Schmollers Jahrbuch 120 (2000), 567 – 586
Duncker & Humblot, Berlin

The premium risk problem in health insurance*

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Abstract

Individuals face premium risk if their future health status is uncertain. This paper examines premium insurance, guaranteed renewable contracts and community rating as ways of dealing with premium risk. Particular emphasis is laid on the possibility to switch health insurers at no cost. Which of the three approaches works best depends on the possibilities to write contracts contingent on health status, the effectiveness of measures against cream-skimming under community rating and society's preference for redistribution in favor of high risks.

Zusammenfassung

Das Prämienrisiko in der Krankenversicherung entsteht dadurch, dass der zukünftige Gesundheitszustand und damit die zukünftige Versicherungsprämie unsicher ist. Diese Arbeit untersucht mit der Prämienversicherung, Krankenversicherungsverträgen mit garantierter Vertragsverlängerung sowie einem Diskriminierungsverbot drei Arten, das Prämienrisiko auf Krankenversicherungsmärkten zu versichern. Besondere Aufmerksamkeit gilt der Möglichkeit, die Krankenversicherung kostenfrei zu wechseln. Welche der drei Arten am besten geeignet ist, das Prämienrisiko zu versichern, hängt davon ab, inwieweit der Gesundheitszustand in Verträgen spezifizierbar ist, wie effektiv Maßnahmen gegen Risikoselektion sind und ob Umverteilung zu hohen Risiken erwünscht ist.

JEL-Classification: D8, G22, I11.

1. Introduction

Kenneth Arrow (1963) was the first economist who discussed the premium risk problem in health insurance. He pointed out the advantage of equalized premiums when the health status of individuals is uncertain:

* I thank Max Albert, Friedrich Breyer, Alastair Fischer, Andreas Haufler, Martin Kolmar and three anonymous referees for helpful comments and suggestions.

> "If a plan guarantees to everybody a premium that corresponds to total experience but not to experience as it might be segregated by smaller subgroups, everybody is, in effect, insured against a change in his basic state of health which would lead to a reclassification." (p. 964)

Such a plan would require ex post cross-subsidies between individuals. Arrow doubts that this can be sustained because "insurance plans could arise which charged lower premiums to preferred risks and draw them off, leaving the plan which does not discriminate among risks with only an adverse selection of them." In this case, individuals must expect that changes in their health status lead to adaptation of their premiums. They are subject to premium risk.

The conjecture that premium risk can be a major problem is supported by evidence from the United States, the only OECD country where a majority of the population is covered by private health insurance.[1] In the individual and small group market, long-term health insurance is not available at a guaranteed price.[2] Consumers are exposed to premium risk after their short-term contracts end or when their long-run contracts are being renewed.

In the theoretical literature, two responses to this phenomenon can be found which do not rely on government intervention. On the one hand, Cochrane (1995) takes the position that separate insurance against changes in premiums is possible. On the other hand, Pauly, Kunreuther and Hirth (1995) show how guaranteed renewability of health insurance contracts can be established with the help of prepayments. These two approaches are discussed first before I turn to regulation in the form of community rating as a means of dealing with premium risk.

Cochrane analyzes the premium risk problem in a complete markets model. He argues that individuals can insure premium risk by signing two kinds of insurance contracts. Besides taking out normal health insurance, they can buy *premium insurance*: Whenever their health status and hence the premium changes in an unexpected way, a settlement will take place. E.g. if an individual becomes a higher risk type than average, she will receive an indemnity, or, as labeled by Cochrane, a severance payment, to compensate for her higher health insurance premiums. In principle, individuals who turn out to be a lower risk type than average, could be obliged to make a payment. This may give individuals the incentive to save too little in order to be unable to make such a payment. Cochrane therefore suggests supplementing the insurance against changes in premiums with mandatory medical savings.

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1 See Chollet and Lewis (1997), pp. 104-105.

2 See Diamond (1992), pp. 1238-1239.

The system outlined by Cochrane has two advantages. First, premium risk is covered. Second, individuals can switch at no cost between health insurers. The main criticism of Cochrane's approach is his strong assumption about the possibilities of writing contracts contingent on health status. If this assumption is not fulfilled, premium insurance is not possible. Individuals might not be able to claim their adequate payment when they could not prove that their state of health had deteriorated. Anticipating possible opportunistic behavior by the insurer, a rational individual would not sign a premium insurance contract.

The advantage of the approach by Pauly, Kunreuther and Hirth (1995) is that contracts written contingent on the health status are not required. They show that premium risk can be covered by *guaranteed renewable contracts*. These health insurance contracts provide a premium guarantee against a prepayment. The premium schedule makes it rational for all types to remain in the contract because the prepayment allows premiums in future periods to be so low that even the lowest risk types cannot get a cheaper new contract. Cross-subsidies between types are possible and there is no premium risk. Since the insured can be certain that they can prolong their contracts at predetermined prices, this concept is labeled guaranteed renewability. In contrast to Cochrane's medical savings accounts, guaranteed renewable contracts exist. In Germany, individuals can always prolong their contract at a premium which is the same for all members who signed the contract. Private health insurance companies save a fraction of premiums for health expenditure in old age. These savings are not contingent on health status. Furthermore, they are not transferable to other insurers. Therefore, there is a strong disincentive to switch to another insurer.

The disadvantage of guaranteed renewable contracts is that they *lock-in* individuals with a health insurer. First, this situation might be exploited by the insurer. For instance, the insurance company might be ungenerous by denying payment in case of a loss when it is not certain that the particular case falls under the terms of contract or by honoring claims slowly. It is also possible that the insurer might supply as little quality of service as possible. This effect is especially important in cases where health insurance follows the managed care approach. As quality of health care is impossible or very costly to verify in front of a court, an individual may not be able to enforce adequate quality. Second, lock-in may be a disadvantage even without opportunistic behavior by the insurer. The individual carries the risk that her health insurer might turn out to be badly managed or not up-to-date with the latest developments in health care. Third, Koopmans (1964) and Kreps (1979) have pointed out that individuals who face uncertainty about their future tastes may have a preference for flexibility. In health insurance, future tastes may differ with respect to the health care procedures offered by different health insurers. Guaranteed renewable contracts restrict the flexibility of individuals because these can be locked in with a health insurer which is not their ex post preferred one.

A regulatory approach to the premium risk problem is *community rating* which prohibits insurers from differentiating premiums according to health status. In its purest form it requires a uniform premium for all insured. This form of regulation is usually seen as a means to achieve equity goals. Drèze (1994), however, has pointed out that universal access to health insurance on terms independent of health status can also be desirable on efficiency grounds when there is no insurance against changes in premiums.

Universal access can be guaranteed by public provision of health care like in the National Health Service in the UK. Community rating, however, has the advantage of allowing competition between health insurers. Premium risk would be eliminated in a private health insurance market without the need to write contracts contingent on types and without the lock-in problem caused by guaranteed renewability. But community rating also has disadvantages. As Pauly (1984) has argued, insurers have an incentive to *cream-skim* low risk individuals when premiums are not allowed to reflect differences in expected health costs. Therefore, resources may be wasted and the health plans may be distorted in order to attract low risk individuals. Thus, under community rating, choice between health insurers may be of a different quality than in a health insurance market with risk-based premiums.

Finally, it should be pointed out that community rating necessarily introduces *ex ante redistribution* between high and low risk individuals. In most industrial countries, however, this redistribution is regarded as fair because, to a large extent, the health status of individuals is seen to be beyond their responsibility. Risk-based premiums would unjustly put a higher burden on people with a poor health status while under community rating individuals with a good health status subsidize those with a bad health status.

To sum up, there are three principal ways of dealing with premium risk. In an ideal world, a market for insurance against changes in the risk type could be expected to solve the problem. This is the premium insurance approach by Cochrane. When contracts cannot be written contingent on health status, individuals could sign guaranteed renewable contracts and commit to an insurer by means of prepayments. This would allow the insurer to give a premium guarantee for the future. Finally, community rating may be a regulatory approach to solve the premium risk problem.

The three approaches differ in three important respects:

- Premium insurance requires contracts written contingent on health status as opposed to guaranteed renewable contracts and community rating.

- The contracts differ in the freedom of choice individuals have with respect to future health insurance contracts. Guaranteed renewable contracts restrict this choice while premium insurance and community rating allow switching between health insurers free of charge.
- Community rating is the only system which requires ex ante redistribution between risk types. Under guaranteed renewability and premium insurance, an individual initially pays a premium according to her risk type.

Freedom of choice plays a central role in the context of premium risk. First, freedom of choice can be viewed as a disciplining device for health insurers. An insurance company which supplies bad service is punished by the loss of consumers. Second, freedom of choice can serve as self-insurance against the risk of being locked in with a badly managed health insurer. Third, freedom of choice may be seen as a representation of a preference for flexibility when future tastes are uncertain. In the following, the analysis therefore postulates that individuals derive utility from freedom of choice between insurers.[3]

The paper deals with the question which approach to the premium risk problem is best suited to insure premium risk while preserving freedom of choice between health insurers. It is structured as follows. In Section 2, the three ways to cover premium risks in competitive insurance markets are analyzed in an insurance model. Section 3 interprets the theoretical results and discusses policy implications. Section 4 concludes the paper.

2. The model

2.1 The first-best

Individuals are assumed to live for two periods $t = 1, 2$. They work only in the first period and earn labor income w. In both periods consumers are subject to the risk of needing health care. An amount L is spent in case they become sick. Ex ante all individuals are identical. In period 1 they have the probability π_1 of becoming sick. The sickness probability in period 2, $\tilde{\pi}_2$, is not yet known in period 1 but the distribution function $\Phi(\pi_2)$ and the respective density function $\phi(\pi_2)$ where $\pi_2 \in [\underline{\pi}, \overline{\pi}]$ with $0 < \underline{\pi} < \overline{\pi} \leq 1$ is common knowledge. $\phi(\pi_2)$ is assumed to be strictly positive for $\pi_2 \in [\underline{\pi}, \overline{\pi}]$. At the beginning of period 2, the loss probability π_2 is revealed to individuals and

[3] A similar approach has been taken by Harsanyi (1977) and Sen (1985). In the context of moral standards, Harsanyi introduced the idea that individuals assign a positive procedural utility to free personal choice. His argument naturally carries over to decisions concerning one's own utility. Sen argues that "the quality of life a person enjoys is not merely a matter of what he or she achieves, but also of what options the person has had the opportunity to choose from" (p. 69-70).

to insurers. Thus in the first period, individuals are uncertain about their future health status or type (I treat the terms synonymous). They are risk averse and have the following expected utility function:

$$E_{t=1}\left[u(c_1, c_2)\right] = E_{t=1}\left[v(c_1) + v(c_2) + \sigma\right] \tag{1}$$

with $v > 0, v' > 0, v'' < 0$. c_t denotes consumption in period t. For simplicity, it is assumed that there is no discounting and that the market interest rate is zero. σ is the consumer's ex ante intrinsic valuation of the possibility to choose free of charge between health insurers in period 2. I assume that this measure of freedom of choice takes the following form

$$\sigma = \begin{cases} 0 & \text{if the consumer cannot choose free of charge} \\ & \text{between insurers at } t = 2 \\ \kappa & \text{if the consumer can choose free of charge} \\ & \text{between insurers at } t = 2 \text{ given that her type is } \pi_2 \end{cases} \tag{2}$$

with $\kappa > 0$.

Insurers are risk neutral. It is therefore Pareto-optimal if insurers assume all risk. If insurers make zero profits, the Pareto-optimal allocation can thus be found by maximizing expected utility (1) subject to

$$c_1 + c_2 = w - (\pi_1 + E_{t=1}[\tilde{\pi}_2])L\ . \tag{3}$$

In the optimum, the consumption level c^* is constant:

$$c_1 = c_2 = c^* = \frac{w - \left(\pi_1 + E_{t=1}[\tilde{\pi}_2]\right)L}{2}\ . \tag{4}$$

In addition, consumers will have free choice between insurers in period 2. Therefore maximized utility is

$$E_{t=1}[u^*] = 2v(c^*) + \int_{\underline{\pi}}^{\overline{\pi}} \kappa\phi(\pi_2)d\pi_2\ .$$

2.2 Premium insurance

Cochrane (1995) shows that an efficient risk allocation and complete freedom of choice can be reached by premium insurance. In his model, individuals live infinitely or have an uncertain lifetime. Insurance markets are assumed to be competitive and insurers are risk-neutral. Here I illustrate his idea in a two-period setting. Individuals sign two types of contracts:

1. Individuals buy a one-period health insurance contract in period 1 and a one-period health insurance contract in period 2. Health insurers observe the risk type of individuals. Due to competition, they charge a premium $\pi_t L$ in period t. Therefore, individuals face an uncertain premium $\tilde{\pi}_2 L$ in period 2. However, they can choose freely between health insurers in both periods.

2. To insure premium risk in period 2, individuals buy a separate premium insurance contract in period 1. This contract pays an indemnity $g(\pi_2)$ in period 2 if the consumer turns out to be type π_2. In period 1, individuals pay a premium z to the premium insurer.

In equilibrium, premium insurers make zero profits which implies that the premium is equal to the expected value of the indemnity, i.e.

$$z = E_{t=1}\left[g(\tilde{\pi}_2)\right]. \tag{5}$$

If the consumer does not carry any premium risk, then the indemnity must take the following form

$$g(\pi_2) = \pi_2 L + k \tag{6}$$

where k is a constant. Solving (5) and (6) for z yields

$$z = E_{t=1}[\tilde{\pi}_2]L + k \,. \tag{7}$$

If $g(\pi_2)$ is negative, consumers have to make a payment to the premium insurance ex post. If consumers may not be held to do so, setting $k = -\underline{\pi}L$ guarantees that $g(\pi_2) \geq 0$ because the indemnity is lowest if the individual turns out to be type $\underline{\pi}$. Therefore premium insurance with nonnegative indemnities can be implemented by a premium $z = (E_{t=1}[\tilde{\pi}_2] - \underline{\pi})L$ and an indemnity $g(\pi_2) = (\pi_2 - \underline{\pi})L$ in period 2.[4] If premium insurance exists, then the first-best can be achieved. Consumers are fully insured at fair premiums and can choose free of charge between insurers each period. This result, however, relies on the condition that premium insurance contracts can be written contingent on the risk type.

[4] Cochrane suggests a different solution to the problem that consumer cannot be forced to pay insurers ex post. Individuals regularly pay out-of-pocket payments into a medical savings account. Negative indemnities are withdrawn from and positive indemnities flow into the account. By an appropriate specification of the out-of-pocket payments, it can be guaranteed that the medical savings account balance is always nonnegative (see Cochrane (1995), pp. 453–454).

2.3 Guaranteed renewability

The basic idea of the guaranteed renewability approach by Pauly, Kunreuther and Hirth (1995) is that health insurers provide a premium guarantee against a prepayment. Individuals are free to switch after their type has been revealed but nobody switches because the premium guarantee is at least as low as the premium for the lowest risk types. Premium risk is insured because everybody pays the same premium. The resulting ex post losses for the insurer are covered by the prepayment. As opposed to premium insurance, guaranteed renewable contracts do not require contracts contingent on the risk type of individuals.

In this section, the analysis of Pauly, Kunreuther and Hirth (1995) is extended. Individuals are allowed to choose the degree of insurance against premium risk provided by guaranteed renewable contracts while Pauly, Kunreuther and Hirth only consider the case of full insurance against premium risk. Specifically, guaranteed renewability is provided by health insurance contracts which specify guaranteed premiums (p_{l1}, p_{l2}) for both periods. Individuals are free to abandon these contracts in the second period. They will do so if their risk-based premium is lower than their premium guarantee. Thus in the second period, the following switching condition holds:

$$\pi_2 L \leq p_{l2} \,. \tag{8}$$

Therefore p_{l2} defines a switching threshold $\hat{\pi}$,

$$\hat{\pi} = \frac{p_{l2}}{L} \tag{9}$$

such that all types with $\pi_2 \leq \hat{\pi}$ will switch while types $\pi_2 > \hat{\pi}$ will remain in the guaranteed renewable contract. The zero profit condition for the contract is

$$p_{l1} + p_{l2}\big(1 - \Phi(\hat{\pi})\big) = \left[\pi_1 + \int_{\hat{\pi}}^{\overline{\pi}} \pi_2 \phi(\pi_2) d\pi_2\right] L \,. \tag{10}$$

Solving for p_{l1} and p_{l2} from (9) and (10) yields

$$p_{l1} = \left[\pi_1 + \underbrace{\int_{\hat{\pi}}^{\overline{\pi}} \pi_2 \phi(\pi_2) d\pi_2 - \hat{\pi}\big(1 - \Phi(\hat{\pi})\big)}_{\geq 0}\right] L \tag{11}$$

and

$$p_{l2} = \hat{\pi} L \,. \tag{12}$$

Equations (11) and (12) show that the guaranteed renewable contracts (p_{l1}, p_{l2}) are a means to provide partial insurance against premium risk. In period 2 consumers will not pay more than $\hat{\pi}L$. To obtain this insurance, consumers give the insurance company a prepayment in the first period. This prepayment serves to compensate for the switching of types with $\pi_2 \leq \hat{\pi}$ which undermines the possibility of cross-subsidies between these types and types with $\pi_2 > \hat{\pi}$ in period 2.

It is convenient to write the premiums p_{lt} as functions of $\hat{\pi}$. As the derivatives show

(13) $$p_{l1}'(\hat{\pi}) = \big(\Phi(\hat{\pi}) - 1\big)L \begin{cases} < 0 & \text{for} \quad \underline{\pi} \leq \hat{\pi} < \overline{\pi} \\ = 0 & \text{for} \quad \hat{\pi} = \overline{\pi} \end{cases}$$

(14) $$p_{l2}'(\hat{\pi}) = L > 0$$

there is a one-to-one correspondence between contracts (p_{l1}, p_{l2}) and $\hat{\pi}$ for $\hat{\pi} \in [\underline{\pi}, \overline{\pi}]$. Buying a contract $(p_{l1}(\hat{\pi}), p_{l2}(\hat{\pi}))$ is equivalent to choosing the switching threshold $\hat{\pi}$ with the corresponding premium guarantee $p_{l2}(\hat{\pi}) = \hat{\pi}L$. Defining expenditure on health insurance $\tilde{I}$ by

(51) $$\tilde{I} = \begin{cases} p_{l1}(\hat{\pi}) + \pi_2 L & \text{if} \quad \pi_2 \leq \hat{\pi} \\ p_{l1}(\hat{\pi}) + p_{l2}(\hat{\pi}) & \text{if} \quad \pi_2 > \hat{\pi} \end{cases},$$

the following lemma shows the importance of $\hat{\pi}$ for the consumer's exposure to premium risk.

Lemma 1: *Raising $\hat{\pi} < \overline{\pi}$ implies a mean-preserving increase in risk in expenditure on health insurance $\tilde{I}$.*

Proof: See Appendix

Rothschild and Stiglitz (1970) have shown that expected utility for risk-averse individuals decreases upon a mean-preserving increase in risk. Thus, Lemma 1 indicates that a risk-averse consumer *ceteris paribus* will always prefer to set $\hat{\pi} = \underline{\pi}$. However, she will pay a price by losing the chance to change insurers without charge in the second period. To explore this trade-off in detail, I turn to the consumer's optimization problem. She maximizes expected utility as given by (1) subject to the following constraints:

(16) $$c_1 = w - s - p_{l1}(\hat{\pi}) \quad \text{and} \quad c_2 = s - \tilde{I} + p_{l1}(\hat{\pi}) \, .$$

With savings s and $\hat{\pi}$ as the choice variables, the maximization problem can be written as

$$\begin{aligned}\max_{s,\hat{\pi}} E_{t=1}\left[u(s,\hat{\pi})\right] = & \, v\big(w - s - p_{l1}(\hat{\pi})\big) \\ & + \int_0^{I_{\max}} v\big(s - \tilde{I} + p_{l1}(\hat{\pi})\big)dF(I,\hat{\pi}) \\ & + \int_{\underline{\pi}}^{\hat{\pi}} \kappa\phi(\pi_2)d\pi_2 \end{aligned} \tag{17}$$

where $I_{\max} = (\pi_1 + \overline{\pi})L$ and $\hat{\pi} \in [\underline{\pi}, \overline{\pi}]$ $F(I,\hat{\pi})$ is the distribution function of $\tilde{I}$ given any $\hat{\pi}$. As types in $[0,\hat{\pi}]$ will be able to switch at no cost in period 2, the last term is the ex ante valuation of the possibility to choose free of charge between health insurers. The first-order conditions are

$$E_{t=1}\left[u_s(s,\hat{\pi})\right] = -v'(c_1) + \int_0^{I_{\max}} v'(c_2)dF(I,\hat{\pi}) = 0 \tag{18}$$

and at least one of the following conditions

$$E_{t=1}\left[u_{\hat{\pi}}(s,\hat{\pi})\right] \leq 0 \quad \text{and} \quad E_{t=1}\left[u_{\hat{\pi}}(s,\hat{\pi})(\hat{\pi} - \underline{\pi})\right] = 0 \tag{19}$$

$$E_{t=1}\left[u_{\hat{\pi}}(s,\hat{\pi})\right] \geq 0 \quad \text{and} \quad E_{t=1}\left[u_{\hat{\pi}}(s,\hat{\pi})(\overline{\pi} - \hat{\pi})\right] = 0 \tag{20}$$

where

$$\begin{aligned} E_{t=1}\left[u_{\hat{\pi}}(s,\hat{\pi})\right] = & \left.\begin{aligned} & - v'(c_1)p_{l1}{}'(\hat{\pi}) \\ & + \int_0^{I_{\max}} v'(c_2)p_{l1}{}'(\hat{\pi})dF(I,\hat{\pi}) \\ & + \int_0^{I_{\max}} v(c_2)dF_{\hat{\pi}}(I,\hat{\pi}) \end{aligned}\right\} < 0 \\ & + \kappa\phi(\hat{\pi}) \qquad\qquad\qquad\qquad \geq 0\,. \end{aligned} \tag{21}$$

for $\hat{\pi} < \overline{\pi}$.

In the Appendix, it is shown that the sum of the first three terms in equation (21) must be negative. This follows from Lemma 1 and the risk-aversion of individuals. The last term of $E_{t=1}[u_{\hat{\pi}}(s,\hat{\pi})]$ is nonnegative because individuals value freedom of choice. Thus, equation (21) shows the trade-off between freedom of choice and insurance against premium risk faced by the consumer. A higher $\hat{\pi}$ leads to more exposure to premium risk but leaves the consumer with a higher chance of being able to choose between insurers.

Conditions (18), (19) and (20) determine the optimal values s^* and $\hat{\pi}^* \in [\underline{\pi}, \overline{\pi}]$. Clearly, the first-best solution is not feasible. The consumer faces premium risk or is restricted in her choice between insurers in the second period. Therefore, guaranteed renewable contracts are inferior to premium insurance if contracts contingent on the risk type can be written. If this not the case and premium insurance insures premium risk only imperfectly, however, then guaranteed renewable contracts – although they restrict freedom of choice – may be a better way to deal with the trade-off between premium risk and freedom of choice.

2.4 Community rating

The first-best is associated with full insurance at a premium of $E_{t=1}[\tilde{\pi}_2]L$ in period 2 and free choice between insurers. It is therefore straightforward to examine government intervention in the form of community rating: insurance companies would only be allowed to charge uniform premiums and would be restricted to offer full coverage contracts. This regulation, however, is not sufficient.

- First, if the condition

$$(1-\underline{\pi})v(c^*) + \underline{\pi}v(c^* - L) > v\big(c^* - E_{t=1}[\tilde{\pi}_2]L\big)$$

  holds, the first-best cannot be sustained as low risk individuals would not insure themselves voluntarily in period 2. Then a premium of $E_{t=1}[\tilde{\pi}_2]L$ would not be compatible with zero expected profits because the average loss probability of the voluntarily insured would be higher than $E_{t=1}[\tilde{\pi}_2]$. This could lead to the breakdown of the health insurance market as rising premiums cause more and more individuals to opt out of health insurance. Thus, insurance must be compulsory to achieve the first-best.

- Second, insurers do not have an incentive to accept individuals whose loss probability is above the premium they are allowed to charge. If it were possible to deny insurance coverage to these individuals, then only the lowest risk types would receive coverage at fair premiums while all other individuals would remain uninsured. Hence, implementation of the first-best requires open enrollment, i.e. insurers must accept any applicant. Each insurer could expect that the average loss probability of a person he insures is $E_{t=1}[\tilde{\pi}_2]$ and competition would lead to a premium of $E_{t=1}[\tilde{\pi}_2]L$.

Therefore, the threefold regulation of community rating of full coverage contracts, compulsory insurance and open enrollment can achieve the first-best in the setting of our model. Individuals have free choice between insurers in period 2 and face no premium risk. Although low risk types might ex post prefer not to be insured and be negatively affected by compulsory insurance, they would agree to compulsory insurance in period 1 when they do not yet know their type.

3. Discussion

3.1 Premium risk and unregulated insurance markets

The analysis in the last section has shown that the ability of unregulated insurance markets to cover premium risk while allowing freedom of choice crucially depends on the possibility to write contracts contingent on individual health status. Premium insurance is superior to guaranteed renewable contracts if contracts are complete. However, premium insurance is also more demanding than guaranteed renewable contracts. It requires that contracts contingent on risk types can be enforced. Although it has been assumed in the analysis that types are observable, it may be difficult to describe types ex ante in a contract. As opposed to other forms of insurance, the state in which a payment needs to be made is not identified by an actual damage. The only indicators available are the health condition and the health insurance premium of an individual.

Clearly, there exist a number of diagnoses which are indisputable and the cost of which can be assessed well. For instance, a patient with kidney failure needs regular dialysis. The expected costs of this treatment can easily be determined. However, there are also many health conditions which can hardly be included in a contract in a satisfactory manner. As Newhouse (1984) notes, not only the presence but also the severity of changes in health would need to be specified. Frequently, presence and severity will be hard to measure. Newhouse mentions depression as an example. An insured might claim intensive psychotherapy while the insurance declares that occasional counseling is sufficient. It will be difficult for a court to resolve such a conflict. Given these difficulties, premium insurance contracts are most likely to be incomplete.

To some extent the market may be able to overcome this incompleteness. Klein and Leffler (1981) have shown that the objective to attract customers in the future can give firms an incentive to honor contracts which are not enforceable by a third party. Therefore, premium insurers could have an interest in establishing a reputation for paying an adequate indemnity even if an insured is not able to enforce this payment. It is, however, doubtful whether reputation is a strong enough mechanism. Other scenarios involving numerous court trials are equally possible.

A stronger defense of the market mechanism has been advanced by Cochrane (1995, pp. 459–460). He argues that it is not necessary to determine the individual health status as it can be inferred from premiums. In the model, for instance, second period premiums can simply be divided by L to obtain π_2. However, this only holds if all insurance contracts are perfect substitutes. A free market for health insurance does not meet this requirement.

Health insurance contracts differ in many respects, e.g. in the access to certain providers and in the therapies they cover. Given a multitude of contracts, it will not be possible to infer health status from premiums. Higher premiums may be due to better service or higher probability of needing these services. Of course, this problem could be solved by requiring individuals to buy a standard health insurance contract. Then, however, freedom of choice is restricted since product variety is one of the main reasons why a market for health insurance is desirable in the first place.

Inferring health status from premiums creates another problem. The consumer and the health insurer then have the incentive to enter into a fraudulent conspiracy. By officially signing a contract with a high premium but actually paying only a low premium (or obtaining additional benefits for the high premium), they could receive a higher indemnity from the premium insurer.[5]

These arguments can neither prove nor refute that a premium insurance market can function. Nevertheless, there is reason to be skeptical about the possibility of perfect premium insurance. In particular, the fact that premium insurance does not exist may be due to the problems of premium insurance. For example, such insurance should exist in the United States where private health insurance covers most of the population.[6]

Guaranteed renewable contracts, however, exist. They are used in the German private health insurance system. There, individuals can always prolong their contract at a premium which is the same for all members who signed the contract. Private health insurers are required by law to calculate premiums in such a way that they remain constant over an individual's lifetime.[7] Since health expenditure generally rises with age, the premium exceeds expected costs in the early years. Thus, individuals make prepayments which are saved by insurers to finance the premiums in old age which are below age-specific expected average costs. Individuals have the right to leave an insurer without any requirements but they hardly ever do so because the savings accumulated by their insurer are not transferable to other insurers. After a few years of membership, the loss in savings usually exceeds any possible gains from switching to another insurer.

Private health insurance in Germany is therefore based on guaranteed renewable contracts with a premium guarantee which makes it rational for

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5 See Pauly *et al.* (1991) for a similar argument in the context of government tax credits according to health status.

6 However, existing regulation may obstruct the development of premium insurance. In addition, there are only few countries with private health insurance and even where it exists, its market share is small (see Chollet and Lewis (1997), pp. 104–109).

7 For a detailed description of the way premiums must be calculated, see Panek-Akrae (1986) and Scheepker (1997).

all types to remain in the contract. Premium risk is insured but the price of not making savings transferable is the lock-in situation. There have been complaints that insurers exploit this situation.[8] In particular, insurers have raised their premiums which they justified by increases in medical expenditure. Although this is allowed by law, the lock-in situation may be responsible for this. Knowing that individuals will not switch, insurers have no incentive to control costs.[9]

Overall, the extent to which a private market is able to cover premium risk while allowing freedom of choice is speculative because it is not known how well premium insurance can work in practice. Nevertheless, the following scenario seems probable. Premium insurance is able to cover a limited number of easily identifiable health conditions without eliminating premium risk altogether. The government may facilitate the working of the premium insurance market by making up a standardized list of diagnoses.[10] Depending on the extent to which such premium insurance contracts can cover premium risk, individuals buy these contracts or prefer guaranteed renewable contracts.

3.2 Government regulation

In the model, the threefold regulation of community rating of full coverage contracts, compulsory insurance and open enrollment is able to achieve the first-best. Individuals would have free choice between insurers while facing no premium risk. This result needs to be emphasized as such a regulatory scheme is usually proposed to achieve equity goals. In a dynamic model, it can achieve efficiency gains if premium insurance does not work perfectly.

Community rating, however, suffers from problems not captured by the model. Pauly (1984) points out that regulated premiums may lead to the problem of *cream-skimming*. When insurers are not allowed to discriminate premiums according to health status, then insurers would like to attract low risk individuals and deter those whose expected health costs are above premium income. Open enrollment may not be sufficient to rule out this behavior. There remains a strong incentive for health insurers to offer plans that

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8 See Meyer, H.D. (1999).

9 The lock-in problem is the motivation for a proposal by U. Meyer (1992). He recommends to make the savings accumulated by health insurer transferable if an individual would like to switch to another insurer. The transfer should be contingent on the risk type. High risk types should obtain a higher transfer than low risk types to compensate for the higher premium they have to pay for a new health insurance contract. Therefore, Meyer's proposal would effectively establish premium insurance and faces the problems mentioned above.

10 This idea has been advanced by Fischer and Serra (1996) as part of a proposal for the reform of private health insurance in Chile.

are of high utility for low risks but of low utility for high risks. These plans are attractive for low risks as they lower the cross-subsidies between low and high risks.

Van den Ven and van Vliet (1992) give an overview over possible forms of cream-skimming. To avoid high risks and to attract low risks, health insurers may, among other things,

- contract with specialists interesting for low risks but avoid specialists which are important for high risks,
- design a benefit package attractive for low risks but not for high risks,
- reward insurance agents for risk-selection,
- offer package deals attractive to low risks,
- try to influence the compositions of their insured by selective advertising, and
- introduce deductibles which are favorable to low risks.

Two measures, however, may be taken against cream-skimming.

1. *Risk equalization schemes*

   Risk equalization schemes adjust premium revenue for differences in the risk structure of patients between insurers. Their aim is to remove the cause of risk-selection by closing the gap between expected costs and premium revenue. Risk equalization schemes require information on the characteristics of individuals which predict their expected cost.[11]

2. *Regulation of the benefit package*

   A second approach to avoid risk-selection is to regulate the benefit package. Obvious forms of cream-skimming like introducing deductibles or contracting only with certain specialists can simply be prohibited. Furthermore it might be necessary to exclude benefits that are only interesting for low risks as these benefits might be used by healthy individuals to recapture their cross-subsidies.

Glazer and McGuire (2000) show that a perfect risk equalization scheme is possible even if the risk type cannot be observed. Only an imperfect signal for the risk types is needed. Glazer and McGuire demonstrate that in this case the optimal risk equalization scheme overcompensates for cost differences between observable groups. In this respect, community rating is less demanding than premium insurance, which requires that risk types are identifiable. Nevertheless, it is doubtful whether risk equalization schemes can completely eliminate incentives for cream-skimming. Therefore, the

[11] See van de Ven and Ellis (2000) for a survey.

regulation of the benefit packages is likely to be useful as well. However, this will most probably lead to health insurance contracts which differ from those in a market with unregulated premiums. This points to a restriction of freedom of choice which does not appear in the model. Even though consumers can freely choose between health insurers under community rating, their choice is likely to be limited compared to an unregulated market. Nevertheless, positive effects of the possibility to change insurers at no cost may prevail if freedom of choice is interpreted as a disciplining device for health insurers or as self-insurance against being locked-in with a badly managed health insurance company.

The assumption in the model that individuals are ex ante identical also needs to be emphasized. It drives the result that community rating can achieve the first-best result. In a strict sense, this assumption completely holds only if individuals' health status is judged behind a thick veil of ignorance, i.e. before birth and even before the parents and their decisions are known. With birth and increasing age individuals' health status becomes more and more differentiated. Nevertheless, in their twenties when individuals sign their first health insurance contracts, a large part of the population is likely to be very similar with respect to their health status. Seen from the perspective of this age, community rating can be welfare-improving for most individuals as most changes in health status are still to come. Individuals whose health status is not as good as average, e.g. those suffering from diabetes, however, will profit disproportionally from community rating. Many, however, would regard this as fair. In this case community rating serves efficiency aims – premium insurance against *future* changes in health status – and equity aims – subsidies to individuals with *realized* changes in health status – at the same time.

Comparing community rating with the premium insurance and guaranteed renewable contracts therefore yields no definite answers. On the one hand, the incentive to cream-skim may alter the health insurance market in such a way that the variety of health plans is reduced as compared with an unregulated market. In addition, the redistributive effects are likely to be larger than the ex post cross-subsidies implied by pure ex ante efficiency. On the other hand, community rating eliminates premium risk and allows switching between health insurers without facing a premium adjustment. This gives insurers strong incentives to supply high quality and avoids lock-in with a badly managed insurer.

The case for community rating is strengthened when society deems it to be equitable that the healthy subsidize the sick. However, it should be stressed that community rating is not the only way of achieving this equity objective. Pauly, Danzon, Feldstein and Hoff (1991) have argued in favor of a scheme in which the government acts as a premium insurer and taxes and subsidizes individuals according to their health status with risk-adjusted tax credits or vouchers. This scheme can only be implemented by the government because it is ex ante redistributive. However, it faces the same problems as the Cochrane model. To make sure that everybody obtains adequate health insurance coverage, Pauly *et al.* therefore propose to supplement this plan with subsidized high-risk pools.

Guaranteed renewable contracts can also establish ex ante redistribution. These contracts then correspond to a national health service or to a system in which individuals are assigned to insurers as proposed by Diamond (1992). Tax contributions take the role of prepayments. In such systems, individuals can still have the option of opting out and of buying private health insurance. However, this choice will in most cases be unattractive since services are available free of charge if they are obtained from the national health service or the assigned insurer while tax contributions have to be paid anyway. As opposed to community rating and government-provided premium insurance, this option is therefore hardly compatible with competition between health insurers for individuals.[12]

4. Conclusion

This paper has examined three approaches of dealing with premium risk. Particular emphasis has been laid on the possibility of switching health insurers at no cost. First, it was shown that premium insurance can cover premium risk and allow free choice between health insurers. However, this solution is based on the possibility to write contracts contingent on health status. Second, it was demonstrated that guaranteed renewable contracts can cover premium risk without this requirement, but only at the cost of restricting free choice. Finally, regulation in the form of community rating can in principle provide free choice of health insurers without the need to write contracts contingent on health status. Which of the three approaches works best in practice depends on factors which cannot be determined in a theoretical analysis. Of crucial importance are the possibilities to write contracts contingent on health status, the effectiveness of measures against cream-skimming under community rating and society's preference for redistribution in favor of high risks. If contracts are very incomplete and cream-skimming can be prevented effectively, then community rating may not only serve equity aims but can be expected to achieve efficiency gains as well.

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[12] In the system proposed by Diamond (1992), however, competition is possible at the risk pool level.

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Appendix

Proof of Lemma 1

First, it is shown that expected health expenditure does not depend on $\hat{\pi}$:

$$\begin{aligned}
E_{t=1}[\tilde{I}] &= \int_{\underline{\pi}}^{\hat{\pi}} \big(p_{l1}(\hat{\pi}) + \pi_2 L\big)\phi(\pi_2)d\pi_2 + \big(p_{l1}(\hat{\pi}) + p_{l2}(\hat{\pi})\big)\big(1-\Phi(\hat{\pi})\big) \\
&= p_{l1}(\hat{\pi}) + \int_{\underline{\pi}}^{\hat{\pi}} p_{l2}(\hat{\pi})\phi(\pi_2)d\pi_2 + \hat{\pi}L\big(1-\Phi(\hat{\pi})\big) \\
&\overset{(11),(12)}{=} \left[\pi_1 + \int_{\underline{\pi}}^{\overline{\pi}} \pi_2\phi(\pi_2)d\pi_2\right]L \\
&= \big[\pi_1 + E_{t=1}[\tilde{\pi}_2]\big]L
\end{aligned}$$

Therefore all distributions of $\tilde{I}$ have the same mean irrespective of $\hat{\pi}$.

Turning to $F(I,\hat{\pi})$, the distribution of $\tilde{I}$ given any $\hat{\pi}$, the lowest possible level of I is $p_{l1}(\hat{\pi}) + \underline{\pi}L$ while the highest possible level is $p_{l1}(\hat{\pi}) + p_{l2}(\hat{\pi})$. For $\pi_2 \in (\underline{\pi}, \hat{\pi})$, health expenditure is $p_{l1}(\hat{\pi}) + \pi_2 L$ which implies that the probability of $I \leq p_{l1}(\hat{\pi}) + \pi_2 L$ is $\Phi(\pi_2)$. Therefore the distribution of $\tilde{I}$ is as follows:

$$F(I,\hat{\pi}) = \begin{cases} 0 & \text{if} \quad I \leq p_{l1}(\hat{\pi}) + \underline{\pi}L \\ \Phi(\pi_2) & \text{if} \quad I = p_{l1}(\hat{\pi}) + \pi_2 L \\ 1 & \text{if} \quad I \geq p_{l1}(\hat{\pi}) + p_{l2}(\hat{\pi}) \end{cases} \tag{22}$$

As all distributions have the same mean, an increase in $\hat{\pi}$ is a mean-preserving increase in risk if $\int_0^I F_{\hat{\pi}}(I,\hat{\pi})dI \geq 0$ for all I with strict inequality for at least one I. To see that this indeed the case first note that $F_{\hat{\pi}}(I,\hat{\pi}) = 0$ for $I < p_{l1}(\hat{\pi}) + \underline{\pi}L$. Second, we have $p_{l1}{}'(\hat{\pi}) < 0$ for $\hat{\pi} \in [\underline{\pi}, \overline{\pi})$ by equation (13).

Therefore, given any I such that $p_{l1}(\hat{\pi}) + \underline{\pi}L \leq I < p_{l1}(\hat{\pi}) + \pi_2 L$, for $I = p_{l1}(\hat{\pi}) + \pi_2 L$ to hold, π_2 must rise if $\hat{\pi}$ increases. Then $\Phi(\pi_2)$ will increase and it follows that $F_{\hat{\pi}}(I, \hat{\pi}) > 0$. Third, at $I = p_{l1}(\hat{\pi}) + p_{l2}(\hat{\pi})$, $F(I, \hat{\pi})$ falls from 1 to $\Phi(\hat{\pi})$ when $\hat{\pi}$ is raised because $p_{l1}{}'(\hat{\pi}) + p_{l2}{}'(\hat{\pi}) = (1 - \hat{\pi})\Phi(\hat{\pi})L > 0$. Finally, for $I > p_{l1}(\hat{\pi}) + p_{l2}(\hat{\pi})$, we obtain $F_{\hat{\pi}}(I, \hat{\pi}) = 0$. Hence

$$F_{\hat{\pi}}(I, \hat{\pi}) = \begin{cases} = 0 & \text{for} \quad I < p_{l1}(\hat{\pi}) + \underline{\pi}L \\ > 0 & \text{for} \quad p_{l1}(\hat{\pi}) + \underline{\pi}L \leq I < p_{l1}(\hat{\pi}) + \pi_2 L \\ < 0 & \text{for} \quad I = p_{l1}(\hat{\pi}) + p_{l2}(\hat{\pi}) \\ = 0 & \text{for} \quad I > p_{l1}(\hat{\pi}) + p_{l2}(\hat{\pi}) \end{cases}$$

For $\int_0^I F_{\hat{\pi}}(I, \hat{\pi})dI$ we therefore obtain

$$\int_0^I F_{\hat{\pi}}(I, \hat{\pi})dI = \begin{cases} = 0 & \text{for} \quad I < p_{l1}(\hat{\pi}) + \underline{\pi}L \\ > 0 & \text{for} \quad p_{l1}(\hat{\pi}) + \underline{\pi}L \leq I < p_{l1}(\hat{\pi}) + \pi_2 L \\ \geq 0 & \text{for} \quad I = p_{l1}(\hat{\pi}) + p_{l2}(\hat{\pi}) \\ = 0 & \text{for} \quad I > p_{l1}(\hat{\pi}) + p_{l2}(\hat{\pi}) \end{cases}$$

where the „$\geq$" follows from the fact that the mean is unchanged. Hence, the increase of $\hat{\pi}$ implies a mean-preserving increase in risk.

Proof of

$$-v'(c_1)p_{l1}{}'(\hat{\pi}) + \int_0^{I_{\max}} v'(c_2)p_{l1}{}'(\hat{\pi})dF(I, \hat{\pi}) + \int_0^{I_{\max}} v(c_2)dF_{\hat{\pi}}(I, \hat{\pi}) \qquad < 0 .$$

From (18) it follows that

$$v'(c_1) = \int_0^{I_{\max}} v'(c_2)dF(I, \hat{\pi}) .$$

Thus

$$-v'(c_1)p_{l1}{}'(\hat{\pi}) + \int_0^{I_{\max}} v'(c_2)p_{l1}{}'(\hat{\pi})dF(I, \hat{\pi}) + \int_0^{I_{\max}} v(c_2)dF_{\hat{\pi}}(I, \hat{\pi}) = \int_0^{I_{\max}} v(c_2)dF_{\hat{\pi}}(I, \hat{\pi})$$

By *Lemma 1* an increase in $\hat{\pi}$ leads to a mean increase in risk for $\hat{\pi} < \overline{\pi}$. v is strictly concave by assumption. Applying the result of Rothschild and Stiglitz (1970) we have

$$\int_0^{I_{\max}} v(c_2)dF_{\hat{\pi}}(I, \hat{\pi}) < 0 .$$