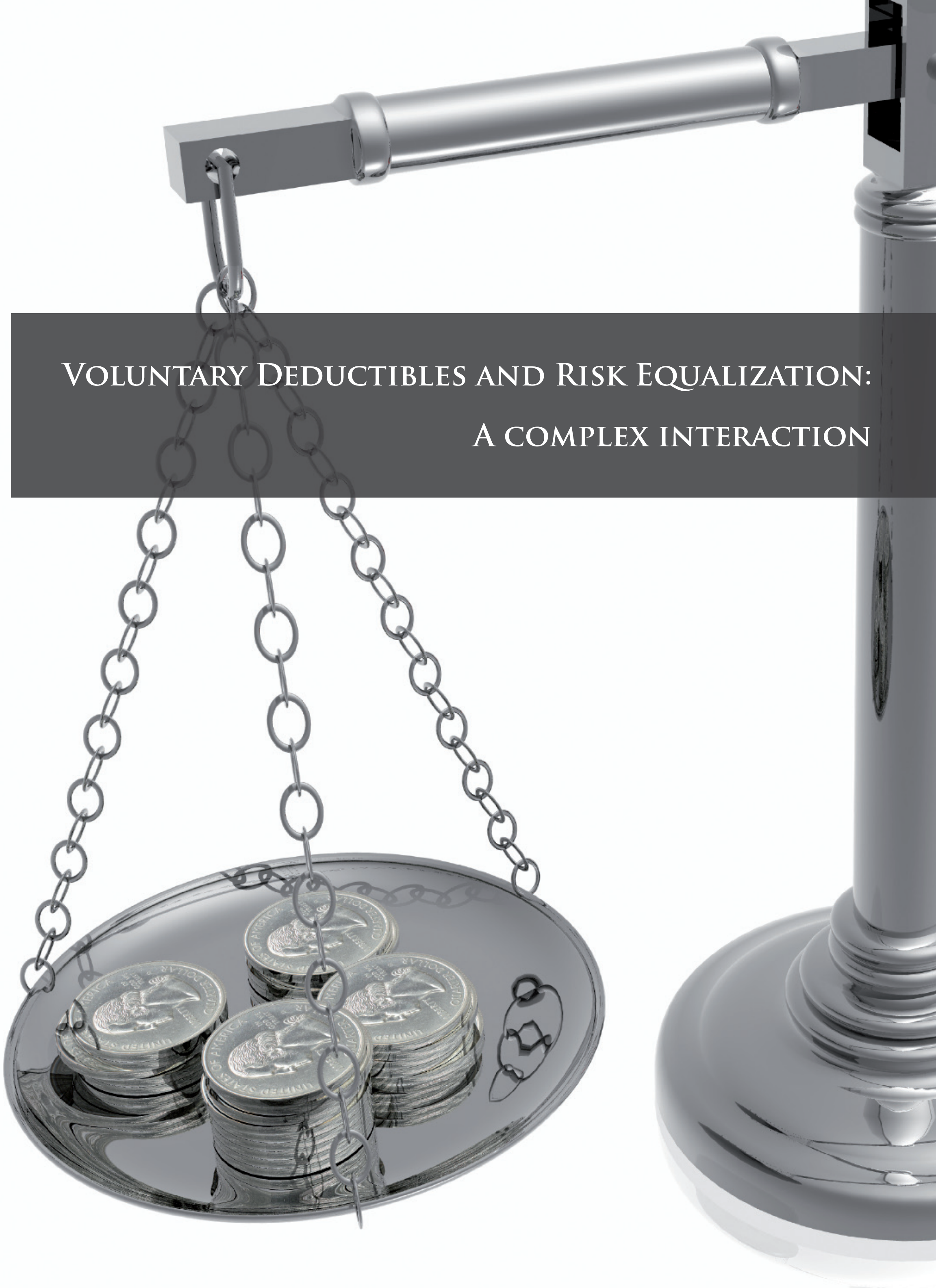

Voluntary Deductibles and Risk Equalization:

A complex interaction

Richard C. van Kleef

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Voluntary Deductibles and Risk Equalization: A complex interaction

Vrijwillige eigen risico's en risicoverevening: Een complexe interactie

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Chapter 6:

Kleef, R.C. van, W.P.M.M. van de Ven and R.C.J.A. van Vliet. 2008. 'Shifted deductibles for high risks: more effective in reducing moral hazard than traditional deductibles', *Forthcoming in the Journal of Health Economics* (DOI: 10.1016/j.jhealeco.2008.09.007).

Introduction

Chapter 1

Governments around the world use health insurance as an instrument to establish universal access to medical care. In some countries, e.g. Germany, the Netherlands and Switzerland, there is a trend towards managed competition among insurers and providers of care and towards higher levels of consumer cost sharing. A popular form of cost sharing is the voluntary deductible, i.e. the option for consumers to pay medical expenditures up to a certain amount themselves in return for a rebate on their out-of-pocket premium. Voluntary deductibles increase consumer choice and can reduce medical consumption.

This study focuses on some crucial policy choices concerning the premium rebate for a voluntary deductible in the particular context of a *competitive*, *social* health insurance market. Here, *competitive* means that consumers can periodically switch among insurance plans offered by risk-bearing insurers and *social* means that a sponsor (e.g. government) aims at realizing risk- and income solidarity. Regarding the social aspects, this thesis will only focus on risk solidarity, i.e. the cross-subsidies from low-risk (e.g. the young and healthy) to high-risk consumers (e.g. the old and unhealthy) intended to make insurance plans affordable for the latter. For curative care, social health insurance schemes with competitive elements can be found, for instance, in Belgium, Germany, Ireland, the Netherlands, Switzerland, and the United States.

In a competitive market, insurers are forced to adjust the premium rebate to the difference in (expected) expenses between consumers who choose a deductible and those who do not. From a social perspective, this *market-based* rebate might be unacceptable. The goal of this study is to reveal some crucial policy choices and trade-offs concerning the market-based rebate and to examine the associated research questions. Although this study particularly focuses on the Dutch, German and Swiss context, the conclusions will be important for other countries as well.

This first chapter introduces the relevant policy choices and formulates the associated research questions. Section 1.1 starts from the principles of a free (i.e. unregulated) insurance market and analyzes the difference in expected expenses between consumers who choose a deductible and those who do not. A conclusion will be that this difference consists of three components whose size will be indicated in Section 1.2. Section 1.3 switches to the principles of social health insurance and describes some crucial characteristics to clarify the context and relevance of this study. Special attention will be paid to risk equalization - a system aimed at adjusting for risk-related expenditure differences among individuals. Section 1.4 considers how risk equalization influences the market-based rebate, which raises a number of relevant research questions.

1.1 The market-based premium rebate for a voluntary deductible in a free insurance market

A competitive insurance market tends towards equivalence between the premium and the expected costs per insurance contract (Van de Ven and Ellis, 2000). On the one hand, 'premiums exceeding the expected costs' motivate consumers to switch to another insurance plan (or level of coverage) with a premium better reflecting their expected costs. On the other hand, 'expected costs exceeding the premium' motivate insurers to keep the consumer away from the insurance plan (i.e. risk selection) or to charge a higher premium (i.e. premium differentiation). This dynamically results in a situation of risk-rated premiums and product differentiation with equivalence between the premium and the expected costs per insurance contract.

The equivalence principle implies that, within a premium-risk group, the *market-based* premium rebate for a voluntary deductible will equal the difference in expected costs between consumers who choose a deductible and those who do not. According to Bakker (2000), this difference can consist of four components: out-of-pocket expenditures, moral hazard reduction, the effect of self-selection and the reduction in administration costs.

1.1.1 Out-of-pocket expenditures

Out-of-pocket expenditures refer to the shift of medical expenses from the insurer to the consumer (starting from full coverage with the consumer opting for a deductible). The higher the deductible, the higher will be the out-of-pocket expenditures for the consumer and the lower will be the medical expenses paid or reimbursed by the insurer.

1.1.2 Moral hazard reduction

Moral hazard refers to the positive correlation between medical consumption and insurance coverage, as described by Arrow (1963), Zeckhauser (1970) and Feldstein (1973), among others. The RAND-experiment empirically demonstrated the existence of moral hazard and the effect of deductibles, by showing how medical expenditures decrease with a higher level of consumer cost sharing (Newhouse, 1993; Keeler, 1988; Manning, 1987). Recent non-experimental studies confirm this relationship (e.g. Van Vliet, 2004; Gardiol et al., 2006).

1.1.3 Self-selection component

Self-selection (i.e. adverse selection) refers to the selection that occurs because high-risk consumers have an incentive to buy more insurance coverage than low-risk consumers within the same premium-risk group. This implies that, in any heterogeneous premium-risk group, the relatively low risks have a greater incentive to opt for a deductible than the relatively high risks (for the same premium rebate). As a consequence of self-selection, the insurer will learn that those choosing a deductible are on average healthier and younger than the opposite group, which implies a difference in the average medical expenses. From here on, this component will be referred to as the self-selection component.

1.1.4 Reduction in administration costs

Reduction in administration costs refers to the administrative savings occurring when consumers with a deductible do not send their bills to the insurance company if they expect no reimbursement. Obviously, these savings are absent if bills are sent directly from the provider to the insurer, which is often the case in preferred-provider arrangements. Under such arrangements the administration costs might be even higher for those with a deductible than for those with full coverage, since the insurer must pass on the bill for out-of-pocket expenditures to the consumer. In practice, health insurance markets (can) have both types of payment stream, resulting in uncertainty about the actual size of the reduction (or the increase) in administration costs caused by voluntary deductibles. This component will therefore not be considered in this thesis.

1.1.5 Conclusion

Thus, on a competitive insurance market, insurers are forced to adjust the premium rebate for a voluntary deductible to the difference in expected costs between consumers who choose a deductible and those who do not. In an unregulated market, this difference in expected costs reflects, in fact, the difference in insurance claims (i.e. the expenses that are paid or reimbursed by the insurer) between these groups, consisting of the three components shown in figure 1.1.

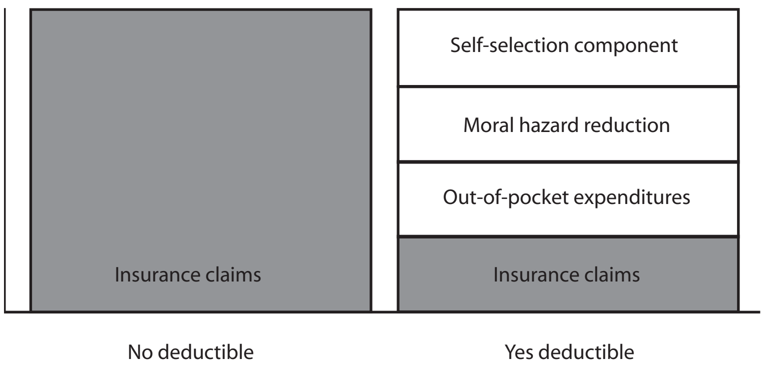

Figure 1.1 Difference in insurance claims (i.e. expenses paid or reimbursed by the insurer) between consumers with and without a voluntary deductible in a certain premium-risk group

1.2 The difference in insurance claims between consumers with and without a deductible

In the former (free) private health insurance in the Netherlands, which existed until 2006, the premium rebate for a voluntary deductible often exceeded the deductible amount. In actuarial terms, the possibility to offer such a rebate depends on the moral hazard reduction and the self-selection component. (Obviously, out-of-pocket expenditures alone cannot exceed the deductible amount.) On its turn, the size of the self-selection component depends on the level of premium differentiation: the more heterogeneous the premium-risk groups are, the larger will be the difference in health care expenses between individuals who choose a deductible and those who do not. In this context, it is interesting to mention that in most (or even all) competitive, social health insurance schemes the out-of-pocket premiums must be community-rated, which leads to very heterogeneous premium-risk groups. This could mean that the self-selection component (as indicated in figure 1.1) is larger in a social market than in a free market.

Bakker (1997) gives an indication of the self-selection component under community-rating by combining the stated preferences of 10,553 respondents with administrative data from a Dutch insurer. All respondents were enrolled in the Dutch sickness fund insurance during 1993 (in which co-payments were hardly applied) and paid a community-rated out-of-pocket premium. In a survey these respondents were confronted with the hypothetical situation that a deductible for prescription drugs would be introduced. All were asked whether they would wish to purchase supplementary insurance for an 'appropriate' premium to cover out-of-pocket expenditures caused by that deductible. 51 percent of the respondents answered with a 'yes'. The average annual medical expenditures were € 1,003 for those preferring supplementary insurance and € 620 for the opposite group, which indicates a substantial self-selection component of € 383 (in Euros of 1993). To examine whether the premium rebate could have exceeded the deductible amount, Bakker (ibid.) estimated the out-of-pocket expenditures (by a two-part model) and the moral hazard reduction (as a percentage of the expected expenditures, using the results of the RAND experiment) due to the deductible. The results are shown in table 1.1 and indicate that the premium rebate could have exceeded the deductible amount indeed, even with a high deductible of € 681, which was about 83% of the average annual medical expenditures of all respondents (i.e. € 817, in Euros of 1993).

Table 1.1 Composition of the difference in insurance claims between individuals who preferred a deductible and those who did not (in Euros of 1993, based on stated preferences of 10,553 Dutch sickness fund insured, source: Bakker, 1997, d=deductible level)

	d=0	*d*=136	*d*=227	*d*=454	*d*=681
Out-of-pocket expenditures	-	61	86	126	153
Moral hazard reduction	-	159	175	196	207
Self-selection component	-	383	383	383	383
Total	-	604	644	705	743

Thinking about these results in terms of policy implications, however, one should be aware of three important characteristics of Bakker's (1997) study. In the first place, the results are based on stated preferences which are not necessarily in line with revealed preferences. In the second place, the questionnaire did neither mention the deductible amount nor the premium for supplementary insurance. As a consequence, the results are based on the assumption that the deductible choice is independent of the premium (rebate) and the deductible level, which is not necessarily true. In the third place, the survey question concerned a deductible for prescription drugs while in practice deductibles may apply to a broader package of curative care. Nevertheless, the results in table 1.1 indicate that consumers are able to segment in groups of high risks and low risks. Contrary to the period in which Bakker's study was carried out, information is now available on the *revealed* preferences regarding voluntary deductibles in social health insurance. This information comes from the Swiss basic health insurance (introduced in 1996) in which consumers can opt for deductibles up to a maximum of CHF 2,200 (= € 1,320 on January 1, 2008). This study will analyze such data from a large Swiss insurer. To examine the actual size of the three components shown in figure 1.1, a first empirical research question is:

Q1: How large are the three components of the difference in insurance claims between consumers with and without a voluntary deductible in practice?

1.3 Social health insurance: two strategies for achieving cross-subsidies

As described above, a free insurance market dynamically tends towards a situation of risk-rated premiums and product differentiation with equivalence between the premium and the expected costs per insurance contract. In a free insurance market, premiums can easily range from € 400 to € 40,000 per person per year (Van de Ven and Schut, 2007). From a social perspective, this might be undesired, since insurance coverage can become unaffordable for high-risk individuals. In general terms, a sponsor can apply two strategies to make health insurance affordable in a competitive market: premium-rate restrictions and explicit subsidies. For good understanding of the policy choices that will be discussed later on, these two strategies will be briefly addressed.

1.3.1 Strategy 1: premium-rate restrictions

Premium-rate restrictions can take several forms such as community-rating, a ban on risk-rating according to certain risk characteristics or a premium-rate band. Such measures create implicit cross-subsidies from low-risk to high-risk individuals, which result in lower premiums for high-risks compared to a free market and, thereby, increases the affordability of health insurance. An adverse effect of this strategy is that it creates incentives for cream skimming, i.e. risk selection by insurers. Cream skimming can take different forms. A direct form is selective acceptance of applicants based on their risk profile (e.g. health status and medical history). Indirect forms are, for instance, selective advertising, bad service and bad quality of care for non-preferred consumers, structuring coverage such that it is unattractive for non-preferred consumers, and avoiding contracts with physicians who have a good reputation in treating non-preferred patients/consumers. Open enrollment requirements, i.e. the obligation for insurers to accept new enrollees, can be used to avoid direct risk selection, but cannot avoid the indirect forms.

From a social perspective, the negative effects of cream skimming are obvious: a bad quality of care for high-risk consumers and a welfare loss for society. The first effect is the direct result of the disincentive for insurers to meet the preferences of high risks; the second effect is a consequence of the (wasted) costs of selection efforts and the decreased incentive for insurers to improve efficiency if the returns from cream skimming are higher (Van de Ven et al., 2000).

1.3.2 Strategy 2: explicit subsidies

A second strategy to make health insurance affordable in a competitive market is that of explicit premium subsidies, which could mean that a sponsor (e.g. government) creates a subsidy fund with (mandatory) contributions, e.g. from employers, tax revenues or directly from consumers, and allocates this fund such that consumers can afford a certain level of insurance coverage. The payment flows of a subsidy system can be organized in different ways. Van de Ven et al. (2000) distinguish among three modalities, shown in figure 1.2. In modality A, contributions and subsidies are located between consumers and the fund. The subsidy system does not (directly) affect the out-of-pocket premium. This is different in modality B where subsidies are given to the insurer instead of the consumer. The out-of-pocket premium for consumer *i* equals the out-of-pocket premium that consumer *i* would have paid under modality A minus the subsidy that the insurer receives for *i*. In modality C, both the contributions and subsidies are located between the insurer and the subsidy fund. Modality A is often referred to as 'subsidy-model' or 'voucher-model' and modalities B and C are often referred to as 'risk equalization models' (Van de Ven and Schut, 2007).[1] This study exclusively focuses on risk equalization since modalities B and C are most common in the countries of interest. In concrete terms, risk equalization means that insurers receive a risk-related subsidy for each enrollee in their insurance pool.

1 Tax subsidies can be categorized under modality A with the government controlling the fund. Tax subsidies will, however, not be considered in this study.

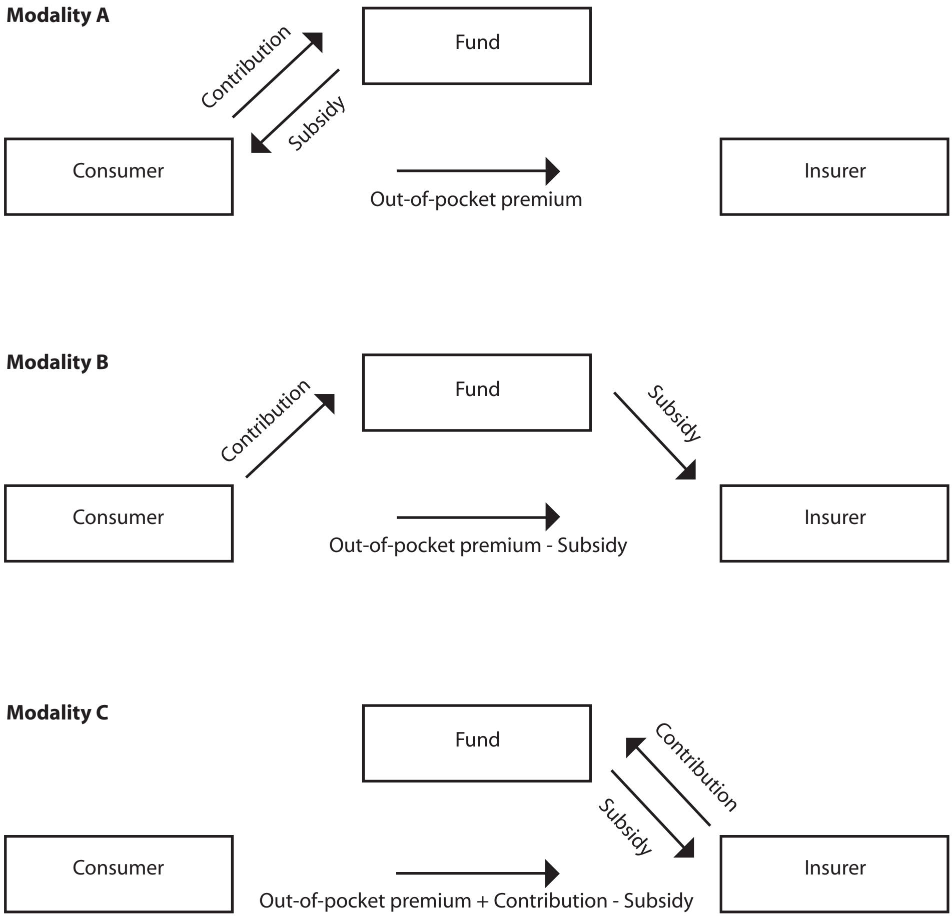

Figure 1.2 Three modalities of organizing payment flows

1.3.3 Which expenses to be subsidized?

If a sponsor wants to achieve a certain level of cross-subsidies in a competitive insurance market, it has to define accurately the particular types of health care expenses to be subsidized. This requires two relevant policy choices. The first concerns the benefit package: the sponsor has to define the types of medical care to be included as well as the level of mandatory cost sharing applying to these benefits. In this thesis the standardized benefit package is considered as given.

The focus of this study will be on the second policy choice, which concerns the types of expenses to be subsidized, given the benefit package. This choice means that the sponsor accurately distinguishes between 'S(ubsidy)-type expenses', i.e. expenses for which cross-subsidies are desired and 'N(on-subsidy)-type expenses', i.e. expenses for which cross-subsidies are not desired (Van de Ven and Ellis 2000). Typical S-type expenses could be the expenses related to age, gender, and health status and typical N-type expenses could be the expenses related to provider characteristics (such as price, efficiency and practice style), regional factors (such as distance to medical facilities), market characteristics (such as the insurer's ability to manage the provision of care) and individual characteristics (such as life-style).

1.3.4 The context of this study

Thus, in sum, a sponsor can apply two strategies to achieve (the desired level of) cross-subsidies in a competitive market: premium-rate restrictions and risk equalization. From a social perspective, the second strategy might be preferred over the first, since it does not require direct regulation of the insurance market, i.e. insurers can be free in risk-rating their premiums, which avoids incentives for cream skimming. However, no sponsor in the world applies risk equalization solely. Therefore, this study assumes the common scenario: a combination of risk equalization, community-rated out-of-pocket premiums per insurance plan and open enrollment. In this thesis, the out-of-pocket insurance premium will simply be referred to as 'premium'.[2]

1.4 Voluntary deductibles and risk equalization

In the presence of risk equalization, the market-based premium rebate for a voluntary deductible will be smaller than in a free insurance market (section 1.2). The reason is that equalization payments will (partly) adjust for risk-related expenditure differences between individuals who choose a deductible and the opposite group. In other words: risk equalization (partly) reduces the self-selection component. As a result, the market-based premium rebate will be less than a *full* reflection of the difference in insurance claims (figure 1.1). The following empirical research question needs to be answered to indicate the market-based rebate under risk equalization:

Q2: To what extent does risk equalization reduce the self-selection component?

Dependent on the quality of the risk equalization system, the sponsor will be confronted with the question whether the (remaining) market-based premium rebate for a voluntary deductible is acceptable. More specifically, this implies that the sponsor should decide for the different components, i.e. out-of-pocket expenditures, the moral hazard reduction and the (remaining) self-selection component, whether it is desired to be actually reflected into the rebate or not. An obvious scenario is that sponsors want the premium rebate to

2 This thesis does not focus on the contribution to the risk equalization fund (figure 1.2) and the way this fund is filled.

reflect the first two components, but not the third. The argument could be that the out-of-pocket expenditures and moral hazard reduction would not have occurred in the absence of voluntary deductibles, while the self-selection component is merely a consequence of market segmentation. One option to avoid (or reduce) the self-selection component is to improve risk equalization. If this is not possible for some reason, a second option is to apply premium rebate restrictions. As mentioned in section 1.3.1, however, *premium* restrictions can have important adverse effects. In order to clarify the particular implications of *rebate* restrictions, a third important research question is:

Q3: What are the consequences of premium *rebate* restrictions?

An illustration of the consequences of risk equalization for the market-based premium rebate comes from the Netherlands where a new basic health insurance was introduced in 2006. The new scheme with mandatory coverage replaced a dual scheme with mandatory coverage for relatively low-income people (about two thirds of the population) and private (voluntary) insurance for high-income people (about one third of the population). In the new scheme, insurers can offer voluntary deductibles with a maximum of € 500 per person per year.[3] The interesting aspect is that in the new scheme (with risk equalization) the premium rebates for deductibles are substantially lower than in the former private scheme (without risk equalization). Accordingly, only 5 percent of all individuals chose a voluntary deductible in 2006 (while in the former private scheme about 50 percent of all enrollees used to have a voluntary deductible). If it turns out that risk equalization reduces the entire self-selection component, the rebate can only consist of out-of-pocket expenditures and moral hazard reduction, which raises a fourth important question:

Q4: Could a premium rebate based only on out-of-pocket expenditures and moral hazard reduction be sufficiently large to induce consumers to take a deductible?

The answer to Q4 depends on the minimum premium rebate that consumers need to receive to be induced to take a deductible. In theory, a risk-averse income-maximizing consumer chooses a deductible if the rebate exceeds the expected out-of-pocket expenditures, i.e. if he or she expects a financial gain. In the absence of a self-selection component, such a financial gain can only be offered in the presence of a (substantial) moral hazard reduction. The larger the moral hazard reduction, the higher the premium rebate and the larger the number of individuals choosing a deductible. If the sponsor prefers large numbers of consumers opting for a deductible (e.g. for reasons of efficiency), a fifth research question becomes relevant:

Q5: What can be done to maximize the moral hazard reduction, given a certain deductible level?

3 Since 2008 there is a mandatory deductible of € 150, which can be voluntarily increased to € 650. For reasons of simplicity, this study disregards the presence of a mandatory deductible.

The previous research questions mainly focus on the implications of risk equalization for voluntary deductibles. There are, however, crucial implications in the opposite direction as well. In general terms, computation of equalization payments consists of two steps. In the first step, an expenditure model is estimated with a relevant set of risk factors as explanatory variables such as age, gender and health indicators. In the second step, the coefficients obtained in step 1 are used to compute the equalization payment for individual *i* as the expected expenditures for *i* minus the average expected expenditures in the population.[4] In the absence of voluntary deductibles, it seems straightforward to use the insurance claims[5], i.e. the expenses which are (to be) reimbursed or paid by the insurer, as the dependent variable in the estimation of the risk equalization model. With voluntary deductibles, however, the insurance claims are influenced by out-of-pocket expenditures and moral hazard reduction, which raises a sixth research question:

Q6: What are the consequences of out-of-pocket expenditures and moral hazard reduction for the definition of the dependent variable in the (estimation of the) risk equalization model?

1.5 Goal and structure of this thesis

The goal of the following chapters is to examine these six research questions. The answers will provide a theoretical and empirical framework for making crucial choices and trade-offs concerning the premium rebate for a voluntary deductible in the particular context of a competitive insurance market with risk equalization, open enrollment and premium regulation. A final step will be to confront this framework with the way voluntary deductibles are actually dealt with in the Dutch, German and Swiss basic health insurance markets:

Q7: What can be learned from this study for Germany, the Netherlands and Switzerland?

The answer to Q7 will underline the relevance of this thesis. It will be instructive and surprising to see how the three governments made different choices with respect to (the premium rebate for) voluntary deductibles, which are not all rational given the conclusions of this study.

This thesis contains a collection of empirical studies and theoretical considerations concerning the seven research questions. Chapter 2 empirically indicates the extent of the three components of the difference in insurance claims as depicted in figure 1.1. Real-

4 The equalization payment for *i* can also equal *i*'s expected expenditures, for instance. The precise modality is, however, irrelevant. The important aspect is that in both models the difference in equalization payments between two individuals equals the difference in expected expenditures between them.

5 Possibly from some previous year.

world data from a Swiss insurance company is used to examine the market-based rebate under different risk equalization models. In addition, chapter 2 theoretically discusses the consequences of using different expenditure levels as the dependent variable in the risk equalization model. Chapter 3 *empirically* demonstrates the consequences of self-selection on the functioning of risk equalization models. Chapter 4 and chapter 5 empirically examine whether consumers are likely to choose a deductible in the absence of a self-selection component in the premium rebate, using data from a Swiss and Dutch insurer, respectively. Chapter 6 introduces an alternative to traditional deductibles, which is expected to increase the moral hazard reduction (and thereby the viability of voluntary deductibles in the absence of a self-selection component). Chapter 7 returns to the research questions formulated in this chapter and use the answers to build a framework for policy makers. In chapter 8, this framework is used for providing specific recommendations for the German, Dutch and Swiss competitive, social health insurance schemes.

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Risk equalization and voluntary deductibles: a complex interaction

with Konstantin Beck, Wynand van de Ven and René van Vliet
Journal of Health Economics 27: 427-443

ABSTRACT - The presence of voluntary deductibles in the Swiss and Dutch mandatory health insurance has important implications for the respective risk equalization systems. In a theoretical analysis we discuss the consequences of equalizing three types of expenditures: the net claims that are reimbursed by the insurer, the out-of-pocket expenditures and the expenditure savings due to moral hazard reduction. Equalizing only the net claims, as done in Switzerland, 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 we examine the effect of self selection and conclude that the Swiss and Dutch risk equalization systems do not fully adjust for differences in health status between those who choose a deductible and those who do not. We discuss how this may lead to incentives for cream skimming and to a reduction of cross subsidization between healthy and unhealthy individuals compared to a situation without voluntary deductibles.

Chapter 2

2.1 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 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.[2] 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 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.

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

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.[6] 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.

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* 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.

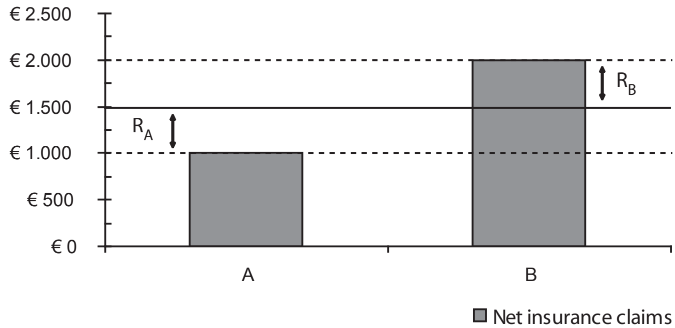

Figure 2.1 Equalizing the net claims when insured have the same level of coverage

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 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.

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

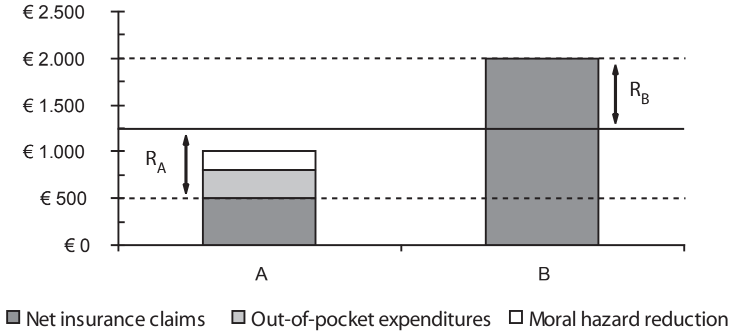

Figure 2.2 Equalizing the net claims in a situation with a deductible option

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.

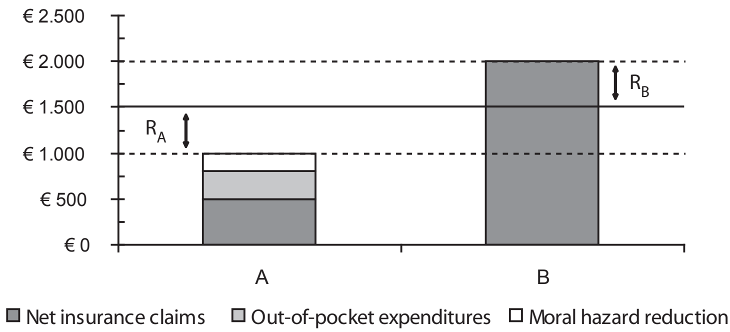

Figure 2.3 Equalizing the net claims, out-of-pocket expenditures and moral hazard reduction in a situation with a deductible option

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 *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:

$$(2.1) \qquad R_j = (\overline{NET}_j + \overline{OOPE}_j + \overline{RMH}_j) - (\overline{NET} + \overline{OOPE} + \overline{RMH})$$

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).

$$(2.2) \qquad R_j = (\overline{NET}_j - \overline{NET}) + (\overline{OOPE}_j - \overline{OOPE}) + (\overline{RMH}_j - \overline{RMH})$$

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 $(\overline{NET}_A - \overline{NET})$, € 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.

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 * € 1,625 + 2/3 * € 1,375) [8] to the insured

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.

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.

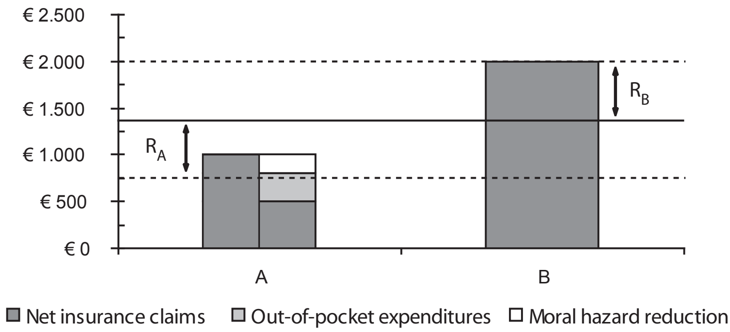

Figure 2.4 Equalizing the net claims when the risk equalization model explains some of the variance in choice of deductible

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

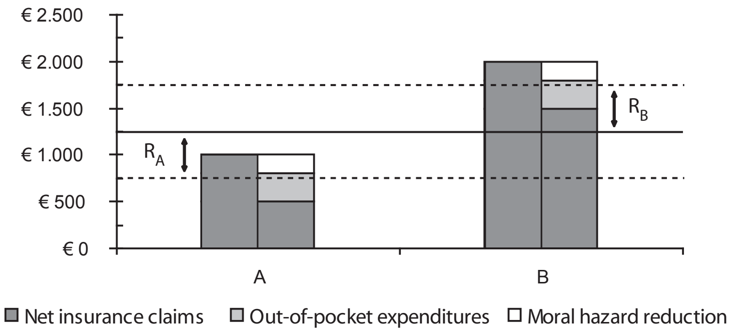

Figure 2.5 Equalizing the net claims in an exceptional situation where the average out-of-pocket expenditures and moral hazard reduction are the same in all risk groups distinguished in the equalization system.

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.[9] 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 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 per deductible. Row III shows the average out-of-pocket expenditures

9 Under the assumption that the risk equalization system equalizes all three types of expenditures considered in Section 2.3.

known to the insurer.[10] 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)

	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	**Expenditures up to the total deductible *x***	196	312	379	479	395

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

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.

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, $E(Y)_i$ 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.

$$(2.3) \qquad E(Y)_i \quad = \quad p(Y_i > 0) \quad * \quad E(Y_i \mid Y_i > 0)$$

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

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 $E(Y)_i$ and the associated coefficient of variation (= *cv* = standard deviation divided by mean), an estimate of the scale parameter *k* can be obtained via:

$$(2.4) \qquad k = 1/(cv)^2$$

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).[11]

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

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

$$(2.6) \qquad c = x * \lambda, \;\; and \;\; \lambda = k / E(Y)_i$$

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.

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

$E(OOPE)_{i,x}$ 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 Γ(*c*, *k*) and 1 - Γ(*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)

	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

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).[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)

	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%

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 *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.

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.[13]

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.

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.

Table 2.4 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)

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 *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 2.3 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 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

	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

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

	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

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

	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

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

	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

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

	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

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 = 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 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

	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

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.

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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 2.11 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)

How self-selection affects risk equalization: The example of voluntary deductibles

with Konstantin Beck and Florian Buchner
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ABSTRACT - In various health insurance schemes around the world managed competition is applied to combine the efficiency advantages of a competitive market with some level of cross-subsidization from low-risk to high-risk consumers. Most of these schemes have a risk equalization (i.e. risk-adjustment) system to reduce incentives for cream-skimming caused by community-rating. This chapter demonstrates the consequences of self-selection on the functioning of risk equalization systems. We conclude that self-selection can have serious impacts on the level of cross-subsidization among plans and on the extent to which insurers can incorporate plan-specific cost reductions into their premiums.

Chapter 3

3.1 Introduction

In an increasing number of health insurance schemes around the world managed competition is applied to combine the efficiency advantages of a competitive market with some level of cross-subsidization from low-risk to high-risk consumers.[1] With competitive we mean that consumers can periodically switch among insurance plans offered by risk-bearing insurers. With cross-subsidization we mean that (to a certain extent) low-risk consumers (e.g. the young and healthy) subsidize medical expenses of high-risk consumers (e.g. the elderly and chronically ill).

In most of these schemes, implicit cross-subsidies are enforced by community-rated premiums. In the Dutch, German and Swiss health insurance schemes for curative care this form of premium regulation is supplemented by a risk equalization system in order to reduce incentives for cream-skimming (i.e. incentives for insurers to contract selectively with consumers who are profitable because of the community-rated premium).[2] The essence of risk equalization is that insurers receive/contribute risk-related payments from/to an equalization fund for each enrollee. In this respect, risk equalization can be considered adequate if cream-skimming is no longer beneficial for insurers.

This paper will show the relevance of involving two other criteria for evaluating the functioning of risk equalization systems in the particular context of managed competition. These are 1) the level of cross-subsidization among different insurance plans and 2) the extent to which insurers can incorporate plan-specific cost reductions (e.g. due to voluntary deductibles or managed care) into their premiums. Throughout the paper, the first measure will be referred to as the solidarity criterion and the second measure will be referred to as the efficiency criterion.

Both the level of cross-subsidization among plans and the extent to which insurers can incorporate plan-specific cost reductions into their premiums are seriously affected by self-selection, i.e. the choice of plan by consumers in view of their risk characteristics. The effect of self-selection can be illustrated by the following example in which consumers can choose between an efficient managed-care plan and an inefficient traditional plan. The premium must be community-rated per plan (but can differ between the two plans). Assume that the risk equalization system estimates equalization payments as the (expected) expenditure differences among risk groups based on age (and not on health status). In fact, this is more or less the case in Switzerland and Germany (in 2008). In such a situation the equalization payment that insurers receive from the fund is too high for the healthy and too low for the unhealthy. An interesting situation occurs if all the healthy choose the managed-care plan and all the unhealthy choose the traditional plan. In that case, unadjusted differences in health will be incorporated into the premium difference between the two plans, which reduces the

1 For the principles of managed competition we refer to Enthoven (1978).

2 Another term for risk equalization is risk adjustment.

level of cross-subsidization compared to a situation where consumers choose their plan randomly. Another interesting situation occurs if all the young choose the managed-care plan and all the old choose the traditional plan. In that case the equalization payments will adjust for all expenditure differences between the old and young, including the efficiency gains from managed care. As a result, the plan-specific cost reductions cannot be incorporated into the premiums, contrary to a situation where consumers choose their plan randomly.

The goal of this paper is to (further) demonstrate the effects of self-selection on the outcomes of risk equalization in competitive markets. Our arguments will be empirically illustrated with data from a Swiss insurer on the revealed preferences of 89,693 enrollees concerning their deductible choice. This exhibition will show the (policy) relevance of weighting the solidarity and efficiency criteria. Although we particularly focus on the risk equalization systems in Germany, the Netherlands and Switzerland, our conclusions will also be relevant for other competitive schemes with community-rating and risk equalization, such as the Medicare insurance in the United States.

Section 3.2 starts with a description of the data and introduces some necessary assumptions for the considerations that will follow. Starting from a simplified risk equalization formula, section 3.3 describes the effect of self-selection in terms of the solidarity criterion and section 3.4 describes the effect of self-selection in terms of the efficiency criterion. In addition, section 3.5 discusses two other interesting issues that can be learned from our empirical illustration, i.e. how self-selection leads to biased equalization payments and the rationale for community-rating. Finally, section 3.6 will conclude this study and section 3.7 will address some relevant policy implications.

3.2 Data

The administrative data used in our empirical illustration are from a Swiss insurer and include, among others, individual-level information on reimbursed medical expenses, deductible choice and age in the year 2003. In that year, Swiss residents, who are obliged to obtain basic health insurance since 1996, had a mandatory deductible of CHF 230 which could be voluntarily increased to CHF 400, CHF 600, CHF 1,200 or CHF 1,500.[3] Our analysis includes 89,693 individuals of which 71,864 had chosen no voluntary deductible for 2003 and of which 17,829 had chosen the highest voluntary deductible for 2003. For a description of the Swiss scheme we refer to Beck (2003) and for a description of the data we refer to Van Kleef et al. (2008).

3 CHF 1 = € 0.61 / $ 0.90, on January 1, 2008.

The revealed preferences concerning deductible choice will be used to illustrate the effects of self-selection on the functioning and outcomes of risk equalization. For reasons of simplicity, we make the following assumptions on how the regulator estimates the equalization payments and how insurers calculate their premiums.

Let us assume that the insurance market consists of only two insurance plans: the standard-deductible plan and the highest-deductible plan.[4] We will refer to these as the ordinary plan and the deductible plan, respectively. The risk equalization system distinguishes between two risk groups: the 'young' and the 'old', with the dividing line being 56 such that both groups represent about 50 percent of the population. Table 3.1 shows how the 89,693 insured are divided over the two plans and two risk groups.

Table 3.1 Number of individuals

	Ordinary	Deductible	Total
Young	31,162 (35%)	13,624 (15%)	44,786 (50%)
Old	40,702 (45%)	4,205 (5%)	44,907 (50%)
Total	71,864 (80%)	17,829 (20%)	89,693 (100%)

In practice, estimation of equalization payments is based on observed expenses for the total population or a nationwide random sample, mostly from some previous year. The essence is that insurers receive/contribute a risk-related payment for each enrollee. For details about the principles of risk equalization we refer to Van de Ven and Ellis (2000) and for details about the specific risk equalization systems (and their context) in the three countries we refer to Beck et al. (2003), Lamers et al. (2003), Buchner and Wasem (2003), Van de Ven et al. (2003) and Van de Ven et al. (2007). In general terms, equalization payment R for an enrollee in risk group j is estimated as:

$$(3.1) \qquad R_j = C_j - C$$

In our example we will follow the Swiss and German approach where C_j represents the average medical expenses paid by the insurer in risk group j and C represents the average of these expenses in the population. Table 3.2 shows C in our data.

4 In 2003 the standard deductible in the Swiss basic health insurance was CHF 230.

Table 3.2 Medical expenses paid by the insurer in CHF (CHF 1 = € 0.61 / $ 0.90, on January 1, 2008)

	Ordinary	Deductible	Mean
Young	2,521	301	1,846
Old	4,564	1,098	4,239
Mean	3,678	489	3,044

In addition, we assume that insurers calculate the community-rated premium for a plan as the average medical expenses (paid by the insurer) minus the equalization payment (to be) received from / contributed to the equalization fund (as calculated by formula (3.1)). So, in a situation without risk equalization (i.e. $R = 0$ for all risk groups) the premium would equal CHF 3,678 (i.e. (31,162 / 71,864) * 2,521 + (40,702 / 71,864) * 4,564) for the ordinary plan and CHF 489 (i.e. (13,624 / 17,829) * 301 + (4,205 / 17,829) * 1,098) for the deductible plan.

In the empirical illustration we also need an indication of the cost reduction in the deductible plan. From the insurer's perspective this cost reduction will consist of two components, i.e. out-of-pocket expenditures and a moral hazard reduction (Bakker, 2000). In their empirical study about the effect of risk equalization on the premium rebates for voluntary deductibles in Switzerland Van Kleef et al. (2008) provide an indication of both the out-of-pocket expenditures and the moral hazard reduction. Since their data is exactly the same as the data used for this illustration, we adopt their estimation results and refer to their paper for the estimation procedure and its validity.[5] The main methodological problem in determining out-of-pocket expenditures was that this component could not be obtained from the data directly because of unfiled claims, which occur when (some) insured do not send their bills to the insurer when they expect no reimbursement. The main methodological problem regarding the moral hazard reduction was that this component is hard to distillate from real-world data because of its entanglement with expenditure differences due to self-selection. The estimated out-of-pocket expenses *OOPE* and moral hazard reduction *MHR* are shown in table 3.3 and 3.4, respectively, and the total cost reduction *S* is shown in table 3.5.[6]

5 In sum, a four-step estimation procedure was used to estimate the out-of-pocket expenditures and the moral hazard reduction: 1) estimate an expenditure model on the group of insured without a voluntary deductible, 2) predict expenses of the insured with a voluntary deductible by combining their characteristics with the coefficients obtained in the first step, 3) estimate expected out-of-pocket expenditures using the results of the second step, 4) estimate moral hazard reduction due to deductible *d* as the expected expenses for insured with deductible *d* minus the medical expenses paid by the insurer and minus their expected out-of-pocket expenditures.

6 Note that these out-of-pocket expenditures are due to the voluntary deductible only (i.e. apart from the mandatory deductible).

Table 3.3 Estimated out-of-pocket expenditures OOPE in CHF

	Ordinary	Deductible	Mean
Young	0	390	119
Old	0	566	53
Mean	0	432	86

Table 3.4 Estimated moral hazard reduction MHR in CHF

	Ordinary	Deductible	Mean
Young	0	252	77
Old	0	530	50
Mean	0	318	63

Table 3.5 Total cost reduction S (=OOPE + MHR) in CHF

	Ordinary	Deductible	Mean
Young	0	642	196
Old	0	1,096	103
Mean	0	750	149

3.3 The solidarity criterion

In practice, the quality of risk equalization systems is mainly evaluated in terms of the (remaining) incentives for cream-skimming. As mentioned above, these incentives are a consequence of the predictable profits and losses caused by the requirement of community-rating. From a social perspective, the adverse effects of cream-skimming are obvious: a bad quality of care for high-risk consumers and a welfare loss for society. The first effect is the direct result of the disincentive for insurers to meet the preferences of high risks; the second effect is a consequence of the (wasted) costs of selection efforts and the decreased incentive for insurers to improve efficiency if the returns from cream-skimming are higher (Van de Ven et al., 2000).

In terms of the (remaining) incentives for cream-skimming, risk equalization can be considered adequate if predictable profits and losses are reduced such that cream-skimming is no longer beneficial. In a competitive market with multiple insurance plans, however, this is not the only relevant criterion to evaluate the functioning of the risk equalization system. Instead, the solidarity and efficiency criteria can be important as well. This section will illustrate the relevance of the solidarity criterion.

Assume that in our example the only information that insurers possess about consumers is whether they are of risk type 'young' or risk type 'old'. In this scenario there are no incentives for cream-skimming if the equalization payments adjust for the difference in medical expenses between these two groups. Following the risk equalization system of formula (3.1), the equalization payment would equal CHF -1,198 (i.e. 1,846 – 3,044) for the young and CHF +1,195 (i.e. 4,239 – 3,044) for the old. Subtracting these equalization payments from the medical expenses paid by the insurer (table 3.2) gives the total costs per risk group, as shown in table 3.6. Accordingly, the community-rated premium equals CHF 3,521 (i.e. (31,162 / 71,864) * 3,719 + (40,702 / 71,864) * 3,369) for the ordinary plan and CHF 1,123 (i.e. (13,624 / 17,829) * 1,499 + (4,205 / 17,829) * -97) or the deductible plan.

Table 3.6 Medical expenses paid by the insurer C minus equalization payment R in CHF

	Ordinary	Deductible
Young	3,719	1,499
Old	3,369	-97
Community-rated premium	3,521	1,123

The absence of incentives for cream-skimming does not necessarily mean that risk equalization is adequate. The explanation is to be found in the level of cross-subsidization between the two plans. The difference in premiums between the two plans (further: premium rebate) equals CHF 2,398. This premium rebate mainly consists of three components, i.e. out-of-pocket expenditures, moral hazard (reduction) and health-related expenditure differences caused by self-selection (Bakker, 2000). In this context, self-selection occurs in a way that low-risk individuals (e.g. the young and healthy) are more likely to choose a deductible than high-risk individuals (e.g. the elderly and chronically ill).[7] As a result, the average medical expenses are substantially lower in the deductible plan than in the ordinary plan. In our example, this 'self-selection component' of the premium rebate equals CHF 1,648 (i.e. CHF 2,398 minus the out-of-pocket expenditures of CHF 432 and minus the moral hazard reduction of CHF 318).[8]

The larger the self-selection component of the premium rebate, the lower is the level of cross-subsidization between the two plans. It is up to the regulator to decide on the extent to which such a self-selection component is acceptable, which requires a trade-off between efficiency and cross-subsidies. On the one hand, a self-selection component in the premium rebate might be desired, since it will increase the number of consumers opting for a deductible,

7 For other evidence on 'adverse' selection we refer to Browne (1992) and Beck (2004).

8 Note that in the absence of risk equalization the self-selection component would have been CHF 2.439, i.e. CHF 3.678 (table 2) minus CHF 489 (table 2) minus CHF 750 (table 5). Thus, this simple equalization model with just two risk groups corrects for CHF 791 (i.e. CHF 2.439 minus CHF 1.648) of the self-selection component.

resulting in a larger moral hazard reduction. On the other hand it might be undesired, since it reduces cross-subsidies, resulting in an increase of the premium for (high-risk) individuals who do not prefer a deductible.

Obviously, improvements of the risk equalization system in terms of risk adjusters reduce the self-selection component of the premium rebate (and thus results in a higher level of cross-subsidization between the two plans). However, Van Kleef et al. (2008) have found that even a quite sophisticated risk equalization system with information on age, gender and health status does not reduce this component completely. This is in line with a study on consumer information surplus by Van de Ven and Van Vliet (1994). If desired, a way to increase the level of cross-subsidization between the plans is to include more relevant risk adjusters in the risk equalization system.

When evaluating risk equalization systems, the solidarity criterion is not just relevant with respect to deductible plans, as demonstrated in this section, but also for other plan types such as managed-care plans. In all cases where plan choice is correlated with risk characteristics that are *not* included in the risk equalization system, the effects on cross-subsidization are analogous with those described in this section.

3.4 The efficiency criterion

Successful application of managed competition might require that insurers can fully incorporate plan-specific cost reductions into their premiums. If this condition is achieved then consumers have maximum financial incentives to switch to efficient plans, which results in maximum incentives for insurers to contain cost.[9] This condition will, presumably, not be achieved when equalization payments are estimated according to formula (3.1), which is, in principle, the case in Switzerland and Germany and to a smaller extent also in the Netherlands. The degree to which cost reductions can be reflected in the premiums depends on the correlation between the risk groups of the risk equalization system on the one hand and plan choice and cost reductions on the other.

Let us refer to the ordinary plan as plan ORD and to deductible plan as plan ALT. From the insurer's perspective, plan ALT leads to cost reduction S^{ALT} (compared to plan ORD). Four relevant scenarios can be distinguished, which are shown in figure 3.1. We define $h_j \in [0,1]$ as the share of consumers who have chosen plan ALT within risk group *j* and S_j^{ALT} as the average cost reduction of those in risk group *j* with the alternative plan.

9 Given the level of cross-subsidization among plans.

	Correlation *r* between plan choice and risk groups in the risk equalization system	Correlation *r* between cost reductions and risk characteristics in the risk equalization system	Percentage *pr* of cost reduction S^{ALT} that can be incorporated into the premium (rebate)
I	$r = 1$	$0 \leq r \leq 1$	$pr = 0$
II	$r = 0$	$0 \leq r \leq 1$	$pr = 100$
III	$0 < r < 1$	$0 < r < 1$ and $S_o^{ALT} = \frac{h_y}{h_o} S_y^{ALT}$	$pr = 100$
IV	$0 < r < 1$	$0 < r < 1$ and $S_o^{ALT} \neq \frac{h_y}{h_o} S_y^{ALT}$	$0 < pr < 100$

Figure 3.1 Four relevant scenarios

Hence, we briefly describe these four scenarios intuitively. A technical proof with the relevant equations is provided in appendix I.

3.4.1 Scenario I

If all the young choose plan ALT and all the old choose plan ORD, there is full correlation between plan choice and the two risk groups of the risk-equalization system. In this scenario the cost reduction S^{ALT} cannot (at all) be incorporated into the premium rebate for plan ALT. The simple explanation is that payments R_{young} and R_{old} (computed according to formula (3.1)) capture all cost differences between the two groups, including the cost reduction in plan ALT.

3.4.2 Scenario II

If the share of young choosing plan ALT and the share of old choosing plan ALT are equal, there is no correlation between plan choice and the two risk groups. In this scenario the cost reduction can be fully incorporated into the premium for plan ALT. Note that equalization payments might capture cost reductions because of correlation between cost reductions and the risk groups of the risk-equalization system (e.g. if the cost reduction in plan ALT is larger for the old than for the young). The resulting over-compensations (for the young) and under-compensations (for the old), however, have no effect on the premium rebate since the risk-composition of both plans is the same. In other words, the total over-compensation (for the young) and under-compensation (for the old) is equal in both plans, such that the net effect on the premium (rebate) is zero.

3.4.3 Scenario III

In practice, the level of correlation between plan choice and the risk groups of the risk equalization system probably lies in between these extremes. Only in one (exceptional) scenario the cost reduction can be fully incorporated into the premiums. This is the case when the average cost reduction in group young, i.e. $h_Y S_Y^{ALT}$, equals the average cost reduction in group old, i.e. $h_O S_O^{ALT}$. For instance, if 50 percent of the young choose plan ALT and 25 percent of the old choose ALT then no cost reduction is captured by equalization payments if, in absolute terms, S_j^{ALT} is two times higher for the old than for the young. Presumably, this scenario occurs only by chance.

3.4.4 Scenario IV

Outside the former three scenarios, the risk equalization system will only capture *a part* of the cost reduction resulting from plan ALT. The remaining part can be reflected in the premiums. Presumably, this is the dominant scenario in Switzerland, the Netherlands and Germany. Ceteris paribus, a richer risk equalization system (with more risk adjusters) leads to a stronger correlation between plan choice and the risk groups of the equalization system, resulting in a shift towards scenario I. This is interesting since most governments aim at improving the risk equalization system in order to reduce incentives for cream skimming and/or to increase the level of cross-subsidization among plans. Paradoxically, these improvements might indeed reduce incentives for cream skimming and increase cross-subsidization, but will further reduce the extent to which plan-specific cost reduction can be directly incorporated into premiums.

Tables 3.1 and 3.5 show that our illustration can be placed in scenario IV, i.e. correlation between the risk groups of the risk equalization model on the one hand and plan choice and cost reductions on the other hand is present, but the average cost reduction is not the same for the young and the old. This implies that the cost reduction cannot be fully incorporated into the premium rebate. The precise amount of the cost reduction captured by the equalization payments can be easily calculated as the difference in premium rebate between a situation with formula (3.1) and a situation with formula (3.2) in which equalization payments are corrected for plan-specific cost reduction *S*.

(3.2) $$R_j = (C_j + S_j) - (C + S)$$

Applying formula (3.2) provides a community-rated premium rebate of CHF 2,429, which is CHF 31 higher than the rebate of CHF 2,398 with formula (3.1). This amount is relatively low (= 4.1 percent of the total average cost reduction), but will increase with a better equalization system. Analogous with the procedure used above, we calculated this amount with the structure of age/gender-groups in the Swiss equalization system of 2008 and found an amount of CHF 44 (5.9 percent of total average cost reduction).

It is up to the regulator to decide on the extent to which plan-specific cost reductions should actually be reflected in the premiums. This requires a trade-off between efficiency and practicability. On the one hand a larger effect of cost containment on the premiums increases the financial incentives for consumers to switch to efficient plans and, thereby, increases the incentives for insurers to actually contain cost. On the other hand a correction of equalization payments as proposed in formula (3.2) is less straightforward than our simplified example might suggest. In order to perform a correction for plan-specific cost reductions, these cost reductions must be known. This implies that in case of deductibles information must be available on the out-of-pocket expenditures and the moral hazard reduction and that in case of managed care plans information must be available on the relative efficiency gains. Whereas it might be possible to gather information on out-of-pocket expenditures, it will be difficult to find valid information on the moral hazard reduction and other efficiency gains. Literature broadly reports on the methodological problems of estimating these effects (e.g. Gardiol et al., 2006; Grandchamp, 2006; Van Vliet, 2004).

An additional problem when correcting for plan-specific cost reductions is that, in practice, the average cost reductions are not static, as in our example, but result from a dynamic interaction between the premium rebate (remaining after risk equalization) and the group of consumers choosing a deductible. The particular cost reduction in the deductible plan depends on the risk profile of those choosing a deductible. The complicating factor is that this risk profile depends on the premium rebate, which again depends on the risk profile, and so on. Consequently, it will be difficult to correct accurately for this cost reduction, particularly in a prospective risk equalization model, as present in the Netherlands.

3.5 What else can be learned from the simplified example?

In addition to the above-mentioned effects of self-selection in terms of the solidarity and efficiency criteria, the empirical example reveals two other interesting issues. These are the bias of equalization payments as theoretically described by Schokkaert and Van de Voorde (2004 and 2007), and the rationale for community-rated premium rebates.

3.5.1 Bias of equalization payments

Given the information in table 3.6, we can easily calculate the financial result per subclass as the community-rated premium minus [*C*-*R*]. From the insurer's perspective, an average loss of CHF 253 occurs on the young and an average profit of CHF 252 occurs on the old, as shown in table 3.7. This confronts insurers with incentives to select the old.

Table 3.7 Profits / losses from the insurer's perspective in CHF

	Ordinary	Deductible	Mean
Young	-198	-377	-253
Old	152	1220	252

The reason for profits and losses *per sub-class*, i.e. young/ordinary, old/ordinary, young/deductible and old/deductible, is that within risk group *j*, *C* is lower for insured with the deductible plan than for those with the ordinary plan. The equalization payment for a risk group is based on the mean of *C* in that group. Accordingly, the payment is too low for insured with the ordinary plan and too high for those with the deductible plan.

Consequently, profits and losses *per risk group*, i.e. the young and the old, occur because of correlation between plan choice and the risk groups of the risk equalization system. Although the equalization payment is too low for *both* the young and the old in the ordinary plan, the under-compensation is larger for the young, since the proportion of insured with the ordinary plan is lower in group 'young' than in group 'old'. For the same reason, the over-compensation in the deductible plan is higher for the old than for the young.[10] In overall terms, this results in a loss on the young and a profit on the old.

Schokkaert and Van de Voorde (2004 and 2007) recognize how self-selection leads to biased equalization payments (leading to the profits and losses in table 3.7). They propose an alternative approach in which estimation of equalization payments is separated into two steps. In our example the first step would be to estimate a (OLS) model with both age and plan choice as explanatory variables. In the second step the equalization payment would be computed with the coefficients obtained in step 1. The essence of this approach is that (in the second step) the coefficient for plan choice is neutralized.[11]

10 Grandchamp (2006) indicates the over- and under- compensation in the current Swiss risk equalization system.

11 In Belgium this approach is used with respect to the characteristic 'medical supply' for which the government wants no compensation. If this characteristic would be totally excluded from the equalization system then its effect would be partly captured by other variables, which is undesired. Schokkaert and Van de Voorde (2004 and 2007) show how their approach reduces this undesired effect.

Grandchamp (2006) applies this procedure to the specific case of voluntary deductibles. In our example the equalization payment would equal CHF -926 for the young and CHF +925 for the old.[12] If we calculate [*C-R*] (i.e. the medical expenses paid by insurer minus the equalization payment), we find a premium of CHF 3,556 for the ordinary plan and CHF 980 for the deductible plan. Although the profits/losses on the old/young fall to zero with this approach, the profits and losses per sub-class remain. This implies that within plans insurers still have incentives for cream-skimming. A closer look is needed to see how, with this alternative approach, self-selection (further) reduces the level of cross-subsidization among plans. In section 3.4, we found that with the conventional approach only CHF 31 of cost reductions could not be incorporated into the premium. Under this alternative approach the premium rebate for the deductible plan equals CHF 2,576, which is CHF 178 higher than with the conventional approach. This implies that under the alternative approach, profits and losses on risk groups (i.e. the old and the young in our example) are avoided at the expense of a loss of cross-subsidies of CHF 147 (i.e. 178 – 31) between the two plans.

3.5.2 Does a community-rated premium rebate fit all?

Furthermore, the results in table 3.5 raise an interesting question for policy-makers: should the premium rebate be community-rated or risk-rated? Apparently, the out-of-pocket expenditures and moral hazard reduction are higher for the old than for the young. Nevertheless, the community-rated premium rebate is the same for these groups.

The requirement of community-rating is a simple measure to avoid unacceptable differentiation of the premium rebate. However, as risk equalization includes more relevant risk adjusters, the self-selection component in the rebate reduces. In the absence of a self-selection component, rebates can only be based on the out-of-pocket expenditures and moral hazard reduction. In such a situation, a risk-rated rebate might be more efficient than a community-rated rebate. The explanation is that for high-risk individuals (who have above-average out-of-pocket expenditures) a risk-rated rebate (reflecting the average out-of-pocket expenditures and moral hazard reduction in their risk group) is more attractive than a community-rated rebate (reflecting the average of these components in the population). Larger numbers of high risks choosing a deductible are likely to result in a larger moral hazard reduction and a higher level of efficiency.[13]

12 OLS estimation with C as the dependent variable and a dummy for risk group (young=0, old=1) and a dummy for plan choice (ordinary=0, deductible=1) as explanatory variables, gives E(C) = 2,630 + 1,851*risk group – 2,577*plan choice. Mean of the coefficient for plan choice equals (17,829/89,693)*-2,577 = -512. Given that the mean of C equals 3,044, equalization payment R_j is computed as (2,630 + 1,851*risk group – 512) – 3,044.

13 See Van Kleef et al. (2006) who simulate the number of consumers opting for a deductible under community-rated and risk-rated premium rebates, respectively.

3.6 Conclusion

In a growing number of health insurance schemes around the world managed competition is applied to combine the efficiency advantages of a competitive market with cross-subsidization from low-risk to high-risk consumers. In most of these schemes a risk equalization system is present in order to reduce incentives for cream-skimming, caused by the requirement of community-rating.

In practice, the functioning of risk equalization in a competitive market is mainly evaluated in terms of (remaining) incentives for cream skimming. This paper has shown that in a market with multiple insurance plans two other criteria can be relevant, i.e. the level of cross-subsidization among plans (i.e. the solidarity criterion) and the extent to which insurers can incorporate plan-specific cost reductions into their premiums (i.e. the efficiency criterion). Both criteria become relevant in the presence of self-selection, i.e. if consumers choose their insurance plan in view of their risk characteristics. As plan choice is correlated with individual risk characteristics which *are not* included in the risk equalization system, the level of cross-subsidization among plans decreases. As plan choice is correlated with individual risk characteristic which *are* included in the risk equalization system, the extent to which insurers can incorporate plan-specific cost reductions into their premiums decreases.

Both criteria entail serious trade-offs. With respect to the solidarity criterion, policy-makers have to decide on the extent to which risk-related premium differences among plans are acceptable, which requires a trade-off between efficiency and cross-subsidization. This has been illustrated by empirical data on deductibles choice: on the one hand a (large) effect of self-selection on the premium difference among plans might be desired, since it increases the number of consumers opting for a deductible, resulting in a larger moral hazard reduction; on the other hand it might be undesired, since it reduces cross-subsidies, resulting in an increase of the premium for (high-risk) individuals who do not prefer a deductible. With respect to the efficiency criterion, policy-makers have to decide on the extent to which plan-specific cost reductions should directly return in premiums, which requires a trade-off between efficiency and practicability. On the one hand a larger effect of cost containment on premiums increase the financial incentive for consumers to switch to efficiency plans; on the other hand a correction of equalization payments to achieve such a larger effect is complicated because no direct information on cost reductions is available.

In addition, this paper has illustrated how self-selection leads to a bias of equalization payments and how the resulting under- and overcompensations of certain risk groups leads to incentives for cream-skimming. Whether to correct for this bias entails a trade-off between practicability and the incentives for cream skimming.

3.7 Policy implications

What do these conclusions mean for Switzerland, the Netherlands, Germany and other countries that have implemented the managed competition model with risk equalization and the requirement of community-rating? The implications of self-selection in terms of the solidarity and efficiency criteria depend on the quality of the risk equalization system in terms of risk adjusters and the extent to which equalization payments are corrected for plan-specific cost reductions, respectively.

The Swiss risk equalization system takes into account region, age and gender as risk adjusters. As indicated by Van Kleef et al. (2008), such a poor system leaves much room for risk-related premium differences among plans. This also holds for the German system. However both schemes will be significantly improved in the near future.[14] Although the Dutch system is better than the Swiss and German systems, since it includes sophisticated parameters for health, it does probably not completely adjust for risk-related expenditure differences either (ibid.). This confronts policy makers with the trade-off between cross-subsidization and efficiency.

Each of the three countries basically estimates equalization payments as observed expenditure differences among risk groups. In Switzerland and Germany, medical expenses paid by the insurer are used as the cost level for calculating equalization payments. This implies that plan-specific cost reductions will be (partly) captured by the equalization payments and can, therefore, not be (fully) incorporated into the premiums. In the Netherlands this is different because the current (2008) risk-equalization system use 'medical expenses paid by the insurer + out-of-pocket expenditures + moral hazard reduction' as the cost level to estimate equalization payments.[15] This implies that the out-of-pocket expenditures and moral hazard reduction can be fully incorporated into the premium rebate for voluntary deductibles. However, this does not hold for other types of plan-specific cost reductions such as the efficiency gains in managed-care plans.

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14 In Germany the information on health status is very limited in the current system (inscription or no inscription in an accredited disease management program), which will change in 2009 with the introduction of 50 – 80 diseases as risk factors. In Switzerland no information on health status is taken into account in the current system, which will probably change in 2012 with the introduction of prior hospitalization as a risk adjuster.

15 The reason for taking into account 'cost paid by the insurer + out-of-pocket expenditures + moral hazard reduction' is, however, not related to the arguments raised in this paper. It is unclear whether moral hazard reduction will be taken into account in the future.

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Appendix 3.1

We keep this appendix as general as possible by describing the risk equalization system as a scheme where all enrollees are classified according to m risk groups. Equalization payment R_j for members of risk group j, (with j = 1, 2 …m) is defined as the difference between average costs of the given risk group, C_j, and average costs of the total population, C, which means $R_j = C_j - C$. Similar to the rest of this paper, C strictly refers to the *medical expenses paid by the insurer*. To simplify the argumentation we restrict the number of risk classes to two ($j \in \{Y, O\}$), with Y referring to the young and O referring to the old. We further assume that individuals can choose between two insurance plans: the ordinary plan ORD and the alternative plan ALT (which can be a plan with higher deductibles, managed care or anything alike). We define $h_j \in [0,1]$ as the share of individuals that have chosen ALT within risk group *j*. For all individuals with alternative plan ALT costs are reduced by a multiplicative factor $r \in (0,1)$ in comparison to the ordinary plan ORD. As an aside, *r* can consist of higher out of pocket payments, reduced moral hazard and cost reductions due to managed care: $r = r_{oope} + r_{rmh} + r_{mc}$. For reasons of simplicity, we assume that correlation between plan choice and risk characteristics *not* included in the risk equalization system is absent, i.e. $C_j^{ALT} = C_j^{ORD}(1-r)$. Accordingly, the average costs per risk group reads:

$$
\begin{aligned}
(3.3) \qquad C_j &= C_j^{ORD}(1-h_j) + C_j^{ALT} h_j \\
&= C_j^{ORD}(1-h_j) + C_j^{ORD} h_j (1-r) \\
&= C_j^{ORD}(1-h_j r)
\end{aligned}
$$

with $j \in$ {Y,O} and C_j^{ORD} the average costs of those in risk group *j* with the ordinary plan. Using $C_j^{ORD}(1-r)$ instead of C_j^{ALT}, enables us to show exactly the consequences of *r*. The average costs in the population reads:

$$
(3.4) \qquad C = \frac{\sum_{i \in \{Y,O\}} C_i^{ORD}(1-h_i r) n_i}{\sum_{i \in \{Y,O\}} n_i}
$$

Accordingly, the equalization payment written explicitly is:

$$
(3.5) \qquad R_j = C_j^{ORD}(1-h_j r) - \frac{\sum_{i \in \{Y,O\}} C_i^{ORD}(1-h_i r) n_i}{\sum_{i \in \{Y,O\}} n_i}
$$

In order to calculate the premium rebate for the alternative plan, given (3.5), we compare the ordinary premium P^{ORD} with the alternative premium P^{ALT}. The ordinary premium covers the insurer's total costs, *i.e. medical costs paid by the insurer minus the equalization payment*, for insured with the ordinary plan (while loading is neglected). The insurer's total costs for the old in the ordinary insurance reads:

$$(3.6)\qquad TOTALCOSTS_{O}^{ORD} = C_{O}^{ORD} - C_{O}^{ORD}(1-h_{O}r) + \frac{\sum_{i\in\{Y,O\}} C_{i}^{ORD}(1-h_{i}r)n_{i}}{\sum_{i\in\{Y,O\}} n_{i}}$$

$$= C_{O}^{ORD} h_{O} r + \frac{\sum_{i\in\{Y,O\}} C_{i}^{ORD}(1-h_{i}r)n_{i}}{\sum_{i\in\{Y,O\}} n_{i}}$$

An analogue expression (with all indices changed from O to Y) can be derived for the young, so that the premium becomes a weighted average of $TOTALCOST_{O}^{ORD}$ and $TOTALCOSTS_{Y}^{ORD}$:

$$(3.7)\qquad P^{ORD} = \frac{\sum_{i\in\{Y,O\}} C_{i}^{ORD}(1-h_{i}r)n_{i}}{\sum_{i\in\{Y,O\}} n_{i}} + \frac{(1-h_{O})n_{O}}{\sum_{i\in\{Y,O\}}(1-h_{i})n_{i}}\left\{C_{O}^{ORD} h_{O} r\right\}$$

$$+ \frac{(1-h_{Y})n_{Y}}{\sum_{i\in\{Y,O\}}(1-h_{i})n_{i}}\left\{C_{Y}^{ORD} h_{Y} r\right\}$$

Replacing in $TOTALCOSTS_{O}^{ORD}$ the first term C_{O}^{ORD} by the reduced expenses $C_{O}^{ORD}(1-r)$, we get $TOTALCOSTS_{O}^{ALT}$. And by replacing the indices O by Y we get $TOTALCOSTS_{Y}^{ALT}$. The weighted average of $TOTALCOSTS_{O}^{ALT}$ and $TOTALCOSTS_{Y}^{ALT}$ gives the premium for all insured in the alternative plan:

$$(3.8)\qquad P^{ALT} = \frac{\sum_{i\in\{Y,O\}} C_{i}^{ORD}(1-h_{i}r)n_{i}}{\sum_{i\in\{Y,O\}} n_{i}} + \frac{h_{O}n_{O}}{\sum_{i\in\{Y,O\}} h_{i}n_{i}}\left\{C_{O}^{ORD}(h_{O}-1)r\right\}$$

$$+ \frac{h_{Y}n_{Y}}{\sum_{i\in\{Y,O\}} h_{i}n_{i}}\left\{C_{Y}^{ORD}(h_{Y}-1)r\right\}$$

We want to know, to what extent risk equalization affects the rebate that can be given for choosing the alternative plan. Average cost reduction S^{ALT} in the alternative plan is the weighted average of the cost reductions for the old and the young (we introduce weights g_{j}^{PLAN} in order to simplify notation):

$$(3.9) \qquad S^{ALT} = \left(\frac{h_Y n_Y}{\sum_{i \in \{Y,O\}} h_i n_i} \right) C_Y^{ORD} r + \left(\frac{h_O n_O}{\sum_{i \in \{Y,O\}} h_i n_i} \right) C_O^{ORD} r$$

$$= g_Y^{ALT} C_Y^{ORD} r + g_O^{ALT} C_O^{ORD} r$$

Given (3.7) and (3.8) the rebate equals the difference between the two premiums:

$$(3.10) \qquad P^{ORD} - P^{ALT} = g_O^{ORD} \left\{ C_O^{ORD} h_O r \right\} + g_Y^{ORD} \left\{ C_Y^{ORD} h_Y r \right\}$$

$$- g_O^{ALT} \left\{ C_O^{ORD} (h_O - 1) r \right\} - g_Y^{ALT} \left\{ C_Y^{ORD} (h_Y - 1) r \right\}$$

(3.10) equals (3.9) only in two exceptional scenarios. The first is scenario II in figure 3.2, in which correlation between plan choice and risk groups of the risk equalization system is absent, i.e. $h_y = h_o$ and consequently $g_O^{ALT} = g_O^{ORD}$ and $g_Y^{ALT} = g_Y^{ORD}$. The second is scenario III in figure 3.2, in which correlation is present, but total cost reductions are on average the same in group young and group old, i.e. $h_y \neq h_o$ while $C_Y^{ORD} h_Y r = C_O^{ORD} h_O r$. Thus, scenario III implies that $h_y \neq h_o$ while $C_O^{ORD} r = (h_Y / h_O) C_Y^{ALT} r$, or in other terms that $h_y \neq h_o$ while $S_O^{ORD} = (h_Y / h_O) S_Y^{ALT}$ Presumably, these exceptional scenarios in which cost reductions can be fully incorporated into the premium occur only by chance.

Another scenario is one with full correlation between plan choice and risk groups where 100 percent of the cost reduction will be captured by the equalization payments (= scenario I in figure 3.1). This scenario will occur if all members of one risk class choose the alternative plan while all members of the other class do not (i.e. $h_Y = 1$ and $h_O = 0$). When we introduce this assumption in (3.7) and (3.8) it turns out that both premiums become identical, $P^{ORD} = P^{ALT}$, i.e. the rebate becomes zero. Such a situation occurs if we estimate the equalization payments separately for the four sub-classes (i.e. young/ordinary, young/alternative, old/ordinary and old/alternative) instead of the two risk groups. This can be illustrated by comparing the equalization payments of the young in both plans (i.e. young/ordinary and young/alternative):

$$(3.11) \qquad R_Y^{ALT} = C_Y^{ORD}(1-r) - \frac{\sum_{i\in\{Y,O\}} C_i^{ORD}(1-h_i r)\, n_i}{\sum_{i\in\{Y,O\}} n_i}$$

$$= C_Y^{ORD} - C_Y^{ORD} r - \frac{\sum_{i\in\{Y,O\}} C_i^{ORD}(1-h_i r)\, n_i}{\sum_{i\in\{Y,O\}} n_i}$$

$$(3.12) \qquad R_Y^{ORD} = C_Y^{ORD} - \frac{\sum_{i\in\{Y,O\}} C_i^{ORD}(1-h_i r) n_i}{\sum_{i\in\{Y,O\}} n_i}$$

These payments differ by $C_Y^{ORD} r$, which is exactly the cost reduction S_Y^{ALT} of the alternative plan. Consequently, this cost reduction cannot be incorporated into the premium rebate. Computing the equalization payments per sub-class (i.e. risk type / plan) makes it sure that all cost reductions will be captured by the equalization payments and cannot be reflected into the premium. The reasoning for the old is analogous.

Does risk equalization reduce the viability of voluntary deductibles?

with Konstantin Beck, Wynand van de Ven en René van Vliet
International Journal of Health Care Finance and Economics 7: 43-58

ABSTRACT - Theoretically, a risk-averse consumer takes a deductible if the premium rebate (far) exceeds his/her expected out-of-pocket expenditures. In the absence of risk equalization, insurers are able to offer high rebates because those who select into a deductible plan have below-average expenses. This chapter shows that, for high deductibles, such rebates cannot be offered if risk equalization would 'perfectly' adjust for the effect of self selection. Since the main goal of user charges is to reduce moral hazard, some effect of self selection on the premium rebate can be justified to increase the viability of voluntary deductibles.

Chapter 4

4.1 Introduction

In a number of health insurance schemes the insured can opt for a voluntary deductible in return for a premium rebate. The main goal of these deductibles is to reduce moral hazard. The extent to which this goal will be achieved is greatly affected by the number of insured choosing a deductible. Obviously, this number is positively correlated with the rebate *offered* by insurers and negatively correlated with the rebate *demanded* by the insured.

In free, unregulated health insurance markets insurers can offer high rebates due to the effect of self selection. Self selection occurs because, within a premium-risk group, low-risk individuals have a greater incentive to opt for a deductible than high-risk individuals. However, in an increasing number of countries there is a system of risk equalization in which insurers receive a payment for the relatively high risks in their insurance pool and contribute a payment for the relatively low risks. To some extent, these equalization payments will adjust for differences in health status between the insured who choose a deductible and those who do not. The goal of this paper is to indicate whether the rebates offered in the *absence* of (perfect) risk equalization, can still be offered in the *presence* of 'perfect' risk equalization. If the answer is negative then the viability of voluntary deductibles will be reduced, i.e. numbers of insured opting for a deductible will be lower. Consequently, moral hazard reductions will be smaller. In this context, 'perfect' risk equalization refers to an equalization system fully adjusting for the effect of self selection. The rationale of this paper is that countries like Switzerland and the Netherlands tend to improve risk equalization and consider voluntary deductibles as an appropriate instrument to reduce moral hazard.

We analyzed panel data from Switzerland with information on expenditures and deductible choice of 134,758 Swiss insured. Theoretically, risk-averse insured take a deductible *only if* the premium rebate (far) exceeds their expected out-of-pocket expenditures, i.e. if they expect to obtain a financial gain. In the first step of the analysis we estimated the actual financial gain (i.e. premium rebate minus out-of-pocket expenditures) obtained by the group of insured with voluntary deductible *d* in 2003. In the second step we examined whether the rebate actually offered for *d* could have been offered in the presence of 'perfect' risk equalization.

Prior to the empirical results, we theoretically consider (the composition of) both the *demanded* and *offered* premium rebate. Section 4.2 is concerned with the *demanded* premium rebate and uses the expected-utility model to show why risk-averse consumers take a deductible *only if* they expect to obtain a financial gain. Section 4.3 is concerned with the *offered* premium rebate and considers in more detail how this rebate will be reduced by improvements in the risk equalization system. Section 4.4 describes the data used, followed by a discussion of the methods in Section 4.5 and a report on the results in Section 4.6. Section 4.7 concludes this study and discusses some policy implications.

4.2 Demanded premium rebate

If an expected-income maxizing consumer with mandatory health insurance would be risk neutral and would face no transaction costs then he/she would take a deductible if the premium rebate exceeded the product of the possible losses $z_1, z_2, \ldots z_h$ and the probabilities $p_1, p_2, \ldots p_h$ of these losses to occur. The possible loss z_h equals the costs of health intervention *h* that have to be paid out-of-pocket. The maximum value of $\Sigma\, z_h\, p_h$ equals the deductible amount *d*, since the expenditures above this amount are reimbursed by the insurer.

In both economics and psychology it is widely argued that individuals consider more than (just) the expected value $\Sigma\, z_h\, p_h$ when making choices under uncertainty. Arguing that a gain of 200 is not necessarily 'worth' twice as much as a gain of 100, Daniel Bernoulli and Gabriel Cramer hypothesized that an individual evaluates choices under uncertainty by the expected utility $U = U(z_h\, p_h)$ instead of the expected value (von Neumann and Morgernstern, 1944). In existing literature the *von Neumann-Morgenstern expected utility model* is widely used to model the demand for insurance. Since the demand for deductibles is in fact the opposite of the demand for insurance, the model can also be used to consider the choice whether to take a deductible, starting from full coverage. In the following two sections we assume the consumer to be risk-averse. Notice that the context of this study is *mandatory* health insurance, in which individuals are *obliged* to insure. Theoretically, these insured are not necessarily risk averters; they could be risk lovers. Nonetheless, it is doubtful whether consumers are risk loving in the context of *health* insurance.

Similar to existing literature on the demand for health insurance, the expected-utility model used here does not take into account moral hazard. We further assume that individuals face no transaction costs in case of switching from a non-deductible to a deductible plan or the other way around. The role of transaction costs will be discussed in Section 4.2.3.

4.2.1 Expected-utility theory and the demand for insurance

According to the expected-utility model, the utility function of a risk-averse consumer is characterized by a diminishing marginal utility of income, as shown in figure 4.1. If the consumer is assumed to have income I_0 corresponding to utility $U(I_0)$, and if the probability to incur medical expenditures *z* equals *p* and the probability to have no medical expenditures equals 1-*p*, then his/her expected income equals $E(I)$, ceteris paribus.

$$(4.1) \qquad E(I) \;=\; p*(Io - z) + (1-p)*Io \;=\; Io - p*z$$

Accordingly, the consumer's expected utility in a situation without insurance equals $E(U(I))$, as shown in figure 4.1.

(4.2) $$E(U(I)) = p * U(Io - z) + (1 - p) * U(Io) = U(Io) - p * (U(Io) - U(Io - z))$$

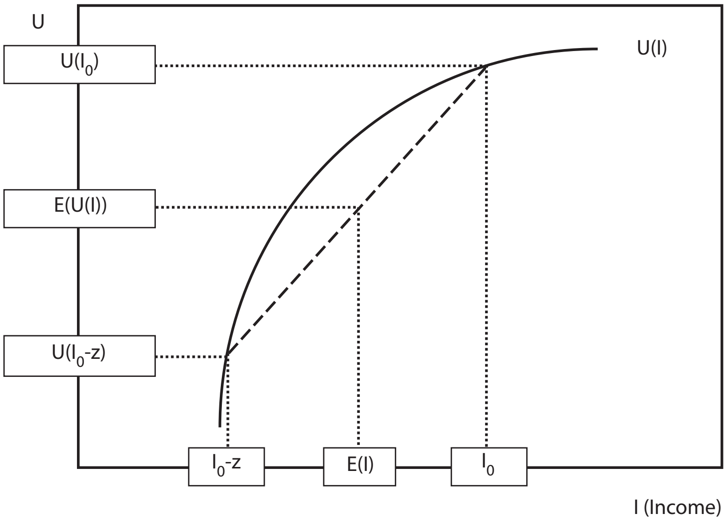

Figure 4.1 The demand for insurance (p=0.5)

At a certain moment the consumer is offered an insurance policy for an actuarially fair premium $I_0 - E(I)$. This insurance policy takes away the uncertainty about whether and when there will be an income loss because of medical expenditures *z*. Consequently, the actual utility of income after paying the actuarially fair premium $I_0 - E(I)$ is higher than the expected utility *E(U(I))* in a situation *without* insurance. The utility gain of this insurance policy equals D-C, as shown in figure 4.2.

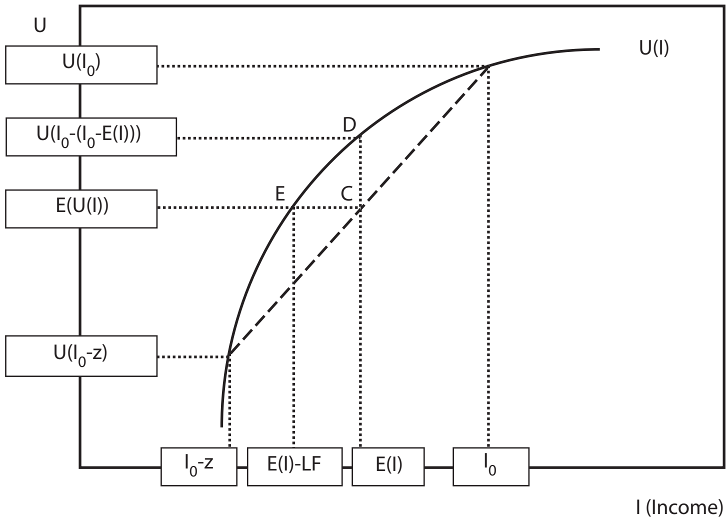

Figure 4.2 The maximum loading fee (p=0.5)

So, a rationally behaving risk-averse consumer will always purchase insurance for an actuarially fair premium. Moreover, he/she will also buy insurance for a higher premium, as long as the loading fee does not exceed C-E. The maximum acceptable loading fee can be defined as the maximum amount that the insured is willing to pay for insurance, apart from the actuarially fair premium.

4.2.2 Expected-utility theory and the demand for voluntary deductibles

In case of voluntary deductibles in mandatory health insurance we must go the other way around to approach the minimum compensation C_{min} demanded by an insured to be induced to take a deductible. Let us assume that *U(I)* in figure 4.3 is the utility curve of a risk-averse consumer with a mandatory policy with full coverage and income I_0 (after paying the insurance premium). Notice that this starting point differs from that in the previous section.

At a certain moment, the consumer is offered the possibility to take a deductible *d* in return for an actuarially fair premium rebate *PR* that equals his/her expected out-of-pocket expenditures. We assume *p* to be the probability of medical expenditures to exceed *d* and assume 1-*p* to be the probability of medical expenditures to be zero. For reasons of simplicity, the probability to incur medical expenditures in between is assumed to be zero. Accordingly, the actuarially fair premium rebate *PR* equals *p*d*. Consequently, having a deductible results in income $I_0 + PR - d$ if medical expenditures exceed the deductible amount and results in income $I_0 + PR$ if medical expenditures are zero, as shown in figure 4.3. The expected income $E_d(I)$ in case of a deductible with an actuarially fair premium rebate equals:

$$(4.3) \qquad E_d(I) = p*(Io + PR - d) + (1-p)*(Io + PR) = Io$$

Expected utility $E_d(U(I))$ is lower than $U(I_0)$ since the consumer is a risk averter and a deductible plan results in more uncertainty about the level of income than full insurance.

$$(4.4) \qquad E_d(U(I)) = p*U(Io + PR - d) + (1-p)*U(Io + PR)$$

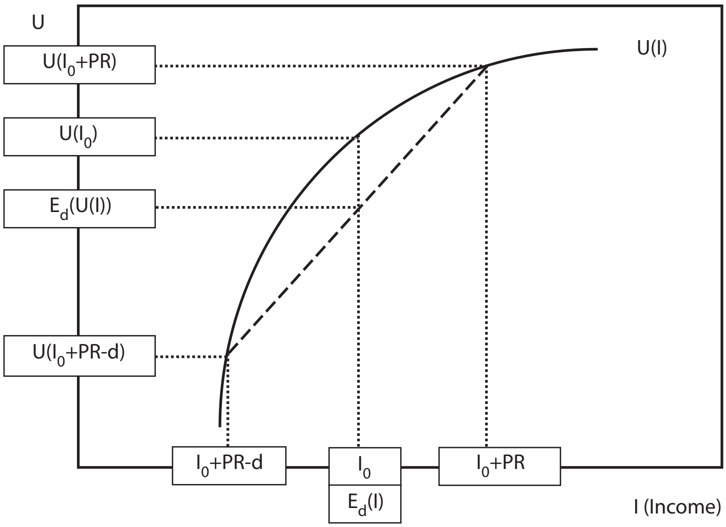

Figure 4.3 The demand for deductibles (p=0.5)

To induce the consumer to take a deductible, the insurer has to increase the premium rebate with compensation C such that $E_d(U(I))$ equals or exceeds $U(I_0)$, as shown in figure 4.4. We define the *minimum compensation* C_{min}, such that $E_d(U(I))$ equals $U(I_0)$. So, the minimum compensation is in fact the opposite of the maximum loading fee discussed in Section 4.2.1. Whereas a risk-averse consumer is willing to pay a loading fee for an insurance policy, he/she demands a compensation to be induced to take a deductible. As shown in figure 4.4, C increases both $I_0 + PR - d$ and $I_0 + PR$, resulting in a higher expected income and a higher expected utility in case of a deductible.

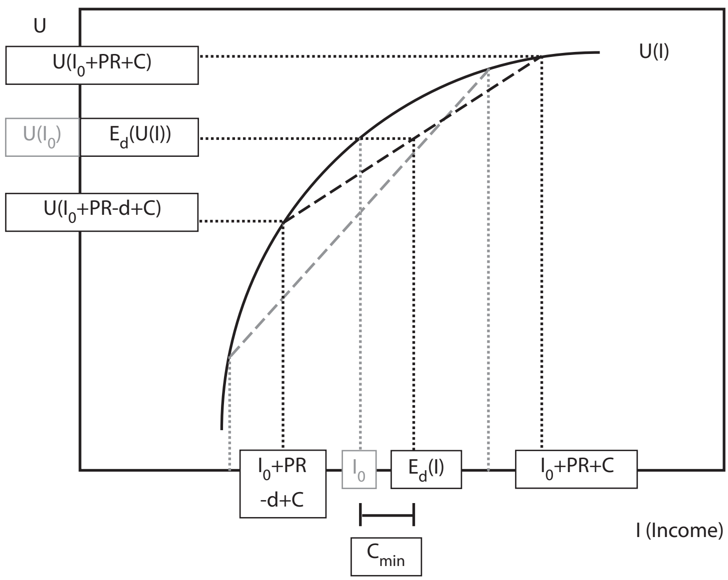

Figure 4.4 The minimum compensation (p=0.5)

In a study on the (hypothetical, survey-) choice whether to take a deductible among the Dutch privately insured, Van de Ven and Van Praag (1981) found that, for all deductible amounts included, the demanded premium rebate was about 80 percent higher than the actuarially fair rebate. This implies that these insured would demand for a rebate nearly twice the expected out-of-pocket expenditures before they would be willing to take a deductible.

4.2.3 Expected compensation

Among others, Edwards (1955), Kahneman and Tversky (1979), Machina (1982), Fishburn (1983) argue that choices under uncertainty are not only influenced by risk aversion, but also by individual preferences and perceptions about both probabilities and prices. Burrows et al. (1993) report on inertia as being an important explanation for the fact that people are not switching in situations where this would benefit them in terms of (expected) utility. Kunreuter and Pauly (2004) argue that decisions are not always 'optimal' in terms of expected utility as a result of search and transaction costs, which occur as a consequence of searching for the best policy and switching from the current policy to a new one. Insured probably have greater inclination to switch between two policies in a situation where these costs are low than in a situation where these costs are high, ceteris paribus.

Following both this literature and the basic assumptions underlying the expected utility model, the *demanded compensation* is probably affected by a mixture of factors, such as the expected out-of-pocket expenditures, the deductible amount *d*, the level of risk aversion *r* (Pratt, 1964), the level of income *I*, the amount of transaction and search costs, and personal characteristics such as inertia. We do not explore these individual components in further detail, since the remainder of this paper focuses on the *total* demanded compensation regardless of its composition.

4.2.4 Conclusion

According to the previous consideration we assume insured *i* to take a voluntary deductible *d* if the offered premium rebate *OPR* exceeds his/her demanded premium rebate *DPR*.

$$(4.5) \qquad DPR_{i,d} < OPR_d$$

with $DPR_{i,d}$ as the sum of the expected out-of-pocket expenditures $E(OOPE)_{i,d}$ and the minimum compensation $C_{min,i,d}$.

$$(4.6) \qquad DPR_{i,d} = E(OOPE)_{i,d} + C_{\min,i,d}$$

4.3 Offered premium rebate

In a free, unregulated health insurance market the offered premium rebate *OPR* for a certain deductible can be based on out-of-pocket expenditures, reductions in moral hazard, reductions in administration costs, and the effect of self selection, due to that deductible (Bakker et al., 2000).

4.3.1 Out-of-pocket expenditures and cost reductions

The insured with a deductible pay the expenditures up to the deductible amount out of their own pocket, resulting in a shift of costs from the insurer to the insured. In a competitive health insurance market, insurers will be forced to reflect these out-of-pocket expenditures in the premium rebate.

A second component is the reduction in moral hazard. Moral hazard can be defined as the increase in (more expensive) medical consumption because of insurance. Based on the RAND-experiment, Keeler et al. (1988) conclude that full insurance coverage leads to about 70 percent higher medical expenditures than no insurance coverage. So, compared to full coverage, deductibles are expected to reduce total expenditures. In the RAND experiment a 95-percent coinsurance plan with a stop-loss of $ 1,000 resulted in 31 percent lower medical expenditures than a full-coverage plan (Manning, 1987). The average medical expenditures of those not having a deductible in the RAND-experiment were $ 749 (in 1984 US-dollars).

A more recent study by Van Vliet (2004) shows that in the Dutch private health insurance market of 1996 a deductible of Dfl. 1,750 led to a reduction in medical expenditures of about 14 percent. The average expected medical expenditures of the insured having that deductible were Dfl. 2,548 (in 1996 Dutch guilders).

In a reimbursement scheme, a third component could be a reduction in administration costs. Part of the insured will not send their bills to the insurer before the total amount exceeds the deductible. Consequently, the insurer does not have to handle the bills of those whose expenditures remain below the deductible amount in the accounting period. However, many health insurance schemes are characterized by arrangements between insurers and providers of care. Due to these arrangements a reduction in administration costs is expected to be negligible since (a part of) the bills are sent directly from the provider to the insurer, with the insured being notified afterwards. Hence, we assume a reduction in administration costs to be absent.

4.3.2 Self selection

In a competitive health insurance market without risk equalization, the premium rebate is not just a reflection of out-of-pocket expenditures and the cost reductions mentioned above, but also comprises the effect of self selection. Self selection occurs because high risks have a greater incentive to buy (more) insurance coverage than low risks within the same premium-risk group. Many studies have found evidence of self selection in health insurance (e.g. Browne 1992, Gardiol et al. 2005, Beck 2004). In the context of the present study, self selection occurs because the healthy insured have a greater incentive to opt for a voluntary deductible than the unhealthy insured (given a certain premium rebate). In a heterogeneous risk pool self selection results in market segmentation such that those who choose the deductible on average are healthier and have lower expenditures than those who do not choose a deductible, ceteris paribus. Competition will force the insurer to increase the premium for full coverage and decrease the premium (i.e. increase the premium rebate) for the deductible plan. Consequently, the premium rebate for a certain deductible is not only based on out-of-pocket expenditures plus the reduction in moral hazard due to that deductible, but also on differences in ex-ante health status between those whose choose a deductible and those who do not. The more heterogeneous premium-risk groups are, the larger will be this effect of self selection.

In the presence of risk equalization among insurers, the effect of self selection on the premium rebate will be smaller. If the equalization payments do 'perfectly' adjust for expenditure differences due to differences in ex-ante health status between the healthy and the unhealthy then the *effect* of self selection on the premium rebate is zero (although there might be substantial self selection). For instance, this scenario occurs if the level of deductible is included as a risk factor in the risk equalization system.

4.3.3 Conclusion

If the equalization payments fully adjust for the effect of self selection then the offered premium rebate can be based exclusively on the expected out-of-pocket expenditures $E(OOPE_d)$, and expenditure reductions MR_d due to decreased moral hazard.

$$OPR_d = E(OOPE_d) + MR_d \tag{4.7}$$

4.4 Data

To estimate the actual financial gains obtained in the Swiss basic health insurance and to examine whether the premium rebates actually offered could have been offered in the presence of perfect risk equalization, we analyzed 2003-data from a Swiss sickness fund.

4.4.1 Swiss sickness fund insurance

Since the Revised Health Insurance Law came into force in January 1996, all Swiss residents must have basic health insurance.

4.4.1.1 General

In 2002, there were 93 insurance companies operating under the health insurance law, which defines the scope of the benefits package as well as the conditions under which insurers and providers of care are operating. Among others, the package includes inpatient and outpatient care, physician's services, physiotherapy, laboratory analyses, health care at home, nursing home care, technical aid, medicaments from pharmacy and physicians, and alternative and complementary benefits. Insurers are obliged to accept all applicants, thereby avoiding explicit risk selection in principle. The insured may change insurer twice per year. To equal out different starting positions of the competing insurers when open enrollment started in 1996 and to avoid risk selection by insurers, government created a solidarity fund responsible for risk equalization (Beck et al., 2003). Every canton has its own risk equalization system, which takes into account age and gender and equalizes the actual net expenditures, i.e. the expenditures reimbursed by the insurer.

4.4.1.2 Individual deductibles

There are user charges in the form of individual deductibles starting from a mandatory minimum. The insured can reduce their premium by opting for a higher deductible. In order to protect solidarity, premium rebate limits are set by the federal government. 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 above the deductible. During inpatient care those from single-occupant households must pay hotel-type expenses of CHF 10 per day. During the years in our data 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. A voluntary deductible of CHF 170 (€ 110, 2006) resulted in a premium rebate of up to 8 percent. For voluntary deductibles of CHF 370, 970 and 1,270 (€ 235, € 610 and € 800 respectively, 2006) the rebates were at most 15, 30 and 40 percent of the community-rated premium per insurer per canton, respectively. Children are exempted from mandatory deductibles and their voluntary deductible options are all lower then the options for adults and seldom chosen.

4.4.2 Data

The data are taken from administrative sources and contain background information and medical expenditures for insured from 4 Swiss cantons who were enrolled in the sickness fund in 1998. These insured, all older than 26 years, were followed 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 set includes information on age, gender, medical expenditures, insurance premium, deductible level, premium rebate, region and years of enrollment. Medical expenditures are divided into eleven categories of medical care, i.e. physician care, medicaments from physicians, medicaments from pharmacies, physiotherapy, laboratory analyses, stationary and ambulatory hospital care, health care at home, nursing home care, technical aid, and other. Apart from nursing home care, this benefit package is comparable to that in other health insurance schemes. To generalize the results and conclusions, expenditures for nursing home care were not taken into account in the empirical analysis.

The first line of table 4.1 shows the gross expenditures, i.e. the expenditures registered by the insurer, per deductible amount. These expenditures are probably incomplete because of unfiled claims. The reason is that some of the insured will send their bills to their insurer *only if* the total amount exceeds the deductible, i.e. if they expect to get any reimbursement. Obviously, the amount of unfiled claims is expected to increase with a higher deductible.

To get a better indication of the expenditure differences among insured with different deductible amounts, table 4.1 also shows the average expenditures above CHF 1,500 and the proportion of insured with expenditures exceeding CHF 1,500. These expenditures are not affected by unfiled claims, since all insured with expenditures exceeding CHF 1,500, in principle, send all bills to the insurer in order to get (some) reimbursement. For these insured the gross expenditures registered by the insurance company reflect to their actual expenditures.

Table 4.1 Mean (std dev) per deductible level in 2003 (currency = CHF; CHF 1 = € 0.63)

	x=230 *d*=0	*x*=400 *d*=170	*x*=600 *d*=370	*x*=1,200 *d*=970	*x*=1,500 *d*=1,270
Gross expenditures	3,874 (7,422)	2,967 (6,298)	2,457 (5,888)	1,743 (5,927)	884 (2,732)
Expenditures > CHF 1,500	2,826 (7,224)	2,020 (6,087)	1,670 (5,644)	1,184 (5,701)	489 (2,464)
Proportion of insured with expenditures > 1,500	0.54 (0.50)	0.46 (.50)	0.37 (0.48)	0.25 (0.43)	0.15 (0.36)
Age	59 (16)	57 (14)	54 (14)	53 (14)	48 (11)
N (total = 134,758)	71,864	30,457	11,305	3,303	17,829

At first glance, table 4.1 reveals that there is a high correlation between the level of deductible and expenditures > CHF 1,500. This can be the result of both a reduction in moral hazard and the effect of self selection. Self selection is evident in the correlation between the level of deductible and age.

4.5 Method

In the first part of the empirical analysis we quantified the actual financial gain obtained for voluntary deductible *d* in 2003. In the second part we examined whether the premium rebate offered for deductible *d* could have been offered in the presence of 'perfect' risk equalization.

4.5.1 The actual financial gain

For insured *i* we calculated the actual financial gain $C_{i,d}$ from having a voluntary deductible *d* as the offered premium rebate for this deductible, OPR_d, minus his/her out-of-pocket expenditures $OOPE_{i,d}$ due to this deductible. Obviously, $C_{i,d}$ can also be a financial loss instead of a financial gain.

$$(4.8) \qquad C_{i,d} = OPR_d - OOPE_{i,d}$$

The data set contains information on the actual rebates for different deductible plans, but lacks some information on expenditures for the insured whose expenditures did not exceed the deductible amount, as mentioned in Section 4.4.2. To correct for unfiled claims we used the following three-step procedure:

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.

4.5.2 Expected expenditures

Expenditures of the insured without a voluntary deductible were assumed to be recorded in full. 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. To estimate the total expenditures $E(Y)_i$ we used the two-part model defined in equation (4.9).

$$(4.9) \qquad E(Y)_i \quad = \quad p(Y_i > 0) \quad * \quad E(Y_i \mid Y_i > 0)$$

We estimated $p(Y_i > 0)$ by a logistic regression. For the estimation of the second part of equation (4.9), we considered two options. The first, described by Duan et al. (1983), is applying OLS to the logarithm of positive medical expenditures. An important disadvantage of this option with regard to our analysis is that the predictions need to be retransformed to monetary units. The second option is GLM with a log-link and a choice of distributions. We chose to use this option since the predictions do not need to be retransformed and a distribution can be chosen that fits the data in a proper way (Manning and Mullahy, 2001). The distribution chosen in our analysis 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. For the estimation of both the first and the second part of equation (4.9) the following information was used to create the explanatory variables: age, gender, region and gross expenditures in three previous years.

Dummy variables were created to represent 14 age/gender groups, and 9 different regions, and continuous 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 4.4.2.

As a next step, the coefficients obtained were used to predict the expenditures of the insured *with* a voluntary deductible. For these insured the predicted expenditures were - a fraction $F(d)_0$ - higher than the gross expenditures recorded in the data. 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 to be insignificant, since differences in health and risk are sufficiently captured by including prior expenditures of three preceding years in our model, differentiated as well into ten types of expenditures. In the remainder of the analysis unobserved differences in health status are assumed to be absent. Accordingly, the expected expenditures can be seen as the expenditures that these insured would have had in a situation without a voluntary deductible.

During the years in our data, the deductible levels did not change. So, given $F(d)_0$, the gross expenditures in years *t*-1, *t*-2, and *t*-3 were probably affected by moral hazard and unfiled claims as well. This could have biased the prediction 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 gross expenditures in prior years by 1+ $F(d)_0$. This further increased the relative difference in predicted and gross 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 gross expenditures. Accordingly, we multiplied the (original) gross 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 $s \geq 8$.

4.5.3 Expected out-of-pocket expenditures

As a next step we wanted to predict the out-of-pocket expenditures due to the voluntary deductible. Since all the insured in the data had a mandatory deductible of CHF 230, the total deductible *x* equaled voluntary deductible *d* + CHF 230. The out-of-pocket expenditures of an individual *i* due to his total deductible *x* were estimated according to equation (4.10).

$$(4.10) \qquad E(OOPE)_{i,x} = E(Y)_i * \Gamma(c_i, k+1) + x * (1 - \Gamma(c_i, k))$$

with

$$(4.11) \qquad c_i = x * \lambda_i, \quad and \quad \lambda_i = k / E(Y)_i$$

and with Γ(.) the cumulative density function of the gamma distribution with parameters *c* and *k* (Van Vliet 1995). Equation (4.10) can be seen as the weighted sum of the expected out-of-pocket expenditures if medical expenditures are below x $(= E(Y)_i * \Gamma(c_i, k+1) / \Gamma(c_i, k))$ and the out-of-pocket expenditures if medical 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 $Y > x$ (Van Vliet 1995, 2004).

The final step in estimating the out-of-pocket expenditures $E(OOPE)_{i,d}$ due to a voluntary deductible *d* was to subtract the expected out-of-pocket expenditures due to the *mandatory* deductible of CHF 230 from the expected out-of-pocket expenditures due to the *total* deductible x. We estimated the out-of-pocket expenditures due to the mandatory deductible the same way as the total out-of-pocket expenditures, with x in (4.10) and (4.11) being replaced with 230. Table 4.2 shows the average results per deductible.

The first row of table 4.2 shows what the expenditures of the five subgroups would have been in a situation without a voluntary deductible. The difference with the first row of table 4.1 captures both moral hazard and unfiled claims.

Table 4.2 Mean (std dev) of expected (out-of-pocket) expenditures per deductible level in 2003 (currency = CHF; CHF 1 = € 0.63)

	x=230	*x*=400	*x*=600	*x*=1,200	*x*=1,500
	d=0	*d*=170	*d*=370	*d*=970	*d*=1,270
Expected expenditures E(Y)	3,876 (4,102)	3,351 (3,617)	2,929 (3,961)	2,136 (3,440)	1,373 (1,735)
Expected out-of-pocket expenditures due to the total deductible	195 (47)	314 (89)	408 (154)	596 (314)	566 (343)
Expected out-of-pocket expenditures due to the mandatory deductible	195 (47)	188 (50)	172 (58)	147 (62)	134 (61)
Expected out-of-pocket expenditures due to the voluntary deductible	0 (0)	126 (39)	236 (96)	449 (253)	432 (285)

4.5.4 The necessary expenditure reduction due to less moral hazard

As a final step we wanted to examine whether the premium rebates actually offered in 2003, could have been offered in the presence of perfect risk equalization. With perfect risk equalization, the premium rebate for a deductible can be based only on out-of-pocket expenditures and a reduction in moral hazard, as argued in Section 4.3.1. In such a situation the actual rebates found in our data could have been offered *only if* the expenditure reduction due to less moral hazard equals or exceeds the actual financial gain found, as follows from equation (4.7) and (4.8). Accordingly, we calculated the (relative) necessary expenditure reduction $\overline{m}$ according to equation (4.12).

$$(4.12) \qquad \overline{m} = \overline{C}_d \ / \ \overline{E(Y)}_d$$

with $\overline{C}_d$ the actual average financial gain found for the group of insured with voluntary deductible *d* and $\overline{E(Y)}_d$ the average expected total expenditures.

4.6 Results

4.6.1 General statistics

To quantify the actual financial gain for the insured with a deductible, we first estimated the total expenditures and the out-of-pocket expenditures, as described in Section 4.5. Table 4.3 indicates the validity of the procedure used to estimate the out-of-pocket expenditures. For the insured *without* a voluntary deductible, it shows the *actual* values of expenditures between CHF 230 (mandatory deductible level) and CHF 400, 600, 1200 and 1500 (total deductible levels) and the *predicted* expenditures in these intervals. Notice that for these insured the *gross* expenditures on top of the mandatory deductible of CHF 230 in year *t* are not affected by unfiled claims or reductions in moral hazard. The *predicted* expenditures of these insured might be slightly affected by the corrections described in Section 4.5.2. However, the effect is negligible since these corrections were only applied to the gross expenditures of those with a voluntary deductible in one of the previous years; less then 3 percent of the insured *without* a deductible in year *t* had a voluntary deductible in *t*-1, *t*-2 and/or *t*-3. From table 4.3 it can be concluded that the predicted expenditures closely agree with the actual expenditures in these intervals. The distribution test mentioned in Section 4.5.2 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 4.3 Mean (std dev) of actual and predicted expenditures between CHF 230 and CHF x for the insured without a voluntary deductible in 2003 (N=71,864; currency = CHF; CHF 1 = € 0.63)

	Actual expenditures	Predicted expenditures
Between CHF 230 and 400	135 (67)	135 (36)
Between CHF 230 and 600	286 (148)	284 (79)
Between CHF 230 and 1,200	682 (403)	678 (215)
Between CHF 230 and 1,500	852 (531)	850 (284)

4.6.2 Potential gain for insured without a voluntary deductible

It could be easily calculated how large the average financial gain of those *without* a voluntary deductible would have been if they had collectively chosen a voluntary deductible. This amount, which we define as the *potential* gain, is shown in table 4.4. It is calculated as the average premium rebate that these insured would have received for voluntary deductible *d* minus their average expected out-of-pocket expenditures due to *d*. This calculation ignores a possible reduction in moral hazard. If this would be taken into account as well then the potential gain would be even higher since a larger reduction in moral hazard might result in lower out-of-pocket expenditures.

From table 4.4 it can be concluded that on average a voluntary deductible would have been beneficial for these insured. Table 4.4 also shows the proportion of insured that would have had a (positive) financial gain. Of course, part of these insured knew for sure that their out-of-pocket expenditures would exceed the deductible amount due to a chronic illness, for instance. They were not likely to choose a deductible as long as the premium rebate did not (far) exceed the deductible amount. Nonetheless, table 4.4 reveals that this was definitely not the case for all the insured who did not choose a deductible. For 23 percent of these insured a voluntary deductible of CHF 170 would have been beneficial. This figure is 27 percent a voluntary deductible of CHF 370, 38 percent for a voluntary deductible of CHF 970 and 43 percent for a voluntary deductible of CHF 1,270. Apparently, these (ex-post) potential gains were not large enough to induce these insured to take a deductible.

Table 4.4 Potential gain for insured without a voluntary deductible in 2003 (N=71,864; currency = CHF; CHF 1 = € 0.63)

	d = 170	*d* = 370	*d* = 970	*d* = 1,270
Premium rebate	170	367	877	1,116
Predicted expenditures between CHF 230 and CHF 230+d	135	284	678	850
Average potential gain	35	83	199	266
Proportion of insured with potential gain > 0	0.23	0.27	0.38	0.43

4.6.3 Actual financial gain in practice

After predicting the total expenditures for insured with voluntary deductible *d* we estimated their out-of-pocket expenditures according to equation (4.10) and (4.11). The average actual financial gain could be calculated by subtracting the estimated out-of-pocket expenditures from the premium rebate for voluntary deductible *d*. Table 4.5 shows the average actual gain per deductible in 2003.

We may not directly conclude that the actual financial gain exactly equals the *minimum* compensation considered in Section 4.2. The reason is that some of the insured with deductible *d* would possibly also have chosen *d* in return for a lower rebate. However, we expect that the *minimum* compensation will not be far from the actual financial gain since the previous section revealed that a substantial number of insured did not choose a deductible while it would have yielded them a considerable financial advantage.

In general terms, these results indicate that the insurer had to offer a substantial premium rebate (relative to the out-of-pocket expenditures) to induce almost 50 percent of the insured to take a deductible. As described in Section 4.3, this is no problem in a health insurance market without *perfect* risk equalization like the Swiss basic health insurance. Premium rebates in these insurance markets can be very high because of the effect of self selection, despite the legal restrictions on premium rebates.

4.6.4 Necessary reduction in moral hazard

If we assume risk equalization to adjust perfectly for differences in health status between the insured with and the insured without a voluntary deductible, the premium rebate can be based only on the out-of-pocket expenditures plus the reduction in moral hazard, as argued in Section 4.3.1. The bottom row of table 4.5 shows how large the expenditure reduction due to less moral hazard had to be to offer the actual premium rebates (found in the data) in the presence of perfect risk equalization. The reduction is presented as a percentage of the average expected expenditures of the insured with *d*.

Table 4.5 Average financial gain due to voluntary deductible d for all insured with d in 2003 (currency = CHF; CHF 1 = € 0.63)

	***d* = 170**	***d* = 370**	***d* = 970**	***d* = 1,270**
Premium rebate	170	367	877	1,116
$E(OOPE)_d$	126	236	449	432
Average gain	44	131	427	684
Average gain as % of $E(OOPE)_d$	35%	56%	95%	158%
Average gain as % of E(Y)	1.3%	4.5%	20.0%	48.8%

To offer the actual rebate found for a voluntary deductible of CHF 170, the expenditure reduction had to be 1.3 percent relative to the expected expenditures of these insured, ceteris paribus. For the groups of insured having a voluntary deductible of CHF 370, 970 or 1,270 the reductions had to be 4.5, 20 and 48.8 percent, respectively.

To examine whether these reductions are likely to occur, these results can be compared with the results discussed in Section 4.3.1. In the RAND-experiment an expenditure reduction of 31 percent was found for a 95%-coinsurance plan with a maximum on out-of-pocket expenditures of $1,000. This plan can be seen as a high-deductible plan with the deductible amount being 134 percent (= $1,000 / $ 749) of the average expenditures that insured were expected to have in case of full-coverage (Manning et al., 1987). Van Vliet (2004) found that in the Dutch private health insurance of 1996 a deductible of Dfl. 1,750 led to an expenditure reduction of 14 percent. This deductible amount was about 69 percent (= Dfl. 1,750 / Dfl. 2,548) of the average expenditures that insured were expected to have in case of full-coverage.

From table 4.2 it can be calculated that in our data a voluntary deductible of CHF 170 is about 5 percent (= CHF 170 / CHF 3,351) of the average expenditures that the insured with this deductible were expected to have in a situation *without* a voluntary deductible. For voluntary deductibles of CHF 370, 970 and 1,270 these figures are 13 percent (= CHF 370 / CHF 2,929), 45 percent (= CHF 970 / CHF 2,136) and 92 percent (= CHF 1,270 / CHF 1,373), respectively. Comparing the necessary reduction with the results of Manning et al. (1987) and Van Vliet (1994), we conclude that the actual rebate offered for a deductible of CHF 1,270 could definitely not have been offered in the presence of 'perfect' risk equalization. We should be careful with a conclusion regarding the deductible of CHF 970 because of the low number of insured having that deductible in our data. Regarding the deductibles of CHF 170 and CHF 370 we conclude that the premium rebates actually offered could probably also have been offered in the presence of perfect risk equalization.

With respect to the lower deductibles, i.e. CHF 170 and CHF 370, one should notice that these results do not imply that a reduction of 1 percent will *always* be large enough to offer an attractive premium rebate. If the voluntary deductible of CHF 170 would have been the highest deductible available then the insured with voluntary deductibles of CHF 370, 970 and 1,270 in our dataset would presumably have taken the voluntary deductible of CHF 170. Since these insured are on average healthier, the average medical expenditures and average out-of-pocket expenditures in the group of insured with a voluntary deductible of CHF 170 would have been lower. Consequently, the necessary expenditure reduction would have been larger, according to equation (4.12).

4.7 Conclusion and policy implications

Theoretically, a risk-averse consumer takes a voluntary deductible *only if* the premium rebate exceeds his/her expected out-of-pocket expenditures, i.e. if he/she expects to obtain a financial gain. In our 2003-data from Switzerland we found that the actual rebates for voluntary deductible d (far) exceeded the average out-of-pocket expenditures for insured with d. Moreover, our results reveal that a substantial number of insured did not choose a deductible although it would have yielded them a considerable financial advantage. This indicates that consumers demand a large financial compensation in order to be induced to take a (high) deductible.

In the *absence* of (perfect) risk equalization insurers can offer high premium rebates due to the effect of self selection. We conclude that, for high deductibles, such premium rebates cannot be offered in the *presence* of 'perfect' risk equalization. In such a situation numbers of insured opting for a high deductible will be lower and the total reduction in moral hazard will be smaller than in the *absence* of (perfect) risk equalization.

The Swiss and the Dutch 2006-equalization schemes are 'imperfect', implying that part of the expenditure differences between the insured with and without voluntary deductible *d* can be reflected in the premium rebate for *d*. As a result, the level of cross-subsidization between the healthy and the unhealthy insured is lower than in a situation with perfect risk equalization. One way to increase cross-subsidization would be to include the level of deductible as a risk factor in the equalization model. Risk equalization would then 'perfectly' adjust for differences in health status between those who choose a deductible and those who do not. As shown in this paper, this would also lead to lower numbers of insured choosing a deductible and a smaller reduction in moral hazard. Since the main goal of user charges is to reduce moral hazard, some effect of self selection on the premium rebate can be justified to increase the viability of voluntary deductibles.

4.8 References

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A voluntary deductible in social health insurance with risk equalization: 'Community-rated or risk-rated premium rebate?'

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ABSTRACT - On 1 January 2006 a new mandatory basic health insurance will be introduced in the Netherlands. One aspect of the new scheme is that the insured can opt for a deductible. This option should increase the individual responsibility and reduce moral hazard. In the new scheme a risk equalization system is aimed to avoid preferred-risk selection and insolvency of insurance companies with a relatively high-risk pool. A crucial issue with respect to a voluntary deductible in this type of social health insurance is whether the premium rebate should be community-rated or risk-rated. The Dutch government has chosen the former, which means that the premium rebate will be independent of health status and risk. Our analysis shows that, in a situation with 'accurate' risk equalization, a community-rated premium rebate could lead to an adverse selection spiral. Over time, this spiral results in none of the insured taking a deductible and thus no reduction in moral hazard.

Chapter 5

5.1 Introduction

On 1 January 2006 a new mandatory basic health insurance will be introduced in the Netherlands for the whole population. One aspect of the new scheme is that the insured can choose to have a deductible.[1] One of the issues related to the practical implementation of a voluntary deductible is whether the premium rebate should be community-rated or risk-rated. The Dutch government has chosen the former, implying that the premium rebate will be independent of health status and risk.

In this paper we analyze the consequences of a community-rated premium rebate in combination with the risk equalization system that will be functioning in new basic health insurance. Risk equalization is aimed to avoid subtle forms of preferred-risk selection and upward premium spirals for insurers with a relatively high-risk pool. The need for risk equalization comes from the ban on premium differentiation and the obligation for insurers to accept every new applicant. As part of risk equalization, the insurers receive a compensation for the relatively high-risk individuals in their insurance pool and pay a contribution for the relatively low-risks. On the one hand, risk equalization among insurers can reduce incentives for cream skimming. On the other hand, it could be problematic with regard to the introduction of a voluntary deductible.

Without risk equalization, the premium rebate for a deductible does not only reflect cost sharing, a reduction in moral hazard and a reduction in administration costs, but also the effect of adverse selection by insured. Adverse selection is the phenomenon that in each premium-risk group, the relatively healthy consumers are more likely to opt for a deductible than the relatively unhealthy consumers. Adverse selection thus results in market segmentation, which allows the insurer to ask different premiums from the two groups. Competition will force the insurers to ask cost-based premiums, which implies that they increase the premium for the (relatively unhealthy) insured choosing full coverage and decrease the premium (i.e. further increase the premium rebate) for the insured taking the deductible. Thus, without a risk equalization system the difference in expected expenditures between the two groups of insured, which results from their different health status, is reflected in the premium rebate for the deductible.

However, with a risk equalization system, the insurer receives a compensation for the unhealthy insured and has to pay a contribution for the healthy insured. So, the difference in expected expenditures between the two groups, which is the result of their different health status, is then (partly) reflected in these compensations and contributions. This holds true both in the absence and presence of voluntary deductibles. Accordingly, the differences in health status between the two groups cannot be (fully) reflected in the premium rebate for a deductible.

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1 With a maximum of 500 euro per individual per year.

The purpose of this study is to analyze the expected implications of a community-rated premium rebate in combination with an accurate risk equalization system.[2] For example, will the cost reduction for the insurer recover the community-rated premium rebate? If it doesn't, the insurer will be forced to decrease the premium rebate, resulting in lower numbers of insured taking a deductible, an even lower cost reduction and so on. Over time, this could lead to none of the insured taking a deductible and no reduction in moral hazard. In addition, our study examines whether this so-called adverse selection spiral can be avoided by a *risk-rated* premium rebate.

In section 5.2, we briefly describe the expected implications of risk equalization by considering the components of the cost reduction resulting from a deductible. In section 5.3 we present a set of determinants, which we assume to affect the choice of taking a deductible for a given premium rebate. In sections 5.4 and 5.5 we report on a simulation analysis in which we examined whether the insurer's total cost reduction can be large enough to recover the offered premium rebate. In this analysis we took into account different assumptions with respect to the level of risk-rating. Finally, in section 5.6 we conclude and discuss this study.

It is important to keep in mind that the main purpose of this study is to indicate the implications of a community-rated premium rebate in a situation where risk equalization accurately compensates for differences in health. Considering the large number of assumptions underlying the choice of taking a deductible, the importance of this study lies in the overall conclusions rather than specific tables and figures. Although the new Dutch basic health insurance is taken as the context of our study, the main results and conclusions will also be relevant for other mandatory social health insurance schemes with 'accurate' risk equalization.

5.2 Implications from risk equalization

5.2.1 Prospective risk equalization

The new Dutch basic health insurance is aimed to guarantee equal access to a package of health care benefits required by law. In this new scheme, which is schematically shown in figure 5.1, the insured pay an income-dependent premium to a Central Fund and a nominal premium of about 1,100 euro directly to their insurer. Insurers are obliged to accept every eligible applicant, while it is forbidden to differentiate the nominal premium. In order to avoid subtle forms of preferred-risk selection and insolvency of insurance companies, the Central Fund determines compensations and contributions, which the insurers receive and pay for each enrollee in their insurance pool (Pupp 1981, Van Vliet 2004). The compensations

2 With 'accurate' we mean that risk equalization does fully adjust for differences in health status between those who choose a deductible and those who do not.

are financed with the income-dependent premium revenues and with the contributions by insurers. The compensations and contributions are prospectively calculated, using the following risk characteristics: age, gender, diagnostic cost groups (DCG), pharmacy cost groups (PCG), degree of urbanization and eligibility status (Van de Ven et al. 2004). Ideally, the compensation or contribution for insured *i* equals the expected costs of *i* minus the 'standard' nominal premium (Van Vliet 1992). The insurers are competing on the level of the nominal premium. For more details about the (developments) in the Dutch social health insurance, we refer to Schut and Van de Ven (2004).

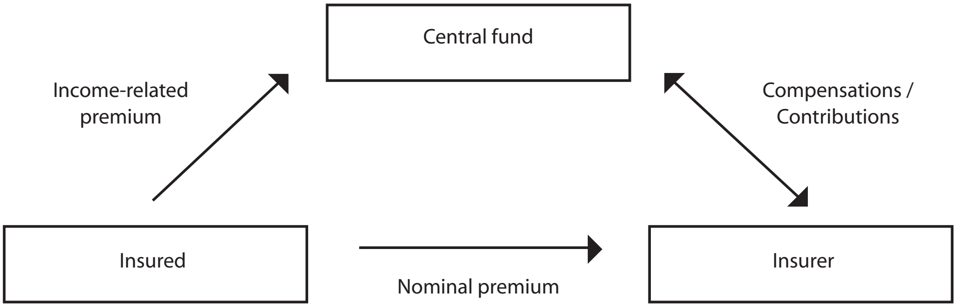

Figure 5.1 The new Dutch mandatory basic health insurance scheme

Whereas risk equalization reduces incentives for cream skimming and avoids problems for the insurer's solvency, it will also lead to a lower premium rebate that the insurer can offer to those insured opting for a deductible (see section 5.2.3).

5.2.2 Cost reduction resulting from deductibles

According to Bakker et al. (2000), the cost reduction resulting from a deductible compared to full insurance consists of three components: cost sharing, a moral hazard reduction and a reduction in administration costs. These components are briefly described within the context of the new Dutch mandatory basic health insurance.

5.2.2.1 Cost sharing

Insured with a deductible have to pay the costs up to the deductible amount out-of-pocket, resulting in a shift of costs from the insurer to the insured (compared to full coverage). In a competitive health insurance market, insurers will be forced to reflect this cost reduction in the premium rebate.

5.2.2.2 Reduction in moral hazard

A second component of the cost reduction resulting from a deductible is a reduction in moral hazard. Moral hazard can be defined as the increase of (more expensive) health care consumption because of insurance. One of the most authoritative investigations in estimating the effect of coverage on medical consumption is the RAND-experiment (Manning et al. 1987; Newhouse et.al. 1993). Based on this experiment Keeler e.a. (1988) conclude that full coverage leads to 75 percent higher health care costs compared to a situation without insurance. Whereas broad coverage could lead to an *increase* of medical consumption, less coverage (e.g. deductibles) could lead to a *decrease* of medical consumption. Keeler e.a. (1988) report that in the RAND-experiment, deductibles between $50 and $1000 led to a cost reduction between 15 percent and 39 percent of the average health costs ($842). Since the RAND-setting is US-specific and already more than 20 years old, one may not directly conclude that in the new Dutch mandatory health insurance a deductible will result in a similar moral hazard reduction. Gardiol et al. (2003) have studied the effects of deductibles on health care expenditure in the context of the Swiss mandatory health insurance. They report 33.6 percent lower expenditures for insured with a high deductible compared to insured with a low deductible. They found that this difference can be attributed to a selection effect (17.1 percent) and to a reduction in moral hazard (16.5 percent). Van Vliet (2001, 2004) has investigated the reduction in moral hazard resulting from deductibles among the privately insured in the Netherlands. He reports that deductibles between 50 and 800 euro result in a reduction in health expenditures in the range of 8 to 14 percent relative to the average total health costs of 1,072 euro. Other Dutch studies[3] about the effect of insurance on medical expenses among privately insured show similar results (Rutten 1978, Starmans and Verkooijen 1990, Van der Gaag and Van der Ven 1978, Van Vliet and Van de Ven 1986).[4]

5.2.2.3 Reduction in administration costs

In a reimbursement scheme, a third component of the cost reduction resulting from a deductible could be a reduction in administration costs. Since the costs under the deductible amount have to be paid out-of-pocket, most of the insured will not send their bills to the insurer before the total amount exceeds the deductible. Consequently, the insurer does not have to handle the bills of those with medical costs below the deductible amount (in the

3 For a broad overview of other studies: see Bakker (1997).

4 It should be noted that there are some crucial differences between the private health insurance market and the new Dutch mandatory health insurance, such as the higher average income of the privately insured, the way in which health consumption is financed (reimbursement in the private market versus reimbursement and 'delivery in kind' in the new mandatory health insurance) and the absence of open enrollment in the private market.

period for which the deductible holds). In the new Dutch scheme part of the health care interventions are delivered in kind. In such a situation bills are settled between the insurer and providers, presumably resulting in hardly any reduction in administration costs.

5.2.3 Selection effect

In a competitive health insurance market without risk equalization the premium rebate is not only a reflection of the cost reduction described above, but also of the effect of adverse selection. Adverse selection can be defined as the selection that occurs because high-risks have a greater incentive to buy (more) insurance coverage than low-risks within the same premium-risk group. Many studies have found evidence of adverse selection within the health insurance market (e.g. Browne 1992, Gardiol et al. 2003). In the context of this study, adverse selection occurs because the healthy insured have a greater incentive to opt for a deductible than the unhealthy insured. In a heterogeneous risk pool adverse selection will result in average health care costs that are lower for the (relatively healthy) insured choosing a deductible than the (relatively unhealthy) insured not choosing a deductible. Competition will force the insurer to increase the premium for the latter and decrease the premium (i.e. increase the premium rebate) for the former. As risk pools are more heterogeneous, this effect of adverse selection will be larger.

As considered in section 5.1, this adverse-selection component will be smaller in the presence of risk equalization among insurers. If risk equalization fully compensates for the differences in health between the insured with a deductible and the insured with full coverage then the adverse selection component of the premium rebate is zero (although there might be substantial adverse selection).

5.2.4 Research question

In this paper we assume that the consumer's direct premium to the insurer is community-rated. The better the risk equalization system compensates for differences in costs due to differences in health status, the smaller will be the premium rebate for a voluntary deductible. If risk equalization completely compensates for differences in health, then the premium rebate exclusively consists of cost sharing, a reduction in moral hazard and a reduction of administration costs. This will be the case if the level of deductible is used as a risk adjuster in calculating the compensations and contributions for risk equalization. In such a situation the effect of adverse selection is fully reflected in these compensations and contributions and cannot be reflected in the premium rebate.

The central question of this paper is whether, in a situation of accurate risk equalization, the cost reduction resulting from a deductible will recover the community-rated premium rebate. The importance of this question lies in the implications of community-rating in a situation where the actual cost reduction resulting from a deductible does not exceed the offered premium rebate. Such a 'loss' will force the insurers to decrease the premium rebate, resulting in lower numbers of insured taking a deductible, an even lower cost reduction for the insurer, a further decrease of the premium rebate and so on. Over time, this so-called adverse selection spiral could lead to none of the insured taking a deductible and no reduction in moral hazard.

If the cost reduction due to a deductible does not recover the offered *community-rated* premium rebate, it may be wise to allow the insurers to *risk-rate* the premium rebate. In section 5.5 we report on an analysis in which we calculated the actual cost reduction. This was done for a community-rated premium rebate, an 'age/gender'-related premium rebate and a 'completely' risk-rated premium rebate. In this analysis we had to make several assumptions with respect to the insured's choice of taking a deductible.

5.3 Choice of taking a deductible

A deductible option means that the insured can choose between full coverage and paying the cost up to a certain amount out-of-pocket. Choosing the latter would mean that an insured receives a rebate on the premium paid for full coverage. Presumably, a rationally behaving insured only takes a deductible if the offered premium rebate exceeds his 'demanded' premium rebate. In the competitive new scheme the *offered* premium rebate will probably be a reflection of the (expected) cost reduction from a deductible, as described in the previous section. This section describes the main components that we expect to affect the *demanded* premium rebate.

5.3.1 Demanded premium rebate

Presumably, the demanded premium rebate consists of the expected health care costs that have to be paid out-of-pocket plus an expected compensation for increased uncertainty and transaction costs, among others.

5.3.1.1 Expected out-of-pocket expenditure

A rational, income-maximizing consumer will not take a deductible if the offered premium rebate is lower than his expected out-of-pocket expenditure. The latter depends on the individual's health status and his perception of the probability and cost of health care consumption.

5.3.1.2 Risk aversion

A risk-averse individual will not spend part of his income on a lottery to win the same expected amount (Lapré and Rutten 1999). Similarly, a risk-averse insured will not take a deductible if the premium rebate 'just' equals his expected out-of-pocket expenditures. The demanded premium rebate for a risk-averse utility-optimizing insured will be higher than (just) his expected out-of-pocket expenditure since a higher deductible increases the uncertainty of incurring high health care expenditure. A higher level of risk aversion leads to a higher demanded premium rebate.

5.3.1.3 Transaction costs

Although the benefit package in the Dutch basic health insurance is determined by law, it will take some (immaterial[5]) costs to switch between different deductible plans (Pauly and Kunreuther 2004). The higher these costs are, the less attractive it will be for insured to switch between these plans. However, these costs are expected to be low in the Dutch basic health insurance, since there will be only five deductible amounts.

5.3.2 Conclusion

Concluding this section, we assume the insured to take a deductible if the offered premium rebate exceeds the demanded premium rebate. In the simulation, the offered premium rebate is assumed to be a reflection of the (expected) cost reduction resulting from a deductible and the demanded premium rebate is assumed to consist of the expected out-of-pocket expenditure and a compensation for uncertainty.

5.4 Method

Answering the research question would have been easy if any country in the world had mandatory health insurance with both 'accurate' risk equalization and voluntary deductibles at the time this study was carried out.[6] Since this was not the case, we had to conduct a simulation analysis.

By means of the simulation analysis we examined whether a community-rated premium rebate leads to an adverse selection spiral in a situation of accurate risk equalization. We simulated the extent of the cost reduction resulting from a deductible under several assumptions about

5 In terms of time or other efforts.

6 Although Switzerland has a sickness fund scheme with voluntary deductibles, adverse selection spirals do not occur there since risk equalization is far from accurate.

the level of risk aversion and the reduction in moral hazard. Additionally, we simulated two other scenarios in order to examine whether a risk-rated premium rebate can avoid an adverse selection spiral.

These simulations are based on a dataset of 38,631 insured who were enrolled in the same Dutch sickness fund during the whole year 1995.[7] [8] In the analysis we assumed this dataset to represent a single insurance pool. For reasons of transparency we only took into account a deductible of 500 euro, although the new Dutch basic health insurance has five deductible levels.

5.4.1 Three scenarios

As shown in table 5.1, each scenario is characterized by a different level of risk-rating, varying from a community-rated premium rebate to a completely risk-rated premium rebate. Since our dataset only includes information on age, gender, diagnostic cost groups 'DCG' (Lamers 1998, 1999b), pharmacy cost groups 'PCG' [9] (Lamers 1999a), degree of urbanization and eligibility status, we assumed that the choice of taking a deductible can be fully explained by these variables. Consequently, risk-rating according to these variables results in no consumer information surplus. These variables are nearly the same as those included in the calculation of the compensations and contributions for risk equalization in the new Dutch mandatory health insurance scheme.

For each scenario we aimed to examine the annual number of insured taking a deductible in order to find out whether an adverse selection spiral will occur over time.

Table 5.1 Scenarios

	Premium rebate differentiated according to …
Scenario I	-
Scenario II	Age and gender
Scenario III	Age, gender, DCG, PCG, degree of urbanization and eligibility status

7 This dataset is constructed by Leida Lamers. For detailed information about the dataset we refer to her dissertation 'Capitation payments to competing Dutch sickness funds – based on diagnostic information from prior hospitalizations' (Lamers 1997).

8 Until 2006, the sickness fund insurance has been the mandatory basic health insurance for about 65 percent of the Dutch population. The other 35 percent of the population had private health insurance. With the introduction of the new scheme on 1 January 2006 there comes an end to the co-existence of these schemes.

9 In the new Dutch mandatory health insurance, DCG's and PCG's will be used for calculating the risk adjusted compensations and contributions for risk equalization. DCG's are based on inpatient hospital information and PCG's are based on outpatient pharmacy information.

Thus, in our insurance pool, there is just 1 premium-risk group in scenario I (community-rating), there are 18 premium-risk groups (based on age and gender) in scenario II and there are in theory 16,200 premium-risk groups (based on all 6 variables) in scenario III. For practical reasons it is not likely that insurers will actually differentiate the premium rebate according to all these risk factors. If government would allow insurers to differentiate the premium rebate then the level of risk-rating is likely to resemble scenario II. Moreover, there will probably always be some consumer information surplus. This implies that even if the premium rebate is risk-rated according to all these variables, reality will have more in common with scenario II than with scenario III.

5.4.2 Data

The dataset includes individual level data from *one* sickness fund on health care costs of inpatient room and board, both inpatient and outpatient specialist care, dental care, obstetrics and maternity care, paramedical services (physiotherapy and speech therapy) and sick-transport. Costs of medical care provided by a general practitioner are not included in the dataset. This is because of the uniform annual fee that the general practitioner receives for each sickness fund member in his practice regardless of medical consumption. Next to the costs of health care the dataset includes other variables such as age, gender, type of supplementary insurance, number of hospital admissions and zip code. Since Pharmacy Cost Groups and degree of urbanization[10] in 1995 had already been composed and supplemented to the dataset, the only variable to be derived was Diagnostic Cost Groups. This variable was approximated by the number of days of hospitalization.

The average health costs in the 1995 dataset are 780 euro. As a result of both inflation and the aging of the population the average costs of the same benefit package were about 1560 euro in 2004. The dataset is corrected for this cost expansion. In order to simulate the premium rebate and the number of insured taking a deductible over a period longer than just one year, we created a multi-year dataset by using the 1995-dataset repeatedly.

5.4.3 Offered and demanded premium rebate

We assume the insured to take a deductible if the offered premium rebate *OPR* exceeds the demanded premium rebate *DPR*. As mentioned before, the demanded premium rebate of individual *i* is assumed to be the sum of his expected out-of-pocket expenditure $E(OOPE(d))_i$ plus a compensation for uncertainty C_i.

(5.1) $$DPR_i = E(OOPE(d))_i + C_i$$

10 Derived from zip code.

Because of a lack of experience with the new scheme, it will be difficult for the insurers to determine the premium rebate for the first year after the introduction. We assume the insurer to equal the premium rebate of risk group *j* (for year 1) to the average expected health cost up to the deductible amount $\overline{E(OOPE(d))}_j$ plus the average expected reduction in moral hazard $\overline{E(RMH)}_j$.

$$(5.2) \qquad OPR_{j,\,year\,1} = \overline{E(OOPE(d))}_{j,\,year\,1} + \overline{E(RMH)}_{j,\,year\,1}$$

After year 1, the insurer has experienced the actual cost reduction resulting from insured having a deductible in risk group *j*. For the following years, we assume that the insurer equals the premium rebate for a deductible in risk group *j* for year *t* to the actual average cost reduction from insured having a deductible in risk group *j* in year *t*-1.

$$(5.3) \qquad OPR_{j,\,year\,t} = \overline{(OOPE(d))}_{j,\,year\,t-1} + \overline{RMH}_{j,\,year\,t-1}$$

5.4.4 Expected out-of-pocket expenditure

We estimated the *total* individual health care costs *Y* by equation (5.4) with age, gender, PCG's, DCG's, degree of urbanization and eligibility status as explanatory variables.

$$(5.4) \qquad E(Y)_i = e^{\beta 0 + \beta 1 * X1 + \beta 2 * X2 .... + \beta z * Xz}$$

Then, we estimated the individual expected out-of-pocket expenditure by formula (5.5), in which we assume individual total health care costs to have a gamma distribution with parameters *c* and *k*. For a deductible amount of *d* euro, the expected out-of-pocket expenditure equals (Van Vliet 1995)[11]:

$$(5.5) \qquad E(OOPE(d))_i = E(Y)_i * \Gamma(c, k+1) + d * (1 - \Gamma(c, k))$$

with

$$(5.6) \qquad c = d * \lambda, \ \ and \ \ \lambda = k / E(Y)_i$$

11 Van Vliet (1995) assumed *Y* to have a lognormal distribution to estimate *E(OOPE(d))*. Since we estimate *E(Y)* by an exponential equation we chose to use a gamma distribution to estimate *E(OOPE(d))*.

and with Γ(.) the cumulative density function of the gamma distribution with parameters *c* and *k*. Equation (5.5) can be seen as the weighted sum of the expected out-of-pocket expenditures if health costs are below *d* and the expected out-of-pocket expenditures if health costs exceed *d*. Respectively, the weighting factors are Γ(*c*, *k*) and 1 - Γ(*c*, *k*), i.e. the probability of (*Y*<*d*) and the probability of (*Y*>*d*). From table 5.2 it can be concluded that the prediction with equation (5.5) closely agrees with the actual average costs below *d*.

Table 5.2 Actual costs, actual costs<500 and E(OOPE(d)) in the dataset

	Mean	Min	Max
Actual costs	1560	0	184,096
Actual costs < 500	334	0	500
E(OOPE(d))	322	214	490

5.4.5 Compensation for increased uncertainty

The compensation *C* for (increased) uncertainty resulting from a deductible can be defined as a monetary compensation demanded by insured for facing more uncertainty about the occurrence of health costs compared to full coverage. We calculated this compensation by equation (5.7).

$$(5.7) \qquad C_i = 0{,}5 * S^2(E(OOPE(d)))_i * r$$

with *r* the measure of risk aversion developed by Pratt (1964) and $S^2(E(OOPE(d)))_i$ the variance in the costs up to the deductible amount. We calculated $S^2(E(OOPE(d)))_i$ by equation (5.8) (Bakker, 1997):

$$(5.8) \qquad S^2(E(OOPE(d)))_i = E(Y)_i^{\,2} * (1 + (1/k)) * \Gamma(c, k+2) + d^2(1 - \Gamma(c,k)) - E(OOPE(d))_i^{\,2}$$

The higher the variance in $E(OOPE(d))_i$, the higher will be the uncertainty about the out-of-pocket expenditure and the higher will be the compensation for uncertainty demanded by a risk-averse insured. Van de Ven and Van Praag (1981) found an uncertainty compensation of 80 percent relative to the average expected out-of-pocket expenditure, corresponding to $r = 0.0067$. Another rare study on this subject reports *r*-values of $r = 0.00094$ and $r = 0.00113$ (Marquis and Holmer, 1986). In order to compensate for the variation in these results, our simulation incorporated three different values of *r*, i.e. $r = 0$, $r = 0.003$ and $r = 0.005$. Notice that for a risk-seeking individual the uncertainty compensation would be negative. In our simulation we only took into account situations in which the insured are risk neutral ($r = 0$) or risk-averse ($r = 0.003$ or $r = 0.005$).

5.4.6 Reduction in moral hazard

The study results mentioned in section 5.2.2.2 can be influenced by the context in which deductibles are arranged. Therefore, we should not overestimate the reduction in moral hazard. To avoid overestimations, we assumed the total reduction in moral hazard relative to the average total health costs to equal m, with $0 < m < 0.1$. In the analyses we took into account $m = 0$, $m = 0.05$ and $m = 0.1$, i.e. a reduction in moral hazard of 0, 0.05 and 0.1 relative to the average total health costs, respectively.

The insured only have an incentive for *efficient* health consumption until their health costs exceed the deductible amount. We calculated the individual reduction in moral hazard by equation (5.9).

$$(5.9) \qquad \tilde{m} * E(OOPE(d))_i$$

, with $\tilde{m}$ chosen such that the average reduction in moral hazard of insured having a deductible relative to the average health costs of these insured equals m.

5.5 Results

If the expected individual health care costs $E(Y)_i$ and the expected out-of-pocket expenditure $E(OOPE(d))_i$ are calculated by formulas (5.4), (5.5) and (5.6), the $E(OOPE(d))_i$ appears to vary between € 214 and € 490. Based on $E(OOPE(d))_i$ insured can be categorized in 'health' groups such that each 'health' group represents about one-tenth of the entire population. Following this categorization, 'health' group one contains the healthiest insured and 'health' group ten contains the unhealthiest insured. A change in either health status or probability to consume medical care is reflected in $E(OOPE(d))_i$ possibly resulting in a switch between 'health' groups. Table 5.3 presents the average, minimum and maximum expected out-of-pocket expenditure in these ten health groups.

Table 5.3 'health' groups (N=38,631)

'Health' group	Percent of N	Average *E(OOPE(d))*	Minimum *E(OOPE(d))*	Maximum *E(OOPE(d))*
1	10%	242	214	254
2	10%	260	254	270
3	10%	280	270	294
4	10%	300	294	304
5	10%	308	304	312
6	10%	318	312	332
7	10%	338	332	350
8	10%	356	350	368
9	10%	384	368	398
10	10%	420	398	490

In subsequent graphs these ten health groups define the x-axis. It is important to keep in mind that these health groups are just a reflection of $E(OOPE(d))_i$ taking into account age, gender, PCG's, DCG's, degree of urbanization and eligibility status.

5.5.1 Scenario I 'Community-rated premium rebate'

In this scenario the premium rebate is community-rated, which means that all the insured receive the same premium rebate for a deductible of 500 euro. The expected financial benefit from taking a deductible equals the offered premium rebate minus the expected out-of-pocket expenditure. In this scenario the expected financial benefit is higher for the healthy insured than for the unhealthy insured, as is shown is figure 5.2.

Figure 5.2 depicts the situation for year 1 in which the insurer bases the premium rebate on the average expected cost reduction under the assumption that all the insured will take a deductible. The gray line stands for the average expected out-of-pocket expenditure per health group. If the expected cost reduction (dashed line) for the insurer only consists of the expected out-of-pocket expenditure (left-hand graph) then the expected financial benefit is positive for the healthy insured and negative for the unhealthy insured. A 'substantial' reduction in moral hazard (right-hand graph) increases the average expected cost reduction to such an extent that the premium rebate could exceed the deductible amount. In such a situation, the unhealthiest insured have an expected financial benefit from taking a deductible too.

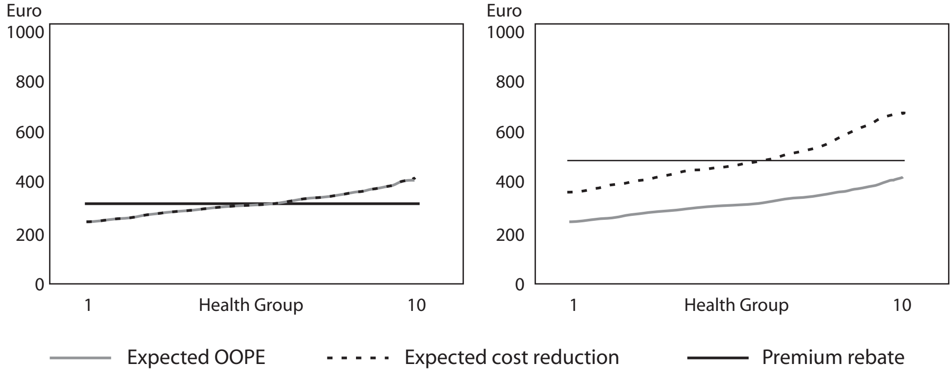

Figure 5.2 Expected out-of-pocket expenditure, expected cost reduction and (community-rated) premium rebate for year 1 with m=0 (left-hand) and m=0.1 (right-hand)

In this scenario, taking a deductible is more attractive for the healthy insured than for the unhealthy insured. Figure 5.3 shows the percentage of insured taking a deductible per health group. As is shown, the unhealthiest insured are the last to be inclined to take a deductible if the premium rebate does not exceed the deductible amount.

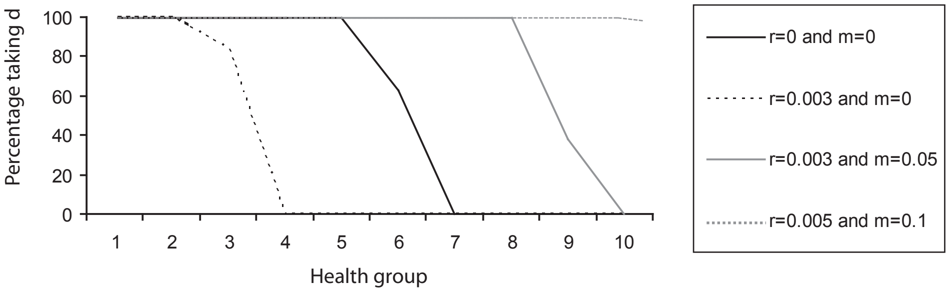

Figure 5.3 Percentage of insured taking a deductible in exchange for a community-rated premium rebate in year 1 per 'health' group

We assumed that the insured do only take a deductible if the premium rebate exceeds the expected-out-of-pocket expenditure plus the compensation for increased uncertainty. As can be seen from the left-hand graph in figure 5.2, the expected cost reduction from the insured taking a deductible is on average lower than the offered premium rebate. This means that the offered (community-rated) premium rebate is expected to result in a loss for the insurer, which will force the insurer to decrease the premium rebate for year 2. In year 2 the *community-rated* premium rebate will still lead to adverse selection, which will again result in a financial loss. Over time, this so-called adverse selection spiral leads to very low premium rebates resulting in none of the insured taking a deductible.

Table 5.4 shows how fast the annual percentage of insured taking a deductible decreases as a result of this adverse selection spiral. It needs to be mentioned that with a reduction in moral hazard of 10 percent (*m* = 0.1) the premium rebate is only slightly lower than the deductible amount. The spiral of adverse selection occurs in every situation, except in the situation of *m* = 0.1 and *r* = 0. Although the premium rebate in this situation is a little lower than the deductible amount, it does exceed the expected-out-pocket expenditure of the unhealthiest insured (490 euro, see table 5.3). Consequently, all of the insured take a deductible and no spiral of adverse selection occurs. If the demanded premium rebate also consists of a compensation for uncertainty, i.e. if $r > 0$, then the offered premium rebate does not exceed the demanded premium rebate of the unhealthiest insured.

Table 5.4 Percentage of insured taking a deductible in exchange for a community-rated premium rebate (100=N=38,631 insured)

Year	Level of risk aversion	Reduction in moral hazard		
		m=0	*m*=0.05	*m*=0.1
1	*r*=0.000	56	93	100
	r=0.003	28	84	99
	r=0.005	18	76	99
2	*r*=0.000	0	79	100
	r=0.003	0	22	98
	r=0.005	0	0	96
3	*r*=0.000	0	23	100
	r=0.003	0	0	97
	r=0.005	0	0	88
4	*r*=0.000	0	0	100
	r=0.003	0	0	95
	r=0.005	0	0	55

Next to the occurrence of an adverse selection spiral, the simulation results in table 5.4 reveal two other issues. In the first place, a larger reduction in moral hazard leads to a higher percentage of insured taking a deductible. This is not surprising since a larger (expected) reduction in moral hazard raises the premium rebate. Secondly, a higher level of risk aversion leads to a lower percentage of insured taking a deductible. Since a higher level of risk aversion will be reflected in a higher demanded premium rebate, a lower number of the insured will take a deductible in exchange for a given premium rebate.

In figure 5.4 the time period is extended to ten years. This reveals that the number of insured taking a deductible drops to zero in all situations where not *all* of the insured take a deductible in year 1.

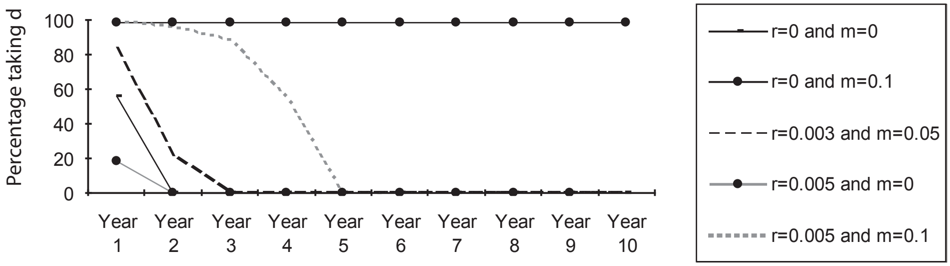

Figure 5.4 Percentage of insured taking a deductible in exchange for a community-rated premium rebate, under several assumptions with respect to the level of risk aversion (r) and the reduction in moral hazard (m) (100%=N=38,631 insured)

From these results it can be concluded that the total cost reduction for the insurer only recovers the community-rated premium rebate if the reduction in moral hazard is 'substantial'. If the average (expected) cost reduction from insured having a deductible is not large enough to offer a premium rebate exceeding the highest demanded premium rebate then a spiral of adverse selection occurs. This will lead to none of the insured taking a deductible over time. As is shown in table 5.3, the highest demanded premium rebate without risk aversion equals € 490, which is very close to the deductible amount. In reality the highest demanded premium rebate is likely to equal the deductible amount.

5.5.2 Scenario II 'Partly risk-rated premium rebate'

We simulated a second scenario in order to examine whether an adverse selection spiral is less likely to occur in a situation where insurers are allowed to differentiate the premium rebate. In this scenario the premium rebate is differentiated according to age and gender, resulting in 18 premium risk-groups, as mentioned in section 5.4.1. Under the same assumptions with respect to the choice of taking a deductible, a higher level of risk rating leads to an increasing expected financial benefit for the unhealthy insured. As is shown in figure 5.5, the opposite holds for the healthy insured.

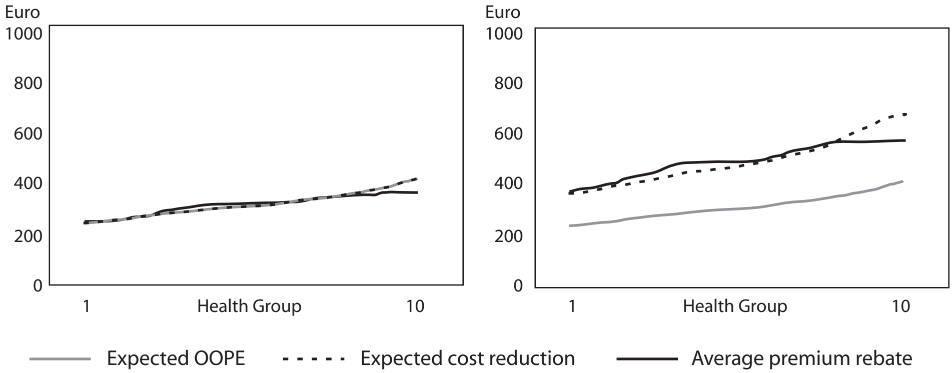

Figure 5.5 Expected out-of-pocket expenditure, expected cost reduction and premium rebate (differentiated according to age and gender) in year 1 with m=0 (left-hand) and m=0.1 (right-hand)

Consequently, a (partly) risk-rated premium rebate makes it more attractive for the unhealthy insured to take a deductible. If relatively more unhealthy insured take a deductible then the average cost reduction for the insurer will be larger since these insured have higher out-of-pocket expenditures. The question is whether this avoids a spiral of adverse selection. Figure 5.6 shows that in this scenario the number of insured taking a deductible seems to stabilize above zero if $m > 0$. A larger reduction in moral hazard increases the premium rebates for the different risk-groups, resulting in a larger number of the insured taking a deductible. A higher level of risk aversion leads to a higher demanded premium rebate, resulting in a lower number of the insured taking a deductible for a given premium rebate.

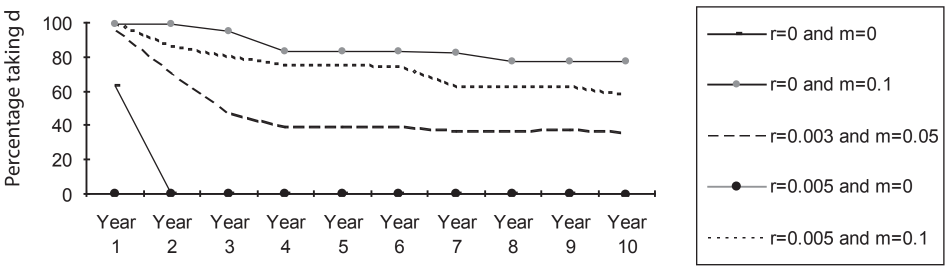

Figure 5.6 Percentage of insured taking a deductible in exchange for a premium rebate differentiated according to age and gender, under several assumptions with respect to the level of risk aversion (r) and the reduction in moral hazard (m) (100=N=38,631)

Table 5.5 reveals another interesting result. This table depicts the percentage of insured taking a deductible in the 9 premium-risk groups for women in year 1 and year 10 under the assumption of $m = 0.05$ and $r = 0.003$. Since the probability to consume health care increases with age, the high-age groups contain relatively more high-risk individuals than the low-age groups. It shows that if not all insured in a premium-risk group take a deductible in year 1 then a spiral of adverse selection leads to a drop of the percentage of insured taking a deductible to zero. In other words, the spiral of adverse selection occurs in every premium risk group in which the premium rebate does not exceed the highest demanded premium rebate. This will generally be the case if the premium rebate does not exceed the deductible amount since the highest demanded premium rebate is close to 500 euro.

Table 5.5 Percentage of insured taking a deductible in exchange for a premium rebate differentiated according to age and gender per premium-risk group for women (m=0.05 and r=0.003)

	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80+
Year 1	97	97	97	96	94	94	98	100	100
Year 10	0	0	0	0	0	0	57	100	100

Thus, a spiral of adverse selection occurs in all premium-risk groups where the unhealthiest insured do not take a deductible. Nonetheless, the total number of insured taking a deductible is higher than with a community-rated premium rebate since risk-rating easily leads to some premium rebates exceeding the deductible amount. This will be the case for premium-risk groups with relatively many high-risk individuals. Because the risk-rated premium rebate reflects the high (expected) out-of-pocket expenditure of these insured, only a small reduction in moral hazard is needed to lift the premium rebate over the deductible amount. So in the long run the percentage of insured taking a deductible mainly depends on the reduction in moral hazard. A larger reduction in moral hazard leads to more premium rebates exceeding the deductible amount and a higher percentage of insured taking a deductible.

5.5.3 Scenario III 'Completely risk-rated premium rebate'

In the third scenario the premium rebate is completely risk-rated, implying that the premium rebate equals the expected individual cost reduction resulting from a deductible. Figure 5.7 shows that without a reduction in moral hazard, the premium rebate exactly equals the individual's expected out-of-pocket expenditure. If all insured are risk neutral they will be indifferent to taking a deductible. A small reduction in moral hazard will lead to all insured taking a deductible since the offered premium rebate then exceeds their demanded premium rebate. However, none of the insured will take a deductible if they are risk-averse and there is no reduction in moral hazard.

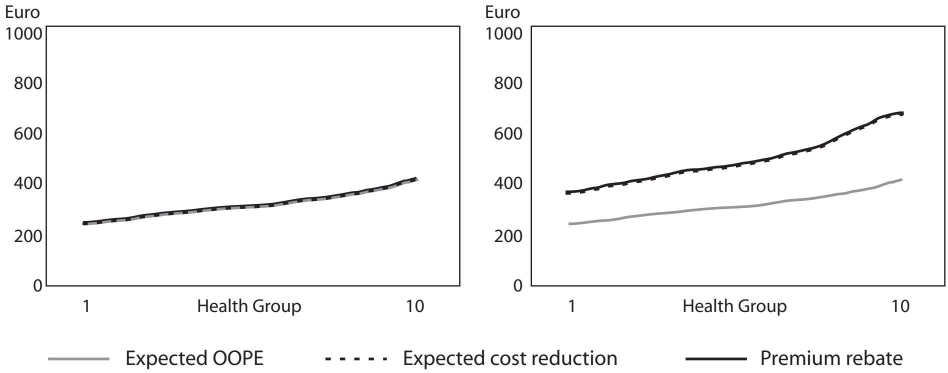

Figure 5.7 Expected out-of-pocket expenditure, expected cost reduction and (completely risk-rated) premium rebate in year 1 with m=0 (left-hand) and m=0.1 (right-hand)

As shown in figure 5.7, the unhealthy insured benefit more from taking a deductible in exchange for a completely risk-rated premium rebate than the healthy insured. Since the expected financial advantage from taking a deductible increases with a worse health status, it will be the healthiest insured who are the first to be inclined *not* to take a deductible. This is shown in figure 5.8, which presents the percentage of insured taking a deductible in year 1 per health group.

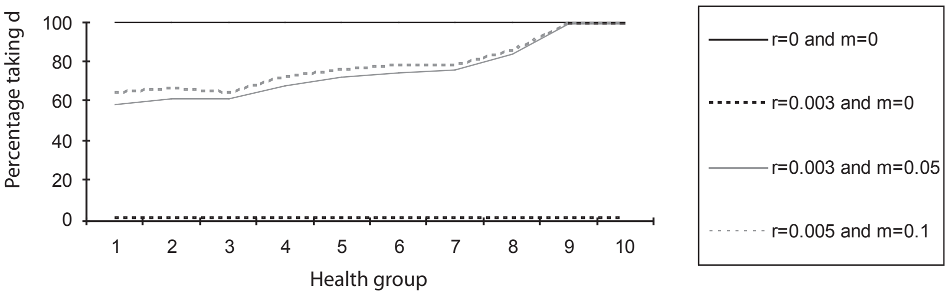

Figure 5.8 Percentage of insured taking a deductible in exchange for a completely risk-rated premium rebate in year 1 per 'health' group (100=N=38,631)

Thus, also in this scenario the percentage of insured taking a deductible mainly depends on the level of risk aversion and the reduction in moral hazard (see equation (5.1)). If there is no reduction in moral hazard, i.e. if $m = 0$, then the premium rebate equals the individual expected out-of-pocket expenditure of the insured. This implies that they do not take a deductible in a situation where they are risk-averse, i.e. if $r > 0$. If the insured are risk-averse they demand for a compensation for increased uncertainty resulting in a demanded premium rebate higher than their expected out-of-pocket expenditures. If there is a reduction in moral hazard, i.e. if $m > 0$, then insured take a deductible if the absolute reduction in moral hazard is larger than the demanded compensation for increased uncertainty.

5.6 Conclusion, implications and discussion

5.6.1 Conclusion

The Dutch government has proposed to introduce a voluntary deductible in the new Dutch mandatory health insurance scheme. A crucial issue with regard to the practical implementation of a voluntary deductible in this scheme is whether the premium rebate should be community-rated or risk-rated. In the new scheme there is risk equalization among insurers, which is aimed to avoid preferred-risk selection and insolvency of insurance companies. As part of risk equalization the insurers receive a compensation for the high-risk individuals in their insurance pool and have to pay a contribution for the low-risk individuals. A side effect of risk equalization is that it compensates for cost differences due to differences in health status between the insured choosing a deductible and the insured choosing full coverage. If risk equalization completely compensates for differences in costs between these groups due to their different health status, then the premium rebate for a deductible can only consist of cost sharing and moral hazard. The Dutch government has decided that the premium rebate for a deductible must be community-rated.

In this study we aimed to examine whether the total cost reduction from insured having a deductible can recover a community-rated premium rebate in a situation where the premium rebate can only be based on cost sharing and moral hazard. Four important conclusions can be drawn from this analysis:

In the first place, the number of insured taking a deductible increases with a larger reduction in moral hazard, whereas the opposite holds for a higher level of risk aversion. A larger reduction in moral hazard results in a higher (expected) cost reduction, a higher premium rebate and a larger number of insured taking a deductible. A higher level of risk aversion makes insured demanding a higher compensation for uncertainty, resulting in fewer insured taking a deductible in exchange for a *given* premium rebate.

Secondly, a higher level of risk-rating goes hand in hand with a higher expected financial benefit from taking a deductible for the relatively unhealthy insured. If the premium rebate is community-rated, the cost reduction from the unhealthy insured having a deductible returns in the premium rebate for all insured having a deductible. The higher the level of risk-rating, the stronger will be the link between the specific cost reduction from insured i and the premium rebate for i, and the more attractive it becomes for the unhealthy insured to take a deductible. Obviously, the opposite holds for the healthy insured, whose expected financial advantage is highest with a community-rated premium rebate.

Thirdly, no spiral of adverse selection occurs as long as the community-rated premium rebate does exceed the highest demanded premium rebate within the insurance pool. In general terms, this will be the case if the community-rated premium rebate exceeds the deductible amount. If the reduction in moral hazard is too small for offering such a premium rebate, taking a deductible is no longer expected to be financially beneficial for *all* the insured in the pool. In such a situation it will be the unhealthiest insured who are first inclined not to take a deductible, resulting in a decline of both the premium rebate and the number of insured taking a deductible. Ultimately, this will result in a spiral of adverse selection such that no insured will take a deductible in the end.

Fourthly, a spiral of adverse selection may also occur in a situation where the premium rebate is related to a restricted set of relevant risk factors, such as age and gender. Under the assumption that insured behave rationally and know whether they are a low or high risk within their premium-risk group, only premium-risk groups with a rebate exceeding the highest demanded premium rebate within that group are safe from a spiral of adverse selection. In the long run, the percentage of insured taking a deductible depends on the number of premium-risk groups fulfilling this requirement.

5.6.2 Implications for policy

The overall conclusion of our study is the existence of a trade-off between the effects of adverse selection and the (un)desirability of risk-rating. Since the (un)desirability of risk-rating is mainly a political issue, we limit ourselves to quoting some technical recommendations based upon the assumption that the introduction of a voluntary deductible is aimed at reducing moral hazard. From our conclusions, the implications for government policy are different for three possible situations.

In the first place it could be that the community-rated premium rebate is *higher* than the highest *demanded* premium rebate in the risk pool, which will generally be the case if the premium rebate is higher than the deductible amount. In such a situation a community-rated premium rebate is not problematical since all insured take a deductible resulting in a maximum moral hazard reduction.

In the second place it could be that the community-rated premium rebate is much *lower* than the deductible amount. In such a situation we recommend government to allow the insurers to risk-rate the premium rebate. Risk-rating could lead to premium rebates exceeding the deductible amount for the unhealthy insured, which induces these insured to take a deductible (every year). In the long run this will lead to a larger reduction in moral hazard than with a community-rated premium rebate. An adverse selection spiral could also be avoided by making the deductible compulsory.

In the third place it could be that the community-rated premium rebate is just a little lower than the highest demanded premium rebate within the risk pool, i.e. when it is slightly below the deductible amount. In this situation the cost reduction could be at its largest if government were to sponsor the gap between the premium rebate and the deductible amount. Fixing the premium rebate at the deductible amount will lead to all the insured taking a deductible, resulting in a maximum reduction in moral hazard. A large reduction in moral hazard could outweigh the amount of sponsorship. Mutatis mutandis the same argument holds for certain risk groups in the case of a partly risk-rated premium rebate.

5.6.3 Limitations

This study illustrates the expected implications of a *community-rated* premium rebate for a deductible in combination with a risk-equalization scheme. We had to make several assumptions since there has never been a mandatory health insurance scheme with both voluntary deductible and accurate risk equalization. Whether it will take two, three or five years for a spiral of adverse selection to lead to no insured taking a deductible greatly depends on the assumptions with respect to the reduction in moral hazard and the choice of taking a deductible. Therefore, the crucial assumptions and their effects on our conclusions are briefly discussed.

We assumed the insured to behave rationally and to be able to make a reasonable estimation of their expected out-of-pocket expenditure in case of a deductible. In view of the fact that some of them have never been faced with a choice of coverage it may be questioned whether they will indeed act this way. Moreover, the expected out-of-pocket expenditures does not only depend on the probability of health care consumption and prices of health care, but also on the individual perceptions of these probabilities and prices. It can even be questioned whether insured are aware of prices and costs since the bills for a large number of health care interventions are settled between insurers and providers. Especially in the first years after the introduction of the voluntary deductible, the insured will presumably be very careful with taking a deductible, possibly resulting in a spiral that is even faster than in our analysis.

We also assumed the reduction in moral hazard to be between 0 and 10 percent relative to total costs, which implies a reduction in moral hazard between 0 and about 50 percent relative to the costs up to the deductible amount. Since the deductible will not be higher than 500 euro (about one-third of average costs of the benefit package), it is doubtful whether our assumption of the upper boundary is realistic. If the insured suffering from a chronic disease know for sure that they will exceed the deductible amount, they will have no incentive for efficient health care consumption. As can be concluded from our analysis, a low reduction in moral hazard makes it more likely that the actual cost reduction does not recover the offered premium rebate.

Further, we assumed the demanded premium rebate to consist exclusively of the individual expected-out-pocket expenditure plus a compensation for uncertainty. However, in practice more factors may be relevant, such as income and age. In our analysis the level of risk aversion exclusively depends on the variance in expected out-of-pocket expenditure and is independent of individual characteristics. Finally, in our analyses we assumed the insurers operating under the mandatory basic health insurance to be myopic, that is they calculate the premium rebate in the first year under the assumption of no adverse selection. In reality, however, in particular after reading this paper, they might anticipate adverse selection and prevent any losses by offering such a low community-rated premium rebate in the first year that no insured will choose a voluntary deductible.

On the basis of this paper one can be skeptic about the number of insured taking a deductible in new Dutch mandatory health insurance.

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Shifted deductibles for high risks: more effective in reducing moral hazard than traditional deductibles

with Wynand van de Ven and René van Vliet
Forthcoming in the Journal of Health Economics

ABSTRACT - In health insurance, a traditional deductible (i.e. with a deductible range [0,*d*]) is in theory not effective in reducing moral hazard for individuals who know (ex-ante) that their expenditures will exceed the deductible amount *d*, e.g. those with a chronic disease. To increase the effectiveness, this chapter proposes to shift the deductible range to $[s_i, s_i + d]$, with starting point s_i depending on relevant risk characteristics of individual *i*. In an empirical illustration we assume the optimal shift to be such that the variance in out-of-pocket expenditures is maximized. Results indicate that for the 10-percent highest risks in our data the optimal starting point of a € 1000-deductible is to be found (far) beyond € 1200, which corresponds with a deductible range of [1200, 2200] or further. We conclude that, compared to traditional deductibles, shifted deductibles with a risk-adjusted starting point lower out-of-pocket expenditures and may further reduce moral hazard.

Chapter 6

6.1 Introduction

A major goal of deductibles in health insurance is to reduce moral hazard.[1] However, a traditional deductible, i.e. with a deductible range $[0,d]$, is in theory not effective in reducing moral hazard for high-risk individuals who know ex-ante that their expenditures will exceed the deductible amount d. These individuals are hardly price sensitive, since cost containment in the deductible range will not prevent them from having the maximum out-of-pocket expenditures at the end of the contract period (usually one calendar year). To increase the effectiveness of a deductible for high risks, we propose to shift their deductible range to $[s_i,s_i+d]$, with s_i referring to the deductible's starting point for individual i.[2] This reduces the probability of exceeding the deductible range and thereby increases the price sensitivity below s_i+d. At the same time, however, such a shift (also) reduces the probability of reaching the deductible range and thereby reduces the price sensitivity below s_i. It is realistic to assume that up to a certain starting point the first effect dominates the second, and that for high starting points the second effect is dominant. We assume the optimal shift to be such that the uncertainty about out-of-pocket expenditures is maximized.

In this paper, we primarily focus on the effect of deductibles on *ex-post* moral hazard (i.e. the positive correlation between medical expenditures and insurance coverage, once a health loss has occurred). Evidence on ex-post moral hazard in health insurance comes from natural experiments, observational comparisons and the (RAND) health insurance experiment. Zweifel and Manning (2000), who summarize the evidence, conclude that, despite variations in estimated price-elasticities among the three sources and according to different types of care, the responsiveness of the demand for medical care to net prices is beyond doubt. We will not focus on the effect of cost sharing on *ex-ante* moral hazard (i.e. the correlation between insurance coverage and the probability of a health loss to occur) for which the evidence is much weaker.

The goal of this paper is to illustrate the concept of shifted deductibles, both theoretically and empirically. In the theoretical part, we consider the responsiveness to deductibles (Section 6.2), discuss the limitations of traditional deductibles and introduce the idea of *shifted* deductibles (Section 6.3). In the empirical part, we illustrate the concept of shifted deductibles with data from a Dutch health insurer (Sections 6.4 and 6.5). Finally, we conclude and discuss the findings (Sections 6.6 and 6.7).

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1 Existing literature discusses also other motives for deductibles. Schlesinger (1999), for instance, argues that, under a proportional loading fee and risk aversion, a deductible plan is preferred over full coverage. The scope of this study, however, is purely on the moral hazard reduction.

2 Note that, in principle, a shifted deductible looks like the doughnut-hole deductible in the US Medicare part D (Rosenthal, 2004). The crucial difference, however, is that its starting point is not uniform, but adjusted to the individual's (ex-ante) risk status. In this conceptual paper we focus on the principles of shifted deductibles with a risk adjusted starting point rather than the implications for particular health care schemes.

6.2 Effective prices versus presenting prices

Under a traditional deductible the consumer's price sensitivity is negatively correlated with the probability *p* of expenditures Y_i to exceed deductible amount *d*, ceteris paribus. The explanation is that the effective price of medical care in the deductible range decreases with the probability of having free care later in the contract period.[3] We define the effective price of a unit medical care as its presenting price minus the product of its presenting price and *p(Y>d)*, as illustrated in figure 6.1.

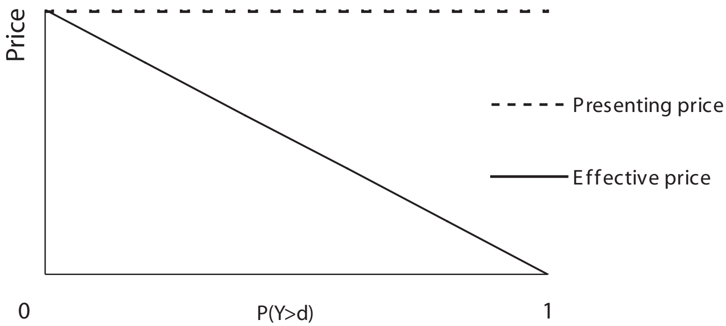

Figure 6.1 Effective price of a unit of medical care for the consumers in relation to its presenting price and the probability of exceeding d.

On a given day in contract period *t*, the probability of exceeding the deductible amount in the remainder of *t* depends on:

1. the amount of medical care already consumed in *t*;
2. the number of days left in *t*;
3. the individual's health status.

In case of *complete* uncertainty about the need for medical care in (the remainder of) *t*, only the first and second determinant are relevant. This means that for an individual who has not yet exceeded deductible *d*, probability *p(Y>d)* increases with a higher amount of care already consumed in *t* and decreases with a lower number of days remaining in *t* (Keeler, 1977).

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3 This can be illustrated by the following example from Newhouse (1993): 'Consider a consumer with 50 percent coinsurance and a $1,000 MDE (maximum dollar expenditure). In any contract period this person will have free care after spending $2,000 on medical services. Suppose the person knows in advance that he/she will spend at least $2,000; then any additional care he/she decides to purchase today is, in effect, free. Alternatively, suppose the person knows that he/she will not spend as much as $2,000; then any additional care he/she decides to purchase today will cost 50 cents on the dollar because he/she will not anticipate free care later in the year. This example suggests a simple rule: the price a utility-maximizing consumer on an insurance plan will use to determine whether a visit (say) was worth its cost is the presenting price of the visit (say $20) minus the product of the probability of exceeding the MDE and the presenting price of the visit, thus, if there is a 25 percent chance of exceeding the MDE, the effective price (to the consumer) of a $20 office visit is $15 ($20-$5).'

In practice, however, individuals will not always find themselves in a situation of *complete* uncertainty. Some individuals have *planned* medical consumption due to the treatment of a chronic disease, for instance. The higher these planned treatment costs are, the higher will be $p(Y>d)$. If the total price of planned consumption exceeds the (remaining) deductible then $p(Y>d) = 1$.

6.3 Framework

This study focuses on the third determinant mentioned above and considers the consequences of variation in health status for the consumer's price sensitivity under a deductible plan.

6.3.1 A traditional deductible

Assume that a group of insured is confronted with a traditional deductible $[0,d]$ for a contract period of one year. Figure 6.2 represents the distribution of annual medical expenditures[4] in this group under full coverage. At group level the introduction of $[0,d]$ is expected to *increase* out-of-pocket expenditures and to *decrease* total expenditures (Manning et al., 1987; Keeler et al., 1988; Van Vliet 2004). From a welfare perspective, such a deductible makes sense as long as the welfare gain due to a decrease in total expenditures outweighs the welfare loss due to an increase of uncertainty about future (out-of-pocket) expenditures (Arrow, 1963; Zeckhauser, 1970; Feldstein, 1973; Feldstein and Friedman, 1977; Buchanan et al., 1991). For reasons of simplicity, however, this paper will exclusively focus on the expenditure effects (and thus not on the welfare effects in terms of utility).

If the group is homogeneous in terms of ex-ante health status then the *expected* impact of a traditional deductible $[0,d]$ on price sensitivity is equal for all individuals. In other words, they would experience the same effective price for a *certain* unit of medical care on the *first* day of the contract period (given a constant presenting price). Obviously, a moral hazard reduction results in a shift of the expenditure distribution to the left. For reasons of simplicity and given the conceptual nature of this study, we will not incorporate this complicating aspect in the illustrations.

4 As far as covered by their insurance.

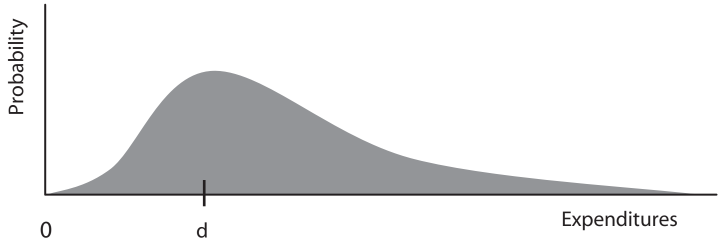

Figure 6.2 A traditional deductible d

If the group is heterogeneous in terms of ex-ante health status then the (ex-ante) probability of exceeding *d* is not the same for all individuals. Consequently, the *expected* impact of a deductible on the price sensitivity varies among individuals as well. Assume the group to consist of different risk types of which two are shown in figure 6.3, with L being (relatively) low risks and H being (relatively) high risks. Obviously, individuals of type H expect to have expenditures (far) beyond the deductible amount. Even a considerable reduction in the total expenditures, i.e. a considerable shift of the expenditure distribution to the left (relative to *d*), will hardly change that expectation.

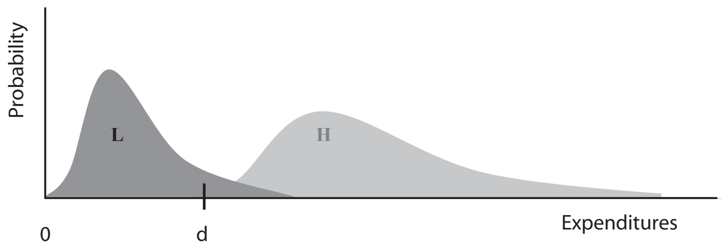

Figure 6.3 A traditional deductible d for low risks L and high risks H

This implies that for risk type H the probability of having maximum out-of-pocket expenditures is close to 1, as shown in figure 6.4. For these individuals the effective price of medical consumption below *d* is close to 0, which theoretically results in hardly any price sensitivity.

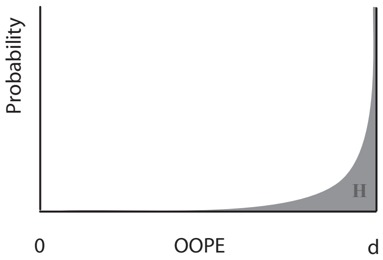

Figure 6.4 Out-of-pocket expenditures (OOPE) for high risks H under a traditional deductible

So, in theory, a traditional deductible is hardly effective for those whose expenditures have a high probability of exceeding the deductible amount. In practice, this is probably the case for those with a chronic disease, who are subject to an expensive treatment program for a long period of time.

6.3.2 Non-uniform cost sharing

From different perspectives Chernew et al. (2000) and Breuer (2005) have recognized the limitations of uniform cost sharing, such as traditional deductibles.[5] They advocate that, given a maximum on out-of-pocket expenditures, cost sharing could lead to larger expenditure reductions if it would be *non-uniform*. Chernew et al. (2000) argue that cost sharing should vary with the elasticity of demand. If an individual must inevitably undergo some treatment and there is a choice about specific treatment, then the costs of the cheapest alternative should not be subject to cost sharing since this would not lead to an efficiency gain. Instead, cost sharing should apply to the costs at the margin. A way to do so is charging a co-payment *only* to those choosing a relatively expensive treatment. Simulation results indicate that, for prostate cancer, treatment-specific cost sharing results in a substantial moral hazard reduction. In their conclusion, Chernew et al. (2000) state that probably also the rate of cost sharing should vary across different diseases and treatment alternatives. This is in line with work of Breuer (2005) who argues that the rate of cost sharing should vary with the price sensitivity for each type of loss. The reason is that the possibility of an individual to either prevent the occurrence of a loss or to control its costs varies across (states of) diseases.

Theoretically, cost sharing as proposed by Chernew et al. (Ibid.) and Breurer (Ibid.) can be more effective than uniform cost sharing, given a certain maximum on out-of-pocket expenditures. It has the important practical drawback, however, of severely complicating

5 With cost sharing we mean that insured pay some portion of the covered medical expenditures themselves (U.S. House of Representatives, 1976). The deductible is one form of cost sharing; other forms are coinsurance and copayments, for instance.

insurance schedules. Given that real-world insurance schedules tend to be transparent, there seems to be a trade-off between the level of transparency and the positive welfare effects due to differentiated cost sharing (Cutler and Zeckhauser, 2000).

Treatment-specific cost sharing, as proposed by Chernew et al. (2000), has two important requirements that might further complicate the implementation. In the first place, it must be possible to determine ex-ante the costs of each treatment path. In the second place, patients must be well-informed about the clinical consequences of different treatment alternatives in order to make a deliberate choice, which does not just depend on the level of cost sharing (Chernew et al., 2000). In practice, these requirements are unlikely to be met for a wide range of treatments.

6.3.3 Shifted deductibles

The previous consideration and illustrations bring us to a simple alternative to traditional deductibles, which is expected to increase the impact of a deductible on individual *i*'s price sensitivity without substantially reducing the transparency of the insurance schedule. The essence is to shift the deductible range from $[0,d]$ to $[s_i,s_i+d]$, such that the probability of exceeding the range reduces. The framework is schematically shown in figure 6.5. For an individual of risk type H, the deductible is shifted from $[0,d]$ to $[s_H,s_H+d]$, with s_H the expenditure level at which full coverage turns into no-coverage and s_H+d the expenditure level at which no-coverage returns into full coverage.

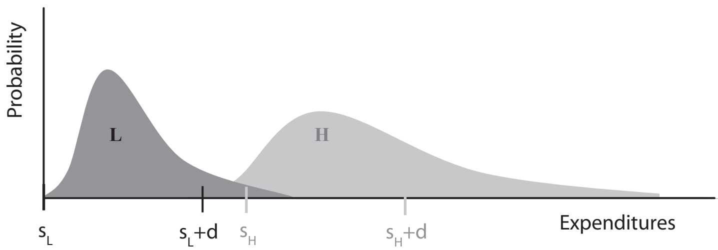

Figure 6.5 Shifted deductible for high risks H

For risk type H, a shift of the deductible range reduces the probability of having maximum out-of-pocket expenditures, as shown in figure 6.6. This is expected to result in a higher effective price of medical consumption below s_H+d and thereby in a higher impact of d on the price sensitivity.

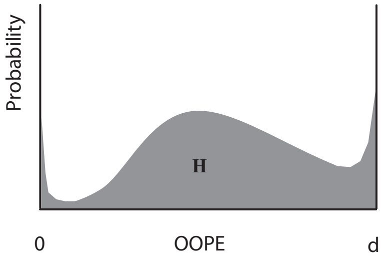

Figure 6.6 Out-of-pocket expenditures (OOPE) for high risks H under a shifted deductible

A crucial question is how far the deductible range should be shifted to maximize the impact of *d* on price sensitivity. A shift reduces both the probability of exceeding the deductible range $p(Y > s+d)$ and the probability of reaching the deductible range $p(Y > s)$. This implies that, for risk type H, the distribution of out-of-pocket expenditures concentrates to *d* in case of a traditional deductible (figure 6.4) and concentrates to zero in case of an extreme shift. According to the arguments in section 6.2, the price sensitivity will be low in both situations, since there is hardly any uncertainty about (the final level of) out-of-pocket expenditures (in the contract period). We assume the optimal starting point, i.e. the value of *s* where the impact of a deductible on price sensitivity is at its largest, to be such that the *uncertainty* about the (total) out-of-pocket expenditures in the contract period is maximized.

This brings us to a reasonable criterion for finding the optimal starting point, which is the variance in out-of-pocket expenditures *VAR(OOPE)*. If expected out-of-pocket expenditures *E(OOPE)* are close to either zero or *d*, there is hardly any uncertainty about the final level of out-of-pocket expenditures, which is reflected in a *VAR(OOPE)* close to zero. Obviously, the uncertainty increases if *E(OOPE)* moves away from these boundaries, which is reflected in an increase of *VAR(OOPE)*. This is illustrated by figure 6.4 (traditional deductible for type H) and figure 6.6 (shifted deductible for type H). The variance in expenditures as a direct measure for uncertainty is not unfamiliar in existing literature. Pratt (1964), for instance, uses it for calculating risk premiums that consumers are willing to pay for insurance apart from their actuarially fair premium.

As mentioned before, a moral hazard reduction results in a shift of the expenditure distribution to the left. Ideally, this effect has to be taken into account if the variance in out-of-pocket expenditures is used to find the optimal starting point. Neglecting this effect results in a non-optimal starting point, which will be too high if the expenditure distribution (used for the estimation procedure) is based on a situation of full insurance and will be too low if the expenditure distribution is based on a situation of no insurance coverage. With respect to the goal of this study, we will, however, not incorporate this correction into our empirical illustration, since this would unnecessarily complicate the exposition.

6.4 Empirical illustration: data and methods

Hence, the concept of shifted deductibles is empirically illustrated using the variance in out-of-pocket expenditures *VAR(OOPE)* as the criterion for finding the optimal starting point.

6.4.1 Data

The administrative data are from a Dutch insurance company, which was operating under the mandatory sickness fund scheme. This scheme existed until the introduction of the basic health insurance in 2006. The data consist of individual level information on medical expenditures in 1991 through 1994 categorized into expenditures for inpatient care, outpatient care, pharmaceuticals, and others. Costs of medical care provided by a general practitioner are not included.[6] Table 6.1 shows information on 1994-expenditures (in Euros of 2006) and reveals that 95.2 percent of the insured had positive expenditures. No expenditures are missing since all bills were sent directly from the provider of care to the insurer. All insured (N=36,408) were 18 years or older.

In the relevant period, all 36,408 individuals had full coverage. As argued in section 6.3, this requires that the procedure used to determine the optimal starting point includes a correction for the effect of a moral hazard reduction on the expenditure distribution. With respect to the primary goal of this study, we will, however, not incorporate such a (complicated) correction. Note that this simplification might lead to a slight overestimation of the optimal starting point.

Table 6.1 Descriptive statistics of 1994-medical expenditures in Euros of 2006

N	Mean	Std dev	Median	p(Y=0)
36,408	1,741	5,313	449	.048

Next to medical expenditures, the dataset includes information on age, gender, hospital days, and health problems. The last were deduced from information on prescribed drugs, e.g. someone having at least four prescriptions for diabetes treatment (on a annual basis) was qualified as diabetic. Similarly, the following health problems and chronic diseases were distinguished: psychosis, COPD (Chronic Obstructive Pulmonary Disease), high cholesterol, heart diseases, inflammations, thyroid disorders, gastric disorders, high blood pressure, and PAD (Peripheral Arterial Disease). In the Netherlands such information is used for categorizing insured into pharmacy-based cost groups (PCG's), which are used in the risk equalization system (Lamers, 1999).

6 This is because of the uniform annual fee that the general practitioner received for each sickness fund member in his practice regardless of medical consumption.

6.4.2 Method

To illustrate the concept of shifted deductibles the data set is assumed to represent a group of individuals who are exposed to deductible *d* for a contract period of one year. For each individual the optimal starting point is deduced with the following four-step procedure:

1. Estimate an expenditure model where medical expenditures *Y* depend on relevant risk factors;

2. Calculate the expected expenditures $E(Y)_i$ for each individual;

3. Calculate the expected out-of-pocket expenditures $E(OOPE)_i$ and the variance in out-of-pocket expenditures $VAR(OOPE)_i$ for each individual and for different values of *s*;

4. Find for each individual the optimal starting point where $VAR(OOPE)_i$ is maximized.

For reasons of transparency we will not include index *i* in the subsequent equations and description.

6.4.2.1 Expected expenditures

To calculate the expected expenditures *E(Y)* we estimated an expenditures model with the actual expenditures in 1994 as the dependent variable. Since *E(Y)* was finally used to predict out-of-pocket expenditures, which mainly concentrate in the left-tail of the medical-expenditure distribution in case of a traditional deductible and around the centre in case of a shifted deductible, we searched for a statistical model that performed well in these expenditure ranges. We chose not to use a two-part model since only 4.8 percent of the insured had zero expenses. Instead we used a single-equation model taking into account both positive and zero expenses. Testing a normal-, lognormal-, poisson- and gamma distribution revealed that the latter fitted the log(expenditures+1) best. Accordingly, GLM with log-link and a gamma distribution was used. An additional advantage of this model is that predictions do not have to be retransformed to monetary units (Duan et al., 1983; Manning and Mullahy, 2001). As will be shown in Section 6.4.2.2, this model seemed to be a robust basis for calculating the expected out-of-pocket expenditures.

Explanatory variables for the expenditure model were based on the following information: age, gender, expenditures in *t*-1 (1993) and *t*-2 (1992). 24 dummies were defined to represent age/gender groups and continuous variables were created for log(inpatient costs *t*-1), log(inpatient costs *t*-2), log(outpatient costs *t*-1), log(outpatient costs *t*-2), log(pharmaceutical costs *t*-1), and log(pharmaceutical costs *t*-2). The R-square found for this model equals 0.1745. The estimation results are shown in table 6.2.

Table 6.2 Estimation results for medical expenditures using a gamma distribution with log-link (N=36,408, R-square=0.1745)

	Estimate	Std error	Chi-square	p
Intercept	4.9728	0.0912	2971.88	<.0001
Men 20-24	0.3364	0.1101	9.34	<.0022
Men 25-29	0.3645	0.0997	13.37	<.0003
Men 30-34	0.4239	0.0974	18.95	<.0001
Men 35-39	0.5442	0.0977	31.03	<.0001
Men 40-44	0.5268	0.0976	29.15	<.0001
Men 45-49	0.7826	0.0976	64.29	<.0001
Men 50-54	0.7964	0.0993	64.29	<.0001
Men 55-59	1.0021	0.0988	102.83	<.0001
Men 60-64	0.9656	0.0997	93.85	<.0001
Men 65-69	1.4516	0.1003	209.33	<.0001
Men ≥70	1.5482	0.0957	261.49	<.0001
Women 18-19	0.2531	0.1231	4.23	<.0398
Women 20-24	0.5441	0.1061	26.29	<.0001
Women 25-29	0.7563	0.0973	60.42	<.0001
Women 30-34	0.7544	0.0950	63.11	<.0001
Women 35-39	0.5614	0.0954	34.64	<.0001
Women 40-44	0.6469	0.0960	45.44	<.0001
Women 45-49	0.6704	0.0950	49.80	<.0001
Women 50-54	0.8170	0.0968	71.27	<.0001
Women 55-59	0.8723	0.0970	80.83	<.0001
Women 60-64	1.0485	0.0977	115.08	<.0001
Women 65-69	1.1682	0.0979	142.24	<.0001
Women ≥70	1.3391	0.0929	207.68	<.0001
Log(pharmacy expenditures t-2)	0.0405	0.0037	117.78	<.0001
Log(pharmacy expenditures t-1)	0.1127	0.0041	767.66	<.0001
Log(outpatient expenditures t-2)	0.0617	0.0038	262.75	<.0001
Log(outpatient expenditures t-1)	0.0952	0.0040	567.81	<.0001
Log(inpatient expenditures t-2)	0.0406	0.0033	151.36	<.0001
Log(inpatient expenditures t-1)	0.0710	0.0033	473.16	<.0001
Scale	0.4346	-	-	-

6.4.2.2 The variance and expectation of out-of-pocket expenditures under a traditional deductible

Given *E(Y)*, the next step was to calculate the expected out-of-pocket expenditures due to deductible *d*. As shown in table 6.2, step 1 provided a value of scale parameter *k* for which the following relation holds:

$$(6.1) \qquad k = 1/(cv)^2$$

with *cv* the coefficient of variation (= standard deviation divided by mean). Given the estimate of *k*, the expected expenditures of an individual with expenses below a *traditional* deductible *d* can be calculated according to equation (6.2), derived by Van Kleef et al. (2006).

$$(6.2) \qquad E(Y \mid Y < d) = E(Y) * \Gamma(c_d, k+1) / \Gamma(c_d, k)$$

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

$$(6.3) \qquad c_d = d * \lambda \quad and \quad \lambda = k / E(Y)$$

Accordingly, the expected out-of-pocket expenditures in case of a traditional deductible [0,*d*] can be calculated by equation (6.4).

$$(6.4) \qquad E(OOPE)_d = E(Y) * \Gamma(c_d, k+1) + d * (1 - \Gamma(c_d, k))$$

Table 6.3 shows that the predicted expenditures below expenditure level *d* closely agree with the actual expenditures below *d*.

Table 6.3 Mean of actual and predicted out-of-pocket expenditures (OOPE) and mean of predicted standard deviation (std dev) with traditional deductible d

d	Actual *OOPE* (std dev)	Predicted *OOPE*	Predicted Std dev
200	170 (60)	154	72
500	360 (182)	332	196
1,000	594 (393)	563	397
2,000	902 (769)	891	751
3,000	1102 (1086)	1122	1044

Given *E(Y)*, $E(OOPE)_d$, c_d, and *k*, the variance in out-of-pocket expenditures *VAR(OOPE)* with deductible *d* can be calculated by equation (6.5) (Van Kleef et al., 2006):

$$(6.5)\qquad VAR(OOPE)_d = E(Y)^2 * (1+(1/k)) * \Gamma(c_d, k+2) + d^2 * (1-\Gamma(c_d, k)) - E(OOPE)_d$$

Table 6.3 shows that the standard deviation of the predicted expenditures in range [0,*d*] estimated with equation (6.5) is in line with the standard deviation of the actual expenditures in range [0,*d*].

6.4.2.3 The variance and expectation of out-of-pocket expenditures under a shifted deductible

In case of a shifted deductible [*s*,*s*+*d*] the calculation of *E(OOPE)* and *VAR(OOPE)* is more complicated. Compared to a traditional deductible [0,*d*], a new expenditures range [0,*s*] occurs. Thus, $E(OOPE)_{s,d}$ should be calculated as the expected expenditures in expenditure range [0,*s*+*d*] minus the expected expenditures in range [0,*s*]. Translating this into equation (6.4) results in equation (6.6):

$$(6.6)\qquad E(OOPE)_{s,d} = E(Y) * (\Gamma(c_{s+d}, k+1) - \Gamma(c_s, k+1)) - s * (\Gamma(c_{s+d}, k) - \Gamma(c_s, k)) + d * (1-\Gamma(c_{s+d}, k))$$

with

$$(6.7)\qquad c_s = s * \lambda \quad and \quad c_{s+d} = (s+d) * \lambda$$

Accordingly, $VAR(OOPE)_{s,d}$ can be calculated by equation (6.8):

$$(6.8)\qquad VAR(OOPE)_{s,d} = E(Y)^2 * (1+(1/k)) * (\Gamma(c_{s+d}, k+2) - \Gamma(c_s, k+2)) - 2 * s * d * (\Gamma(c_{s+d}, k+1) - \Gamma(c_s, k+1)) + s^2 * (\Gamma(c_{s+d}, k) - \Gamma(c_s, k)) + d^2 * (1-(\Gamma(c_{s+d}, k)) - E(OOPE)^2_{s,d}$$

Table 6.4 shows the mean of actual and predicted expenditures in expenditure range [*s*,*s*+*d*] for different values of *s*. Similar to the results in table 6.3, the estimated standard deviation of expected expenditures in [*s*,*s*+*d*] is close to the standard deviation of actual expenditures in this range.

Table 6.4 Mean of actual and predicted out-of-pocket expenditures (OOPE) and mean of predicted standard deviation (std dev) with a shifted deductible of €1,000 and starting point s

s	Actual *OOPE* (std dev)	Predicted *OOPE*	Predicted Std dev
0	594 (393)	563	398
200	499 (436)	486	424
500	406 (447)	411	428
1,000	307 (433)	328	414
2,000	200 (385)	230	375
3,000	148 (346)	173	339

Now, the question is how to find the value of *s* for which $VAR(OOPE)_{s,d}$ is maximized, given *E(Y)*, *k*, and *d*. As argued above, this value would maximize the uncertainty about the out-of-pocket expenditures and thereby the price sensitivity. From equation (6.8) it is clear that no analytical solution exists for this maximization problem. Therefore, we resorted to a numerical method. This boiled down to an iterative procedure in which *E(OOPE)* and *VAR(OOPE)* were calculated for a range of values of *s* until the maximum was found.

6.4.2.4 Determining s for risk group j

The procedure described above produces a different value of optimal starting point for individuals who differ in terms of the explanatory variables. For reasons of transparency it might be preferred to differentiate the deductible's starting point at group level instead of the individual level. The pros and cons of this alternative are illustrated in Section 6.5.2 using the following criteria to distinguish among risk groups: the optimal starting point (at individual level) itself, age, and health problems. Obviously, many other risk factors can be used. The optimal starting point for a certain group is simply calculated as the average optimal starting point of all individuals in that group.

6.5 Empirical results

In sum, the first part of the empirical analyses was aimed at finding the optimal starting point for each individual and the second part was aimed at categorizing individuals into risk groups in order to differentiate the starting point at group level. In this section, the results are presented separately.

6.5.1 The optimal starting point at individual level

For each individual the optimal starting point was calculated for five values of *d*, i.e. € 200, € 500, € 1,000, € 2,000 and € 3,000. The mean optimal starting point (and standard deviation) equals 939 (1,102), 879 (1,101), 801 (1,094), 675 (1,068) and 579 (1,033), respectively. The distribution of the optimal starting point per deductible is shown in table 6.5. The results reveal three important findings.

For all individuals the deductible range should be shifted to have maximum variance in out-of-pocket expenditures. So, for all individuals the ex-ante uncertainty about out-of-pocket expenditures is higher with a shifted deductible than with a traditional deductible, also for low risks.

For the relatively high risks the deductible range should be shifted *substantially* in order to achieve maximum variance in out-of-pocket expenditures. For more than 10 percent of the insured, the optimal starting point for a deductible of € 1,000 (about 57 percent of the overall mean expenditures in the data) is higher than € 1,200.

An increase of *d* results in (just) a slight decrease of the optimal starting point. The reason is that medical expenditures in general - and also in our data - are positively skewed. The skewer the distribution, the smaller will be the decrease of the optimal starting point relative to an increase of *d*.

Table 6.5 Distribution of the (individual) optimal starting point per deductible d

Percentile	*d*=200	*d*=500	*d*=1,000	*d*=2,000	*d*=3,000
1	73	41	12	2	1
5	122	81	41	11	2
10	162	116	64	21	5
25	271	221	151	71	31
50	461	411	331	211	125
75	791	732	645	494	372
90	1,441	1,382	1,292	1,121	971
95	2,081	2,031	1,936	1,761	1,591
99	4,294	4,241	4,151	3,971	3,791
100	15,921	15,864	15,773	15,592	15,411

6.5.2 The optimal starting point at group level

Alternatively, the deductible's starting point can be differentiated at group level instead of the individual level. This is illustrated below, using the following three factors to distinguish among risk groups: the optimal starting point (at the individual level) itself, age, and health.

Table 6.6 presents the results for a deductible of € 1,000 per category of the optimal starting point. Those with an optimal starting point between € 0 and € 500 are given a deductible range of [€0, €1,000], those with an optimal starting point between € 500 and € 1,000 are given a deductible range [€500, €1,500], and so on. Accordingly, about 66 percent is given a range of [€0, €1,000], which is, in fact, a traditional deductible. About 19 percent is given a range of [€500 to €1,500], about 7 percent is given [€1,000, €2,000] and for the remaining 8 percent the range is shifted even further. Table 6.6 also shows the mean out-of-pocket expenditures for both a traditional and a shifted deductible. These out-of-pocket expenditures are calculated as the actual expenditures in range $[0,d]$ (traditional deductible) and $[s,s+d]$ (shifted deductible) in the original data. Note that these means would probably be lower in case of a moral hazard reduction, due a shift of the expenditure distribution to the left. Nevertheless, these results reveal two important issues.

First, it is evident that a shifted deductible indeed results in a (substantial) increase of variance in out-of-pocket expenditures. So, in theory, the uncertainty about out-of-pocket expenditures is (substantially) higher with a shifted deductible than with a traditional deductible.

In the second place, these results show that the mean out-of-pocket expenditures under a shifted deductible concentrate around € 500. So, a shift of the deductible range is not just expected to increase the impact on price sensitivity, but also leads to lower out-of-pocket expenditures.

Table 6.6 Mean (std dev) of out-of-pocket expenditures (OOPE) under a traditional and under a shifted deductible of € 1,000

Optimal starting point at individual level	N	Starting point at group level	*OOPE* Traditional	*OOPE* Shifted
0-499	66.4%	0	393 (381)	393 (381)
500-999	19.0%	500	721 (302)	494 (393)
1000-1499	6.9%	1000	835 (229)	513 (378)
1500-1999	3.2%	1500	894 (184)	558 (351)
2000-2499	1.6%	2000	917 (155)	547 (347)
2500-2999	1.0%	2500	947 (126)	514 (357)
3000-3499	0.6%	3000	951 (123)	494 (342)
3500-3999	0.4%	3500	958 (112)	486 (338)
4000-4499	0.3%	4000	982 (69)	515 (329)
4500-15773	0.8%	4500	974 (80)	571 (314)

Table 6.7 presents the average optimal starting point per age group. Differentiating the deductible's starting point according to this criterion has the advantage of being practical and understandable to consumers. From the age of 35 onwards the optimal starting point increases, which is not surprising since the probability of (changing into) a worse health status increases with age.

Table 6.7 Mean (std dev) of optimal starting point and out-of-pocket expenditures (OOPE) under a traditional and under a shifted deductible of € 1,000

Age group	N	Optimal starting point	*OOPE* Traditional	*OOPE* Shifted
18-19	3.3%	135 (189)	379 (459)	281 (487)
20-24	8.6%	231 (362)	418 (540)	278 (586)
25-29	13.2%	328 (406)	445 (473)	277 (508)
30-34	12.0%	367 (377)	483 (396)	308 (432)
35-39	9.6%	324 (305)	476 (360)	309 (387)
40-44	8.8%	343 (324)	490 (359)	322 (386)
45-49	9.3%	431 (412)	522 (361)	332 (389)
50-54	6.7%	540 (497)	565 (353)	362 (383)
55-59	6.4%	638 (546)	569 (348)	339 (374)
60-64	5.7%	753 (720)	592 (347)	357 (376)
65-69	5.3%	1,225 (1,017)	670 (325)	351 (370)
≥70	11.1%	1,576 (1,156)	727 (288)	360 (359)

In a similar way we differentiated the starting point according to health problems. Table 6.8 shows the average optimal starting for psychosis, COPD (Chronic Obstructive Pulmonary Disease), high cholesterol, heart diseases, diabetes, inflammations, thyroid disorders, gastric disorders, high blood pressure, PAD (Peripheral Arterial Disease), and those without any of these health problems.[7] Individuals were identified as suffering from a certain health problem if they had at least four drug prescriptions for treatment of that problem in *t*-1. Three relevant issues can be observed in table 6.8.

In the first place, the mean estimated expenditures are not precisely in line with the mean actual expenditures for these groups. This might lead to a biased value of the optimal starting point since the optimal starting point strongly depends on the expected expenditures, as follows from equations (6.1), (6.3) and (6.7) and is evident in table 6.8. A simple solution could be to include dummies for these health problems in the expenditure model. Given the number of individuals in our data, we chose not to follow this procedure.

In the second place, these results show a substantial variation in optimal starting points within groups. Thus, a categorization according to health problems seems to be less effective (in terms of uncertainty about out-of-pocket expenditures) than a categorization according to the optimal starting point itself (table 6.6). However, for each group a substantial difference in standard deviation can be observed between a traditional and a shifted deductible indicating that uncertainty about out-of-pocket expenditures is substantially higher with a shifted than with a traditional deductible.

In the third place, the optimal starting point for those without any of these health problems is quite high as well, i.e. € 405. Apparently, these health-problem categories do not capture all high risk individuals, which is also evident in the standard deviation of the optimal starting point in the category 'other'. For two reasons it might be better to have a traditional deductible for this group. First, most individuals in this group will be relatively low risks. Only a few (extremely) high risks have a substantial positive impact on the average optimal starting point. Second, the difference in standard deviation between a traditional and a shifted deductible is only marginal.

7 Category 'Other' includes individuals without any of the health problems mentioned in the text and also without one of the following health problems: IBD (Inflammatory Bowel Disease), epilepsy, glaucoma, gout, cancer, mood disorders, Parkinson's disease, rheumatism. The latter health problems were not included in the result Section since the data did not contain sufficient numbers of individuals suffering from these health problems. Note that the sum of N can exceed 100 percent due to co-morbidity.

Table 6.8 Mean (std dev) of predicted expenditures E(Y), optimal si , actual expenditures Y, and out-of-pocket expenditures (OOPE) under a traditional and under a shifted deductible of € 1,000

Disorder	N	*E(Y)*	Optimal starting point	*Y*	*OOPE* Traditional	*OOPE* Shifted
Other	83.9%	1,415 (1,295)	405 (503)	1,238 (3,911)	459 (383)	275 (402)
Psychosis	0.5%	2,877 (2,085)	970 (826)	3,131 (4,789)	810 (246)	507 (370)
COPD	2.1%	3,125 (2,340)	1,069 (926)	3,010 (4,336)	885 (205)	534 (398)
High cholesterol	0.6%	3,757 (2,370)	1,316 (940)	5,060 (10,373)	940 (155)	618 (343)
Heart disease	5.0%	3,851 (2,464)	1,355 (976)	3,361 (6,260)	833 (213)	384 (366)
Diabetes	1.6%	3,870 (2,347)	1,362 (931)	3,833 (5,606)	913 (167)	529 (372)
Inflammations	2.8%	3,954 (2,942)	1,397 (1,166)	4,258 (6,888)	852 (225)	483 (385)
Thyroid disorders	0.7%	4,107 (2,692)	1,456 (1,068)	4,945 (9,113)	841 (208)	448 (366)
Gastric disorders	1.8%	4,463 (3,055)	1,598 (1,212)	5,106 (8,438)	930 (162)	607 (359)
High blood pressure	3.3%	4,516 (2,903)	1,618 (1,151)	4,469 (7,927)	912 (153)	466 (365)
PAD	0.8%	5,715 (2,980)	2,093 (1,183)	5,543 (7,921)	903 (157)	442 (330)

Table 6.6, 6.7 and 6.8 do not directly indicate the loss of variance in out-of-pocket expenditures when going from a differentiation at individual level to a differentiation at group level. Table 6.9 shows the mean and standard deviation of out-of-pocket expenditures for the 10-percent highest risks. The classification of high risks was purely based on the expected expenditures. With differentiation at individual level, a shifted deductible results in a drop of the mean out-of-pocket expenditures by € 422 and an increase of the variance by a factor 4.8. For a categorization according to the optimal starting point these figures equal € 369 and factor 4.6. Using age they are € 253 and factor 4.0, and using health problems they are € 221 and factor 3.7. So, with the age classification, for instance, one would retain 60 percent of the optimal drop in out-of-pocket expenditures and 85 percent of the optimal increase in variance.

Table 6.9 Mean (standard deviation) of out-of-pocket expenditures (OOPE) under both a traditional and shifted deductible of € 1,000 for 10-percent highest risks

Starting point differentiated among …	*OOPE* traditional deductible	*OOPE* shifted deductible
.. individuals	913 (161)	491 (352)
.. categories of optimal s	913 (161)	544 (347)
.. age groups	913 (161)	660 (323)
.. health problems	913 (161)	692 (310)

6.6 Conclusion

A traditional deductible is in theory not effective in reducing moral hazard for high-risk individuals who know (ex-ante) that their expenditures will exceed the deductible amount *d*. These individuals have no incentive for cost-containment, since their probability of having the maximum out-of-pocket expenditures is (nearly) 1. To increase the effectiveness of a deductible, this paper proposes to shift the deductible range from $[0,d]$ to $[s_i,s_i+d]$ with starting point s_i depending on relevant risk characteristics of individual *i*. We conclude that such a shift reduces out-of-pocket expenditures and may lower total health care expenditures (because of reduced moral hazard).

Although the optimal starting point in our empirical illustration might be (slightly) overestimated, five important conclusions can be drawn from our empirical illustration. First, the deductible range for high risks should be shifted substantially in order to have maximum uncertainty about expected out-of-pocket expenditures. For the 10-percent highest risks in our data the optimal starting point of a € 1000-deductible is to be found (far) beyond € 1200, which corresponds with a deductible range of [1200, 2200] or further. Second, the optimal starting point is higher than zero for all individuals, including the low risks. The reason is that the distribution of medical expenditures is positively skewed. However, for low risks the optimal starting point for (relatively) high deductibles is close to zero. Third, the optimal starting point is only slightly affected by a change in deductible amount. Again, the explanation is found in the positive skewness of the medical expenditure distribution: the skewer the distribution the smaller the decrease of the optimal starting point relative to the increase of *d*. Fourth, the optimal starting point heavily depends on the expected expenditures. This implies that the calculation of the optimal starting point will be biased in case of a poor expenditure model. A final conclusion is that differentiation of the starting point at individual level is better, with respect to the variance in out-of-pocket expenditures, than a differentiation at group level. On the other hand, a differentiation at group level might be preferred for reasons of transparency. The total number of risk groups represents a trade-off between the effectiveness of the deductible and transparency. A differentiation according to age groups, however, is rather transparent and is expected to have a substantially higher impact on price sensitivity than a traditional deductible.

6.7 Discussion

This paper shows that shifted deductibles make more sense, from a theoretical point of view, than pure traditional deductibles. A lot of other aspects, however, deserve further elaboration. The main issues are: the criterion used to determine the optimal starting point, the correction for moral hazard reduction, the effects of shifted deductibles on ex-ante moral hazard, and equity aspects.

In this study the criterion for finding the optimal starting point reflects the uncertainty about out-of-pocket expenditures. This requires an expenditure model that accurately predicts the expenditures and correctly reflects how the variance is related to the mean. More practical criteria to determine the starting point could be the median or mean of expenditures (in a certain risk group, e.g. age group or health group). From a theoretical point of view, however, such criteria make less sense than the criterion used in this study.

The estimation procedure in the empirical illustration is based on an expenditure distribution under full insurance coverage. Ideally, this procedure requires a correction for the effect of moral hazard on the expenditure distribution. For reasons of simplicity (and given the conceptual nature of this study) we chose not to incorporate such a correction. This simplification presumably results in a slight overestimation of the optimal starting point. In order to apply an appropriate correction, one needs an accurate picture of how deductibles affect the expenditure distribution. While existing literature offers some evidence on this issue for traditional deductibles, further research is needed to examine the change in the expenditure distribution under shifted deductibles.

This paper primarily focuses on the effect of deductibles on *ex-post* moral hazard. Compared to full coverage, a deductible increases the price of medical consumption experienced by the consumer, which is expected to result in a reduction of medical expenditures. We argued that, at least for high-risk individuals, the effective price of medical consumption is higher under a shifted deductible than under a traditional deductible. Accordingly, it is to be expected that a shifted deductible is more effective in reducing ex-post moral hazard than a traditional deductible. Theoretically, this might also be true for *ex-ante* moral hazard (as far as this form is relevant in health insurance): for a chronically ill with annual treatment costs of about € 2,000 a shifted deductible [2000, 3000] may imply a stronger financial incentive to avoid future losses than a traditional deductible [0, 1000]. In this respect, a shifted deductible with a risk-adjusted starting point might in practice serve as a substitute for the traditional 'first-dollar deductible followed by coinsurance', which is in theory the optimal *uniform* co-payment scheme to reduce both ex-ante and ex-post moral hazard (Winter, 2000).

Our final remark concerns equity. Ceteris paribus, a deductible with a shifted starting point related to health risk factors reduces the difference in out-of-pocket expenditures between low-risk and high-risk individuals. This implies that, under a community-rated insurance premium, the implicit cross-subsidies between these groups are higher with a shifted deductible than with a traditional deductible. This aspect might be of particular interest for social health insurance, since the loss of implicit cross-subsidies is often used as an argument against (higher) mandatory traditional deductibles.

6.8 References

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Conclusion

Chapter 7

This chapter answers the research questions formulated in the introduction, which will provide a framework for crucial policy-choices concerning the premium rebate for a voluntary deductible in the particular context of a competitive health insurance market with risk equalization, open enrollment and premium regulation.

7.1 How large are the three components of the difference in insurance claims between consumers with and without a voluntary deductible in practice?

The empirical results in chapter 2 show a difference of € 1,913 in insurance claims (i.e. medical expenses paid by the insurer), between the 53 percent of individuals[1] without a voluntary deductible and the 13 percent with the highest voluntary deductible (i.e. € 762) in the Swiss basic health insurance of 2003. Estimation results indicate that this difference consists for 14 percent of out-of-pocket expenses, for 10 percent of moral hazard reduction and for 76 percent of the self-selection component. We conclude that, in line with the results of Bakker (1997) based on stated preferences, consumers are obviously able to segment in groups of low risks and high risks.

7.2 To what extent does risk equalization reduce the self-selection component?

Competition forces insurers to adjust the premium rebate for a voluntary deductible to the difference in (expected) expenses between individuals with and without a deductible. In the *absence* of risk equalization, this market-based rebate would reflect the difference in net insurance claims, as indicated above. In the *presence* of risk equalization, the market-based premium rebate is smaller, since equalization payments adjust for risk-related expenditure differences between consumers who choose a deductible and those who do not. In other words: risk equalization reduces the self-selection component. The remaining rebate under different risk equalization models is indicated by the results in chapter 2: under an age/gender/region-model a rebate of € 1,222 would remain; under an age/gender/region/PCG/DCG-model a rebate of € 828 would remain. Although these rebates are substantially lower than the original rebate of € 1,913, they still exceed the average (estimated) out-of-pocket expenditures and moral hazard reduction by € 378. So, it can be concluded that a quite comprehensive risk equalization model with information on age, gender and health status substantially reduces the self-selection component of the premium rebate substantially, but not completely. This is in line with a study on consumer information surplus (measured by stated preferences) by Van de Ven and Van Vliet (1996).

1 Of 26 years or older.

7.3 What are the consequences of premium rebate restrictions?

If the sponsor considers a self-selection component in the premium rebate as unacceptable, two measures can be taken to avoid (or reduce) it. The first is to improve the risk equalization model in terms of risk characteristics such that equalization payments adjust (to a larger extent) for differences in health status between consumers with and without a deductible. The second measure is to restrict the rebate by law. At the time of writing, two forms of rebate restrictions are actually applied in practice: limitation of the rebate (in Germany and Switzerland) and the requirement of community-rating (in Germany, the Netherlands and Switzerland).

Limitation of the rebate is a simple measure to keep the premium rebate at an acceptable level. A drawback, however, is that it creates incentives for cream skimming (i.e. risk selection): if the market-based rebate exceeds the restricted rebate, predictable profits occur on consumers who prefer a deductible and predictable losses occur on the opposite group. Therefore, this measure implies a trade-off between the adverse effects of risk selection and the level of cross-subsidies.

The requirement of community-rating is a simple measure to avoid unacceptable differentiation of the premium rebate. It makes no sense, however, to apply a ban on risk-rating for risk characteristics that are (already) included in the risk equalization model. For these characteristics, all (predictable) expenditure variation is on average adjusted for via the equalization payments. This implies that in case of perfect risk equalization a risk-rated rebate will mainly differ because of variation in out-of-pocket expenditures and moral hazard reduction. From an efficiency perspective, such a risk-rated rebate might, in fact, be preferred over a fully community-rated rebate. The explanation is that for high-risk individuals (who obviously have above-average out-of-pocket expenditures) a risk-rated rebate (reflecting the average out-of-pocket expenditures and moral hazard reduction in their risk group) is more attractive than a community-rated rebate (reflecting the average of these components in the population). Larger numbers of high risks choosing a deductible are likely to result in a larger moral hazard reduction and a higher level of efficiency. Nevertheless, the requirement of community-rating might be preferred for risk groups that are *not* (directly) included in the risk equalization model. For these groups the equalization payments can on average be too low or too high. This implies that, under community-rated premiums for the standard (i.e. no-deductible) plan (as is the situation in all countries at the time of writing), predictable profits and losses occur. If insurers are allowed to risk-rate the premium rebate according to these characteristics, they will be forced to incorporate such predictable profits and losses. In that scenario, premium rebates for voluntary deductibles will not be a pure reflection of out-of-pocket expenditures and moral hazard reduction, but also of the imperfect equalization payments. More specifically, a competitive insurer will be forced to offer a low (or even no) rebate to individuals for whom he is under-compensated and a high rebate to individuals for whom he is over-compensated.

7.4 Could a premium rebate based only on out-of-pocket expenditures and moral hazard reduction be sufficiently large to induce consumers to take a deductible?

Around the world, risk equalization models are being improved. It can therefore be expected that the self-selection component of the rebate for voluntary deductibles will further decrease. This raises the question whether consumers will be sufficiently induced to choose a deductible if a self-selection component would be absent, i.e. if the premium rebate can only consist of (expected) out-of-pocket expenditures and moral hazard reduction. For an answer we must distinguish between two scenarios. If the average out-of-pocket expenditures plus moral hazard reduction in a premium-risk group (and therefore the premium rebate) exceeds the deductible amount, (all) income-maximizing consumers have an incentive to choose a deductible. If the average out-of-pocket expenditures plus moral hazard reduction (and therefore the premium rebate) does not exceed the deductible amount, consumers will choose a deductible only if the premium rebate exceeds their expected out-of-pocket expenditures, as theoretically discussed in chapter 4. The extent to which the rebate must exceed the expected out-of-pocket expenditures depends on the demanded compensation for risk aversion, transaction costs and inertia. So, if the offered premium rebate can just consist of out-of-pocket expenditures plus moral hazard reduction, it will only be attractive if the reduction in moral hazard is large enough for insurers to offer the demanded compensation. Based on the empirical results in chapters 4 and 5, it can be concluded that such rebates will be attractive only for a minority of the population. Moreover, an adverse-selection spiral may occur with hardly any consumer opting for a deductible in the end.

7.5 What can be done to maximize the moral hazard reduction, given a certain deductible level?

In the absence of a self-selection component in the premium rebate, a larger moral hazard reduction is expected to increase the number of individuals choosing a deductible. Chapter 6 introduces an alternative to traditional deductibles which is expected to increase the moral hazard reduction and, thereby, the viability of voluntary deductibles, given deductible level d. The idea is to shift the deductible range for individual i from $[0,d]$ to $[s_i,s_i+d]$, with starting point s_i depending on the individual's risk characteristics. The rationale is simple: traditional deductibles, i.e. with deductible range $[0,d]$, are not effective in reducing moral hazard for high-risk individuals who know (ex-ante) with near certainty that their expenditures will exceed the deductible amount. These individuals will be insensitive to the deductible because cost containment will finally not lead to lower out-of-pocket expenditures. A shift of the deductible range reduces the probability of exceeding the deductible amount and, thereby, increases price sensitivity. However, an extreme shift (e.g. s = € 500,000) would hardly lead to any price-sensitivity as well, since fewer consumers will ever reach the deductible range. It is to be expected that somewhere in between, the price sensitivity will be at its largest. As argued in chapter 6, a reasonable criterion for finding the optimal starting point is the variance in expected out-of-pocket expenditures. Maximum variance indicates maximum uncertainty about out-of-pocket expenditures and maximum price sensitivity. Our results indicate that for the 10-percent highest risks in our data, the optimal starting point of a € 1000 deductible lies beyond € 1,200.

7.6 What are the consequences of out-of-pocket expenditures and moral hazard reduction for the definition of the dependent variable in the (estimation of the) risk equalization model?

While the previous research questions mainly focus on the effects of risk equalization on voluntary deductibles, there are crucial implications in the opposite direction as well. These have to do with the way risk equalization payments are calculated. In general terms, the calculation procedure consists of two steps, i.e. 1) estimation of an expenditure model with a relevant set of risk factors, and 2) calculation of the individual expected expenditures using the coefficients of the estimated model.[2] At the time of writing, the dependent variable in the estimation of risk equalization models is 'observed expenditures'. The theoretical arguments and empirical illustrations in chapters 2 and 3 have shown that this dependent variable should ideally be corrected for out-of-pocket expenditures and moral hazard reduction. In the absence of any correction, a correlation between deductible choice and risk characteristics results in a bias of equalization payments, i.e. these payments will (partly) capture out-of-pocket expenditures and moral hazard reduction. As a result, these two components cannot be fully incorporated into the premium rebate and incentives for cream skimming occur (according to risk characteristics that are adopted in the risk equalization model). The correction of the dependent variable could (simply) mean that for those with a voluntary deductible, observed expenditures are increased by an amount equal to the sum of the (expected) out-of-pocket expenditures and moral hazard reduction. In other words, expenditures that a consumer would have had without a voluntary deductible are taken into account instead of *observed* expenditures. It should be mentioned that this measure requires availability of empirical data on the moral hazard reduction.

7.7 A complex interaction

In sum, it must be concluded that the interaction between voluntary deductibles and risk equalization is a complex one, which leads to crucial policy choices and entails difficult trade-offs among efficiency, risk selection and the level of cross-subsidies.

2 The risk equalization payment for an individual in risk group j equals the expected expenditures for risk type j (minus the share of expenditures that the sponsor wants to be incorporated in insurance premiums that are paid directly by the consumers to the insurer).

7.8 References

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Recommendations

Chapter 8

Competition forces insurers to adjust the premium rebate for a voluntary deductible to the difference in (expected) expenses between consumers who choose a deductible and those who do not. From a social perspective, this market-based rebate might be unacceptable and implies a number of crucial policy-choices. In 2008, voluntary deductibles exist in (at least) three competitive health insurance schemes with risk equalization, which are the Dutch, German and Swiss basic health insurances for curative care. Table 8.1 summarizes the crucial aspects of these schemes in which the government fulfills the role of sponsor. In this chapter we confront these features with our conclusions and provide a number of relevant recommendations.[1]

The German and Swiss risk equalization models are rather poor, since hardly any (Germany) or even no (Switzerland) direct information on health is taken into account. The Dutch model is richer, since pharmacy-based cost groups and diagnostic-based cost groups are good proxies for health (Lamers, 1999a and 1999b). Even the Dutch model, however, does not fully adjust for S-type expense variation (e.g. expense variation related to age, gender and health status) either (Stam, 2007). Nevertheless, it is likely that each of these countries will move towards a situation of perfect risk equalization. Since the recommendations are, at some points, quite opposite for scenarios of perfect and imperfect risk equalization, both scenarios will be addressed.

The subsequent recommendations focus on three particular policy-choices to be made by the government: the desirability of the market-based rebate, the use of rebate restrictions, and the choice of the dependent variable to estimate the risk equalization model. Furthermore, some open research questions on the moral hazard reduction will be formulated.

1 Because in Germany voluntary deductibles have been introduced very recently, our remarks on the German context will be based on speculations rather than observations.

Table 8.1 Relevant regulation with repsect to voluntary deductibles and risk equalization in the Dutch, German and Swiss basic health insurance markets in 2008 [2 3 4]

	Germany	The Netherlands	Switzerland
Voluntary deductible levels	No explicit regulation	€ 0, € 100, € 200, € 300, € 400 and € 500	€ 120, € 420, € 720, € 1,020 and € 1,320
Risk characteristics in the risk equalization model	Age/gender, disability status, yes/no enrollment in disease management program	Age/gender, type of region, main source of income, social economic status, pharmacy cost groups, diagnostic cost groups	Age/gender, (per) region
Premium-rate restrictions	Community-rating per insurer, per plan	Community-rating per insurer, per plan, per province	Community-rating per insurer, per plan, per canton, per age group (0-18, 19-25 and 25<)
Rebate restrictions	The limit is the lower of 20 percent of the annual contribution rate and € 600 No rate-restrictions below the limit	No legal limit Community-rating per insurer, per plan, per deductible level, per province	The limit is 50% of the premium for the standard-deductible plan (given age group / canton) Community-rating per insurer, per plan, per canton, per age group, per deductible level
Dependent variable in the risk equalization model	Health care expenses paid by the insurer	Health care expenses paid by the insurer + out-of-pocket expenditures + moral hazard reduction	Health care expenses paid by the insurer

8.1 Desirability of the market-based rebate: efficiency versus cross subsidies

Because of the equivalence principle, risk-related expenditure differences between individuals with and without a voluntary deductible which are not reflected in the equalization payments will be reflected in the market-based premium rebate. We refer to this rebate-component as the self-selection component. The government should decide whether or not (or to what extent) this component is desired. This decision requires a trade-off between efficiency and cross subsidies. On the one hand, a self-selection component in the premium rebate might be desired, since it increases the number of consumers opting for a deductible, resulting in a larger moral hazard reduction. On the other hand, it might be undesired, since it reduces cross subsidies, resulting in an increase of the premium for (high-risk) individuals who do not prefer a deductible.

2 In the Netherlands there is a mandatory deductible of € 150, which can be voluntarily increased to € 650. For reasons of simplicity, this study disregards the presence of a mandatory deductible.

3 In Switzerland there is a mandatory deductible of € 180, which can be voluntarily increased to € 1,500. For reasons of simplicity, this study disregards the presence of a mandatory deductible.

4 Swiss francs translated to Euros using an exchange rate of 1 CHF = € 0.60 (January 1, 2008)

With perfect risk equalization all risk-related expenditure differences between consumers with and without a deductible are adjusted for, which implies no self-selection component. In that case, the market-based premium rebate for a voluntary deductible will consist only of (expected) out-of-pocket expenditures and moral hazard reduction. Our results indicate that under such circumstances only few (or even no) individuals will be induced to choose a deductible. This is illustrated by the Dutch situation where, since the introduction of the basic health insurance in 2006, insurers are quite reserved with offering (high) premium rebates. In 2008, the average rebate for the highest voluntary deductible (i.e. € 500) was about € 200. [5] Consequently, less than 5 percent of Dutch individuals of 18 years or older actually chose a voluntary deductible. This indicates that consumers need a substantial compensation (for risk aversion and transaction costs). If the market-based premium rebate appears to be too low to be attractive, some form of additional (external) subsidy might be needed if government wants to increase the numbers of consumers opting for a voluntary deductible. On the other hand, one could argue that insurers could raise the premium rebates substantially since it appears that (after risk equalization) the selection component alone exceeds € 200 (WOR 368). Roughly adding out-of-pocket expenditures and moral hazard reduction suggest that a rebate of about € 300 could be offered.

Another strategy to increase the viability of voluntary deductibles under perfect risk equalization is to realize a larger moral hazard reduction. Given deductible d, a strategy to do so is to shift the deductible range for individual i from $[0,d]$ to $[s_i,s_i+d]$, with starting point s_i depending on the individual's risk characteristics. Such a shift is expected to increase the consumer's price sensitivity, resulting in a larger moral hazard reduction. In fact, this concept is also interesting for *mandatory* deductibles, as found in the Netherlands and Switzerland. Compared to a traditional deductible, a shifted deductible with a risk-adjusted starting point will not only increase price sensitivity, but will also reduce the difference in (expected) out-of-pocket expenditures between healthy and unhealthy consumers. So, under community-rated premiums, such shifted deductibles are an escape from the trade-off between moral hazard and the level of cross subsidies.

8.2 Premium (rebate) restrictions

Premium restrictions can take several forms, such as fixed premiums and the requirement of community-rating. With respect to the premium rebate for a voluntary deductible, we observe two forms of restrictions in the three countries, which are *limitation of the rebate* (Germany and Switzerland) and the *requirement of community-rating* (the Netherlands and Switzerland).

5 For any individual of 18 years or older. Source: http://kiesbeter.nl (online comparison of insurance plans).

8.2.1 Limitation of the rebate: cross subsidies versus risk selection

The Swiss and German governments chose to limit the premium rebate for voluntary deductibles by law. Presumably, the goal is to keep the premium rebate at an acceptable level. Although this measure is very effective in achieving its goal, it induces incentives for risk selection, i.e. when the market-based rebate exceeds the limit, insurers will face a predictable profit on those who prefer a deductible and a predictable loss on the opposite group. Therefore, this measure involves a trade-off between the level of cross subsidies and the adverse effects of risk selection such as a welfare loss for society and the disincentive for insurers to meet the preferences of high risks. The only escape from this trade-off is to improve the risk equalization model.

8.2.2 Community-rating: not for risk factors in the risk equalization model

In the Netherlands and Switzerland, premium rebates must be community-rated, while in Germany they are allowed to be risk-rated (below the legal limit). Given the current risk equalization models, both regimes need reconsideration.

In the presence of community-rated premiums for the standard plan (i.e. the no-voluntary-deductible-plan), imperfect risk equalization results in predictable profits and losses. In the absence of rebate-rate restrictions (like in Germany), insurers are forced to incorporate these predictable profits and losses into the premium rebate for a voluntary deductible. More specifically, insurers are forced to give a low (or even no) rebate to individuals for whom the equalization payment is (on average) too low and a high rebate to individuals for whom the equalization payment is (on average) too high. This implies that under imperfect risk equalization, risk-rated rebates will not be a pure reflection of out-of-pocket expenditures and moral hazard reduction, but will also be based on predictable profits and losses that occur because of the community-rated *premium* for the standard plan. Thus, for risk factors not included in risk equalization a ban on risk-rating might be preferred.

It makes no sense, however, to have rebate-rate restrictions for risk characteristics that are (already) taken into account in the risk equalization model (as happens in the Netherlands and Switzerland). On average, no predictable profits and losses exist for these characteristics, since S-type expense variation is adjusted for. So, risk-rating according to these characteristics would result in market-based rebates that mainly differ because of variation in out-of-pocket expenditures and moral hazard reduction. In the light of efficiency such a risk-rated rebate might in fact be preferred over a fully community-rated rebate. The explanation is that expected out-of-pocket expenditures are substantially higher for high-risk than for low-risk consumers, which implies that for high risks a risk-rated rebate (which reflects the average expected out-of-pocket expenditures and moral hazard reduction in their risk group) is more attractive than a full community-rated rebate (reflecting the average of these components in the population, i.e. of all risk types). A risk-rated rebate can be considered more efficient than a community-rated rebate since in that case high-risk consumers are more likely to choose a deductible, resulting in a larger moral hazard reduction. Thus, in sum, rebate-rate restrictions do not make sense with respect to risk characteristics that are (already) included in the risk equalization model.

Note that under *perfect* risk equalization, premium (rebate) restrictions are redundant. If all S-type variation in expenses is completely adjusted for by risk equalization, there is no need for implicit cross subsidies via premium restrictions. Under such circumstances, (free) risk-rated rebates will only differ because of out-of-pocket expenditures and moral hazard reduction.

8.3 Expenditure level used to estimate the risk equalization model

In Switzerland and Germany the dependent variable in the risk equalization model is 'health care expenses paid by the insurer'. In the presence of voluntary deductibles, this choice of dependent variable results in a bias of equalization payments and, thereby, in under- and overcompensation of certain risk groups. As a consequence of these under- and overcompensations, incentives for risk selection occur and out-of-pocket expenditures and moral hazard reduction cannot be fully incorporated into the premium rebate. In both countries, however, this bias is not so much an issue yet, because 1) incentives for risk selection are substantial anyway because the models do not accurately adjust for variation in health status and 2) premium rebates for a voluntary deductible are substantial anyway because of the (remaining) self-selection component.

In the presence of a richer equalization model, however, this bias will become more important. A good way of showing this is to assume the extreme situation of perfect risk equalization where all S-type expenditure differences are in principle adjusted for. In such a situation premium rebates can only be based on out-of-pocket expenditures and moral hazard reduction. If these two components cannot be fully incorporated into the rebate due to the under- and overcompensations, the rebate might become very low or even zero. Obviously, this is undesired from an efficiency perspective, since hardly any consumer will be induced to choose a deductible. Here it holds that the higher the correlation between deductible choice and the S-type risk characteristics in the risk equalization model, the smaller the extent to which these components can be incorporated into the premium rebate. Moreover, the risk equalization payments will under/over compensate groups that differ by S-type risk factors (e.g. age and health status) which paradoxically results in incentives for risk selection by S-type risk factors *included* in the risk equalization model. To avoid this bias of equalization payments and its negative effects, the dependent variable should ideally be corrected for out-of-pocket expenditures and moral hazard reduction, as happens in the Netherlands in 2008.[6]

8.4 Open questions

Given the scope of this study, (at least) two important issues need special attention and further research. The first is the way moral hazard should be treated in the risk equalization model. If government wants this component to be reflected into the premium rebate, the dependent variable used in the estimation of the risk equalization model needs an explicit correction, as mentioned above. With respect to this correction, policy-makers (again) have to make crucial choices. A first choice is whether to increase the dependent variable for individuals with a deductible or to decrease it for individuals without a deductible. A second choice concerns the size of the correction: empirical estimation of this size implies a number of methodological problems in disentangling moral hazard and the self-selection effect. Furthermore, the correction can be either absolute or a percentage of the total expenditures. A fourth choice concerns the level at which the correction should be executed, which can be, for instance, the individual level, the insurer level or the macro level. Further research is needed to examine the consequences of different modalities.

However, before government can decide on how to deal with moral hazard in risk equalization, it should answer a more fundamental question in the first place, i.e. 'Should the premium rebate be the same for individuals with different moral hazard reductions, ceteris paribus?'. The answer can be 'no' with the argument that consumers who manage to reduce their health care consumption to a larger extent, 'deserve' a higher rebate. However, the answer can also be 'yes' with the argument that this group of consumers apparently has above-average moral hazard under the standard plan (i.e. no voluntary deductible). Since this above-average moral hazard does not lead to an above-average premium for the standard plan (because of the requirement of community-rating), this group should not receive a higher rebate for a voluntary deductible.

6 The reason for taking into account 'health care expenses paid by the insurer + out-of-pocket expenditures + moral hazard reduction' is, however, not related to the arguments raised in this thesis. It is unclear whether moral hazard reduction will be taken into account after 2008.

8.5 A complex interaction

In sum, it can be concluded that the trade-offs between efficiency, risk-selection and cross-subsidies are different in the three countries because of substantial differences in the quality of the respective risk equalization systems. This implies that in any competitive, social health insurance market, changes in the risk equalization system require evaluation of the way voluntary deductibles are dealt with.

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Summary

In the Dutch, German and Swiss basic health insurance markets for curative care, consumers can opt for a voluntary deductible in return for a rebate on their out-of-pocket premium. Competition forces insurers to adjust the premium rebate to the difference in (expected) expenses between consumers who choose a deductible and those who do not.

This study focuses on some crucial policy choices concerning the premium rebate for a voluntary deductible in the particular context of a competitive health insurance market with risk equalization, open enrollment and premium regulation.

Without any regulation, the market-based premium rebate for a voluntary deductible would be a reflection of the *out-of-pocket expenditures*, *moral hazard reduction* and the *effect of self-selection*. The first component refers to the expenditures that consumers with a deductible pay themselves; the second stands for reduction in medical consumption for those with a deductible due to the price-effect; and the third refers to the expenditure differences between consumers with and without a deductible caused by the phenomenon that in any premium-risk group, low-risk individuals are more likely to choose a deductible than high-risk individuals.

In the (regulated) Dutch, German and Swiss schemes, the market-based premium rebate is affected by risk equalization, which adjusts for risk-related expenditure differences among individuals in order to avoid undesired premium differentiation and/or risk selection. The better the risk equalization model, the smaller the extent to which risk-related expenditure differences can be incorporated into the premium rebate for a voluntary deductible. In other words: risk equalization reduces the self-selection component of the premium rebate.

This study examines the effect of risk equalization on the premium rebate by an empirical analysis of Swiss data from 2003. The results indicate that, in the absence of risk equalization, the market-based premium rebate for a voluntary deductible of € 760 would have been higher than € 1,900, of which three-quarter would be due to the effect of self-selection. A risk equalization model including information on age, gender, region and health, would have substantially reduced the self-selection component by about 74 percent.

The empirical results indicate that even the Dutch risk equalization model does not *fully* adjust for self-selection. This is confirmed by a recent study[1] on Dutch data which shows that, in case of a voluntary deductible of € 500, a self-selection component of € 200 remains after risk equalization. Adding the expected out-of-pocket expenditures and moral hazard reduction results in a potential rebate of about € 300, which is substantially higher than the average rebate of € 200 that was actually offered by Dutch insurers in 2008.

1 WOR 368, 2008. Herijkingsonderzoek vereveningsmodel 2008. Onderzoek voor het Ministerie van Volksgezondheid, Welzijn en Sport, in het kader van de Werkgroep Onderzoek Risicovereveningsmodel (WOR).

In case of imperfect risk equalization, governments are confronted with the question whether the remaining self-selection component in the premium rebate is socially acceptable. This implies a trade-off between the level of efficiency and the level of cross subsidies from low-risk to high-risk individuals. A larger self-selection component dynamically results in a higher rebate, more consumers opting for a deductible and a larger moral hazard reduction. At the same time, it results in a lower level of cross subsidies and, thus, in higher out-of-pocket premiums for the relatively high-risk individuals who do not prefer a voluntary deductible.

If the government considers the (remaining) self-selection component as unacceptable, the best measure to avoid (or reduce) this effect is to improve the risk equalization model by including more risk characteristics. A second-best measure is to limit the premium rebate by law. This strategy will, however, induce incentives for risk selection: if the difference in expected costs between consumers with and without a deductible exceeds the limited rebate, insurers are confronted with a predictable profit on the first group and a predictable loss on the second.

At the time of writing, the Dutch and Swiss governments require the premium rebate to be community-rated. Presumably, the goal is to avoid unacceptable premium differentiation. Given this goal, however, it makes no sense to apply rate restrictions for risk characteristics that are (already) included in the risk equalization model, like age and gender. With respect to these characteristics, unacceptable expenditure differences are fully adjusted for and cannot be incorporated into the premium rebate. A rebate differentiated according to these characteristics will vary mainly because of differences in the expected out-of-pocket expenditures and moral hazard reduction. Such a differentiated rebate might in fact be preferred over a fully community-rated rebate, since a voluntary deductible will then be more attractive for high-risk individuals. The reason is that for high-risk individuals, who obviously have above-average out-of-pocket expenditures, a risk-rated premium rebate (based on the average out-of-pocket expenditures per risk group) will be higher than a community-rated one (based on the average out-of-pocket expenditures of the whole population). An increase in the number of high risks choosing a deductible is likely to result in a larger moral hazard reduction.

It is to be expected that the risk equalization systems (in the three countries) will be improved in the (near) future, which will further reduce the market-based premium rebate for a voluntary deductible. Under perfect risk equalization, i.e. in the absence of a self-selection component, premium rebates can only consist of the out-of-pocket expenditures and moral hazard reduction. Presumably, consumers will choose a deductible only if the premium rebate exceeds the expected out-of-pocket expenditures. The expected financial advantage can be seen as a compensation for risk aversion and transaction costs, among others. This means that, in the absence of a self-selection component, premium rebates can only be attractive if the moral hazard reduction is large enough for insurers to offer a sufficient compensation. Given deductible d, one option to increase the moral hazard reduction is to shift the deductible range for individual i from $[0,d]$ to $[s_i,s_i+d]$ with starting point s_i depending on relevant risk characteristics. Such a shift increases the probability for individual *i* that cost containment will (finally) result in lower out-of-pocket expenditures and, thereby, increases his or her price-sensitivity. As an aside, a shift of the deductible range is also interesting for *mandatory* deductibles, as present in the Netherlands and Switzerland. Compared to a traditional deductible, a shifted deductible with a risk-related starting point does not only increase the consumer's price sensitivity, but also reduces the difference in (expected) out-of-pocket expenditures between low-risk and high-risk consumers and, thereby, avoids the classical trade-off between the level of cross subsidies and moral hazard.

Next to the consequences of risk equalization for voluntary deductibles, there are important implications in the opposite direction as well. In the presence of voluntary deductibles, the dependent variable in the estimation of the risk equalization model should ideally be adjusted for out-of-pocket expenditures and moral hazard reduction. Without any correction, out-of-pocket expenditures and moral hazard reduction are (partly) captured by the equalization payments. One consequence is that these components cannot be fully incorporated into the rebate. Another consequence is that the under-compensation of risk groups with relatively many consumers opting for a deductible and the over-compensation of risk groups with relatively few consumers opting for a deductible result in incentives for risk selection according to characteristics in the risk equalization model. This is the situation in Switzerland and Germany where the dependent variable equals the *health care expenses paid by the insurer*. With respect to out-of-pocket expenditures, the correction could simply be to increase for each individual the dependent variable in the estimation dataset with his or her (expected) out-of-pocket expenditures, as done in the Netherlands in 2008. With respect to the moral hazard reduction, the particular correction is less straightforward and implies a number of choices, such as 1) whether to increase the dependent variable for individuals with a deductible or decrease it for individuals without a deductible, 2) whether to apply an absolute or relative correction, and 3) whether to apply the correction at the individual level, the insurer level, the macro level, or another level.

The conclusion is that the interaction between voluntary deductibles and risk equalization is a complex one and entails crucial trade-offs among efficiency, risk selection and cross subsidies.

Samenvatting

In de Nederlandse, Duitse en Zwitserse verzekeringsmarkten voor curatieve zorg kunnen verzekerden kiezen voor een vrijwillig eigen risico in ruil voor een korting op hun nominale premie. Concurrentie dwingt verzekeraars de premiekorting per risicogroep gelijk te stellen aan het verschil in (verwachte) kosten tussen verzekerden mét en verzekerden zónder eigen risico.

Dit onderzoek richt zich op enkele cruciale beleidskeuzen betreffende de premiekorting voor een vrijwillig eigen risico in de specifieke context van een concurrerende zorgverzekeringsmarkt met risicoverevening, een acceptatieplicht en premieregulering.

In een vrije verzekeringsmarkt is de premiekorting voor een vrijwillig eigen risico een afspiegeling van de *eigen betalingen*, het *remgeldeffect* en het *effect van zelfselectie*. De eerste component verwijst naar de kosten die verzekerden met een eigen risico uit eigen zak betalen; de tweede betreft de afname van zorgconsumptie ten gevolge van het prijseffect; en de derde staat voor het verschil in ziektekosten tussen verzekerden met en zonder eigen risico vanwege verschillen in gezondheid, die worden veroorzaakt doordat in iedere premierisicogroep jonge / gezonde verzekerden sneller voor een eigen risico kiezen dan ouderen en chronisch zieken.

In de bovengenoemde (gereguleerde) verzekeringsmarkten wordt de premiekorting beïnvloed door het risicovereveningssysteem. Dit systeem heeft als doel verzekeraars te compenseren voor voorspelbare kostenverschillen tussen verzekerden ter voorkoming van onacceptabele premiedifferentiatie en/of risicoselectie. Een gevolg hiervan is dat voor zover gezondheidgerelateerde kostenverschillen tussen verzekerden met en zonder eigen risico worden verevenend, deze kostenverschillen niet tot uitdrukking komen in de korting. Oftewel: risicoverevening reduceert de zelfselectiecomponent van de premiekorting.

Het effect van risicoverevening op de premiekorting blijkt uit een empirische analyse van een Zwitsers verzekerdenbestand uit 2003. De resultaten laten zien dat zónder risicoverevening de premiekorting voor een eigen risico van € 760, in theorie, hoger had kunnen zijn dan € 1,900. Dit verschil in verwachte kosten tussen verzekerden met en verzekerden zonder eigen risico kan voor driekwart worden toegeschreven aan het effect van zelfselectie. Een vereveningsmodel met parameters voor leeftijd, geslacht, regio en gezondheid zou de zelfselectiecomponent substantieel hebben gereduceerd met ongeveer 74 procent.

De empirische resultaten duiden erop dat zelfs het Nederlandse vereveningsmodel niet *volledig* corrigeert voor zelfselectie. Dit wordt bevestigd door recent onderzoek op Nederlandse data waarin wordt aangetoond dat bij een vrijwillig eigen risico van € 500 een zelfselectiecomponent resteert van ongeveer € 200.[1] Wanneer de verwachte eigen betaling en

1 WOR 368, 2008. Herijkingsonderzoek vereveningsmodel 2008. Onderzoek voor het Ministerie van Volksgezondheid, Welzijn en Sport, in het kader van de Werkgroep Onderzoek Risicovereveningsmodel (WOR).

het remgeldeffect hierbij worden opgeteld, resulteert een potentiële premiekorting van circa € 300, welke substantieel hoger is dan de gemiddelde korting van € 200 die de Nederlandse verzekeraars gaven in 2008.

Bij een imperfect vereveningssysteem zal de overheid moeten bepalen of de resterende zelfselectiecomponent in de premiekorting al dan niet wenselijk is, hetgeen een afweging vereist tussen doelmatigheid en risicosolidariteit. Enerzijds leidt een grotere zelfselectiecomponent tot een hogere premiekorting, meer verzekerden die voor een eigen risico kiezen en een groter remgeldeffect; anderzijds leidt het tot een hogere nominale premie voor de (oudere/chronisch zieke) verzekerden die niet voor een eigen risico kiezen.

Als de overheid een (resterend) effect van zelfselectie op de premiekorting als onwenselijk beschouwt, kan zij op twee wijzen ingrijpen. De beste strategie is het verbeteren van het vereveningssysteem zodat het in grotere mate corrigeert voor verschillen in gezondheid tussen verzekerden met en zonder eigen risico. Een alternatief is om de korting wettelijk te limiteren, met als nadeel dat prikkels tot risicoselectie ontstaan: als het verschil in kosten tussen verzekerden met en zonder eigen risico na risicoverevening groter is dan de maximale premiekorting, worden verzekeraars geconfronteerd met een voorspelbare winst op de eerste groep en een voorspelbaar verlies op de tweede.

Op het moment van schrijven bestaat in de Nederlandse en Zwitserse basisverzekering een verbod op differentiatie van de premiekorting. Vermoedelijk tracht de overheid hiermee onacceptabele premieverschillen te voorkomen. Het onderhavige onderzoek laat echter zien dat een verbod op differentiatie overbodig is voor kenmerken die (reeds) zijn opgenomen in het vereveningssysteem, zoals leeftijd en geslacht. Doordat het vereveningssysteem volledig corrigeert voor onacceptabele kostenverschillen gerelateerd aan deze kenmerken, zullen deze verschillen niet tot uitdrukking komen in de premiekorting. Een voor de vereveningskenmerken gedifferentieerde korting zal hoofdzakelijk variëren vanwege verschillen in de verwachte eigen betaling en het remgeldeffect tussen risicogroepen. Een dergelijke korting kan zelfs doelmatiger zijn dan een doorsneepremiekorting doordat het eigen risico aantrekkelijker wordt voor verzekerden met een hoog risico. Zo zullen ouderen (met een bovengemiddelde eigen betaling) eerder een eigen risico kiezen bij een leeftijdsafhankelijke korting (gebaseerd op het gemiddelde van de eigen betaling in hun leeftijdsgroep) dan bij een doorsnee-premiekorting (gebaseerd op de gemiddelde eigen betaling in de populatie). Als meer ouderen een eigen risico kiezen, kan dat een toename van het remgeldeffect betekenen en dus een verbetering van doelmatigheid.

Naar verwachting zullen de vereveningssystemen in de drie landen verder worden verbeterd, waardoor de premiekorting voor een eigen risico, zoals die in de markt tot stand komt, verder zal afnemen. Bij een perfect vereveningssysteem, dat volledig corrigeert voor het effect van zelfselectie, kan de premiekorting uitsluitend bestaan uit de verwachte eigen betaling plus het verwachte remgeldeffect. Verzekerden zullen pas kiezen voor een eigen risico als de premiekorting uitstijgt boven de verwachte eigen betaling. Het verwachte voordeel kan worden gezien als een compensatie voor onder andere risicoaversie en transactiekosten. Het voorgaande impliceert dat in een dergelijke situatie iemand pas een eigen risico kiest als het verwachte remgeldeffect dusdanig is dat verzekeraars een afdoende compensatie kunnen verstrekken. Een methode om het remgeldeffect te vergroten is het eigen risico d voor individu i te verschuiven van het kosteninterval $[0,d]$ naar $[s_i, s_i+d]$ waarbij startpunt s_i afhangt van individuele risicokenmerken. Een dergelijke verschuiving vergroot de kans voor een verzekerde dat doelmatig zorggebruik (uiteindelijk) leidt tot lagere eigen betalingen, waardoor de prikkel tot doelmatig zorggebruik toeneemt. De bovengenoemde verschuiving is tevens interessant voor verplichte eigen risico's, zoals die bestaan in Nederland en Zwitserland. Vergeleken met een eigen risico aan de voet, leidt een verschoven eigen risico niet alleen tot een groter remgeldeffect, maar ook tot een lagere (verwachte) eigen betaling voor ouderen en chronisch zieken. Hiermee neemt het verschil in (verwachte) eigen betaling tussen jonge/gezonde verzekerden en ouderen en chronisch zieken af, waardoor de klassieke afweging tussen doelmatigheid en solidariteit (betreffende de hoogte van het eigen risico) kan worden vermeden.

Naast de implicaties van risicoverevening voor het vrijwillig eigen risico, bestaan er belangrijke effecten in de omgekeerde richting. In een verzekeringsstelsel met vrijwillige eigen risico's, dient bij de schatting van het vereveningsmodel de afhankelijke variabele te worden gecorrigeerd voor eigen betalingen en remgeldeffecten. Zonder adequate correctie zullen eigen betalingen en remgeldeffecten (gedeeltelijk) worden opgenomen in de vereveningsbijdragen met als gevolg dat deze componenten niet (volledig) tot uitdrukking kunnen komen in de premiekorting. Bovendien resulteren de ondercompensatie van risicogroepen met relatief veel verzekerden die voor een eigen risico kiezen en de overcompensatie van risicogroepen met relatief weinig verzekerden die voor een eigen risico kiezen, in prikkels tot risicoselectie op basis van risicokenmerken die zijn opgenomen in het vereveningsmodel. Op het moment van schrijven wordt de bovengenoemde correctie alleen in Nederland toegepast. In Duitsland en Zwitserland bestaat de afhankelijke variabele in het vereveningsmodel slechts uit de 'kosten vergoed door de verzekeraar'. Voor wat betreft eigen betalingen zou de correctie simpelweg kunnen betekenen dat de afhankelijke variabele per verzekerde in de schattingsdata wordt verhoogd met zijn of haar (verwachte) eigen betalingen. Voor wat betreft het remgeldeffect ligt de precieze correctie minder voor de hand en dienen verschillende keuzen te worden gemaakt, zoals: 1) het verlagen van de afhankelijke variabele voor verzekerden zonder eigen risico of het verhogen ervan voor verzekerden met eigen risico, 2) het toepassen van een absolute of een relatieve correctie en 3) het uitvoeren van de correctie op individuniveau, verzekeraarniveau of geaggregeerd niveau.

Samenvattend kan worden gesteld dat de complexe interactie tussen vrijwillige eigen risico's en risicoverevening leidt tot cruciale afwegingen tussen doelmatigheid, risicoselectie en solidariteit.

Dankwoord

Dank

‘Lijkt het je wat om je scriptie een vervolg te geven met een promotieonderzoek?’, luidde de vraag van Professor Van de Ven tijdens een bespreking van mijn afstudeeronderzoek.

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1 Een carrière als postbode/brandweerman lijkt nu toch echt van de baan, Ma.

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Curriculum vitae

Richard van Kleef (1980) is a research fellow at Erasmus University Rotterdam. In 2003, he graduated in Health Policy and Management with his master thesis about voluntary deductibles in social health insurance. The last chapter of that thesis represented a proposal for PhD-research, which was approved in December 2003.

After graduation, Richard started working as a PhD-student at the Institute of Health Policy and Management. From 2004 to 2008, he worked on his dissertation and published his research articles 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).[1] 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 parts of his dissertation at RAN-meetings in Berlin (2006), Ostend (2007) and Dublin (2008). Since the completion of his PhD-manuscript, his research particularly focuses on cost sharing and risk equalization.

As a teacher, Richard is involved in the Bachelor program Health Sciences at Erasmus University where he gives workgroups for the course Multivariate Analyses and both lectures and workgroups for the course Health Care and Health Insurance, of which he is also the coordinator. In addition, he supervises bachelor and master theses.

1 'Economische Statistische Berichten' is a Dutch journal for economic and statistical issues.

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.