University of Zurich

Socioeconomic Institute
Sozialökonomisches Institut

Working Paper No. 0915

Capping Risk Adjustment?

Patrick Eugster, Michèle Sennhauser and Peter Zweifel

August 2009

Socioeconomic Institute
University of Zurich

Working Paper No. 0915

Capping Risk Adjustment?

August 2009

Author's address: Patrick Eugster
E-mail: patrick.eugster@soi.uzh.ch

Michèle Sennhauser
E-mail: michele.sennhauser@soi.uzh.ch

Peter Zweifel
E-mail: pzweifel@soi.uzh.ch

Publisher Sozialökonomisches Institut
Bibliothek (Working Paper)
Rämistrasse 71
CH-8006 Zürich
Phone: +41-44-634 21 37
Fax: +41-44-634 49 82
URL: www.soi.uzh.ch
E-mail: soilib@soi.uzh.ch

Capping Risk Adjustment?

Abstract

When premiums are community-rated, risk adjustment (RA) serves to mitigate competitive insurers' incentive to select favorable risks. However, unless fully prospective, it also undermines their incentives for efficiency. By capping its volume, one may try to counteract this tendency, exposing insurers to some financial risk. This in term runs counter the quest to refine the RA formula, which would increase RA volume. Specifically, the adjuster, "Hospitalization or living in a nursing home during the previous year" will be added in Switzerland starting 2012. This paper investigates how to minimize the opportunity cost of capping RA in terms of increased incentives for risk selection.

The authors gratefully acknowledge helpful suggestions by Konstantin Beck (University of Zurich and CSS Insurance Lucerne), Willard G. Manning (University of Chicago), the Health Economics Executive Board of the Verein für Socialpolitik at the conference 2007, and by two anonymous referees. Further, special thanks goes to the three health insurers that provided data for this study.

1 Introduction

When premiums are community-rated, risk adjustment (RA) is introduced in order to reduce competitive insurers' incentive to select favorable risks. On the other hand, unless fully prospective, it undermines their incentive for efficiency (Ellis and Van de Ven [2000]). This goal conflict has been addressed by Van Barneveld et al. [2001], who estimate optimal thresholds in the cost distribution beyond which risk adjustment sets in. However, the implementation of such a rule becomes difficult when the distribution of health care expenditure (HCE) not only shifts over time (e.g. due to a particularly high rate of cost increase in the hospital sector) but also differs between insurers (e.g. due to more or less reliance on Managed-Care options). Therefore, as a rough-and-ready measure, one might consider simply capping the volume of RA. In this way, one exposes insurers to some residual financial risk. At the same time, there is dissatisfaction with the performance of current RA formulas (Van de Ven et al. [2003]). The expectation is that by adding risk adjusters, incentives for risk selection could be reduced even more. However, refinements of the RA formula quite likely cause the volume of RA to increase. They therefore are in conflict with the desire to preserve efficiency through capping the volume of RA.

This conflict has recently become acute in Switzerland. By 2005, cross-subsidization (between individuals) has reached CHF 4.8 billion (bn.), about 1 percent of Swiss GDP (CHF 1 ≈ US$ 0.83). The volume of partly retrospective RA (between insurers) amounted to CHF 1.2 bn., or some 20 percents of their payments for HCE. These amounts were seen as incompatible with the efficiency goal by the Swiss Council of States, who proposed to limit the volume of RA to its 2004 volume (for the first capping-proposal see Spycher [2000]). At the same time, parliament decided to add the criterion, "Hospitalization or living in a nursing home during the previous year" ("hospitalization" henceforth) to the RA formula, effective 2012. This decision was influenced by Beck et al. [2006], who had found that this criterion serves to substantially reduce insurers' payoff to risk selection.

With this backdrop, the present contribution purports to achieve two objectives. First, it seeks to establish the opportunity cost of capping the volume of RA in terms of increased incentives for risk selection. Second, it investigates the consequences of complementing the RA formula by the criterion "hospitalization". Note that the volume of RA is measured in two ways throughout this paper, drawing on the analogy between RA and a levy (and a subsidy, respectively). In the economics of taxation, a distinction is consistently made between those who pay a levy and those who ultimately bear it. In the case of RA, payments into the scheme are ultimately borne by the favorable risks whose premiums exceed the (estimated) actuarially fair value. They cross-subsidize the premiums of unfavorable risks to the tune of CHF 4.8 bn. (2005), the first figure cited above. A part of this cross-subsidization occurs through community-rated premiums. The remainder is paid (but not borne) by health insurers. This component amounts to CHF 1.2 bn. (2005), the second figure mentioned above. Analysis of RA volume so far has exclusively focused on this second, more visible component. It is designed to neutralize insurers' incentives to select favorable risks and is often referred to as "volume of RA". To avoid confusion, this definition will be used in this paper[1]. However, note that it is the total amount of cross-subsidization that drives consumer behavior. Favorable risks have an interest in avoiding the cross-subsidy by seeking out an insurer who offers a premium closer to the actuarially fair volume, which remains possible as long as RA is not perfect. Conversely, unfavorable risks have an interest in obtaining a high cross-subsidy through their choice of insurer.

The main results of this paper are twofold. First, the introduction of the hospitalization adjuster is shown to inflate the volume of cross-subsidization and of RA in every canton of Switzerland, in some of them by more than 50 percent. Second, reducing the amount of cross-subsidization from an estimated CHF 5.375 bn. to CHF 4.5 bn. (its 2004 volume) would reduce the volume of RA between insurers from an estimated 1.1 to 0.98 bn. To minimize the associated incentives for insurers to increase their risk-selection efforts, the new RA values have to be the higher, the greater the differences between group-specific values prior to the limitation and the greater the group's population share.

The remainder of this paper is structured as follows. Section 2 is devoted to a description of the data basis, descriptive statistics, and checks of the representativeness of the data. Section 3 shows how the volumes of cross-subsidization

[1] Interestingly however, Swiss statistics also do publish the amount of cross-subsidization between individuals as "volume of RA" (see Gemeinsame Einrichtung KVG [2005a]).

and RA change when the additional criterion is introduced. Section 4 then takes up the issue of capping the volume of risk adjustment. The consequences for consumers, insurers, and Swiss cantons are analyzed. In Section 5, limiting the volume of RA is accepted as a way to preserve insurers' incentives for efficiency, giving rise to an optimization problem since insurers' tendency to turn to risk selection again should be minimized. Section 6 discusses the consequences of capping risk adjustment, illustrating them with an empirical example. Section 7 concludes.

2 Data basis, descriptive statistics, and representativeness

In order to carry out this research, three large Swiss health insurers provided individual health insurance data. Their holders of basic health insurance during the period 2001 to 2005 were considered, totalling 2.78 million (mn.) individuals. Besides socioeconomic variables like age, gender, and canton of residence, data on ambulatory and hospital health care expenditure (HCE), drug expenditure, and a variable indicating hospitalization or living in a nursing home in the previous year were collected. To characterize the type of health insurance, the deductible and a variable indicating choice between conventional and Managed-Care contracts were included as well. With 49.5 percent of women, the sample is well balanced with respect to gender. The market share of the three insurers is stable across the age profile, amounting to 25 percent on average. Across the 26 Swiss cantons, they are over-represented in eastern and central Switzerland and under-represented in the northern and western parts of the country.

In Swiss health insurance, premiums are community-rated. They are uniform in 16 cantons, the remaining cantons distinguishing up to three premium regions. In 2005, 32 percent of the population lived in cantons with uniform premiums, while 25 percent lived in a high, 27 percent in a medium, and 16 percent in a low premium region. With regard to the choice of contract, there is a clear trend toward higher deductibles. Whereas in 2001, policies with the minimum deductible (which amounts to CHF 300 or US$ 250 at 2007 exchange rates) had a share of over 56 percent, this share had decreased to 50 percent by 2005. The three highest deductibles (CHF 1,500, 2,000 and 2,500, respectively) increased in importance from 12 to over 22 percent during the same period. There is a similar trend in favor of Managed-Care contracts. Especially consumers aged 31 to 35 use this option, resulting in a share of 22 percent in this age group. However, older age cohorts increasingly prefer Managed-Care contracts as well. For instance, among the over 80 year old, their share went up from 10 to 18 percent between 2001 and 2005.

In Swiss risk adjustment, only two criteria are considered, age and gender. The age classification comprises 15 classes, starting from 19-25 and continuing in 5 year steps. By law, risk adjustment must not lead to financial reallocation between cantons. The national volumes of cross-subsidization (CS) and RA therefore equal the sum of the cantonal volumes. Computing these volumes using the sample data of the three insurers and their market shares yields a CS total of CHF 4.13 bn., the national figure being CHF 4.8 bn. (see Gemeinsame Einrichtung KVG [2005a]).

In all cantons, the calculated volumes of CS (see Table 1) and RA fall short of the official ones. The difference is smallest in the canton of Zurich (ZH), Lucerne (LU), and Valais (VS), amounting to less than 10 percent. It is between 10 and 20 percent in 9 other cantons, where the three insurers only hold small market shares. This marked discrepancy could reflect successful risk-selection efforts, which have high expected return if targeted at a small population at risk (as shown in Zweifel and Eisen [2003], Ch. 5.5). However, there is no significant (negative) correlation between market shares of the three insurers and deviations from the official CS and RA figures, suggesting that risk selection is not the explanation.

Table 2 focuses on CS values, in accordance with the argument proffered in the Introduction that they are the ones that trigger risk-selection effort on the part of consumers. Calculated cross-subsidies per capita for all 30 groups used in risk adjustment are shown, along with their standard errors and official countrywide values. Young men have to bear the highest cross-subsidies (over CHF 2,000 per year), followed by young women with CHF 1,773 per year. Over 90 year old women benefit the most, to the tune of over CHF 8,600, followed by women of age 86 to 90 with CHF 6,917 and men of age 90+ with CHF 6,731. All age groups over 60 are cross-subsidized by the combination of community-rating and risk adjustment. A comparison with official values (see the last column of Table 2) shows calculated

Table 1: Volume of cross-subsidy per canton, CHF (2005)

Canton	CHF mn.*	CHF mn.**	CHF p.c.*	CHF p.c.**
ZH	735.82	796.47	713	771
BE	592.03	678.17	768	879
LU	193.80	211.23	691	753
UR	17.57	19.97	636	723
SZ	57.00	70.85	533	662
OW	13.01	16.41	497	626
NW	15.13	17.23	485	552
GL	16.52	19.89	544	656
ZG	47.57	54.14	566	644
FR	121.48	146.44	625	754
SO	122.07	154.65	614	778
BS	110.21	161.97	719	1,057
BL	149.81	172.14	697	800
SH	39.18	47.50	649	787
AR	20.10	24.85	483	597
AI	6.48	7.43	570	654
SG	196.02	238.19	545	662
GR	95.91	110.26	616	708
AG	259.61	312.05	573	689
TH	105.30	126.78	579	697
TI	226.03	270.02	869	1,038
VD	430.40	502.39	852	994
VS	160.39	170.13	685	726
NE	104.10	130.63	784	984
GE	257.43	333.04	816	1,056
JU	39.45	52.32	733	972

* Simulation, ** Official data from Gemeinsame Einrichtung KVG [2005b]
p.c. = per capita, 1 CHF = 0.83 USD (2007)

values to be too high for younger and too low for older individuals, especially for women. These deviations are mainly responsible for the underestimation of the total CS and RA volumes noted above. Table 2 also shows that the variance of CS values increases with age. While the standard deviation is CHF 494 for young women, it attains to CHF 1,770 for the oldest age class, reflecting the fact that the variance of HCE increases with age. Overall, calculated figures come close enough to official CS values to justify the use of sample data in the investigation below.

Table 2: Simulated and official cross-subsidies per capita according to age and gender, CHF (2005)

Men	Average*	Std.error	Min	Max	Official value
19-25	−2,006.50	505.52	−3,006.17	−707.84	−1,963.87
26-30	−1,227.59	833.80	−2,165.91	2,287.40	−1,889.64
31-35	−900.68	678.91	−1,733.38	1,202.03	−1,771.42
36-40	−979.03	421.93	−1,749.27	247.62	−1,624.49
41-45	−828.69	351.55	−1,435.17	−40.31	−1,398.94
46-50	−543.46	465.97	−1,615.88	349.08	−1,091.94
51-55	−109.82	378.55	−977.63	714.71	−624.63
56-60	290.34	300.27	−557.57	815.53	13.40
61-65	884.74	418.34	228.53	1,648.89	771.06
66-70	1,560.60	598.50	187.69	2,464.57	1,638.40
71-75	2,535.19	548.54	982.57	3,435.54	2,873.43
76-80	3,208.98	653.35	1,884.58	4,128.30	3,845.50
81-85	4,127.79	1,361.80	1,261.52	6,983.73	4,986.30
86-90	5,286.51	1,208.24	2,752.09	7,945.75	6,880.09
90+	6,731.78	1,513.63	2,945.10	8,915.78	9,541.96
Women	**Average***	**Std.error**	**Min**	**Max**	**Official value**
19-25	−1,772.99	494.20	−2,780.08	−974.44	−1,484.37
26-30	−1,024.61	461.54	−2,211.50	−311.71	−946.01
31-35	−746.06	559.49	−1,694.31	−1,125.73	−749.83
36-40	−961.00	328.45	−1,576.69	−316.11	−924.81
41-45	−965.85	279.05	−1,749.34	−535.99	−922.02
46-50	−732.01	309.04	−1,295.60	−177.44	−646.82
51-55	−442.87	268.14	−1,045.08	106.95	−235.80
56-60	−15.51	321.10	−512.16	841.85	205.36
61-65	443.65	247.14	19.55	764.95	737.31
66-70	981.80	395.53	210.13	1,603.77	1,415.39
71-75	1,982.76	446.04	758.34	2,662.32	2,385.07
76-80	3,136.84	656.22	1,838.10	4,406.12	3,671.81
81-85	4,641.23	775.55	2,788.30	6,111.25	5,596.14
86-90	6,917.12	987.66	5,115.11	8,382.98	8,486.06
90+	8,672.75	1,770.15	4,464.86	11,619.96	12,457.28

*: Average over all 26 Swiss cantons
1 CHF = 0.83 USD (2007)

3 Hospitalization as an additional criterion

Current Swiss risk adjustment uses only the two criteria age and gender. However, the hospitalization adjuster will be added to the RA formula from 2012. Beck [2004] and Beck et al. [2006] estimate that this criterion has considerable predictive power in explaining future HCE. To prevent gaming by insurers, stays of less than four days are not counted. Maternity stays are excluded as well since according to Beck [2004], they do not significantly increase HCE in the following year. The new RA formula will continue to be partly retrospective because it uses observed rather than predicted HCE values.

The new criterion has several advantages. It is very easily collected; moreover, being a dummy variable it does not make computation of RA payments much more difficult. While the formula currently distinguishes 30 age-gender cells, the number of classes would only increase to 60 (for a discussion on other alternatives and their drawbacks see e.g. Lamers [1999], Van de Ven et al. [2004], Lamers and Van Vliet [2003a], Lamers and Van Vliet [2003b], Ellis and Van de Ven [2000] Beck et al. [2006], and Van de Ven and Schut [2007]). Moreover, the data is readily available in every insurer's administrative database.

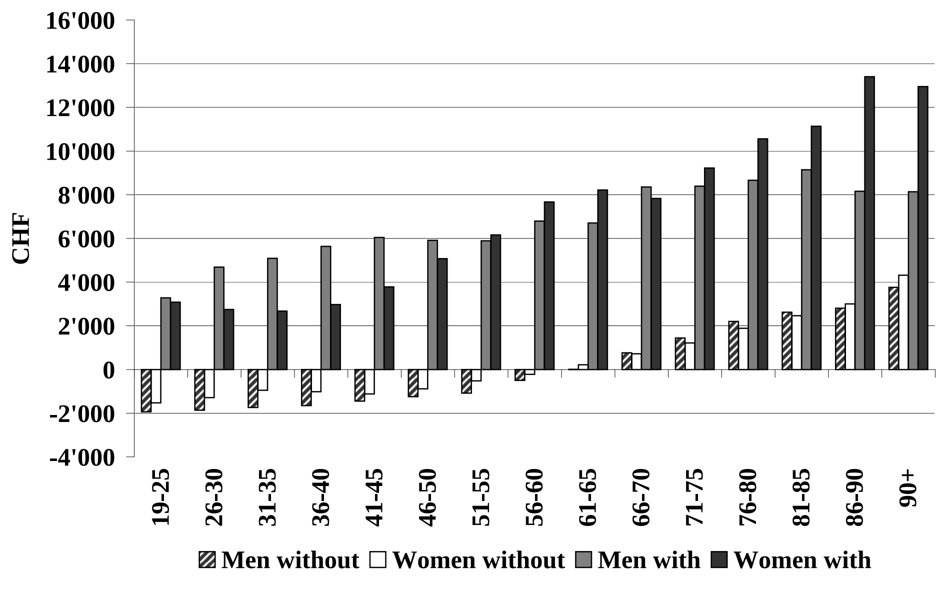

Figure 1: Cross-subsidies by age group, persons without / with hospitalization or living in nursing home during the previous year, canton of Zurich, CHF (2005)

Table 3: Cross-subsidization without and with the hospitalization adjuster, CHF (2005)

Canton	Without the criterion CHF mn.	CHF p.c.	With the criterion CHF mn.	CHF p.c.	% Increase
ZH	735.82	713	898.24	870	22.1
BE	592.03	768	833.26	1,080	40.7
LU	193.80	691	292.31	1,042	50.8
UR	17.57	636	26.00	941	48.0
SZ	57.00	533	84.29	788	47.9
OW	13.37	497	22.98	877	71.9
NW	15.13	485	21.35	684	41.0
GL	16.52	544	24.23	798	46.6
ZG	47.57	566	71.94	855	51.2
FR	121.48	625	184.14	948	51.6
SO	122.07	614	176.52	889	44.6
BS	110.21	719	171.37	1,118	55.5
BL	149.81	697	201.91	939	34.8
SH	39.18	649	59.72	989	52.4
AR	20.10	483	32.94	791	63.9
AI	6.48	570	9.58	842	47.8
SG	196.02	545	298.32	829	52.2
GR	95.91	616	137.59	884	43.5
AG	259.61	573	363.64	803	40.1
TH	105.30	579	173.73	955	65.0
TI	226.03	869	313.01	1,203	38.5
VD	430.40	852	593.60	1,175	37.9
VS	160.39	685	226.85	969	41.4
NE	104.10	784	166.65	1,255	60.1
GE	257.43	816	375.23	1,190	45.8
JU	39.45	733	54.38	1,010	37.8

1 CHF = 0.83 USD (2007)
p.c. = per capita, 1 CHF = 0.83 USD (2007)

Taking this additional criterion into account, calculated cross-subsidies would increase from CHF 4.13 mn. (as of 2005) to CHF 5.82 mn., i.e. by 40 percent. According to Table 3, every canton would exhibit an increase. To put these into perspective, note that premiums e.g. in the canton of Zurich were CHF 4,000. Therefore, the per-capita cross-subsidy of CHF 870 would have attained almost 22 percent of premium under the new RA formula.

Moreover, the change would have completely overthrown the customary CS age and gender profiles. Whereas under the current RA formula, the young of both genders are burdened to the benefit of those beyond age 60, the new formula causes hospitalization to become the crucial determinant of CS values. Figure 1 illustrates the case of the canton of Zurich. The additional adjuster would cause persons with a hospital stay in 2004 to be cross-subsidized in 2005 regardless of age or gender. It is remarkable that until age 50, men benefit more (due to a higher rate of hospitalization) than do women. With the additional criterion, women contribute less to and receive more from cross-subsidization, with the age group 51-55 marking the crossover (except for the 66-70 bracket).

4 Limiting the volume of risk adjustment

The volumes of cross-subsidization and risk adjustment have increased significantly since 1996 (see Table 4), when the new law on health insurance came into effect (and along with it, risk adjustment). Both CS growth (80.1 percent up to 2005) and RA growth (126.8 percent) have consistently outstripped the 60.9 percent of net HCE (defined as payments by health insurers with copayments deducted). While HCE growth, ceteris paribus, increases incentives of both favorable risks and insurers to engage in risk selection, it evidently fails to fully explain the development of CS and RA volumes. Those discrepancies can be interpreted in two ways.

Table 4: Volumes of cross-subsidization (CS) and risk adjustment (RA), CHF (1996-2005)

Year	Volume CS (CHF mn.)	Change (percent)	Volume RA (CHF mn.)	Change (percent)	Volume HCEn* (CHF mn.)	Change (percent)
1996	2,700	–	530	–	10,779	-
1997	2,920	+8.2	531	+0.2	11,361	+5.4
1998	3,195	+9.4	609	+14.7	11,927	+5.0
1999	3,366	+5.3	660	+8.4	12,431	+4.2
2000	3,575	+6.2	735	+11.4	13,190	+6.1
2001	3,826	+7.0	853	+16.1	13,986	+6.0
2002	4,009	+4.8	937	+9.8	14,593	+4.3
2003	4,250	+6.0	1,009	+7.7	15,336	+5.1
2004	4,568	+7.5	1,103	+9.3	16,308	+6.3
2005	4,864	+6.4	1,202	+9.0	17,353	+6.4
Average change		+6.7		+5.4		
Total change	+80.1		+126.8		+60.9	

HCEn*: HCE - deductibles - copayments, ”net HCE”
Note: p.c. = per capita, 1 CHF = 0.83 USD (2007)
Source: Gemeinsame Einrichtung KVG [2005a], Bundesamt für Gesundheit [2007]

On the one hand, rapid growth of RA volume may be the consequence of increases of risk-selection effort in excess of HCE growth. On the part of insurers, this is the predicted response to increasing discrepancies between risk-based premiums and imposed community rating (see Zweifel [2007] for a theoretical development). According to Table 2, this may well have been the case since the increase in variance of HCE (reflected by the standard error of cross-subsidies) is mainly associated with age (and hence, higher HCE). With HCE growing rapidly from 1996 to 2005 (see Table 4 again), its variance likely grew as well and with it the gap between actuarially fair and community-rated premiums. On the part of consumers, the favorable risks they may well have stepped up their efforts at avoiding the rapidly increasing burden of cross-subsidization. One way was to opt for higher deductibles and Managed-Care options because insurers, while not permitted to pass on the full savings, still could pass on more than the "true" savings after deduction of risk-selection effects (which amount to between one- and two-thirds of the full savings in the case of Managed-Care, as estimated in Lehmann and Zweifel [2004]). As stated in Section 2, both contractual variants gained a great deal of market share just between 2001 and 2005. This interpretation points to activities designed to circumvent premium regulation. They could be reigned by perfecting the RA scheme. Recall that with perfect RA, insurers would not be able to offer a share of their "fake" savings to consumers who seek to dodge the cross-subsidy. This consideration motivated the Swiss parliament to pass a refinement of the RA formula by including the hospitalization criterion.

On the other hand, such a refinement causes CS and RA volumes to increase substantially, as evidenced in Section 3. The consequence is to increasingly shelter insurers from financial risk undermining their incentive to improve efficiency. Moreover, risk adjustment seems to have become a redistributive scheme with a life of its own. Indeed, the CS volume in favor of the old grew even faster than the 80 percent shown in Table 4 (not evidenced here), which was not anticipated. These considerations motivated the Swiss Council of States to propose capping the RA volume at its 2004 value (CHF 4.8 bn.).

As a certainly second-best measure, capping the volume of RA (or indeed CS) is considered below. A simple limit in nominal terms would even have the advantage of increasing insurers' risk exposure over time, forcing them to step up their efficiency-enhancing efforts. It could be imposed at three levels, the aggregate (broken down to insurers according to market share, which may be changing over time), the individual insurer (fixed over time), and the consumer (limiting directly the amount of cross-subsidization). Only a cap on total RA volume will be considered because it is invariant to changes in market share and structure. A question that naturally arises at this point is who bears the consequences of a cap. Three parties can be identified.

- *The individual insured.* A cap on RA volume causes premiums to converge towards risk-rated values, causing CS values to decrease [also to a mitigation of moral-hazard effects (see e.g. Zweifel and Breuer [2006])].

- *The insurers.* In a system with community-rated premiums, risk adjustment is introduced to eliminate (or reduce) incentives for risk selection. Capping its volume (directly or indirectly through limiting CS) causes insurers not to be fully compensated anymore for enrolling unfavorable risks. In the Swiss context, there are two predicted responses. One is to eschew high risks, using known means such as losing application forms. The other is to form conglomerates with a shared sales office (see Van de Ven et al. [2003]). Potential clients are quickly assessed on the telephone and assigned to a low-premium affiliate if found a low risk or a high-premium one otherwise. While the lower risks are happy to accept, the high ones often prefer to accept the higher premium to overcoming the hurdles erected by conventional competitors with their lower community-rated premium. Although this practice is not in the spirit of the law, it is legal because each affiliate of the conglomerate does charge a uniform premium.

- *The cantons.* Capping risk adjustment increases the financial burden of cantons with an unfavorable risk structure because the cantons pay part of the subsidies to those (in part high-risk) citizens whose premiums exceed a certain share of their income. However, the federal government is affected as well through matching grants.

5 Optimizing the cap on the volume of risk adjustment

The preceding section has shown that capping the volume of risk adjustment has opportunity costs in terms of increased risk-selection efforts on the part of both insurers and consumers. This gives rise to an optimization problem: How is the cap to be allocated to minimize its opportunity cost? The development below focuses on insurers' incentive for risk selection, neglecting changes in consumer behavior in response to reduced cross-subsidies.

Swiss risk adjustment is based on age and gender. Its values are calculated in the following way,

$$RA_{a,g} = \bar{L}_{a,g} - \bar{L}, \tag{1}$$

where a and g are indexes for age and gender categories, $RA_{a,g}$ is the payment to ($RA_{a,g} < 0$) or from ($RA_{a,g} > 0$) risk adjustment in group (a, g), $\bar{L}_{a,g}$ is average HCE in group (a, g), and $\bar{L}$ is average HCE paid by insurers in the population as a whole. The volume of risk adjustment (V) can then be calculated as in Equation (2),

$$V = \{\sum_{a=1}^{15}\sum_{g=0}^{1} |RA_{a,g}| n_{a,g}\}/2, \tag{2}$$

where n is the number of insureds of risk group with age a and gender g. RA payments are considered in absolute values to avoid canceling out positive and negative values. However, this makes the division by two necessary to avoid double counting.

Favorable risks contribute to the insurer's margin, which can be used to cover the deficits generated by unfavorable risks. The insurer is exposed to a higher risk of insolvency if these deficits are large. Reserves can be used to ensure solvency, but too many outliers endanger the economic survival of the insurer. There are several methods for analyzing the importance of such outliers, such as value at risk or expected loss at risk (see Hull [2006]). However, the easiest way to proceed is to analyze the variance of HCE falling on the insurer.

If one considers age and gender as the only determinants of HCE (which is in accord with current Swiss risk adjustment), then variance in HCE across these groups is given by

$$s_L^2 = \frac{\sum_a \sum_g (\bar{L}_{a,g} - \bar{L})^2 n_{a,g}}{\sum_a \sum_g n_{a,g}} \tag{3}$$

where $\bar{L}$ is total average HCE in a specific canton (recall that risk adjustment is calculated in each canton separately), and $\bar{L}_{a,g}$ is average HCE of a specific age and gender cell. As of 2006, s_L^2 is estimated by Beck et al. [2006] at CHF 12 bn. Risk adjustment thus serves to reduce the variance of HCE falling on insurers (and therefore mitigate the incentive to "skim the cream"). This can be seen by plugging Equation (1) into Equation (3) and rearranging terms,

$$s_L^2 = \frac{\sum_a \sum_g RA_{a,g}^2 n_{a,g}}{\sum_a \sum_g n_{a,g}} \tag{4}$$

and hence,

$$(\sum_a \sum_g n_{a,g}) s_L^2 = \sum_a \sum_g RA_{a,g}^2 n_{a,g}. \tag{5}$$

Equation (5) shows that with a constant number of individuals in each age and gender cells, RA values must be increasing with increasing differences in HCE between groups. This of course serves to increase RA volume as well. If age and gender would be the only determinants of HCE (i.e. if insurers had no private information about individuals, contrary to the analysis by Shen and Ellis [2002a], Shen and Ellis [2002b]), then risk adjustment would eliminate all risk induced by community rating. Prior to capping the volume of risk adjustment, the variance borne by the health insurer (s_{HI}) would be zero, s_{HI}^2=0. This evidently does not hold in the present context because RA in Switzerland is far from perfect (Beck et al. [2006]).[2] Whatever the initial value of s_{HI}^2, capping the volume of risk adjustment causes it to increase. The objective therefore is to minimize this increase, subject to RA volume not exceeding the cap $\bar{V}$. Risk adjustment payments $\widehat{RA}_{a,g}$ are the decision variables in the problem,

$$\min_{\widehat{RA}_{a,g}} \hat{s}_{HI}^2 - s_{HI}^2 \qquad \text{s.t.} \qquad V \leq \bar{V}, \tag{6}$$

[2] Note, however, in both cases (s_{HI}^2=0 or s_{HI}^2=c, where c is a constant) the results for the optimization problem is the same, since a constant cancels out when taking derivatives.

with $\hat{s}^2_{HI}$ denoting the variance when volume is capped. Of course the optimization must take into account that risk adjustment is zero sum. This however is always achieved since positive and negative RA values cancel out.

If volume is defined as in Equation (2), optimization is difficult due to absolute values. An alternative approach is therefore taken here. First, the positive half variance $\hat{s}^2_{HI+}$ (with the restriction on RA volume), and then, the negative half variance $\hat{s}^2_{HI-}$ (with the same restriction on RA volume) is minimized, ensuring that RA values sum to zero,

$$\min_{\widehat{RA}_{a,g}} [(\hat{s}^2_{HI+}) + (\hat{s}^2_{HI-})] - s^2_{HI}. \tag{7}$$

Because s^2_{HI} is predetermined, it is obvious that only the terms in brackets are relevant. The first term can be broken down as shown in Equation (8),

$$\min \hat{s}^2_{HI+} = \frac{\sum_a \sum_g (x_{a,g} - \bar{x})^2 n_{a,g}}{\sum_a \sum_g n_{a,g}} \qquad \text{s.t.} \qquad x_{a,g} > \bar{x}. \tag{8}$$

The symbols are defined as follows,

$$\begin{aligned} x_{a,g} &= (L_{a,g} - \widehat{RA}_{a,g}) \\ \bar{x} &= \bar{L} \\ x_{a,g} - \bar{x} &= (L_{a,g} - \widehat{RA}_{a,g} - \bar{L}) \\ &= (RA_{a,g} - \widehat{RA}_{a,g}). \end{aligned} \tag{9}$$

Here, $\widehat{RA}_{a,g} > 0$ if the insurer receives a payment from the RA scheme and consumers in the (a, g) cell receive a cross-subsidy. Conversely, $\widehat{RA}_{a,g} < 0$ if it pays into the scheme (and low-risk consumers bear a cross-subsidy).

Since the restriction $V \leq \bar{V}$ always holds as an equality in Equation (6), the problem can be solved using a Lagrangian,

$$\begin{aligned} \min_{\widehat{RA}_{a,g}} Z &= (\hat{s}^2_+) - \lambda(\sum_a \sum_g \widehat{RA}_{a,g} n_{a,g} - \bar{V}), \qquad \forall \quad \widehat{RA}_{a,g} > 0 \qquad (10) \\ &= \frac{\sum_a \sum_g (RA_{a,g} - \widehat{RA}_{a,g})^2 n_{a,g}}{\sum_{a=1}^{15} \sum_{g=0}^{1} n_{a,g}} - \lambda(\sum_a \sum_g \widehat{RA}_{a,g} n_{a,g} - \bar{V}) \end{aligned}$$

where the subscript HI is dropped for simplicity. The solution to this problem shows how positive payments received from the RA scheme are optimally reduced. Payments into the scheme ($\widehat{RA}_{a,g} < 0$) are fully analogous. The first-order conditions are,

$$\begin{aligned}\frac{\partial Z}{\partial \widehat{RA}_{a,g}} &= \frac{-2(RA_{a,g} - \widehat{RA}_{a,g})n_{a,g}}{\sum_a \sum_g n_{a,g}} - \lambda n_{a,g} = 0 \\ \frac{\partial Z}{\partial \lambda} &= \sum_{a=1}^{15} \sum_{g=0}^{1} \widehat{RA}_{a,g} n_{a,g} - \bar{V} = 0.\end{aligned} \tag{11}$$

This is a system of linear equations in $\widehat{RA}_{a,g}$ and λ that has full rank and can therefore be solved. An example with four risk classes is given as follows.

Assume a hypothetical RA scheme distinguishing four groups $i = 0, 1, 2, 3$ with n_i the number of individuals in that group and n the overall number of individuals. Let two groups (0 and 1) have below-average and two (2 and 3), above-average expected HCE. RA_i indicates risk adjustment payments for each group. The first-order conditions for negative payments (i.e. payments to the RA scheme, groups 0 and 1) are,

$$\begin{aligned}\frac{\partial Z}{\partial \widehat{RA}_0} &= \frac{-2(RA_0 - \widehat{RA}_0)n_0}{n} - \lambda n_0 = 0 \\ \frac{\partial Z}{\partial \widehat{RA}_1} &= \frac{-2(RA_1 - \widehat{RA}_1)n_1}{n} - \lambda n_1 = 0 \\ \frac{\partial Z}{\partial \lambda} &= \widehat{RA}_0 n_0 + \widehat{RA}_1 n_1 - \bar{V} = 0.\end{aligned} \tag{12}$$

Now λ can be solved for from the first FOC,

$$\lambda = \frac{-2(RA_0 - \widehat{RA}_0)}{n}. \tag{13}$$

Equation (13) shows the determinants of the opportunity cost caused by the cap. First, the greater the population at risk (n), the smaller this cost. Second, the greater the difference between RA payments with and without the cap ($RA_0 - \widehat{RA}_0$), the higher this cost. In addition, the system (12) can be solved to yield,

$$\begin{aligned}(RA_0 - \widehat{RA}_0) &= (RA_1 - \widehat{RA}_1) \\ \widehat{RA}_0 n_0 + \widehat{RA}_1 n_1 &= \bar{V}.\end{aligned} \tag{14}$$

It is evident that the optimal reduction of RA values are the same across risk categories. Solving this system of two equations in the two unknowns yields the following solution payments to the RA scheme,

$$\begin{aligned} \widehat{RA}_0 &= \frac{\bar{V} - (RA_{11} + RA_0)n_1}{n_0 + n_1} = \frac{\bar{V}h_1}{n_1} - (RA_1 - RA_0)h_1 \\ \widehat{RA}_1 &= \frac{\bar{V} - (RA_0 + RA_1)n_0}{n_0 + n_1} = \frac{\bar{V}h_0}{n_0} - (RA_0 - RA_1)h_0 \end{aligned} \quad (15)$$

with h_i noting the share of group i in the subpopulation with below-average HCE. Therefore, the optimal new RA values are

- the lower, the lower the cap is set;
- the lower, the greater the positive difference in RA values prior to the limitation (e.g. $RA_1 > RA_0$);
- the higher, the greater the negative difference in RA values prior to the limitation (e.g. $RA_0 < RA_1$);
- the higher, the higher the group's population share h_i (even for small n_0 since $\bar{V} >> (RA_1 - RA_0)$).

The payments received from the RA scheme can be derived in an analogous way.

6 Consequences of capping risk adjustment

As argued in Sections 1 and 2, risk-selection behavior is ultimately driven by the amount of cross-subsidization contained in contributions to health insurance. And in the case of Switzerland, the political debate revolving around risk adjustment has focused on the CS rather than the RA volume. For these reasons, this section cites more CS rather than RA figures.

6.1 Theoretical considerations

The question as to the optimal value of the cap cannot be addressed in this paper. It requires knowledge of citizens' willingness to pay for avoiding risk-selection efforts by health insurers while keeping community-rated premiums. Experimental evidence concerning willingness to pay for attributes of health services provision has been presented in e.g. Zweifel et al. [2006], Telser et al. [2004], and concerning attributes of health insurance, in Becker [2006] and Becker et al. [2007]. However, willingness to pay for maintaining community-rated premiums has not been measured to the knowledge of the authors. As a second-best solution, parliament could decide on the value of the cap, assuming that politicians represent the preferences of the population.

While the political debate has focused on the national level, cantons will likely be affected as well. As evident from Equations (9) and (11), the opportunity cost of a cap on risk adjustment is linked to the dispersion of HCE, which varies between cantons. If CS an RA volumes were to be limited, many citizens with low incomes would have to pay higher premiums. This creates political pressure for increased redistribution through premium subsidies. More generous cantons would be more prone to increasing their subsidies, which are matched by the federal level, where a substantial amount of redistribution between cantons takes place. Therefore, a limit on CS and RA volumes is likely to induce a certain amount of cross-subsidization between cantons.

Focusing on the opportunity cost of a cap in terms of incentives when an additional adjuster is introduced, there are two effects to be distinguished. First, since HCE is now predicted more precisely, the variance of HCE borne by insurers decreases and with it risk-selection effort. Second, unless the additional adjuster exhibits perfectly negative correlation with the existing ones, CS and RA volumes must increase. However, the incidence of hospitalization increases with age and is higher among women than men; therefore volumes increase. This increase affects the opportunity cost, depending on the situation.

- The benchmark case is no cap, combined with the introduction of the hospitalization criterion into the RA formula. This simply reduces the variance in HCE to be borne by insurers, thus mitigating incentives for risk selection [see Equation (4)].
- The cap is imposed but not binding initially; it becomes binding with the introduction of the additional RA criterion. Therefore the opportunity cost of the cap was zero at the beginning. It would become positive but still small if the CS volume had to be reduced from CHF 4.6 to 4.5 bn. since the effect on insurer behavior is still limited. However, a future reduction from

CHF 6 to 4.5 bn. (say), would cause opportunity cost to rise [see Equation (13)].

- The third alternative is the introduction of the additional RA criterion when the cap is already binding. On the one hand, this would serve to reduce the volatility of HCE falling on health insurers. On the other hand, the restriction on CS volume becomes even more binding. The first effect mitigates incentives for risk selection, while the second strengthens them. The net effect remains ambiguous [see Equation (4) and (13), respectively].

Note that CS and RA volumes can always be reduced by permitting health insurers to charge premiums that are more in line with true risk. For example, suppose smokers pay an additional premium of CHF 50 per year. This would decrease the difference between HCE and premium revenue by CHF 50 ceteris paribus and hence the variance of payments and with it the risk to be borne by the health insurer. Incentives for risk selection decrease. The advantage of more risk-rated premiums is that RA volume declines endogenously without inducing more efforts at risk selection; its drawback is deviating from community-rating. Conversely, the advantage of capping CS and RA volumes is that community-rating can be retained, while its downside is that incentives for risk selection are strengthened.

6.2 Empirical illustration

Since the unit of reference for Swiss risk adjustment is the canton, the effects of limiting its volume can be exemplified by using data for the canton of Zurich, assuming a decrease of CS volume from the estimated nationwide CHF 5.375 bn. level to CHF 4.5 bn. The estimate is derived from pitting expected HCE at the individual level against the mean applicable to each of the 25 health insurers operating in the Canton of Zurich. Expected HCE was estimated using a two-part model along the lines of Steinmann et al. [2007], pooling the data provided by the three health insurers. However, dummy variables reflecting RA cells replaced continuously measured age. Other dummies are female gender and canton of residence.

Figure 2 shows that the estimated age profile of HCE closely reflects to that of the three insurers ("Actual") that provided the data. However, the increase of HCE with higher age at the national level ("Official") is still underestimated. Overall,

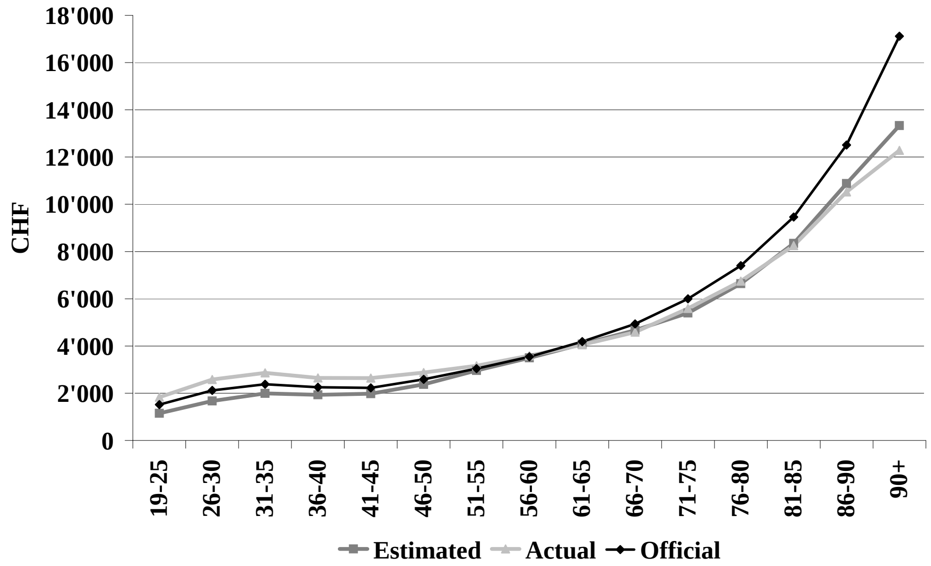

Figure 2: HCE of women by age, actual, estimated (three insurers), and official, Switzerland, CHF (2005)

estimated HCE seem to fit the Swiss average sufficiently well to derive estimates of the effect a cap on CS volume may have, assuming that it is imposed in a way as to minimize its opportunity cost (as expounded in Section 5).

Table 5 illustrates the effects of a reduction of CS from CHF 5.375 bn. to CHF 4.5 bn. for the canton of Zurich (number of insured: 1,032,600). Initially the youngest age class of women pays a premium that exceeds expected HCE by some CHF 1,600, used to finance the higher HCE of Zurich residents above 50 years of age. Capping the CS volume would reduce this excess by CHF 236. On the other hand, the highest age group of females currently receives more than CHF 11,000 as a cross-subsidy. This would be reduced by CHF 435. An exception is the class of 51-55 year old women, which changes from receivers to neutral.[3] These amounts are to be compared with the average Zurich premium, which was about CHF 4,000 in 2005.

[3] According to Equation (14), optimal reduction of RA values is the same across risk categories. However, since the class of 51-55 year old women and 56-60 year old men changes from receiver to payer, RA values have to be adjusted correspondingly.

Table 5: Capping the volume of cross-subsidies, canton of Zurich, CHF (2005)

Women	Without cap	Change	With cap
19-25	−1,618	+236	−1,382
26-30	−1,103	+236	−867
31-35	−772	+236	−536
36-40	−830	+236	−594
41-45	−789	+236	−553
46-50	−350	+236	−114
51-55	283	−283	0
56-60	855	−435	421
61-65	1479	−435	1,045
66-70	2,126	−435	1,691
71-75	2,886	−435	2,451
76-80	4,191	−435	3,757
81-85	5,983	−435	5,549
86-90	8,643	−435	8,209
90+	11,250	−435	10,816
Men	**Without cap**	**Change**	**With cap**
19-25	−2,347	+236	−2,111
26-30	−2,290	+236	−2,054
31-35	−2,191	+236	−1,955
36-40	−2,073	+236	−1,837
41-45	−1,800	+236	−1,564
46-50	−1,479	+236	−1,243
51-55	−548	+236	−312
56-60	223	−223	0
61-65	1,223	−435	788
66-70	2,085	−435	1,650
71-75	3,301	−435	2,866
76-80	3,276	−435	2,841
81-85	4,851	−435	4,417
86-90	7,162	−435	6,728
90+	9,419	−435	8,985

Note: 1 CHF = 0.83 USD (2007)

Naturally, capping the CS volume has an impact on insurers operating in the canton of Zurich as well. First, the decrease in CS values evidenced in Table 5 implies an increase in the deviations between actual and average HCE falling on them. Therefore, the variance of HCE borne by them (s^2_{HI} in Section 5) is bound to increase, very likely triggering additional risk-selection efforts on this part. This effect would even be more pronounced if the cap on CS and RA volumes were to be imposed in a non-optimal way. Second, the amount of RA transferred between insurers would fall. This effect was estimated in the following way. Equation (1) for determining RA values was implemented using the estimated HCE function

Table 6: Change of CS and RA volumes, CHF bn. (2005)

	Without cap	With cap	Change
CS volume between consumers	5.375	4.500	-16.3%
RA volume between insurers	1.123	0.982	-12.5%

Note: 1 CHF = 0.83 USD (2007)

to assign HCE values to age/gender/hospitalization cells of all 25 insurers. Next, the pool over which risk adjustment is defined was restricted to these 25 insurers. For the canton of Zurich, the error incurred is small because out of the 1,032,600 insured, only 172,671 do not belong to one of three insurers considered or one of the additional 22 sampled. Moreover, the resulting underestimation should not influence the percentage reduction much since it affects both uncapped and capped values. With the 25 insurers having a nationwide market share of 60 percent, the resulting total of RA values is scaled up accordingly to obtain CHF 1.123 bn. as the national estimate prior to imposing a cap (see Table 6).

For simplicity, the simulated RA values with the CS cap were not optimized [implementing the equation system (11) would constitute a research paper of its own] but simply allocated evenly to the age/gender/hospitalization status cells of insurers according to their shares in current RA volume. Thus, the cap on CS volume would reduce the RA volume by an estimated 12.5 percent. This is markedly less than the 16.3 percent reduction of CS volume because a great deal of cross-subsidization occurs between consumers enrolled in a given fund.

7 Conclusions

This contribution addresses the conflict of interest arising in the context of imperfect risk adjustment (RA). On the one hand, a refinement of the RA formula would weaken health insurers' incentive to engage in risk selection (given that they are subject to community rating). On the other hand, unless fully prospective, risk adjustment undermines their quest for efficiency. There are three novel aspects to this paper. First, it adopts standard economic theorizing by distinguishing between the insures who pay (through their contributions to the RA scheme) and the favorable risks who ultimately bear these cross-subsidies (CS), amounting to the difference between their actual and their actuarially fair premium. Second, as a rough-and-ready measure to expose insurers to a degree of financial risk, a cap on risk adjustment is considered and the resulting optimization problem studied. The issue is to structure the reduced RA values in a way as to minimize the increase of HCE variance borne by the insurer (and hence risk-selection effort). Third, the study simulates the consequences of a cap (on total CS rather than RA volume) both for consumers and insurers.

In a first step, data provided by three Swiss health insurers are compared to official nationwide averages to assess their representativeness. Overall, the data seem to accord with official statistics to a sufficient degree to justify more detailed investigation.

Next, the refinement of the Swiss RA formula effective 2012 is considered. The inclusion of the additional criterion, "Hospitalization or living in a nursing home during the previous year", is found to inflate CS volume by 40 percent on average and to cause age and gender to lose importance as risk adjusters throughout. This increase of CS (and hence RA) volume contradicts the objective of enhancing insurers' incentives for efficiency by exposing them to more financial risk, to be achieved by a cap on RA volume.

This conflict of interest gives rise to the optimization problem, "Minimize the HCE variance falling on the insurer (and therefore the incentive for risk selection), subject to RA volume not exceeding a politically determined level". The optimal solution calls for a uniform reduction of positive and negative RA values the amount of which depends on existing differences between groups in terms of RA values and their population shares.

A simulation extrapolating from one Swiss canton shows that a reduction of CS volume to CHF 4.5 bn. (by 16 percent) at the national level would reduce the RA volume between insurers by an estimated 12.5 percent. The optimized CS burden would drop slightly for those up to age 55, juxtaposed by a reduction of CS in favor of those above 55. However, HCE variance falling on insurers would increase, strengthening their incentives for risk selection.

This research is subject to several limitations. First, the refinement of the RA formula considered is one among many, e.g. the inclusion of diagnostic information. Second, capping CS (or RA) values to push insurers towards efficiency is certainly second best. This objective could be achieved at a lower opportunity cost if alternatives such as optimized cut-off points in the HCE distribution (beyond which RA sets in) were considered, with potentially quite different implications for CS values between consumers. Third, behavior of insurers was assumed to be driven by the HCE variance falling on them, while that of consumers, by the gap between the actual and the actuarially fair premium. Especially the latter assumption can be criticized for its neglect of fairness considerations. Still, this research does address some of the issues raised by a rough-and-ready measure that may appeal to politicians, such as simply capping the amount of RA (or CS) volume.

References

K. Beck. *Risiko Krankenversicherung. Risikomanagement in einem regulierten Krankenversicherungsmarkt - (Risk of Health Insurance. Risk Management in Regulated Health Insurance).* Haupt Verlag, Bern, 2004.

K. Beck, M. Trottmann, U. Kaeser, B. Keller, S. von Rotz, and P. Zweifel. *Nachhaltige Gestaltung des Risikoausgleichs in der Schweizer Krankenversicherung - (Sustainable Design of Swiss Risk Adjustment).* Ott Verlag, Basel, 2006.

K. Becker. *Flexibilisierungsmöglichkeiten in der Krankenversicherung - (Possibilities of more Flexibility in Health Insurance).* Dr. Kovac Verlag, Hamburg, 2006.

K. Becker, A. Brändle, and P. Zweifel. *Was wollen die Versicherten? Evidenz aus Deutschland und den Niederlanden - (What do the Insured Want? Evidence from Germany and the Netherlands).* Bertelsmann Stiftung, Gütersloh, 2007.

Bundesamt für Gesundheit. *Statistik der obligatorischen Krankenpflegeversicherung 2007.* Bern, 2007.

R. P. Ellis and W. P. Van de Ven. Risk adjustment in competitive health plan markets. In A. Culyer and J. Newhouse, editors, *Handbook of Health Economics*, pages 755–845. North-Holland, Amsterdam, 2000.

Gemeinsame Einrichtung KVG. *Geschäftsbericht (Business Report).* Solothurn, 2005a. URL `www.kvg.org/info/gbericht/default.htm`.

Gemeinsame Einrichtung KVG. *Geschäftsbericht (Business Report).* Solothurn, 2005b.

J. C. Hull. *Options, Futures and Other Derivatives.* Pearson Prentice Hall, New Jersey, 6. edition edition, 2006.

L. M. Lamers. Risk adjusted capitation based on the diagnostic cost group model: An empirical evaluation with health survey information. *Health Services Research*, 33(6):1727–44, 1999.

L. M. Lamers and R. C. J. A. Van Vliet. The pharmacy-based cost group model: Validating and adjusting the classification of medications for chronic conditions to the dutch situation. *Health Policy*, 68:113–128, 2003a.

L. M. Lamers and R. C. J. A. Van Vliet. Health-based risk adjustment: improving the pharmacy-based cost group model to reduce gaming possibilities. *European Journal of Health Economics*, 4:107–114, 2003b.

H. Lehmann and P. Zweifel. Innovation and risk selection in deregulated social health insurance. *Journal of Health Economics*, 23(5):997 – 1012, 2004.

J. Shen and R. P. Ellis. How profitable is risk-selection? a comparison of four risk adjustment models. *Health Economics*, 11:165–174, 2002a.

J. Shen and R. P. Ellis. Cost-minimizing risk adjustment. *Journal of Health Economics*, 21(3):515–530, 2002b.

Spycher. Reform des Risikoausgleichs in der Krankenversicherung. In Bundesamt für Sozialversicherung, editor, *Beiträge zur sozialen Sicherheit*, page 54. Berne, 2000.

L. Steinmann, H. Telser, and P. Zweifel. Aging and future healthcare expenditure: A consistent approach. *Forum for Health Economics and Policy*, 10(2):Article 1, 2007.

H. Telser, S. Vaterlaus, P. Zweifel, and P. Eugster. *Was leistet unser Gesundheitswesen? - (What Does Our Health System Achieve?).* Rüegger Verlag, Zürich, 2004.

E. Van Barneveld, L. Lamers, R. van Vliet, and W. van de Ven. Risk sharing as a supplement to imperfect capitation: A tradeoff between selection and efficiency. *Journal of Health Economics*, 20(2):147 – 168, 2001.

W. Van de Ven, K. Beck, F. Buchner, D. Chernikovsky, L. Gardiol, A. Holly, L. Lamers, E. Schokkaert, A. Shmueli, S. Spycher, C. Can de Voorde, R. C. J. A. van Vliet, J. Wasem, and I. Zmora. Risk adjustment and risk selection on the sickness fund insurance market in five european countries. *Health Policy*, 65:75–98, 2003.

W. Van de Ven, R. V. Vliet, and L. M. Lamers. Health-adjusted premium subsidies in the Netherlands. *Health Affairs*, 23(3):45–55, 2004.

W. P. M. M. Van de Ven and F. Schut. Risk equalization in an individual health insurance market: the only escape from the tradeoff between affordability, efficiency and selection - the Netherlands as a case study. *Working Paper*, 2007.

P. Zweifel. The theory of social health insurance. *Foundations and Trends in Microeconomics*, 3(3):183 – 273, 2007.

P. Zweifel and M. Breuer. The case for risk-based premiums in public health insurance. *Health Economics, Policy and Law*, 1(2):171–188, 2006.

P. Zweifel and R. Eisen. *Versicherungsökonomik (Insurance Economics)*. Springer Verlag, 2. Auflage, Heidelberg, 2003.

P. Zweifel, H. Telser, and S. Vaterlaus. Consumer resistance aganist regulation: the case of health care. *Journal of Regulatory Economics*, 29(3):319–332, 2006.

Working Papers of the Socioeconomic Institute at the University of Zurich

The Working Papers of the Socioeconomic Institute can be downloaded from http://www.soi.uzh.ch/research/wp_en.html

0916	Fine Tuning of Health Insurance Regulation: Unhealthy Consequences for an Individual Insurer, Johannes Schoder, Michèle Sennhauser, Peter Zweifel, August 2009, 18 p.
0915	Capping Risk Adjustment?, Patrick Eugster, Michèle Sennhauser, Peter Zweifel, September 2009, 27 p.
0914	A Pharmaceutical Innovation: Is it Worth the Money? Whose Money?, Michèle Sennhauser, Peter Zweifel, September 2009, 22 p.
0913	Copula-based bivariate binary response models, Rainer Winkelmann, August 2009, 26 p.
0912	Simulating WTP Values from Random-Coefficient Models, Maurus Rischatsch, July 2009, 6 p.
0911	Physician dispensing and the choice between generic and brand-name drugs – Do margins affect choice?, Maurus Rischatsch, Maria Trottmann, July 2009, 15 p.
0910	GPs' preferences: What price fee-for-service?, Peter Zweifel, Maurus Rischatsch, Angelika Brändle, July 2009, 21 p.
0909	Social Mobility and Preferences for Income Redistribution: Evidence from a Discrete Choice Experiment, Ilja Neustadt, Peter Zweifel, July 2009, 31 p.
0908	Robust estimation of zero-inflated count models, Kevin E. Staub, Rainer Winkelmann June 2009, 22 p.
0907	Competitive Screening in Insurance Markets with Endogenous Wealth Heterogeneity, Nick Netzer, Florian Scheuer, April 2009, 28 p.
0906	New Flight Regimes and Exposure to Aircraft Noise: Identifying Housing Price Effects Using a Ratio-of-Ratios Approach, Stefan Boes, Stephan Nüesch, April 2009, 40 p.
0905	Patents versus Subsidies – A Laboratory Experiment, Donja Darai, Jens Großer, Nadja Trhal, March 2009, 59 p.
0904	Simple tests for exogeneity of a binary explanatory variable in count data regression models, Kevin E. Staub, February 2009, 30 p.
0903	Spurious correlation in estimation of the health production function: A note, Sule Akkoyunlu, Frank R. Lichtenberg, Boriss Siliverstovs, Peter Zweifel, February 2009, 13 p.
0902	Making Sense of Non-Binding Retail-Price Recommendations, Stefan Bühler, Dennis L. Gärtner, February 2009, 30 p.
0901	Flat-of-the-Curve Medicine – A New Perspective on the Production of Health, Johnnes Schoder, Peter Zweifel, January 2009, 35 p.
0816	Relative status and satisfaction, Stefan Boes, Kevin E. Staub, Rainer Winkelmann, December 2008, 11 p.
0815	Delay and Deservingness after Winning the Lottery, Andrew J. Oswald, Rainer Winkelmann, December 2008, 29 p.
0814	Competitive Markets without Commitment, Nick Netzer, Florian Scheuer, November 2008, 65 p.
0813	Scope of Electricity Efficiency Improvement in Switzerland until 2035, Boris Krey, October 2008, 25 p.
0812	Efficient Electricity Portfolios for the United States and Switzerland: An Investor View, Boris Krey, Peter Zweifel, October 2008, 26 p.
0811	A welfare analysis of "junk" information and spam filters; Josef Falkinger, October 2008, 33 p.

0810 Why does the amount of income redistribution differ between United States and Europe? The Janus face of Switzerland; Sule Akkoyunlu, Ilja Neustadt, Peter Zweifel, September 2008, 32 p.

0809 Promoting Renewable Electricity Generation in Imperfect Markets: Price vs. Quantity Policies; Reinhard Madlener, Weiyu Gao, Ilja Neustadt, Peter Zweifel, July 2008, 34p.

0808 Is there a U-shaped Relation between Competition and Investment? Dario Sacco, July 2008, 26p.

0807 Competition and Innovation: An Experimental Investigation, May 2008, 20 p.

0806 All-Pay Auctions with Negative Prize Externalities: Theory and Experimental Evidence, May 2008, 31 p.

0805 Between Agora and Shopping Mall, Josef Falkinger, May 2008, 31 p.

0804 Provision of Public Goods in a Federalist Country: Tiebout Competition, Fiscal Equalization, and Incentives for Efficiency in Switzerland, Philippe Widmer, Peter Zweifel, April 2008, 22 p.

0803 Stochastic Expected Utility and Prospect Theory in a Horse Race: A Finite Mixture Approach, Adrian Bruhin, March 2008, 25 p.

0802 The effect of trade openness on optimal government size under endogenous firm entry, Sandra Hanslin, March 2008, 31 p.

0801 Managed Care Konzepte und Lösungsansätze – Ein internationaler Vergleich aus schweizerischer Sicht, Johannes Schoder, Peter Zweifel, February 2008, 23 p.

0719 Why Bayes Rules: A Note on Bayesian vs. Classical Inference in Regime Switching Models, Dennis Gärtner, December 2007, 8 p.

0718 Monoplistic Screening under Learning by Doing, Dennis Gärtner, December 2007, 29 p.

0717 An analysis of the Swiss vote on the use of genetically modified crops, Felix Schläpfer, November 2007, 23 p.

0716 The relation between competition and innovation – Why is it such a mess? Armin Schmutzler, November 2007, 26 p.

0715 Contingent Valuation: A New Perspective, Felix Schläpfer, November 2007, 32 p.

0714 Competition and Innovation: An Experimental Investigation, Dario Sacco, October 2007, 36p.

0713 Hedonic Adaptation to Living Standards and the Hidden Cost of Parental Income, Stefan Boes, Kevin Staub, Rainer Winkelmann, October 2007, 18p.

0712 Competitive Politics, Simplified Heuristics, and Preferences for Public Goods, Felix Schläpfer, Marcel Schmitt, Anna Roschewitz, September 2007, 40p.

0711 Self-Reinforcing Market Dominance,
Daniel Halbheer, Ernst Fehr, Lorenz Goette, Armin Schmutzler, August 2007, 34p.

0710 The Role of Landscape Amenities in Regional Development: A Survey of Migration, Regional Economic and Hedonic Pricing Studies,
Fabian Waltert, Felix Schläpfer, August 2007, 34p.

0709 Nonparametric Analysis of Treatment Effects in Ordered Response Models,
Stefan Boes, July 2007, 42p.

0708 Rationality on the Rise: Why Relative Risk Aversion Increases with Stake Size,
Helga Fehr-Duda, Adrian Bruhin, Thomas F. Epper, Renate Schubert, July 2007, 30p.

0707 I'm not fat, just too short for my weight – Family Child Care and Obesity in Germany, Philippe Mahler, May 2007, 27p.

0706 Does Globalization Create Superstars?,
Hans Gersbach, Armin Schmutzler, April 2007, 23p.