Risk equalization and voluntary deductibles: a complex interaction

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ABSTRACT: In the Swiss and Dutch basic health insurance the option of a voluntary deductible has important consequences for the respective risk equalization schemes. With such a deductible three types of expenditures can be equalized: the net claims that are reimbursed by the insurer, the out-of-pocket expenditures and the expenditure savings due to less moral hazard. In a theoretical analysis we conclude that equalizing just the net claims, as is the case in Switzerland (in 2006), creates incentives for cream skimming and prevents insurers from incorporating out-of-pocket expenditures and moral hazard reductions into their premium structure. In an empirical analysis concerned with the effect of self-selection we conclude that the current (2006) risk equalization models in Switzerland and the Netherlands do not fully adjust for ex-ante differences in health status between those who choose a deductible and those who do not. The paper discusses how this may lead to incentives for cream skimming and a reduction in cross-subsidization between the healthy and unhealthy compared to a situation without voluntary deductibles.

Keywords: health insurance, risk equalization, deductibles, cross-subsidization, self-selection

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1. Introduction

In Switzerland and the Netherlands residents are obliged to obtain basic health insurance. In both countries a risk equalization[1] system has been implemented and risk-bearing 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 the costs up to a certain amount themselves in return for a premium rebate. This deductible option raises two important questions regarding the risk equalization system.

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[1] I.e. risk adjustment.

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[2]. The reason is that variation in these claims is *purely* caused by differences in health and risk. In practice, 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[3]. 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 also attributable to differences in out-of-pocket expenditures and differences in moral hazard (reduction). If in such a situation just the net claims are equalized, as is currently (2006) the case in Switzerland, then out-of-pocket expenditures and moral hazard reductions due to voluntary deductibles 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 these 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 *ex-ante* health and risk. In the absence of risk equalization, competing insurers are forced to incorporate these expenditure differences into the premium structure. In such a situation, the premium rebate for a deductible, i.e. the difference in premium to be paid between the insured with a deductible and those without a deductible, will reflect differences in ex-ante health status. In the presence of risk equalization, the effect of self-selection on the premium rebate will be smaller since the expenditure differences due to the variation in health and risk are (partly) adjusted for via the equalization

[2] The net insurance claims are defined as the costs that are actually reimbursed. Henceforth, these costs 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. But this detail is not relevant for the analyses and conclusions in this paper.

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.

The paper is structured as follows. Section two provides a brief description of the Swiss and Dutch basic health insurance schemes and their risk equalization systems. Section three is concerned with the first question mentioned above and theoretically considers the consequences of equalizing different types of expenditures. After that, the paper focuses on the second question and reports an empirical study aimed at examining the extent to which the current Swiss and Dutch equalization systems adjust for self-selection. Finally, Section eight summarizes and discusses the conclusions.

2. Risk equalization in Switzerland and The Netherlands

The Dutch and Swiss mandatory basic health insurances have many similarities. However, there are important differences with respect to funding, cost sharing and risk equalization.

2.1 Switzerland

Since the Revised Health Insurance Law came into force in January 1996, all Swiss residents must have individual basic health insurance. There is open enrollment, which means that Swiss 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 cost for this package is financed by the insurance premium and 15 percent is financed by cost sharing. The insurance premium is

community-rated per insurer, region and age group (0-18, 19-25 and >25) and is paid directly to the insurer.

There is cost sharing in the form of individual deductibles starting from a mandatory minimum called *franchise ordinaire* (FO). The insured can get a premium rebate by opting for a higher deductible called *franchise à option* (FAO). The federal government has put upper limits on the premium rebate. 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 the mandatory deductible were CHF 170, 370, 970 and 1,270 per person per year. Children (under 18 years of age) are exempted from mandatory deductibles and their voluntary deductible options are all lower then the options for adults and are seldom chosen.

To neutralize different starting positions of the competing social insurers when open enrollment started in 1996 and to avoid preferred risk selection in principle, government implemented risk equalization. Every region has its own equalization system, which equalizes the net insurance claims and takes into account (only) two characteristics, i.e. age and gender. The insurer's ex-post 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 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 package costs is financed by income-related contributions. These contributions are paid into in the Risk Equalization Fund (REF), out of which the insurers receive equalization payments. About 45 percent of the costs are financed by the nominal insurance premiums. These nominal 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 pays the costs for children up to the age of 18 (into the REF) since children are exempted from paying insurance premiums.

If an individual insured (older than 17) has no insurance claim in a certain year, he gets 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 equalization model for 2006 is based on cost information of the year 2003. For the minority of insured who had a deductible in 2003, the claims are adjusted for both moral hazard reduction and unfiled claims. The latter occur when insured, who do not exceed the deductible in a certain year, do not send the bills to the insurance company. The following risk factors are included in the risk equalization model: age interacted with gender, region, source of income, pharmacy-based cost groups (PCGs), and diagnostic-based cost groups (DCGs). For a detailed description about the use and 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 x, with x a fixed amount which is the same for all insured. The payment can be either positive or negative. Ideally, according to government, the deficit between the payment and the (expected) claims (from the

[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.

insurers perspective) is equal for all insured. This deficit has to be covered by the nominal premium. If risk equalization is "perfect" then the insurers have no incentives for preferred risk selection. As insurers are not able to 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[6]. We will not discuss this in further detail since risk sharing is irrelevant for this paper.

2.3 A simplified equalization model

To answer the two questions raised in Section 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.

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 just 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.

3.1 A conceptual framework

Figure 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

[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.

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.

At a certain moment risk equalization is introduced in order to organize 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 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 1]

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[7]. Notice that this regulation is currently (2006) found in Switzerland and the Netherlands. 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 less moral hazard (i.e. moral hazard reduction) of € 200. Consequently, their average net claims drop to € 500. As shown in figure 2, the overall average net claims drop from € 1,500 to € 1,250. If risk equalization is (still) based on

[7] Thus, premiums can be differentiated only according to the level of deductible (i.e. yes/no deductible).

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 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 reduction in moral hazard.

[Figure 2]

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 costs 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 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 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 3]

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 NET, the out-of-pocket expenditures OOPE and moral hazard reduction RMH. If all three types are included then risk equalization payment R for individuals in risk group j equals:

$$R_j = (\overline{NET}_j + \overline{OOPE}_j + \overline{RMH}_j) - (\overline{NET} + \overline{OOPE} + \overline{RMH}) \quad (1)$$

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).

$$R_j = (\overline{NET}_j - \overline{NET}) + (\overline{OOPE}_j - \overline{OOPE}) + (\overline{RMH}_j - \overline{RMH}) \quad (2)$$

Applying equation (2) to the situation of figure 3 shows that the total equalization payment of € -500 for individuals in risk group A is composed of € -750 $(\overline{NET}_A - \overline{NET})$, € 150 $(\overline{OOPE}_A - \overline{OOPE})$ and € 100 $(\overline{RMH}_A - \overline{RMH})$. The total equalization payment of € 500 for individuals in risk group B is composed of € 750, € -150 and € -100, respectively.

3.3 Incentives for cream skimming

In the scenario of section 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 4, equalizing *just* the net claims has a second effect (next to the effect discussed in Section 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 * € 1,625 + 2/3 * € 1,375) [8] to the insured 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 is an incentive for cream skimming. These incentives will not occur when out-of-pocket expenditures and moral hazard reductions are equalized as well

[Figure 4]

Notice that the premium rebate equals € 333 (€ 1,458 - € 1,125). Apparently, 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.

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 defined in the risk equalization system. An example is shown in figure 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

[8] In the group of insured without a deductible 1/3 is of risk type A and 2/3 of is of risk type B.

moral hazard reductions would have no effect on the total equalization payment R_j since

$\overline{\text{OOPE}}_j - \overline{\text{OOPE}} = 0$ and $\overline{\text{RMH}}_j - \overline{\text{RMH}} = 0$ for both risk groups.

[Figure 5]

3.5 Conclusion

We conclude that in a situation with 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) reflect out-of-pocket expenditures and moral hazard reductions in 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 defined 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.

4. Implications of self-selection

In the presence of a consumer information surplus or a ban on premium differentiation according to health risk, a deductible option may lead to 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., 2005; Beck, 2004). In this section the consequences of self-selection are discussed for situations *with* risk equalization and *without* risk equalization.

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 the costs 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 stop-loss, 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 cost sharing 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. (2005) have found that deductibles of CHF 970 (€ 580, 2006) and CHF 1,270 (€ 760, 2006) in the Swiss basic health insurance resulted in cost 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 insurances 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 and premium differentiation, 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.

4.2 With risk equalization

The effect of self-selection on premium differentiation 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[9]. If not, then it can also be based on differences in health status, resulting in lower cross-subsidies between the healthy and the unhealthy compared to a situation without a deductible option. Thus, on the one hand better risk equalization leads to higher cross-subsidies. On the other hand it may lead to lower premium rebates, fewer insured opting for a deductible and less moral hazard reduction. The following sections report of an empirical analysis, which was aimed at indicating the remaining effect of self-selection after risk equalization in both Switzerland and the Netherlands.

[9] Under the assumption that the risk equalization system equalizes all three types of expenditures considered in Section 3.

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 1 shows the percentage of insured with voluntary deductible d 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[10] per deductible. Row III shows the average out-of-pocket expenditures 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 not to be reimbursed.

[Table 1]

[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 forms of co-payment are ignored.

6. Method and estimation results

The aim of the empirical analyses was to examine the remaining effect of self-selection after risk equalization in both Switzerland and the Netherlands. For this, the general equalization model described in Section 2.3 was used and (all of) the three types of expenditures considered in Section 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 after risk equalization.

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 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 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 the expenditures of the insured *with* a voluntary deductible by combining their characteristics with the coefficients obtained in A;

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

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

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 reasonable 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 (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, $E(Y)_i$ and its variance were finally used to estimate the out-of-pocket expenditures that concentrate in the left tail of the distribution. Testing a normal, log-normal, Poisson and Gamma distribution revealed that Gamma is the best in estimating the out-of-pocket expenditures in our data. The fit will be illustrated later on.

$$E(Y)_i = p(Y_i > 0) * E(Y_i \mid Y_i > 0) \quad (3)$$

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 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.

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. However, unobserved differences in health status are expected not to be significant, since differences in health and risk are sufficiently captured by including prior expenditures of three preceding years in our model differentiating as well into ten types of expenditures (see also section 6.1.5). In the remainder of the analysis unobserved differences in health status are assumed to be absent.

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 increasing the actual expenditures in prior years by $1+F(d)_0$. 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 $F(d)_1$ - higher than the actual expenditures. Accordingly, we increased the actual expenditures in prior years (as recorded in the data) by $1+F(d)_1$, and so on. This iterative process converged after 8 steps, i.e.: $F(d)_s$ did not change anymore (for $s \geq 8$).

Accordingly, 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 shows the average expected expenditures per group of

insured with voluntary deductible d. Thus, the difference in average expected expenditures between these groups are fully attributable to self-selection.

6.1.3 Out-of-pocket expenditures

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

$$k = 1/(cv)^2 \quad (4)$$

Given the estimate of k, the expected expenditures of the insured with expenses below the deductible x can be calculated according to equation (5), derived by Van Vliet (1995, 2004)[11].

$$E(Y_i | Y_i < x) = E(Y)_i * \Gamma(c, k+1) / \Gamma(c, k) \quad (5)$$

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

$$c = x * \lambda, \text{ and } \lambda = k / E(Y)_i \quad (6)$$

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 (7), derived by Van Vliet (1995, 2004). The out-of-pocket expenditures due to the mandatory deductible were also estimated by equation (7), with x being replaced by CHF 230.

[11] While x refers to total deductible, d refers to the voluntary part of deductibles (see table 1, line 2 and 3).

$$E(OOPE)_{i,x} = E(Y)_i * \Gamma(c, k+1) + x * (1 - \Gamma(c, k)) \quad (7)$$

$E(OOPE)_{i,x}$ 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 (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 $Y > x$.

Row V and VI in table 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) were calculated as the difference between these two.

[Table 2]

As an aside, an estimate of the unfiled claims could be obtained by subtracting the expected out-of-pocket expenditure given deductible x (row VI, table 2) by the actual recorded expenditures up to deductible x (row III, table 1)[12].

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, $E(Y)_i$ can be seen as the expenditures that insured would have had in a situation *without* a voluntary deductible. Accordingly, an estimate of the moral hazard reduction due to deductible d could be easily calculated as $E(Y)$ (row IV, table 2) minus the net insurance claims (row II, table 1) and minus the out-of-pocket expenditures due to the total deductible (row VI, table 2).

[12] Unfiled claims will occur only if the total expenditures do not exceed the total deductible.

[Table 3]

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 3) divided by $E(Y)$ (row IV, table 2). This relative moral hazard reduction is fairly in line with the findings of Newhouse (1993), Manning et al. (1987), Van Vliet (2004) and Gardiol (2005) described in Section 4.1. However, there is a remarkable result regarding the group of insured with d = 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.

6.1.5 Validity

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 to the *actual* expenditures below x for the group of insured *without* a voluntary deductible. Table 4 shows that for each level of x the prediction closely agrees with the actual expenditures. The distribution test mentioned in Section 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.

[Table 4]

The validity of the correction for self-selection mainly depends on whether or not 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 reduction in moral hazard. So, the

estimated selection-effect must be seen as a lower bound since it is exclusively based on *observed* differences in health and risk.

Two findings indicate that the effect of unobserved risk factors (not explained by our model) is low. First, the estimate of the moral hazard effect is in line with other empirical literature, as shown in Section 6.1.4[13]. Second, a study on self-selection by Van de Ven and Van Vliet (1995) showed that age, gender, region and prior costs explained 75 percent of the difference in expenditures between two groups of Dutch insured, which were distinguished by the stated preference for a deductible- or no-deductible plan. In their set of explanatory variables "prior costs" was incorporated in the form of a dummy indicating non-zero prior-year's costs and the logarithm of positive costs (+1). Given that our model incorporated "prior costs" separately for 10 categories of medical care and separately for three years, it is expected to leave little room for an effect of unobserved risk factors.

6.2 Step 2: Calculation of the equalization payments

To calculate the equalization payments the set of data 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 *ex-post*, i.e. based on actual expenditures, while in the Netherlands they are calculated *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 3 were equalized. This implies that the equalization payment R_j was calculated as the average sum of the net claims, out-of-pocket expenditures and moral hazard reduction in risk group j minus the overall average sum of

[13] 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.

these components. 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 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 costs of *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 is in a PCG and DCG as is currently the case in the Netherlands. Finally, five dummies were created for both PCG's and DCG's to indicate the expenditure level. As an illustration, table 5 shows the adjusted R-squares of the regressions for three sets of risk factors.

[Table 5]

Notice that the current Swiss equalization model (2006) is comparable to the "demographic"-model with risk factors *region* and *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*.

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. We speak of a

potential rebate, since Swiss health insurers are restricted by law to set their rebates below the voluntary deductible amount.

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

Table 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 calculate 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 6]

In Section 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 6 with the estimated out-of-pocket expenditures and moral hazard reduction shown in tables 2 and 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%. With community-rated premiums, as is currently found 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 (ex-ante) 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. Consequently, 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 7. If better risk factors are included then a larger part of the differences in risk will be reflected in these payments.

[Table 7]

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 8. If risk equalization takes into account *age/gender*, *region*, *PCG's* and *DCG's*, the insurer's costs drops from CHF 3,678 to CHF 3,187 for insured with d = CHF 0 and increases from CHF 489 to CHF 1,807 for insured with d = CHF 1,270.

[Table 8]

Obviously, the potential rebates decrease with better risk equalization, as shown in table 9.

[Table 9]

However, comparing the previous tables with tables 2 and 3 reveals that even if *region*, *age/gender*, *PCG's* and *DCG's* are included, the potential rebates for d = CHF 970 and d = CHF 1,270 are substantially higher than the sum of the out-of-pocket expenditures and moral hazard reduction. For d = 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 there still is a substantial effect of self-selection. It should be mentioned that this indication is just a lower bound. The reason is found in

Section 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 found above.

7.2 Including the "level of voluntary deductible" as a risk factor

Incentives for cream skimming and a loss of cross-subsidies (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 the 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 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 10. However, for both the out-of-pocket expenditures and moral hazard reduction it holds that if they 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.

[Table 10]

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 due to the voluntary deductible and expenditure savings due to less moral hazard because of a voluntary deductible. 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 due to a voluntary deductible 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. If risk equalization takes into account *region*, *age and gender* only, as is currently the case in Switzerland, the remaining effect of self-selection is substantially larger. This implies that in both Switzerland and the Netherlands, differences in (ex-ante) 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 (ex-ante) healthy and the (ex-ante) 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 maintain a certain level of cross-subsidization, the Swiss government has put limits on the actual rebates. Our results show that these limits are not the best way to realize cross-subsidization because of an adverse effect. This is illustrated by the results table 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 1), this was the case in Switzerland in 2003, which is a strong incentive for cream skimming.

Another way to increase cross-subsidies 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 currently the case in the Netherlands, 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 more 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 a trade-off between moral hazard and the level of cross-subsidization between the healthy and unhealthy insured.

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Appendix 1

Table 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 11]

Table and figures

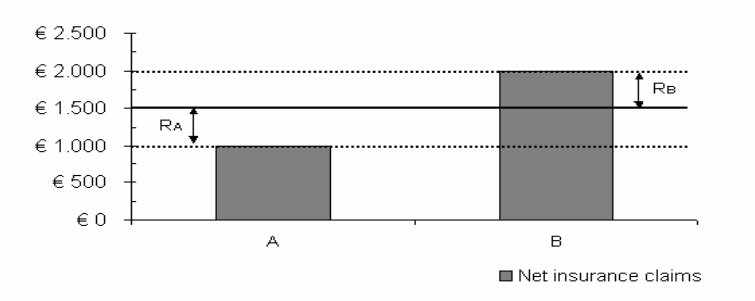

Figure 1Equalizing the net claims when insured have the same coverage

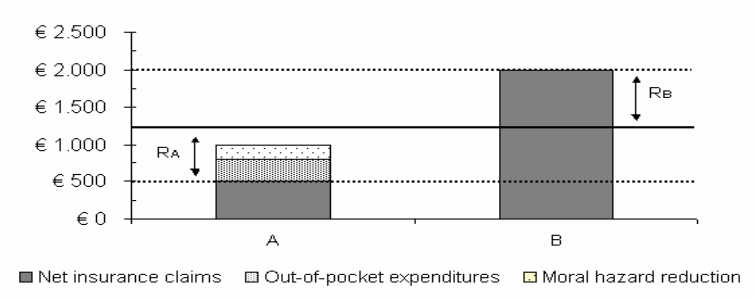

Figure 2 Equalizing the net claims in a situation *with* a deductible option

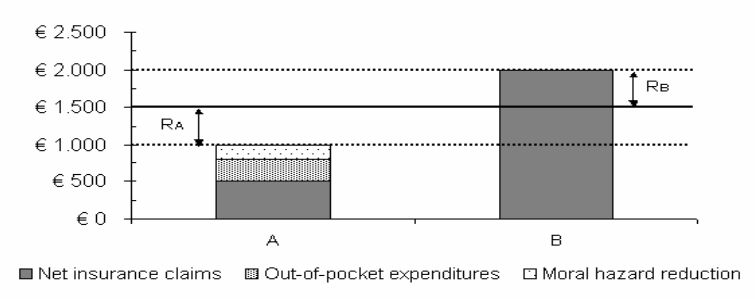

Figure 3Equalizing the net claims, out-of-pocket expenditures and moral hazard reduction in a situation with a deductible option

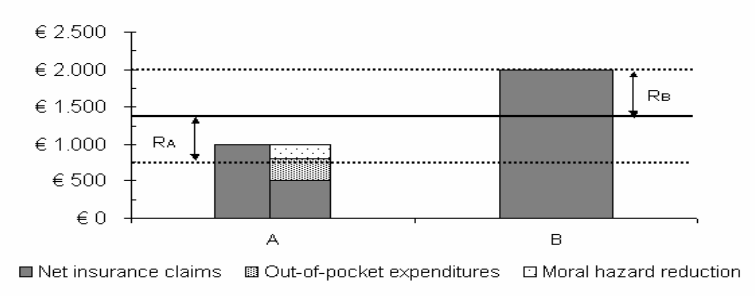

Figure 4 Equalizing the net claims when the risk equalization model explains *some* of the variance in choice of deductible

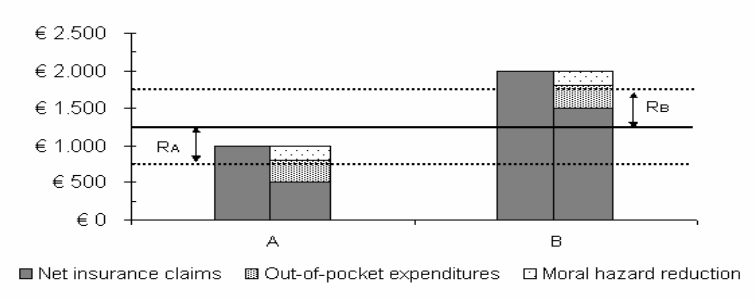

Figure 5 Equalizing the net claims in an exceptional situation where the average out-of-pocket expenditures and moral hazard reduction are the same in all risk groups defined by the equalization system

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

	Mandatory deductible	**230**	**230**	**230**	**230**	**230**
	Voluntary deductible d	**0**	**170**	**370**	**970**	**1,270**
	Total deductible x	**230**	**400**	**600**	**1,200**	**1,500**
	N (total=134,758)	53%	23%	8%	2%	13%
	Actual premium rebate	0	170	367	877	1,116
I	**(Recorded) gross claims**	3,874	2,967	2,457	1,743	884
II	**Net claims**	3,678	2,655	2,078	1,264	489
III	**Costs up to the total deductible x**	196	312	379	479	395

Table 2 Expected total expenditures and expected out-of-pocket expenditures (currency = CHF, CHF 1 = € 0.65, 2006)

	Mandatory deductible		**230**	**230**	**230**	**230**	**230**
	Voluntary deductible d		**0**	**170**	**370**	**970**	**1,270**
	Total deductible x		**230**	**400**	**600**	**1,200**	**1,500**
IV	**Expected expenditures E(Y)**		3,876	3,351	2,929	2,136	1,373
V	**Expected out-of-pocket expenditures due to mandatory deductible**		195	188	172	147	134
VI	**Expected out-of-pocket expenditures due to total deductible x**		195	314	408	596	566
VII	**Expected out-of-pocket expenditures due to voluntary deductible d**	= VI – V	0	126	236	449	432
VIII	**Unfiled claims**	= VI – III	-1	2	29	117	171

Table 3 Moral hazard reduction (currency = CHF, CHF 1 = € 0.65, 2006)

	Mandatory deductible		**230**	**230**	**230**	**230**	**230**
	Voluntary deductible d		**0**	**170**	**370**	**970**	**1,270**
	Total deductible x		**230**	**400**	**600**	**1,200**	**1,500**
IX	**Absolute moral hazard reduction**	= IV - II -VI	3	382	443	276	318
X	**Relative moral hazard reduction**	= IX / IV	0,1%	11,4%	15,1%	12,9%	23,2%

Table 4 Actual and predicted expenditures < CHF x for the insured *without* a voluntary deductible

	Mean actual expenditures (std dev)	**Mean predicted expenditures (std dev)**
< CHF 230	196 (78)	195 (47)
< CHF 400	331 (141)	329 (83)
< CHF 600	482 (218)	478 (126)
< CHF 1,200	877 (463)	873 (260)
< CHF 1,500	1,048 (588)	1,045 (329)

Table 5 Descriptive results of three risk equalization models

	Risk factors	**R-square**	**Mean**	**Std dev**	**Min**	**Max**
Demographic	Region, age/gender	0.08	3,148	1,644	637	7,423
Demographic + approximated PCG's	Region, age/gender, dummies for prescribed drugs in t-1	0.25	3,148	2,941	676	20,805
Demographic + approximated PCG's and DCG's	Region, age/gender, dummies for prescribed drugs in t-1 and hospitalization in t-1	0.29	3,148	3,178	654	43,636

Table 6 Average net claims and potential premium rebates

	d=0 CHF	**d=170 CHF**	**d=370 CHF**	**d=970 CHF**	**d=1,270 CHF**
Actuarially fair premium (net claims)	3,678	2,655	2,078	1,264	489
Potential premium rebate	0	1,023	1,600	2,414	3,189

Table 7 Average equalization payments per level of voluntary deductible for three risk equalization models

	d=0 CHF	**d=170 CHF**	**d=370 CHF**	**d=970 CHF**	**d=1,270 CHF**
-	0	0	0	0	0
Demographic	274	-102	-55	-91	-878
Demographic + approximated PCG's	478	-181	-341	-616	-1,286
Demographic + approximated PCG's and DCG's	491	-188	-348	-637	-1,318

Table 8 Average insurer's costs per level of voluntary deductible for three risk equalization models

	d=0 CHF	d=170 CHF	d=370 CHF	d=970 CHF	d=1,270 CHF
-	3,678	2,655	2,078	1,264	489
Demographic	3,404	2,757	2,133	1,355	1,367
Demographic + approximated PCG's	3,200	2,836	2,419	1,880	1,775
Demographic + approximated PCG's and DCG's	3,187	2,843	2,426	1,901	1,807

Table 9 Potential premium rebate for deductible d after risk equalization

	d=0 CHF	d=170 CHF	d=370 CHF	d=970 CHF	d=1,270 CHF
-	0	1,023	1,600	2,414	3,189
Demographic	0	647	1,271	2,049	2,037
Demographic + approximated PCG's	0	364	781	1,320	1,425
Demographic + approximated PCG's and DCG's	0	344	761	1,286	1,380

Table 10 Potential premium rebate (= VII in table 2 + IX in table 3) with d as a risk factor in the risk equalization model

	d=0 CHF	d=170 CHF	d=370 CHF	d=970 CHF	d=1,270 CHF
Demographic + approximated PCG's and DCG's + d	0	508	679	725	750

Table 11 Mean and standard deviation of dependent variable and age, gender and prior expenditures per level of deductible.

	d=0 CHF Mean (std dev)	d=170 CHF Mean (std dev)	d=370 CHF Mean (std dev)	d=970 CHF Mean (std dev)	d=1,270 CHF Mean (std dev)
Gross expenditures	3,874 (7,422)	2,967 (6,298)	2,457 (5,888)	1,743 (5,927)	884 (2,732)
Age	59 (16)	57 (14)	54 (14)	53 (14)	48 (11)
Gender = male	0.40 (0.49)	0.41 (0.49)	0.47 (0.50)	0.56 (0.50)	0.57 (0.50)
Gross expenditures t-1	3,499 (6,563)	2,726 (5,418)	2,276 (5,673)	1,494 (4,577)	783 (2,438)
Gross expenditures t-2	3,247 (5,820)	2,470 (4,657)	2,020 (4,311)	1,357 (3,605)	739 (2,014)
Gross expenditures t-3	3,011 (5,648)	2,284 (4,193)	1,856 (4,030)	1,279 (3,391)	717 (1,751)