = € 0.65, 2006)

<table>
<thead>
<tr>
<th></th>
<th>230</th>
<th>230</th>
<th>230</th>
<th>230</th>
<th>230</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandatory deductible</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voluntary deductible $d$</td>
<td>0</td>
<td>170</td>
<td>370</td>
<td>970</td>
<td>1,270</td>
</tr>
<tr>
<td>Total deductible $x$</td>
<td>230</td>
<td>400</td>
<td>600</td>
<td>1,200</td>
<td>1,500</td>
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<tr>
<td>N (total=134,758)</td>
<td>53%</td>
<td>23%</td>
<td>8%</td>
<td>2%</td>
<td>13%</td>
</tr>
<tr>
<td>Actual premium rebate</td>
<td>0</td>
<td>170</td>
<td>367</td>
<td>877</td>
<td>1,116</td>
</tr>
<tr>
<td>I (Recorded) gross claims</td>
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<td>2,967</td>
<td>2,457</td>
<td>1,743</td>
<td>884</td>
</tr>
<tr>
<td>II Net claims</td>
<td>3,678</td>
<td>2,655</td>
<td>2,078</td>
<td>1,264</td>
<td>489</td>
</tr>
<tr>
<td>III Expenditures up to the total deductible $x$</td>
<td>196</td>
<td>312</td>
<td>379</td>
<td>479</td>
<td>395</td>
</tr>
</tbody>
</table>

2.6 Method and estimation results

The aim of the empirical analyses was to examine the remaining effect of self-selection after risk equalization. For this, the general equalization model described in Section 2.2.3 was used and (all of) the three types of expenditures considered in Section 2.3 were equalized. The analysis consisted of three steps. The first was to determine the three types of expenditures to be equalized. The second was to calculate the insurer’s equalization payments and the third was to compute the premium (rebate) for a policy with voluntary deductible $d$. Accordingly, the discrepancy between the premium rebate and the sum of average out-of-pocket expenditures and moral hazard reductions indicates the remaining effect of self-selection.

2.6.1 Step 1: Estimation of the three types of expenditures to be equalized

The analysis would have been less complex if the original data provided full information about the three types of expenditures to be equalized, i.e. net insurance claims, out-of-pocket expenditures due to $d$, and moral hazard reduction due to $d$. However, the only type of expenditures that could be obtained from the data directly was the net insurance claims. As discussed in Section 2.5, the recorded out-of-pocket expenditures were incomplete because of unfiled claims. The moral hazard reduction could not be obtained from the data directly because (apart from unfiled claims) differences in gross expenditures between insured with

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10 In fact, the insured in our data-set had a coinsurance of 10 percent and hotel-type expenses of CHF 10 per day during in-patient care. In our analyses these two types of user charges are ignored.
Risk equalization and voluntary deductibles

and without a deductible were probably also caused by self selection. In order to deal with
unfiled claims and the selection effect, the following procedure was used to estimate the out-
of-pocket expenditures and the moral hazard reduction:

A) estimate an expenditure model on the group of insured without a voluntary deductible;

B) predict expenditures of the insured with a voluntary deductible by combining their
characteristics with the coefficients obtained in step A;

C) calculate expected out-of-pocket expenditures using the results of step B;

D) calculate moral hazard reduction due to deductible \( d \) as the expected expenditures for
insured with deductible \( d \) (as obtained in step B) minus their net insurance claims (as
registered in the original data) and minus their expected out-of-pocket expenditures (as
obtained in step C).

The validity of this procedure will be discussed in Section 2.6.1.5.

2.6.1.1 Expenditure model

Expenditures of insured without a voluntary deductible were assumed to be recorded in full
by the insurer and, therefore, in the data. This seems to be plausible since only 18 percent
of these insured had expenditures below the mandatory deductible of CHF 230 and only 12
percent had no expenditures recorded at all. Expenditures were estimated using the two-part
model defined in equation (2.3). A logistic regression was used to estimate the first part. For
the estimation of the second part two basic options were considered, i.e. applying OLS to
the logarithm of expenditures and GLM with a log-link and several distributions. Regarding
the analysis, the first option has the important drawback that the predictions need to be
retransformed to monetary units (Duan et al., 1983). This is not the case with the second
option, which has the additional advantage that a distribution can be chosen, that fits the
data in a proper way (Manning and Mullahy, 2001). Finally, the second option was used in
our analysis. The distribution selected reflects how the variance is related to the mean. As
will be described below, \( E(Y) \) and its variance were finally used to estimate the out-of-pocket
expenditures which concentrate in the left tail of the distribution. Testing a normal, log-
normal, Poisson and Gamma distribution revealed that Gamma does best in estimating the
out-of-pocket expenditures in our data. The fit will be illustrated later on.

\[
E(Y)_i = p(Y_i > 0) \ast E(Y_i | Y_i > 0)
\]
For both parts of the model the explanatory variables were created out of the following information: age, gender, region, and the gross expenditures in three previous years. 14 variables were created to represent age/gender-groups, 9 variables were created to represent 9 different regions, and 30 variables were created for the log(gross expenditures +1) in years $t-1$, $t-2$, and $t-3$ separately for the 10 categories of medical care mentioned in Section 2.5. Appendix 1 shows the mean and standard deviation for both the dependent variable and for age, gender, and prior expenditures per level of deductible.

### 2.6.1.2 Expected expenditures

The coefficients obtained were used to predict the expenditures of those with $d > 0$ CHF. For insured with a deductible $d$ these predicted expenditures were on average - a fraction $F(d)_0$ - higher than the actual expenditures recorded by the insurer. Theoretically, this discrepancy can be the effect of moral hazard, unfiled claims, and unobserved differences in health status. In the remainder of the analysis we assume unobserved differences in health status to be absent. The validity will be discussed in Section 2.6.1.5.

During the years in our data, the deductible levels did not change. So, given $F(d)_0$, the actual expenditures in years $t-1$, $t-2$ and $t-3$ were probably affected by differences in moral hazard and unfiled claims as well. This could have biased the estimation of expected expenditures in year $t$, since prior expenditures were included in our model and most of the insured with voluntary deductible $d$ in year $t$ had the same level of deductible in previous years. We corrected for this by multiplying the actual expenditures in prior years with $1 + F(d)_0$. This further increased the relative difference in predicted and actual expenditures in year $t$, because, obviously, expenditures in $t-1$, $t-2$ and $t-3$ have a positive impact on (predicted) expenditures in year $t$. As a result, the predicted expenditures for insured with deductible $d$ were on average - a fraction $F(d)$, - higher than the actual expenditures. Accordingly, we multiplied the actual expenditures in prior years (as recorded in the data) with $1 + F(d)$, and so on. This iterative process converged after 8 steps, i.e.: $F(d)$ did not change anymore (for $s \geq 8$).

Under the assumption that unobservable risk factors are absent, the obtained estimate of $E(Y)_i$ can be seen as the expected expenditures of individual $i$ in a situation without a voluntary deductible (where no unfiled claims and no moral hazard reduction would have occurred). Row IV of table 2.2 shows the average expected expenditures per group of insured with voluntary deductible $d$. Accordingly, the difference in average expected expenditures between these groups is fully attributable to self selection.
2.6.1.3 Out-of-pocket expenditures

As a next step we wanted to predict expenditures below the deductible. Using the estimate of \( E(Y) \) and the associated coefficient of variation (= \( cv \) = standard deviation divided by mean), an estimate of the scale parameter \( k \) can be obtained via:

\[
(2.4) \quad k = 1/(cv)^2
\]

Given the estimate of \( k \), the expected expenditures of the insured with expenses below the deductible \( x \) can be calculated according to equation (2.5), derived by Van Vliet (1995, 2004).

\[
(2.5) \quad E(Y_i | Y_i < x) = E(Y)_i * \Gamma(c, k + 1) / \Gamma(c, k)
\]

with \( \Gamma(.) \) the cumulative density function of the gamma distribution with parameters \( c \) and \( k \) and with:

\[
(2.6) \quad c = x * \lambda, \text{ and } \lambda = k / E(Y)_i
\]

In the empirical analyses we needed an estimate of the expected out-of-pocket expenditures due to the voluntary part of the deductible, given deductible \( x \). To obtain this estimate we calculated, for the entire group of insured with deductible \( d \), the expected out-of-pocket expenditures due to the total deductible and the expected out-of-pocket expenditures due to the mandatory deductible of CHF 230. Out-of-pocket expenditures due to the total deductible \( x \) were estimated by equation (2.7), derived by Van Vliet (1995, 2004). The out-of-pocket expenditures due to the mandatory deductible were also estimated by equation (2.7), with \( x \) being replaced by CHF 230.

\[
(2.7) \quad E(OOPE)_{i,x} = E(Y)_i * \Gamma(c, k + 1) + x * (1 - \Gamma(c, k))
\]

\( E(OOPE)_{i,x} \) can be seen as the weighted sum of the expected out-of-pocket expenditures if the total expenditures are below \( x \) (= \( E(Y)_i * \Gamma(c, k + 1) / \Gamma(c, k) \)), defined in equation (2.5), and the out-of-pocket expenditures if the total expenditures exceed \( x \) (= \( x \)). Respectively, the weighting factors are \( \Gamma(c, k) \) and \( 1 - \Gamma(c, k) \), i.e. the probability that \( Y < x \) and the probability that \( Y > x \).

---

11 While \( x \) refers to total deductible, \( d \) refers to the voluntary part of deductibles (see table 2.1, line 2 and 3).
Row V and VI in table 2.2 show the expected out-of-pocket expenditures due to the mandatory deductible of CHF 230 and the expected out-of-pocket expenditures due to the total deductible $x$. Accordingly, the expected out-of-pocket expenditures due to voluntary deductible $d$ (row VII, table 2.2) were calculated as the difference between these two.

Table 2.2 Expected total expenditures and expected out-of-pocket expenditures (currency = CHF, CHF 1 = € 0.65, 2006)

<table>
<thead>
<tr>
<th></th>
<th>230</th>
<th>230</th>
<th>230</th>
<th>230</th>
<th>230</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandatory deductible</td>
<td>230</td>
<td>230</td>
<td>230</td>
<td>230</td>
<td>230</td>
</tr>
<tr>
<td>Voluntary deductible $d$</td>
<td>0</td>
<td>170</td>
<td>370</td>
<td>970</td>
<td>1,270</td>
</tr>
<tr>
<td>Total deductible $x$</td>
<td>230</td>
<td>400</td>
<td>600</td>
<td>1,200</td>
<td>1,500</td>
</tr>
<tr>
<td>IV</td>
<td>Expected expenditures $E(Y)$</td>
<td>3,876</td>
<td>3,351</td>
<td>2,929</td>
<td>2,136</td>
</tr>
<tr>
<td>V</td>
<td>Expected out-of-pocket expenditures due to mandatory deductible</td>
<td>195</td>
<td>188</td>
<td>172</td>
<td>147</td>
</tr>
<tr>
<td>VI</td>
<td>Expected out-of-pocket expenditures due to total deductible $x$</td>
<td>195</td>
<td>314</td>
<td>408</td>
<td>596</td>
</tr>
<tr>
<td>VII</td>
<td>Expected out-of-pocket expenditures due to voluntary deductible $d$</td>
<td>$= VI - V$</td>
<td>0</td>
<td>126</td>
<td>236</td>
</tr>
<tr>
<td>VIII</td>
<td>Unfiled claims</td>
<td>$= VI - III$</td>
<td>-1</td>
<td>2</td>
<td>29</td>
</tr>
</tbody>
</table>

As an aside, an estimate of the unfiled claims could be obtained by subtracting the actual recorded expenditures up to deductible $x$ (row III, table 2.1) from the expected out-of-pocket expenditure given deductible $x$ (row VI, table 2.2).\(^\text{12}\)

### 2.6.1.4 Expected moral hazard reduction

Having the actual net insurance claims and an estimate of the out-of-pocket expenditures, the last type of expenditures to be estimated was the moral hazard reduction due to deductible $d$. As argued above, we assumed $E(Y)_i$ to be the expenditures that insured would have had in a situation without a voluntary deductible. Under this assumption, an estimate of the moral hazard reduction due to deductible $d$ could be easily calculated as $E(Y)$ (row IV, table 2.2) minus the net insurance claims (row II, table 2.1) and minus the out-of-pocket expenditures due to the total deductible (row VI, table 2.2).

---

\(^{12}\) Unfiled claims will occur only if the total expenditures do not exceed the total deductible.
Table 2.3 Moral hazard reduction (currency = CHF, CHF 1 = € 0.65, 2006)

<table>
<thead>
<tr>
<th></th>
<th>230</th>
<th>230</th>
<th>230</th>
<th>230</th>
<th>230</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandatory deductible</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voluntary deductible d</td>
<td>0</td>
<td>170</td>
<td>370</td>
<td>970</td>
<td>1,270</td>
</tr>
<tr>
<td>Total deductible x</td>
<td>230</td>
<td>400</td>
<td>600</td>
<td>1,200</td>
<td>1,500</td>
</tr>
<tr>
<td>IX Absolute moral hazard reduction = IV - II -VI</td>
<td>3</td>
<td>382</td>
<td>443</td>
<td>276</td>
<td>318</td>
</tr>
<tr>
<td>X Relative moral hazard reduction = IX / IV</td>
<td>0.1%</td>
<td>11.4%</td>
<td>15.1%</td>
<td>12.9%</td>
<td>23.2%</td>
</tr>
</tbody>
</table>

The relative moral hazard reduction in the group of insured with deductible d could be calculated as the absolute moral hazard reduction (row IX, table 2.3) divided by $E(Y)$ (row IV, table 2.2). The results are in line with the findings of Newhouse (1993), Manning et al. (1987), Van Vliet (2004) and Gardiol (2006) described in Section 2.4.1. However, there is a remarkable result regarding the group of insured with deductible CHF 970. Since their deductible is higher than that of the insured with a voluntary deductible of CHF 370, one would expect to find a larger (relative) reduction in moral hazard. This inconsistency may be a result of the fact that the group of insured with voluntary deductible CHF 970 is relatively small.

2.6.1.5 Validity

The validity of the correction for self selection mainly depends on whether there are differences in health and risk that are not explained by the variables included in our model. The reduction in moral hazard was calculated as the expected expenditures $E(Y)$ minus the net insurance claims and minus the (expected) out-of-pocket expenditures. In the presence of unobserved differences in health and risk, the expected expenditures of those with a (high) deductible were probably overestimated, resulting in an overestimation of the moral hazard reduction. So, the estimated selection effect must be seen as a lower bound since it is exclusively based on observed differences in health and risk. However, the estimate of the moral hazard effect is in line with other empirical literature, as shown in Section 2.6.1.4.

The validity of the correction for unfiled claims mainly depends on the precision of the estimated out-of-pocket expenditures. To test this precision, we compared the predicted expenditures below x with the actual expenditures below x for the group of insured without a voluntary deductible. Table 2.4 shows that for each level of x the prediction closely agrees with the actual expenditures. The distribution test mentioned in Section 2.6.1.1 revealed that for the normal, log-normal and Poisson distribution the correspondence between the actual and predicted expenditures in these intervals was substantially poorer.

Another option to estimate the moral hazard reduction is to use existing empirical data (from the RAND-experiment, for instance). This would probably not have led to different outcomes since our current results are in line with existing literature.
Table 2.4 Actual and predicted expenditures < CHF x for the insured without a voluntary deductible

<table>
<thead>
<tr>
<th></th>
<th>Mean actual expenditures (std dev)</th>
<th>Mean predicted expenditures (std dev)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; CHF 230</td>
<td>196 (78)</td>
<td>195 (47)</td>
</tr>
<tr>
<td>&lt; CHF 400</td>
<td>331 (141)</td>
<td>329 (83)</td>
</tr>
<tr>
<td>&lt; CHF 600</td>
<td>482 (218)</td>
<td>478 (126)</td>
</tr>
<tr>
<td>&lt; CHF 1,200</td>
<td>877 (463)</td>
<td>873 (260)</td>
</tr>
<tr>
<td>&lt; CHF 1,500</td>
<td>1,048 (588)</td>
<td>1,045 (329)</td>
</tr>
</tbody>
</table>

2.6.2 Step 2: Calculation of the equalization payments

To calculate the equalization payments the data set was assumed to represent the entire population. In general terms, the Swiss and Dutch equalization systems calculate the equalization payment \( R \) for insured \( i \) in risk group \( j \) as the average expenditures to be equalized in risk group \( j \) minus the overall average expenditures to be equalized. In Switzerland the payments are calculated \( \text{ex-post} \), i.e. based on actual expenditures, while in the Netherlands they are calculated \( \text{ex-ante} \), i.e. based on predicted expenditures. For reasons of simplicity we followed the Swiss approach. However, it should be mentioned that this choice would not affect the conclusions of the analysis.

As mentioned above, all three types of expenditures discussed in Section 2.3 were equalized. This implies that the equalization payment \( R \) was calculated as the average sum of the net claims, out-of-pocket expenditures and moral hazard reduction in risk group \( j \) minus the average sum of these components in the whole population. The average per risk group was calculated by simple OLS, as is customary in real-life applications of risk equalization and adjustment. In practice, administrators of the Risk Equalization Fund cannot work with non-linear models to calculate predicted expenses, on which the equalization payments are based. The variables in the second column of table 2.5 were used as dummies.

Since the data do not contain information on PCG’s and DCG’s, proxies were constructed to indicate whether or not an insured would have been in a PCG or DCG. If expenditures for prescribed drugs in \( t-1 \) exceeded CHF 1,700 then insured were assumed to be in a PCG and if expenditures for inpatient care in \( t-1 \) exceeded CHF 7,000 insured were assumed to be in a DCG. These monetary thresholds were determined such that on average the same proportion of insured was in a PCG and DCG as in the Netherlands in 2006. Finally, five dummies were created for both PCG’s and DCG’s to indicate the expenditure level. As an illustration, table 2.5 shows the adjusted R-squares of the regressions for three sets of risk factors.
Table 2.5 Descriptive results of three risk equalization models

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>R-square</th>
<th>Mean</th>
<th>Std dev</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic</td>
<td>0.08</td>
<td>3,148</td>
<td>1,644</td>
<td>637</td>
<td>7,423</td>
</tr>
<tr>
<td>Demographic + approximated PCG’s</td>
<td>0.25</td>
<td>3,148</td>
<td>2,941</td>
<td>676</td>
<td>20,805</td>
</tr>
<tr>
<td>Demographic + approximated PCG’s and DCG’s</td>
<td>0.29</td>
<td>3,148</td>
<td>3,178</td>
<td>654</td>
<td>43,636</td>
</tr>
</tbody>
</table>

Notice that the current Swiss equalization model (2006) is comparable to the ‘demographic’-model with risk factors region, age and gender. The current Dutch model (2006) is comparable to the ‘demographic + approximated PCG and DCG’-model with risk factors region, age and gender, pharmacy costs in \( t-1 \), and hospital costs in \( t-1 \).

2.7 Results

The third step of the analysis was to calculate the potential premium rebate per deductible level and to examine whether or not there remains an effect of self selection. Under the assumption that the loading fee is the same for all the insured, the potential rebate for voluntary deductible \( d \) equals the difference in average insurer’s costs between those with \( d>0 \) and those with \( d=0 \). The insurer’s costs equal the net claims minus equalization payment. We speak of a potential rebate, since Swiss health insurers are restricted by law to set their rebates below the deductible amount.

2.7.1 Step 3: Calculation of the potential premium (rebate)

Table 2.6 shows the average net claims per deductible \( d \). Substantial differences can be observed between the insured with \( d=0 \) and those with \( d>0 \). In a competitive health insurance market the insurer will be forced to incorporate these differences into the insurance premium. If the potential rebate is calculated as the average insurer’s costs for insured without a voluntary deductible minus that of insured with deductible \( d \) then it equals CHF 3,189 (CHF 3,678 - CHF 489) for \( d = CHF 1,270 \), etc.

Table 2.6 Average net claims and potential premium rebates

<table>
<thead>
<tr>
<th></th>
<th>( d=0 ) CHF</th>
<th>( d=170 ) CHF</th>
<th>( d=370 ) CHF</th>
<th>( d=970 ) CHF</th>
<th>( d=1,270 ) CHF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actuarially fair</td>
<td>3,678</td>
<td>2,655</td>
<td>2,078</td>
<td>1,264</td>
<td>489</td>
</tr>
<tr>
<td>premium (net claims)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potential premium</td>
<td>0</td>
<td>1,023</td>
<td>1,600</td>
<td>2,414</td>
<td>3,189</td>
</tr>
<tr>
<td>rebate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In Section 2.4 we argued that, in actuarially fair terms, the premium rebate for a voluntary deductible in the Swiss and Dutch insurance schemes can consist of three components: out-of-pocket expenditures, moral hazard reduction and the effect of self selection. Comparing the results in table 2.6 with the estimated out-of-pocket expenditures and moral hazard reduction shown in tables 2.2 and 2.3 reveals that in the absence of risk equalization the effect of self selection would be enormous. For instance, the premium rebate of the highest deductible could be about 2.5 times the deductible amount, consisting of a self selection effect of 76%, moral hazard effect of 10%, and out of pocket payments of 14%. Under community-rated premiums, as present in Switzerland and the Netherlands, this would have two important consequences. First, cross subsidies between the healthy and the unhealthy will be lower than in a situation without voluntary deductibles since expenditure differences due to differences in health and risk can be reflected in the premium rebate. Second, cream skimming might occur since insurers will never offer a rebate of 2.5 times the deductible amount. With a restricted premium rebate the insured choosing a deductible will be profitable while those not choosing a deductible will be unprofitable.

In the presence of risk equalization the insurer receives a payment for the relatively high-risk enrollees and contributes a payment for the relatively low risks. Obviously, the variance of these payments depends on the number and quality of risk factors included in the equalization model. Because of differences in health status and risk, the payment received by the insurer is larger for the group of insured without a voluntary deductible than for the group of insured with a voluntary deductible, as shown in table 2.7. If better risk factors are included then a larger part of the differences in risk will be reflected in these payments.

### Table 2.7 Average equalization payments per level of voluntary deductible for three risk equalization models

<table>
<thead>
<tr>
<th>Risk Equalization Model</th>
<th>d=0 CHF</th>
<th>d=170 CHF</th>
<th>d=370 CHF</th>
<th>d=970 CHF</th>
<th>d=1,270 CHF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Demographic + approximated PCG’s</td>
<td>274</td>
<td>-102</td>
<td>-55</td>
<td>-91</td>
<td>-878</td>
</tr>
<tr>
<td>Demographic + approximated PCG’s and DCG’s</td>
<td>478</td>
<td>-181</td>
<td>-341</td>
<td>-616</td>
<td>-1,286</td>
</tr>
<tr>
<td>Demographic + approximated PCG’s and DCG’s</td>
<td>491</td>
<td>-188</td>
<td>-348</td>
<td>-637</td>
<td>-1,318</td>
</tr>
</tbody>
</table>

As a result of these payments the insurer’s costs increase for insured with a voluntary deductible and decrease for insured without a voluntary deductible, as shown in table 2.8. If risk equalization takes into account age/gender, region, PCG’s and DCG’s, the insurer’s costs drop from CHF 3,678 to CHF 3,187 for insured with \( d = CHF \ 0 \) and increase from CHF 489 to CHF 1,807 for insured with \( d = CHF \ 1,270 \).
Table 2.8 Average insurer’s costs per level of voluntary deductible for three risk equalization models

<table>
<thead>
<tr>
<th></th>
<th>$d=0$ CHF</th>
<th>$d=170$ CHF</th>
<th>$d=370$ CHF</th>
<th>$d=970$ CHF</th>
<th>$d=1,270$ CHF</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>3,678</td>
<td>2,655</td>
<td>2,078</td>
<td>1,264</td>
<td>489</td>
</tr>
<tr>
<td>Demographic</td>
<td>3,404</td>
<td>2,757</td>
<td>2,133</td>
<td>1,355</td>
<td>1,367</td>
</tr>
<tr>
<td>Demographic + approximated PCG’s</td>
<td>3,200</td>
<td>2,836</td>
<td>2,419</td>
<td>1,880</td>
<td>1,775</td>
</tr>
<tr>
<td>Demographic + approximated PCG’s and DCG’s</td>
<td>3,187</td>
<td>2,843</td>
<td>2,426</td>
<td>1,901</td>
<td>1,807</td>
</tr>
</tbody>
</table>

Obviously, the potential rebates decrease with better risk equalization, as shown in table 2.9.

Table 2.9 Potential premium rebate for deductible $d$ after risk equalization

<table>
<thead>
<tr>
<th></th>
<th>$d=0$ CHF</th>
<th>$d=170$ CHF</th>
<th>$d=370$ CHF</th>
<th>$d=970$ CHF</th>
<th>$d=1,270$ CHF</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>0</td>
<td>1,023</td>
<td>1,600</td>
<td>2,414</td>
<td>3,189</td>
</tr>
<tr>
<td>Demographic</td>
<td>0</td>
<td>647</td>
<td>1,271</td>
<td>2,049</td>
<td>2,037</td>
</tr>
<tr>
<td>Demographic + approximated PCG’s</td>
<td>0</td>
<td>364</td>
<td>781</td>
<td>1,320</td>
<td>1,425</td>
</tr>
<tr>
<td>Demographic + approximated PCG’s and DCG’s</td>
<td>0</td>
<td>344</td>
<td>761</td>
<td>1,286</td>
<td>1,380</td>
</tr>
</tbody>
</table>

However, comparing the previous tables with tables 2.2 and 2.3 reveals that even if region, age/gender, PCG’s and DCG’s are included, the potential rebates for $d = \text{CHF} 970$ and $d = \text{CHF} 1,270$ are substantially higher than the sum of the out-of-pocket expenditures and moral hazard reduction. For $d = \text{CHF} 970$ the difference equals CHF 561 (i.e. $1,286 - (449 + 276)$) and for CHF $d = 1,270$ it equals CHF 630 (i.e. $1,380 - (432 + 318)$). This indicates that a substantial effect of self selection remains. It should be mentioned that this indication is just a lower bound. The reason is found in Section 2.6.1.5. In the presence of unobserved risk factors the reduction in moral hazard is probably overestimated, resulting in an underestimation of the remaining effect of self selection.

2.7.2 Including the ‘level of voluntary deductible’ as a risk factor

Incentives for cream skimming and a loss of cross subsidization (compared to a situation without voluntary deductibles) will be reduced by improvements in the equalization system. One way to avoid these two consequences is to include the level of deductible as a risk factor in the equalization model. In that case the model will perfectly adjust for differences in expenditures to be equalized. Self selection would then have no effect on the premium (rebate).
However, if the level of deductible is included as a risk factor then the conclusion of Section 2.3 becomes more relevant. When all three types of expenditures are equalized then the potential rebate for voluntary deductible $d$ will be a full reflection of the (expected) out-of-pocket expenditures and the moral hazard reduction due to deductible $d$, as shown in table 2.10. If out-of-pocket expenditures and moral hazard reduction are not equalized, they cannot be incorporated into the premium rebate. This implies that if just the net insurance claims are equalized, the potential rebates will equal zero, as illustrated in figure 2.2.

Table 2.10 Potential premium rebate (= VII in table 2.2 + IX in table 2.3) with $d$ as a risk factor in the risk equalization model

<table>
<thead>
<tr>
<th>Demographic + approximated PCG’s and DCG’s + $d$</th>
<th>$d=0$ CHF</th>
<th>$d=170$ CHF</th>
<th>$d=370$ CHF</th>
<th>$d=970$ CHF</th>
<th>$d=1,270$ CHF</th>
</tr>
</thead>
<tbody>
<tr>
<td>$d=0$ CHF</td>
<td>0</td>
<td>508</td>
<td>679</td>
<td>725</td>
<td>750</td>
</tr>
<tr>
<td>$d=170$ CHF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$d=370$ CHF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$d=970$ CHF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$d=1,270$ CHF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.8 Conclusion and discussion

In Switzerland and the Netherlands the option to take a voluntary deductible raises two important questions regarding the risk equalization system. The first is ‘What are the effects of equalizing different types of expenditures?’ In the presence of a voluntary deductible, three types of expenditures can be equalized, i.e. the net insurance claims, out-of-pocket expenditures, and expenditure savings due to moral hazard reduction. If risk equalization explains all of the variance in choice of deductible, which will be the case if the level of deductible is included as a risk factor in the equalization model, then equalizing just the net insurance claims prevents insurers from incorporating out-of-pocket expenditures and moral hazard reduction due to deductible $d$ into the premium rebate for deductible $d$. If risk equalization explains some (but not all) of the variance in choice of deductible, which will probably be the case when the level of deductible is not included as a risk factor in the equalization model, then equalizing just the net insurance claims will also confront insurers with incentives for cream skimming. We conclude that both consequences can be avoided by equalizing the out-of-pocket expenditures and moral hazard reduction as well.

The second question is ‘What are the consequences of self selection?’. Self selection occurs because within each premium-risk group healthy individuals have a stronger incentive to opt for a deductible than unhealthy individuals. As a result of self selection the average expenditures will be lower for insured with a high deductible than those with a low (or no) deductible. In a competitive market the insurer is forced to reflect these differences in the premium rebates for deductibles. We conclude that in the absence of risk equalization the premium rebate in our data could far exceed the deductible amount due to a large selection effect. Risk equalization substantially reduces the potential rebates since expenditure differences due to differences in health risk are (partly) adjusted for via the equalization payments. However, we conclude that even a sophisticated equalization model, which takes
into account region, age and gender, PCG’s and DCG’s as risk factors, does not fully adjust for self selection. This implies that in both Switzerland and the Netherlands, differences in health status between the insured with a voluntary and those without a deductible can (partly) be incorporated into the premium structure, which is in conflict with the aim of risk equalization to realize cross subsidies between the healthy and the unhealthy. In order to increase these cross subsidies the level of deductible could be included as a risk factor in the equalization model. However, this makes it even more important to equalize all three types of expenditures discussed above.

A substantial effect of self selection on the (potential) premium rebates leads to a reduction of cross subsidies from the healthy to the unhealthy insured. In order to protect cross subsidization, the Swiss government has put limits on the actual rebates. Our results show that these limits are not the best way to achieve cross subsidization because of an adverse effect. This is illustrated by the results in table 2.9, which reveals that the potential premium rebate (after risk equalization according to region, age/gender) for a voluntary deductible of CHF 1,270 equals CHF 2,037. This implies that even if government equals the limit to the deductible amount, the insured with the highest deductible are on average more profitable to the insurer than those without a deductible. With a view to the actual rebates (table 2.1), this was the case in Switzerland in 2003, which is a strong incentive for cream skimming.

A way to increase cross subsidization without this adverse effect is to improve risk equalization. However, our results show that even if risk equalization is based on region, age/gender and medical information, which is the case in the Netherlands (in 2006), it does not perfectly adjust for self selection. This could be an important motive for governments to include the level of deductible as a risk factor in the equalization model. If this new risk factor is to be included then it is even more important that all three types of expenditures are equalized. To include all these expenditures, information must be available on the out-of-pocket expenditures and the moral hazard reduction.

If the level of deductible is actually included as a risk factor, the premium rebates will be lower since differences in health status are then adjusted for via the equalization payments. While this increases cross subsidization, it also leads to a lower number of insured opting for a deductible and less moral hazard reduction (Van Kleef et al., 2006). Thus, from a cost control perspective it is better to have some effect of self selection on the premium rebate, resulting in a larger number of insured taking a deductible and probably a larger moral hazard reduction. Thus, the choice whether or not to improve risk equalization by including the level of deductible as a risk factor can be considered as a trade-off between moral hazard and the level of cross subsidization between the healthy and unhealthy insured.
2.9 References

Bakker FM, Vliet RCJA van, Ven WPMM van de. Deductibles in health insurance: can the actuarially fair premium rebate exceed the deductible? Health Policy 2000; 53; 123-141.


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Appendix 2.1

Table 2.11 shows how the mean and standard deviation of the outcome variable (gross expenditures) and explanatory variables age, gender and prior expenditures differ across the five levels of deductible. For reasons of privacy the information on prior expenditures is not shown for each of the 10 categories of medical care used in our model. For the same reason information on region of residence is not included.

<table>
<thead>
<tr>
<th></th>
<th>$d=0$ CHF</th>
<th>$d=170$ CHF</th>
<th>$d=370$ CHF</th>
<th>$d=970$ CHF</th>
<th>$d=1,270$ CHF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (std dev)</td>
<td>Mean (std dev)</td>
<td>Mean (std dev)</td>
<td>Mean (std dev)</td>
<td>Mean (std dev)</td>
</tr>
<tr>
<td><strong>Gross expenditures</strong></td>
<td>3,874 (7,422)</td>
<td>2,967 (6,298)</td>
<td>2,457 (5,888)</td>
<td>1,743 (5,927)</td>
<td>884 (2,732)</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>59 (16)</td>
<td>57 (14)</td>
<td>54 (14)</td>
<td>53 (14)</td>
<td>48 (11)</td>
</tr>
<tr>
<td><strong>Gender = male</strong></td>
<td>0.40 (0.49)</td>
<td>0.41 (0.49)</td>
<td>0.47 (0.50)</td>
<td>0.56 (0.50)</td>
<td>0.57 (0.50)</td>
</tr>
<tr>
<td><strong>Gross expenditures $t-1$</strong></td>
<td>3,499 (6,563)</td>
<td>2,726 (5,418)</td>
<td>2,276 (5,673)</td>
<td>1,494 (4,577)</td>
<td>783 (2,438)</td>
</tr>
<tr>
<td><strong>Gross expenditures $t-2$</strong></td>
<td>3,247 (5,820)</td>
<td>2,470 (4,657)</td>
<td>2,020 (4,311)</td>
<td>1,357 (3,605)</td>
<td>739 (2,014)</td>
</tr>
<tr>
<td><strong>Gross expenditures $t-3$</strong></td>
<td>3,011 (5,648)</td>
<td>2,284 (4,193)</td>
<td>1,856 (4,030)</td>
<td>1,279 (3,391)</td>
<td>717 (1,751)</td>
</tr>
</tbody>
</table>
Richard van Kleef (1980) graduated in Health Policy and Management with his master thesis about voluntary deductibles in social health insurance. The last chapter of his thesis represented a proposal for PhD-research, which was approved in December 2003. After graduation, Richard started working at the Institute of Health Policy and Management of the Erasmus University Rotterdam. From 2004 to 2008, he carried out his PhD-project and published his papers in the *Journal of Health Economics* (2), the *Journal of Risk and Insurance* (1), the *International Journal on Health Care Finance and Economics* (1) and *Economische Statistische Berichten* (3). In addition, he presented his work at international conferences, including the European Conferences on Health Economics in 2004 (London) and 2006 (Budapest), the conferences of the International Health Economics Association in 2005 (Barcelona) and 2007 (Copenhagen) and the conference of the American Society of Health Economists in 2008 (Durham, NC, United States). In 2006, Richard became a member of the Risk Adjustment Network (RAN) and presented his work at RAN-meetings in Berlin (2006), Ostend (2007) and Dublin (2008). After the completion of his dissertation, his research at Erasmus continued to focus on cost sharing and risk equalization.