Public Choice (2005) **124:** 283–308
DOI: 10.1007/s11127-005-2049-z

Health insurance in a democracy: Why is it public and why are premiums income related?

MATHIAS KIFMANN
Universität Konstanz, Fach D 136, 78457 Konstanz, Germany;
E-mail: Mathias.Kifmann@uni-konstanz.de

Accepted 8 April 2004

Abstract. Many democracies have public health insurance systems which combine redistribution from the rich to the poor and from the healthy to the sick. This paper shows that such systems can be in the interest of the poor and the rich from a constitutional perspective. Necessary conditions are that insurance markets are incomplete and that income inequality is neither too low nor too high. Then even the rich can prefer a public health insurance system financed by income-dependent contributions compared to a system financed by a flat fee or a private health insurance system.

Introduction

Many democracies have extensive public health insurance systems which are tax financed or in which contributions are linked to income.[1] These systems tie together income redistribution and redistribution from the healthy to the sick. In principle, however, these two dimensions of redistribution could be separated. Income redistribution could be delegated to the tax system while health insurance could be financed by a flat fee. It is therefore of interest to enquire why in practice we find that the two dimensions of redistribution are combined.

An approach to this question is to argue that such systems are desirable from a welfare perspective. Here it has been shown that a combination of income redistribution and redistribution from the healthy to the sick can be superior to a pure optimal income tax. This is the case if low-income individuals face higher health risks than high-income individuals (see, e.g., Blomqvist & Horn, 1984; Rochet, 1991; Cremer & Pestieau, 1996; Petretto, 1999). An explanation based on the welfare properties of a combined system, however, does not take into account the decision-making process in a democracy. In particular, it seems unlikely that this process leads to the maximization of a social welfare function.

This paper takes a different approach to explain the prevalence of health insurance systems which combine the two dimensions of redistribution. Specifically, the analysis wants to demonstrate that such health insurance systems can be supported by the overwhelming majority of the population and are therefore likely to exist and to be politically stable in a democracy. This is shown in a constitutional analysis in which individuals can choose the way health insurance is financed at the constitutional stage.[2] It is assumed that a public health insurance system is only adopted if all individuals unanimously agree on such a system.

A key assumption of this paper is that insurance markets are incomplete and that it is therefore not possible to buy insurance against *premium risk*, i.e. changes in risk-based health insurance premiums due to a deterioration of the health status. Furthermore, the paper follows the contributions by Usher (1977), Breyer (1995), Epple Romano (1996) and Gouveia (1997) and assumes that the amount of public health insurance is determined by majority rule if a public health insurance system is agreed upon at the constitutional stage. Under these assumptions, it is shown that everyone may prefer a scheme which is financed by contributions linked to income compared to no public scheme or a public scheme financed by a flat fee. The poor are better off because they obtain a private good at a subsidized price. More surprisingly, the rich can also be in favor of such a system. For them, combining income redistribution and redistribution between the healthy and sick has the decisive advantage that a majority can be in favor of a positive provision of public health insurance. Although the rich pay an income transfer to the poor, they can benefit from a public health insurance system because it insures premium risk.

The attractive political economy feature of a public health insurance system financed by contributions linked to income has first been pointed out by Pauly (1994). However, the experience in the United States, the only major democracy which does not have a public health insurance system for all its citizens, makes him skeptical that such a system is always desirable from a constitutional perspective. This paper sheds some light on this issue by analyzing in detail the conditions determining the choice at the constitutional stage.

The analysis in this paper is also related to a contribution by Breyer and Haufler (2000) who argue that public health insurance systems should not be financed by contributions linked to income. According to their analysis, shifting income redistribution to the tax system can create efficiency gains. This paper shows that such a proposal might not find sufficient political support if the two dimensions of redistribution are to be separated completely.

The paper is structured as follows. In the next section, the model is presented. The section that follows analyzes and compares the three different policy regimes: (i) no government provision, (ii) public provision financed by a flat fee and (iii) public provision financed by income-proportional taxes. In the fourth section, the consequences of moral hazard with respect to the health status are examined and a policy regime with limited income redistribution is analyzed. The results and implications of the model are discussed in the fifth section. Conclusions are presented in the last section.

The Model

The analysis is based on a simplified version of the model by Gouveia (1997) in which individuals can differ in their market income y and their probability of falling ill π. Whereas Gouveia assumes that y and π are drawn from a continuous distribution, it is assumed in the following that y and π can each take two values. On the one hand, individuals are either rich or poor. Their exogenous income is y_i, $i = r, p$ with $y_r > y_p$. The proportion of rich individuals is λ, so mean income is $\bar{y} \equiv \lambda y_r + (1 - \lambda) y_p$. In the following, it is assumed that $\lambda < 0.5$, which implies that median income is below mean income $\bar{y}$. On the other hand, individuals can become ill with probability π_j, $j = l, h$. In this case, their utility can be increased by health insurance z which may be provided by the government (g) or purchased in the market (m). Total health insurance is given by $z = g + m$. Utility when healthy depends only on consumption c and is $u(c)$ with $u' > 0$, $u'' < 0$, $\lim_{c\to 0} u'(c) = \infty$. When ill, utility also depends on the amount of health insurance received and is $u(c) + v(z)$ with $v < 0$, $v' > 0$, $v'' < 0$, $\lim_{h\to 0} v'(h) = \infty$. Expected utility is therefore given by

$$EU_{ij} = u(c_{ij}) + \pi_j v(z_{ij}).$$

At the constitutional stage, individuals are assumed to know their income but not their risk type π_j. At a later stage, each individual becomes an h-type with probability μ_i and an l-type with probability $1-\mu_i$, where $0 < \pi_l < \pi_h \leq 1$.[3] It is assumed that $\mu_r \leq \mu_p$, i.e. income and the probability of becoming a high risk may be negatively correlated. With respect to the average probability of becoming a high risk, $\bar{\mu} \equiv \lambda\mu_r + (1 - \lambda)\mu_p$, we suppose that $\bar{\mu} < 0.5$ which implies that the median type has a lower illness probability than the average probability $\bar{\pi} \equiv \bar{\mu}\pi_h + (1 - \bar{\mu})\pi_l$. Once the type is revealed, health insurance is available at an actuarially fair price of π_j per unit of health insurance provided in the state of illness.

Since the price of health insurance depends on the risk type, premiums are uncertain and individuals face premium risk. In the first-best, the premium for health insurance does not depend on the risk type. Denoting the premium for health insurance and the amount of health insurance depending on the risk and income type by P_{ij} and z_{ij} respectively, the first-best is obtained by solving the following problem

$$\max_{P_{ij}, z_{ij}} EU_i = (1 - \mu_i)[u(y_i - P_{il}) + \pi_l v(z_{il})] + \mu_i [u(y_i - P_{ih}) + \pi_h v(z_{ih})]$$
$$\text{s.t.} \quad (1 - \mu_i)P_{il} + \mu_i P_{ih} = (1 - \mu_i)\pi_l z_{il} + \mu_i \pi_h z_{ih}. \tag{1}$$

Assuming an interior solution, all marginal utilities u' and v' are equal at the optimum. Hence, the amount of health insurance and the payment P does not depend on the risk type. We obtain

$$P^* = \bar{\pi} z_i^*$$

where z_i^* is defined by

$$u'(y_i - \bar{\pi} z_i^*) = v'(z_i^*).$$

Ideally, individuals would like to obtain a contract which reaches a first-best risk allocation. Two such contracts have been discussed in the literature. On the one hand, Cochrane (1995) proposes *premium insurance*. This contract pays out an indemnity if the individual becomes a high risk, which covers the higher health insurance premium. In this model, this indemnity equals $(\pi_h - \pi_l)z_i^*$. Regardless of the risk type, the individual then faces a net health insurance premium of $\pi_l z_i^*$. The corresponding fair premium for premium insurance is $\mu_i(\pi_h - \pi_l)z_i^*$. On the other hand, pauly, Kunreuther and Hirth (1995) have shown that *guaranteed renewable contracts* can insure premium risk. These are long-run health insurance contracts which include a premium guarantee. To avoid that low risk types opt out of the health insurance contract, the guaranteed premiums correspond to the premiums of a new health insurance contract for low risks. This leads to ex post losses, which are covered by a prepayment. Since no individual has an incentive to switch to another insurer after his or her risk type has been revealed, all individuals pay the same premium regardless of their risk type and premium risk is perfectly insured. In the model, guaranteed renewable contracts would promise health insurance z_i^* at a guaranteed premium equal to $\pi_l z_i^*$. The necessary prepayment is $\mu_i(\pi_h - \pi_l)z_i^*$.

Premium insurance requires that the risk type can be specified in a contract whereas guaranteed renewable contracts must specify the optimal amount of health insurance z_i^*. Drafting such contracts may be difficult. This opens the possibility of ex post opportunism on part of the insurer. Under premium insurance, the insurer may claim that the person is a low risk type even though he or she in fact is a high risk type. Under guaranteed renewable contracts, the insurer may provide a lower amount of health insurance than optimal. For this reason, individuals may therefore prefer not to buy such contracts if contracts are incomplete.[4] In the following, we suppose that this is the case and make

Assumption 1—incomplete contracts: Premium risk cannot be insured in the market.

The alternative way to insure premium risk is a public health insurance system which does not discriminate according to the risk-type. In particular,

Table 1. Regimes at the constitutional stage

Regime	Government provision	Finance
NG	n	Risk-based
FF	y	Flat fee
IP	y	Income-proportional

individuals could draft a constitution that specifies a public health insurance system. Ideally, the constitution would establish an income-contingent health insurance level $g_i = z_i^*$ and the system would be financed by contributions $\bar{\pi} z_i^*$ linked to income. Such "income-dependent social insurance" has been proposed by Pauly (1994). However, if contracts are incomplete, then a constitution faces the same problem as private insurance contracts. The amount of health insurance can only be described by words such as "adequate" or "cost-effective" in a constitution which leaves ample room for interpretation. Furthermore, it will hardly be possible to specify how benefits are to differ according to income. Realistically, a constitution will need to guarantee uniform benefits for everyone and can only specify the rules that determine the amount of health insurance provided by the public system. In the following, we make

Assumption 2—majority rule: If a public health insurance system is agreed upon in the constitution, then the amount of public health insurance will be determined by majority rule.

This assumption can be justified by conforming to the general principle according to which most nonconstitutional decisions are taken in a democracy.

At the constitutional stage, the following three regimes are compared:

NG: Health insurance is exclusively provided by private insurers.

FF: Health insurance is provided by the public system and financed by a flat fee which is the same for all individuals.

IP: Health insurance is provided by the public system and financed by contributions which are proportional to income.

In the regimes with a public system, all individuals obtain the same amount of public health insurance and can top up their public health insurance by supplementary health insurance.

The sequence of events is as follows:

1. Individuals make a constitutional choice on the health insurance system. A public health insurance system is only installed if *all* individuals agree

on it. Otherwise, health insurance will only be provided by private insurers (regime NG).
2. The risk-type $j = l, h$ of each individual is revealed.
3. If there is a public health insurance system, the amount of public health insurance is determined by majority rule.
4. Individuals can buy (additional) health insurance at an actuarially fair price with respect to their risk type.

The main question of the analysis is which regime will be chosen at the constitutional stage. In particular, it is of interest to know under what circumstances regime IP, which is found in most democracies, will be preferred by everyone. In the following section, we first evaluate the outcome of each regime at the constitutional stage. Then the three regimes are compared.

Analysis of Regimes

No public health insurance system

Under regime NG, individuals will buy health insurance at an actuarially fair price after their risk type has been revealed. The problem of an individual of type ij with income y_i, $i = r, p$, is

$$\max_{m_{ij}} EU_{ij} = u(y_i - \pi_j m_{ij}) + \pi_j v(m_{ij}). \tag{2}$$

The first-order condition yields

$$u'(y_i - \pi_j m_{ij}) = v'(m_{ij}) \tag{3}$$

which defines m^*_{ij}. Clearly, $m^*_{rj} > m^*_{pj}$, i.e. rich individuals will buy more health insurance than poor individuals. Furthermore, $m^*_{il} > m^*_{ih}$ because health insurance is more costly for high-risk types.

Ex ante, i.e. before the risk-type is revealed, the expected utility of income type $i = r, p$ is

$$\begin{aligned} EU_i^{\text{NG}} = \mu_i[u(y_i - \pi_h m^*_{ih}) + \pi_h v(m^*_{ih})] \\ +(1 - \mu_i)[u(y_i - \pi_l m^*_{il}) + \pi_l v(m^*_{il})]. \end{aligned} \tag{4}$$

A first-best risk allocation is not reached because

$$u'(y_i - \pi_h m_{ih}) = v'(m_{ih}) > u'(y_i - \pi_l m_{il}) = v'(m_{il}),$$

i.e. marginal utility depends on the risk type.

Public provision financed by a flat fee

Under regime FF, the public health insurance system is financed by a flat fee F. The budget constraint of the public health system is

$$F = \bar{\pi} g^{\mathrm{FF}}. \tag{5}$$

After their risk type has been revealed, individuals consider whether to vote for public health insurance. Their alternative is to buy private health insurance. In the public health insurance system, the price per unit health insurance is $\bar{\pi}$. In the private health insurance system, the corresponding price is π_j. Thus all h-types will vote in favor of a positive amount of public health insurance while all l-types will vote for $g^{\mathrm{FF}} = 0$. The latter are in a majority due to the assumption $\bar{\mu} < 0.5$. Therefore, the result of the vote is $g^{\mathrm{FF}} = 0$ and no public health insurance is provided. Expected utility is identical to regime NG and given by Equation (4).

Public provision financed by income-proportional contributions

Under regime IP, the public health insurance system is financed by a proportional income tax, where t denotes the tax rate. The budget constraint of the public health insurance system is

$$t\bar{y} = \bar{\pi} g.$$

An individual with income y_i pays

$$t y_i = \frac{y_i \bar{\pi}}{\bar{y}} g$$

for g units of public health insurance. Thus, the price of one unit of public health insurance is equal to

$$\frac{t y_i}{g} = \frac{y_i \bar{\pi}}{\bar{y}} \tag{6}$$

and depends on the income of the individual.

An individual will vote for a positive amount of public health insurance if and only if the price of health insurance in the market is at least as high as the price of public health insurance, i.e. if and only if

$$\pi_j \geq \frac{y_i \bar{\pi}}{\bar{y}}.$$

Thus, ph-individuals will always vote for a positive g while rl-individuals always prefer $g = 0$. If

$$\pi_l \geq \frac{y_p \bar{\pi}}{\bar{y}}, \tag{7}$$

then also pl-individuals and therefore a majority is in favor of a positive amount of public health insurance.

Two subcases can be distinguished, depending on whether rh-types are also in favor of public health insurance:

1. If

$$\pi_h < \frac{y_r \bar{\pi}}{\bar{y}},$$

rh-types vote against public health insurance. A pl-type is the median voter. All r-individuals are ex post worse off compared to the regimes NG and FF, which implies that r-types would never be in favor of a public health insurance system at the constitutional stage.

2. If condition

$$\pi_h \geq \frac{y_r \bar{\pi}}{\bar{y}} \tag{8}$$

is met, then rh-types vote in favor of public health insurance. Again, a pl-type is the median voter because neither r- nor h-types form a majority. Now r-types benefit ex post from regime IP compared to the other regimes. Therefore, there is a possibility that r-types support regime IP at the constitutional stage.

In all cases, the median voter is a pl-type. If condition (7) is fulfilled, then the amount of public health insurance g_{pl}^{IP} is therefore given by the solution to the following problem[5]

$$\begin{aligned}\max_{g_{pl}^{\mathrm{IP}}} EU_{pl} &= u((1-t)y_p) + \pi_l v\big(g_{pl}^{\mathrm{IP}}\big) \\ &= u\left(y_p - \frac{y_p \bar{\pi}}{\bar{y}} g_{pl}^{\mathrm{IP}}\right) + \pi_l v\big(g_{pl}^{\mathrm{IP}}\big).\end{aligned}$$

$g^{\mathrm{IP}} = g_{pl}^{\mathrm{IP}}$ is characterized by the first-order condition

$$u'\left(y_p - \frac{y_p \bar{\pi}}{\bar{y}} g_{pl}^{\mathrm{IP}}\right) = \frac{\pi_l \bar{y}}{\bar{\pi} y_p} v'\big(g_{pl}^{\mathrm{IP}}\big). \tag{9}$$

At the constitutional state, expected utility under regime IP if condition (7) is met therefore equals

$$EU_i^{\mathrm{IP}} = \mu_i\left[u\left(y_i - \frac{y_i\bar{\pi}}{\bar{y}}g^{\mathrm{IP}} - \pi_h\hat{m}_{ih}^*\right) + \pi_h v\big(g^{\mathrm{IP}} + \hat{m}_{ih}^*\big)\right] + (1-\mu_i)\left[u\left(y_i - \frac{y_i\bar{\pi}}{\bar{y}}g^{\mathrm{IP}} - \pi_l\hat{m}_{il}^*\right) + \pi_l v\big(g^{\mathrm{IP}} + \hat{m}_{il}^*\big)\right] \quad (10)$$

where $\hat{m}_{ij}^*$ is defined by the solution to the problem

$$\max_{\hat{m}_{ij}} EU_{ij} = u\left(y_i - \frac{y_i\bar{\pi}}{\bar{y}}g^{\mathrm{IP}} - \pi_j\hat{m}_{ij}\right) + \pi_j v\left(g^{\mathrm{IP}} + \hat{m}_{ij}\right) \quad \text{s.t.} \quad \hat{m}_{ij} \geq 0.$$[6]

If condition (7) is not fulfilled, then $g^{\mathrm{IP}} = 0$ and expected utility is identical to regimes NG and FF (see Equation (4)).

Comparing the regimes

In this section, we compare the three regimes at the constitutional stage. In particular, we want to determine under which circumstances regime IP will be preferred by everyone. A necessary condition for this result is that a majority is in favor of positive government provision under regime IP (condition (7)). This condition is also sufficient for all p-individuals to be strictly in favor of regime IP at the constitutional stage. They are ex post always better off under regime IP compared to the other regimes:

- pl-types prefer regime IP if condition (7) is fulfilled because they face a lower price for health insurance than under regimes NG and FF and because the amount of health insurance is determined by their preferences.
- ph-types must be better off under regime IP, too. Since they receive public health insurance at a price below their expected cost, their expected utility is increasing in g up to g_{ph}^{IP} which is defined by

$$u'\left(y_p - \frac{y_p\bar{\pi}}{\bar{y}}g_{ph}^{\mathrm{IP}}\right) = \frac{\pi_h\bar{y}}{\bar{\pi}y_p}v'\big(g_{ph}^{\mathrm{IP}}\big).$$

  $\pi_h > \pi_l$ implies $g_{ph}^{\mathrm{IP}} > g_{pl}^{\mathrm{IP}}$. Thus ph-types, although they ideally would like to have more public health insurance at price $\frac{y_i\bar{\pi}}{\bar{y}}$, are better off compared to regimes NG and FF.

The interesting question remaining is whether r-types can also be in favor of regime IP at the constitutional stage. Even though r-types as a whole cross-subsidize p-types, they can in principle be better off from an ex ante perspective because the public health system allows a transfer from state l into state h. Since ex post rl-types are always worse off in regime IP compared to regimes NG and FF, a necessary condition is that rh-types are better off in regime IP. Thus, condition (8) is necessary for r-types to be better off ex ante. With condition (7), we therefore have two necessary conditions for regime IP to be Pareto-superior to the two other regimes.

Condition (7) is equivalent to

$$\frac{y_r}{y_p} \geq 1 + \frac{\bar{\mu}}{\lambda}\left(\frac{\pi_h}{\pi_l} - 1\right) \equiv f\left(\frac{\pi_h}{\pi_l}, \bar{\mu}, \lambda\right). \tag{11}$$

Note that $\pi_h > \pi_l$ implies $f(.) > 1$, i.e. pl-types will only support public health insurance if there is a minimum income inequality as measured by the income ratio y_r/y_p. Furthermore, the function $f(.)$ has the following properties

$$\frac{\partial f}{\partial \frac{\pi_h}{\pi_l}} = \frac{\bar{\mu}}{\lambda} > 0,$$

$$\frac{\partial f}{\partial \bar{\mu}} = \frac{\frac{\pi_h}{\pi_l} - 1}{\lambda} > 0,$$

$$\frac{\partial f}{\partial \lambda} = -\frac{\bar{\mu}\left(\frac{\pi_h}{\pi_l} - 1\right)}{\lambda^2} < 0.$$

Therefore pl-types are more likely to vote in favor of public health insurance:

- the larger y_r/y_p and λ because the transfers from the rich to pl-types are increasing in these parameters, and
- the smaller π_h/π_l and $\bar{\mu}$ because the transfers from pl-types to the high risks are increasing in these parameters.

Condition (8) is equivalent to

$$\frac{y_r}{y_p} \leq \frac{(1-\lambda)\frac{\pi_h}{\pi_l}}{1 - \bar{\mu} + (\bar{\mu} - \lambda)\frac{\pi_h}{\pi_l}} \equiv k\left(\frac{\pi_h}{\pi_l}, \bar{\mu}, \lambda\right). \tag{12}$$

Therefore, income inequality must not be too high if rh-types are to profit ex post from the public health insurance system. The function $k(.)$ has the following properties

$$\frac{\partial k}{\partial \frac{\pi_h}{\pi_l}} = \frac{(1-\lambda)(1-\bar{\mu})}{\left(1-\bar{\mu}+(\bar{\mu}-\lambda)\frac{\pi_h}{\pi_l}\right)^2} > 0,$$

$$\frac{\partial k}{\partial \bar{\mu}} = -\frac{(1-\lambda)\frac{\pi_h}{\pi_l}\left(\frac{\pi_h}{\pi_l}-1\right)}{\left(1-\bar{\mu}+(\bar{\mu}-\lambda)\frac{\pi_h}{\pi_l}\right)^2} < 0,$$

$$\frac{\partial k}{\partial \lambda} = \frac{(1-\bar{\mu})\frac{\pi_h}{\pi_l}\left(\frac{\pi_h}{\pi_l}-1\right)}{\left(1-\bar{\mu}+(\bar{\mu}-\lambda)\frac{\pi_h}{\pi_l}\right)^2} > 0.$$

Condition (12) is therefore more likely to be met:

- the smaller y_r/y_p because the transfer from rh-types to the poor is increasing in this ratio,
- the larger π_h/π_l because the transfers to rh-types are increasing in this ratio,
- the smaller $\bar{\mu}$ because then there are more low risk individuals who subsidize rh-types, and
- the larger λ because then rh-types need to subsidize fewer poor individuals.

Thus, conditions (11) and (12) characterize a lower and an upper bound for income inequality. Only if y_r/y_p is in between these bounds, regime IP can be Pareto-superior to regimes NG and FF. If income inequality is too low, then the public health insurance system will not be supported by pl-types; if it is too high, then rh-types will not benefit ex post from regime IP.

The properties of the functions $f(.)$ and $k(.)$ show that for a given probability ratio π_h/π_l, conditions (11) and (12) are more likely to be fulfilled simultaneously, the larger λ and the smaller $\bar{\mu}$. Setting the functions equal to each other and solving for $\bar{\mu}$ yields the solutions

$$\bar{\mu}_1 = \lambda \quad \text{and} \quad \bar{\mu}_2 = \frac{1}{1-\pi_h/\pi_l} < 0.$$

Since $\bar{\mu}$ is positive by assumption, this implies that conditions (11) and (12) can be simultaneously met if and only if $\bar{\mu} \leq \lambda$. An intuition for this result can be obtained if one notes that $\bar{\mu} = \lambda$ implies

$$\frac{\pi_l}{\bar{\pi}} = \frac{y_p}{\bar{y}} \quad \text{and} \quad \frac{\pi_h}{\bar{\pi}} = \frac{y_r}{\bar{y}}.$$

Thus for $\bar{\mu} = \lambda$, conditions (7) and (8) are both met with equality, since for pl- and rh-types the advantages and disadvantages of regime IP are exactly offsetting. The transfers from pl-types to high risks are exactly compensated by the transfers they receive from the rich. Likewise, the health insurance transfers obtained by rh-types are equivalent to their income transfers to the poor. This implies that an increase in $\bar{\mu}$ starting from $\bar{\mu} = \lambda$ which increases $\bar{\pi}$ and therefore the price of public health insurance for pl- and rh-types (see Equation (6)) induces both types to be against public health insurance. Decreasing $\bar{\mu}$, however, lowers the price of public health insurance. Thus, for $\bar{\mu} < \lambda$, pl- and rh-types are both in favor of public health insurance.

Figures 1 and 2 illustrate the two possible cases. The graphs display the values of the functions $f(.)$ and $k(.)$ depending on the probability ratio π_h/π_l. In Figure 1, $\bar{\mu} = 0.2 < \lambda = 0.25$. The shaded area between the the graphs of functions $k(.)$ and $f(.)$ shows the values of y_r/y_p, which are compatible with conditions (7) and (8). In Figure 2, $\bar{\mu} = 0.25 > \lambda = 0.2$. The graph of function $f(.)$ is above the graph of function $k(.)$. Therefore, conditions (7) and (8) are not compatible.

In order to find out whether a Pareto-improvement is indeed possible, the ex ante utilities of r-types need to be compared. Under regimes NG and FF, expected utility is given by Equation (4). We therefore obtain for rich individuals

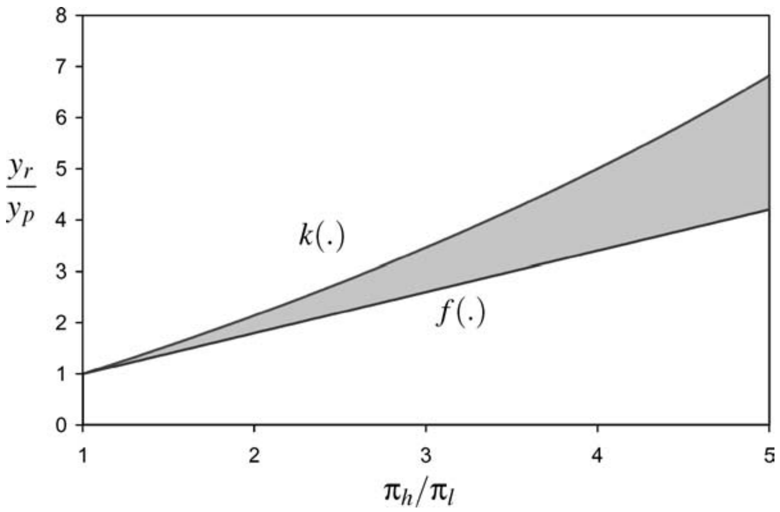

Figure 1. Necessary conditions for a Pareto-improvement, $\bar{\mu} < \lambda$.

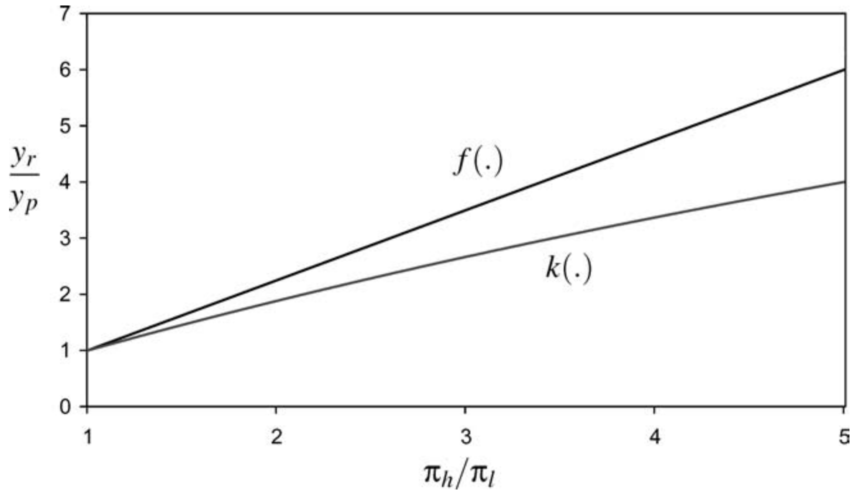

Figure 2. Necessary conditions for a Pareto-improvement, $\bar{\mu} > \lambda$.

$$EU_r^{\mathrm{NG/FF}} = \mu_r[u(y_r - \pi_h m_{rh}^*) + \pi_h v(m_{rh}^*)] + (1-\mu_r)[u(y_r - \pi_l m_{rl}^*) + \pi_l v(m_{rl}^*)] \quad (13)$$

where m_{rj}^* is defined by $u'(y_r - \pi_j m_{rj}^*) = v'(m_{rj}^*)$.

Expected utility of r-types under regime IP if the level of public health insurance g^{IP} is determined by Equation (9) equals[7]

$$EU_r^{\mathrm{IP}} = \mu_r\left[u\left(y_r - \frac{y_r\bar{\pi}}{\bar{y}}g^{\mathrm{IP}} - \pi_h\hat{m}_{rh}^*\right) + \pi_h v\left(g^{\mathrm{IP}} + \hat{m}_{rh}^*\right)\right] + (1-\mu_r)\left[u\left(y_r - \frac{y_r\bar{\pi}}{\bar{y}}g^{\mathrm{IP}} - \pi_l\hat{m}_{rl}^*\right) + \pi_l v\left(g^{\mathrm{IP}} + \hat{m}_{rl}^*\right)\right] \quad (14)$$

where $\hat{m}_{rj}^*$ is given by the solution to the problem

$$\max_{\hat{m}_{rj}} EU_{rj} = u\left(y_r - \frac{y_r\bar{\pi}}{\bar{y}}g^{\mathrm{IP}} - \pi_j\hat{m}_{rj}\right) + \pi_j v\left(g^{\mathrm{IP}} + \hat{m}_{rj}\right) \quad \text{s.t.} \quad \hat{m}_{rj} \geq 0.$$

If the difference in expected utility

$$\Delta EU_r^{\mathrm{IP}} = EU_r^{\mathrm{IP}} - EU_r^{\mathrm{NG/FF}} \quad (15)$$

is positive and condition (7) is met, then the rich and therefore all individuals are in favor of regime IP at the constitutional stage. Whether these condition are fulfilled depends on the parameters of the model, i.e. $\pi_l, \pi_h, y_p, y_r, \bar{\mu}$

and λ, and the utility function of the individuals. In particular, risk aversion and the shape of the health insurance utility function $v(z)$ play a central role. Consider, for example, the limiting case of risk neutrality in which $u(c) = c$ and $v(z) = z$. Then, we obtain

$$EU_r^{\text{NG/FF}} = y_r \quad \text{and} \quad EU_r^{\text{IP}} = y_r + \left(1 - \frac{y_r}{\bar{y}}\right)\bar{\pi} g$$

and therefore

$$\Delta EU_r^{\text{IP}} = \left(1 - \frac{y_r}{\bar{y}}\right)\bar{\pi} g < 0 \quad \text{if} \quad g > 0.$$

Clearly, if rich individuals do not care about a transfer from the state l to state h, then regime IP is only costly for them because it induces an income transfer to poor individuals. However, if both utility functions are strictly concave, then it is possible that ΔEU_r^{IP} is positive and that the parameters fulfill conditions (7) and (8). This can be shown by a numerical example based on the utility functions

$$u(c) = -e^{-0.15c} \quad \text{and} \quad v(z) = -e^{-0.15z}.$$

Furthermore, it is assumed that $\mu_r = \mu_p = \bar{\mu} = 0.2$, $\lambda = 0.25$, $y_p = 60$ and $\pi_l = 0.2$, which implies that the functions $f(.)$ and $k(.)$ are as in Figure 1.

Figure 3 shows the functions $f(.)$, $k(.)$ and $\Delta EU_r^{\text{IP}} = 0$, depending on the probability ratio π_h/π_l. If the income ratio is above the S-shaped function

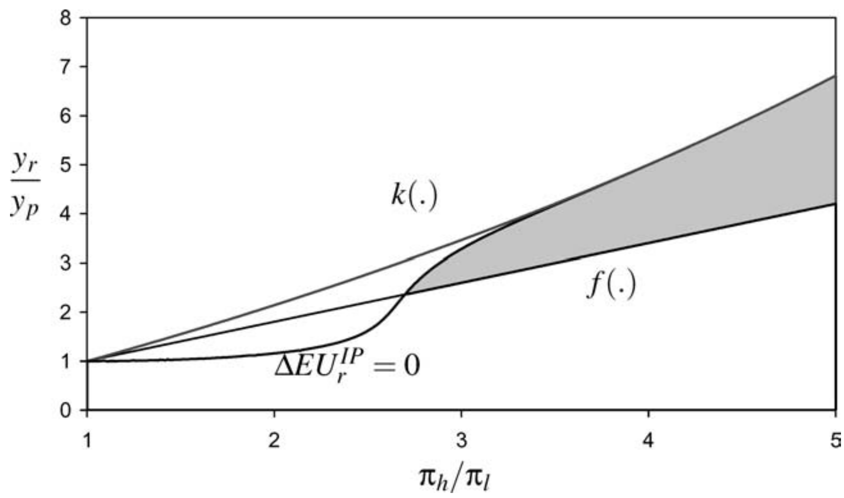

Figure 3. Pareto-improving public health insurance.

$\Delta EU_r^{\text{IP}} = 0$, then expected utility under regimes NG and FF is higher than that under regime IP. If the income ratio is below this function, then regime IP is superior. Since the function $k(.)$ describes a necessary condition for rich individuals to be better off, $\Delta EU_r^{\text{IP}} = 0$ is bounded above by $k(.)$.

The numerical simulation demonstrates that for low values of π_h/π_l, the requirement that pl-types are ex post in favor of public health insurance (function $f(.)$) implies that rich individuals will be worse off from an ex ante perspective. For higher values of π_h/π_l, however, the shaded area shows that there are values of y_r/y_p such that pl-types are ex post and rich individuals ex ante in favor of regime IP. Since the poor always support regime IP if income inequality is above function $f(.)$, the shaded area demonstrates that regime IP can be Pareto-superior to regimes NG and FF at the constitutional stage.

In reality, income and the probability of becoming a high risk are likely to be negatively correlated, which implies $\mu_r < \mu_p$ in this model. The effects of this assumption are shown in Figure 4 which relies on the same parameters as in Figure 3. Only the values of μ_r and μ_p differ. The average probability of becoming a high risk remains at $\bar{\mu} = 0.2$. Line a displays $\Delta EU_r^{\text{IP}} = 0$ for $\mu_r = \mu_p = 0.2$ as Figure 3. Line b shows the corresponding function for $\mu_r = 0.16$ and $\mu_p = 0.21\bar{3}$ and line c for $\mu_r = 0.13$ and $\mu_p = 0.22\bar{3}$. Thus, a negative correlation of income and health leads to a downward shift of the function $\Delta EU_r^{\text{IP}} = 0$ and therefore makes it less likely that rich individuals ex ante support public health insurance. However, Figure 4 also shows that even if income and health are negatively correlated, the rich and poor can be in favor of public health insurance.

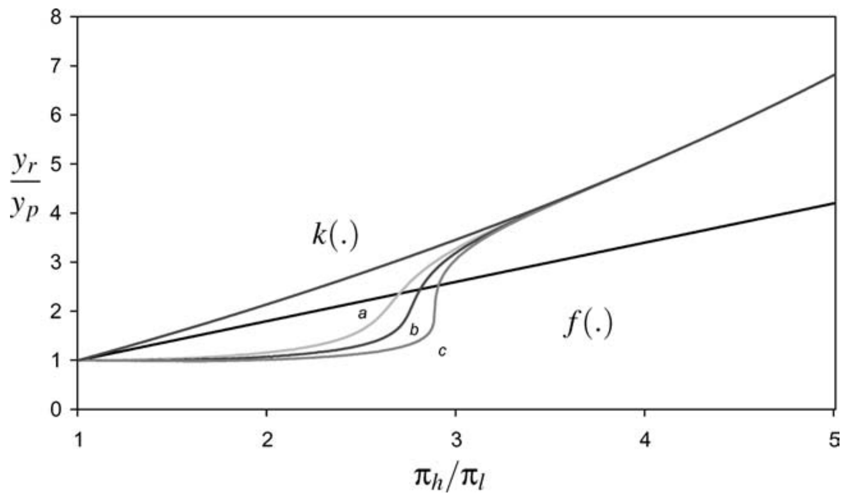

Figure 4. Negative correlation of income and health.

We can therefore summarize the main result of this paper. Even the rich and therefore all individuals can prefer a public health insurance system financed by contributions linked to income compared to a private health insurance system or a public health insurance system financed by a flat fee if

- the proportion of rich individuals is larger than the proportion of high-risk types in the population,
- individuals are sufficiently risk averse,
- risk types are sufficiently different and therefore future premiums sufficiently uncertain, and
- income inequality as measured by the income ratio is high enough to induce poor and healthy individuals to be in favor of public health insurance but low enough to avoid excessive transfers to the poor.

Extensions

Moral hazard

So far we have assumed that the probability μ_i to become an h-type is exogenous. The existence of public health insurance, however, may change this probability if individuals influence μ_i by their behavior. In this case, public health insurance risk can give rise to *ex ante moral hazard* because individuals do not bear the full costs of becoming a high-risk type. The following relationship is likely to hold:

$$\mu_i = \mu_i(g) \quad \text{with} \quad \mu_i'(g) > 0. \tag{16}$$

What are the consequences of ex ante moral hazard for the political support of regime IP? First, the necessary conditions for a Pareto-improvement become stronger if $\mu_i(g)$ and therefore $\bar{\mu}(g) = \lambda\mu_r(g) + (1-\lambda)\mu_p(g)$ increases. On the one hand, the necessary minimum inequality will be higher because the $f(.)$ function shifts upwards (this follows from condition (11) and $\partial f/\partial\bar{\mu} > 0$). On the other hand, the maximum inequality will be lower since the $k(.)$ function shifts downwards (by condition (12) and $\partial k/\partial\bar{\mu} < 0$). This is illustrated in Figure 5 where it is assumed that moral hazard increases $\bar{\mu}$ from 0.2 to 0.22.

If moral hazard is so strong that $\bar{\mu}(g) > \lambda$, the necessary conditions for a Pareto-improvement cannot be met and public health insurance will not be chosen at the constitutional stage even if premiums are income related. If $\bar{\mu}(g) < \lambda$ as in Figure 5, public health insurance can still be Pareto-superior. The median voter is a pl-type. If a positive amount of public health insurance

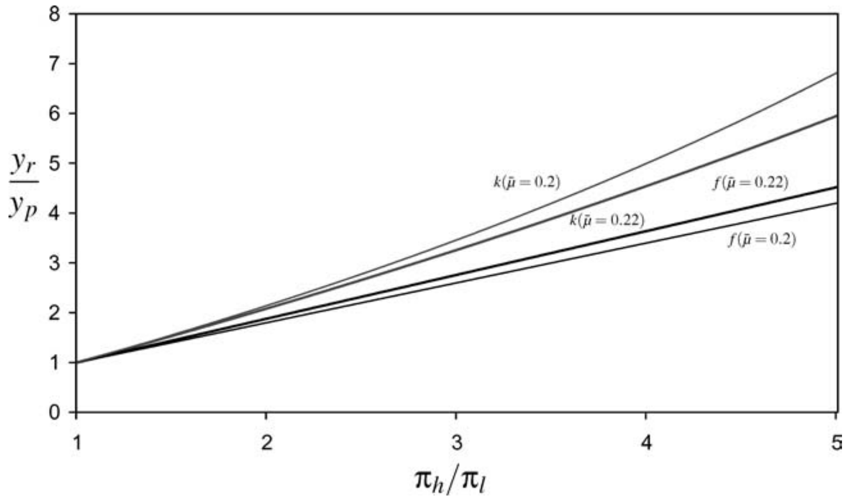

Figure 5. Necessary conditions under moral hazard.

is demanded, it is given by the first-order condition

$$u'\left(y_p - \frac{y_p\bar{\pi}\left(\breve{g}_{pl}^{\mathrm{IP}}\right)}{\bar{y}}\breve{g}_{pl}^{\mathrm{IP}}\right) = \frac{\pi_l\bar{y}}{\bar{\pi}\left(\breve{g}_{pl}^{\mathrm{IP}}\right)y_p}v'\left(\breve{g}_{pl}^{\mathrm{IP}}\right). \tag{17}$$

where $\breve{g}_{pl}^{\mathrm{IP}}$ denotes the amount of public health care with moral hazard. Note that the price for one unit of health care,

$$\frac{ty_p}{g} = \frac{y_p\bar{\pi}(g)}{\bar{y}}, \tag{18}$$

is higher than without moral hazard because $\bar{\pi}(g) = \bar{\mu}(g)\pi_h + (1 - \bar{\mu}(g))\pi_l$ increases with g. Therefore, we have $\breve{g}^{\mathrm{IP}} < g^{\mathrm{IP}}$, i.e. less public health care than without moral hazard.[8]

As above, p-types are better off if the necessary conditions are met. For r-types Equation (14) has to be modified to

$$\begin{aligned} \breve{EU}_r^{\mathrm{IP}} &= \mu_r\left(\breve{g}^{\mathrm{IP}}\right)\left[u\left(y_r - \frac{y_r\bar{\pi}(\breve{g}^{\mathrm{IP}})}{\bar{y}}\breve{g}^{\mathrm{IP}} - \pi_h\breve{m}_{rh}^*\right) + \pi_h v\left(\breve{g}^{\mathrm{IP}} + \breve{m}_{rh}^*\right)\right] \\ &\quad + \left(1 - \mu_r\left(\breve{g}^{\mathrm{IP}}\right)\right)\left[u\left(y_r - \frac{y_r\bar{\pi}(\breve{g}^{\mathrm{IP}})}{\bar{y}}\breve{g}^{\mathrm{IP}} - \pi_l\breve{m}_{rl}^*\right) + \pi_l v\left(\breve{g}^{\mathrm{IP}} + \breve{m}_{rl}^*\right)\right] \end{aligned}$$

where $\breve{m}_{rj}^*$ denotes the value corresponding to m_{rj}^* under moral hazard. Expected utility of the rich tends to be lower than without moral hazard. This

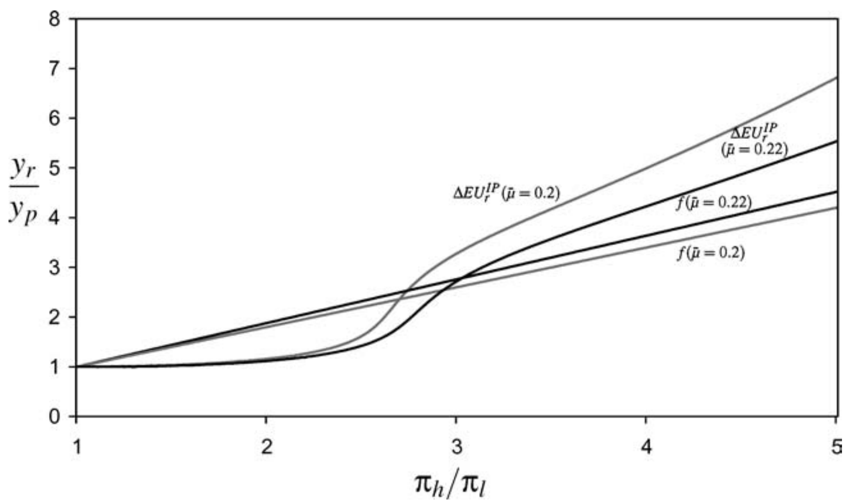

Figure 6. Pareto-improving health insurance under moral hazard.

decreases the difference in expected utility

$$\Delta EU_r^{\mathrm{IP}} = E\check{U}_r^{\mathrm{IP}} - EU_r^{\mathrm{NG/FF}}$$

and therefore shifts the curve $\Delta EU_r^{\mathrm{IP}} = 0$ downward ($EU_r^{\mathrm{NG/FF}}$ remains unchanged because it is based on $g = 0$). This is illustrated in Figure 6, which shows $\Delta EU_r^{\mathrm{IP}}$ for $\bar{\mu} = 0.2$ and $\bar{\mu} = 0.22$ (all other parameters are the same parameters as in Figure 3). Together with the upward shift of $f(.)$ function ex ante moral hazard due to public health insurance therefore makes it less likely that everybody will be in favor of income-financed public health insurance. Nevertheless, this is still possible as long as moral hazard is not too strong.

Limited income redistribution

A system with income-proportional contributions may induce too much redistribution to be attractive for rich individuals. An alternative is a system with limited income redistribution (*LIR*) as in Germany where income is liable to contributions only up to a certain limit. With the income limit $\tilde{y}$ and the tax rate $\tilde{t}$, contributions b are then given by

$$b = \begin{cases} \tilde{t}y & \text{for} \quad y \leq \tilde{y} \\ \tilde{t}\tilde{y} & \text{for} \quad y > \tilde{y} \end{cases} \tag{19}$$

where we assume $\tilde{y} \le y_r$. The budget constraint is

$$\tilde{t}\,\bar{y}^{\,\mathrm{LIR}} = \bar{\pi}\, g \tag{20}$$

where $\bar{y}^{\,\mathrm{LIR}} \equiv (1-\lambda)y_p + \lambda\tilde{y}$. If $\tilde{y} < y_r$, we have $\bar{y}^{\,\mathrm{LIR}} < \bar{y}$. For p-types, the price for one unit of health care,

$$\frac{\tilde{t}\,y_p}{g} = \frac{y_p\bar{\pi}}{\bar{y}^{\,\mathrm{LIR}}}, \tag{21}$$

is therefore higher than under income-proportional contributions if $\tilde{y} < y_r$ (see Equation (6)). As above, ph-types will always vote for a positive amount of public health care. For pl-types the condition is

$$\pi_l \ge \frac{y_p\bar{\pi}}{\bar{y}^{\,\mathrm{LIR}}}, \tag{22}$$

which is stronger than condition (7) because there is less income redistribution. For rl-types, things remain unchanged. They continue to be against public health insurance because the system still entails redistribution from the rich to the poor and from the healthy to the sick. For rh-individuals the price per unit of health care is now

$$\frac{\tilde{t}\,\tilde{y}}{g} = \frac{\tilde{y}\bar{\pi}}{\bar{y}^{\,\mathrm{LIR}}}. \tag{23}$$

Thus, rh-individuals support public health care if

$$\pi_h > \frac{\tilde{y}\bar{\pi}}{\bar{y}^{\,\mathrm{LIR}}}.$$

This condition is weaker than condition (8) if $\tilde{y} < y_r$. Thus, rh-individuals are more likely to be in favor of public health care.

The median voter continues to be a pl-individual. Thus, if condition (22) is met, $g^{\mathrm{LIR}} = g_{pl}^{\mathrm{LIR}}$ is characterized by the first-order condition

$$u'\!\left(y_p - \frac{y_p\bar{\pi}}{\bar{y}^{\,\mathrm{LIR}}}\, g_{pl}^{\mathrm{LIR}}\right) = \frac{\pi_l\,\bar{y}^{\,\mathrm{LIR}}}{\bar{\pi}\, y_p}\, v'\!\left(g_{pl}^{\mathrm{LIR}}\right). \tag{24}$$

Because of the higher price of public health care for p-types, we have $g^{\mathrm{LIR}} < g^{\mathrm{IP}}$ if $\tilde{y} < y_r$, i.e. less public health care than that under regime IP.

The expected utility of rich individuals under regime LIR is given by

$$\tilde{EU}_r^{\text{LIR}} = \mu_r\left[u\left(y_r - \frac{\tilde{y}\bar{\pi}}{\bar{y}^{\text{LIR}}}g^{\text{LIR}} - \pi_h\tilde{m}_{rh}^*\right) + \pi_h v\left(g^{\text{LIR}} + \tilde{m}_{rh}^*\right)\right]$$
$$+ (1-\mu_r)\left[u\left(y_r - \frac{\tilde{y}\bar{\pi}}{\bar{y}^{\text{LIR}}}g^{\text{IP}} - \pi_l\tilde{m}_{rl}^*\right) + \pi_l v\left(g^{\text{LIR}} + \tilde{m}_{rl}^*\right)\right] \quad (25)$$

where $\tilde{m}_{rj}^*$ denotes the value corresponding to m_{rj}^* under regime LIR. The corresponding difference in expected utility is

$$\Delta EU_r^{\text{LIR}} = \tilde{EU}_r^{\text{LIR}} - EU_r^{\text{NG/FF}}. \quad (26)$$

Since regime LIR gives rise to less income redistribution than does regime IP, ΔEU_r^{LIR} is generally higher than under regime IP. Therefore, rich individuals are more likely to support public health insurance at the constitutional stage. As long as income redistribution is sufficient to induce pl-types to vote for a positive amount of public health care, regime LIR can therefore lead to Pareto-improving health insurance even if this is not possible under regime IP.

Figure 7 shows for the numerical example above that regime LIR can considerably expand the possibilities that public health insurance is chosen at the constitutional stage. First note that regime LIR can always reproduce regime IP if we set $\tilde{y} = y_r$. Thus the shaded area A leads to Pareto-improving public health insurance under both regimes. If $\tilde{y} < y_r$, however, regime LIR can lead to Pareto-improving public health insurance when regime IP does

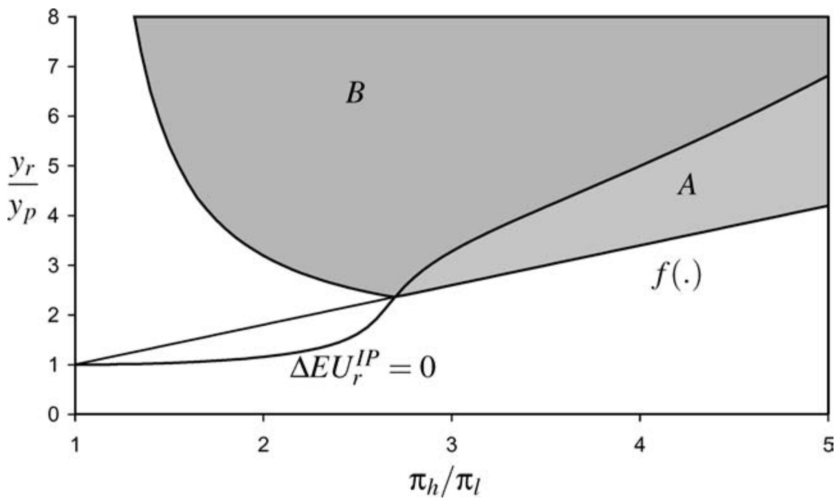

Figure 7. Pareto-improving public health insurance under regimes LIR/IP.

not. Area B shows the additional possibilities.[9] The rich may now support public health insurance even for higher values of y_r/y_p for a given value of π_h/π_l. For example, regime IP could only be sustained for $y_r/y_p \leq 5$ if $\pi_h/\pi_l = 4$. Regime LIR, however, can also lead to Pareto-improving public health insurance for $y_r/y_p > 5$. Furthermore, public support is possible for additional values of π_h/π_l compared to regime IP, e.g. for $\pi_h/\pi_l = 2$.

To sum up, the analysis can also account for the existence of public health insurance systems with limited income redistribution as in Germany (see also the discussion of the Swiss system in the next section). As long as such a system induces sufficient income redistribution to yield a positive amount of health insurance in a majority voting equilibrium, it may obtain more popular support at the constitutional level than a regime with income-proportional contributions.

A system with limited income redistribution can also cope better with moral hazard. Since there is less income redistribution, the price of public health care is higher for pl-types. Compared to regime IP, they prefer a lower amount of public health insurance than under income-proportional contributions (see footnote 8). This will give rise to less moral hazard if $\mu_i'(g) > 0$ which reinforces the argument that regime LIR may be preferred to regime IP at the constitutional stage.

Discussion

The model demonstrated that public health insurance systems which redistribute from the healthy to the sick and from the rich to the poor can be supported by the overwhelming majority of the population. It therefore provides an explanation why such systems are likely to exist and to be politically stable in a democracy. The model relied on a number of specific assumptions which are discussed in the following. In addition, we point out how the analysis can account for the existence of flat fees in Switzerland and the absence of a comprehensive public health insurance system in the United States. Last but not least, it is argued that proposals to separate health insurance from income redistribution might not find sufficient political support.

The model

The model made a number of simplifying assumptions. In particular, only two risk and two income types were considered. Allowing the probability of becoming ill to take further values should not alter the results. With respect to income, however, the result that regime IP leads to a Pareto-improvement will cease to hold once there are very rich individuals whose income transfers exceed any gain due to premium insurance. However, the conclusion that even individuals who pay an income transfer from an ex ante perspective are better off under regime IP should continue to hold. Therefore, a large majority can still be in favor of regime IP at the constitutional stage. Furthermore, a public health insurance system with limited income redistribution may find sufficient public support even if a system with income-proportional premiums is rejected.

The model has also abstracted from other reasons why a public health insurance system could be attractive for the rich. For example, the rich may want the poor to have sufficient health insurance for altruistic reasons or to avoid the spread of diseases. It may also be in the interest of the rich that the poor are sufficiently healthy to be productive. However, these arguments rather support a system which focusses exclusively on the poor such as Medicaid in the United States as opposed to a comprehensive public health system for all citizens.

A key assumption of the analysis is that premium risk cannot be insured in the market. In the German private health insurance system, however, long-term guaranteed renewable contracts are available which guarantee future premiums independent of changes in the risk types. In the United States, individuals can obtain health insurance independent of their risk type through their employer. Nevertheless, these systems face severe problems. The German system is heavily regulated to insure its stability. In particular, individuals lose the prepayments accumulated by their insurer if they switch to another insurer.[10] In the United States, individuals suffer from job lock-in once they have become a high risk or lose their health insurance if they change their job.[11] Therefore premium risk coverage in practice is far from perfect. The assumption that premium risk cannot be insured, although somewhat oversimplified, can therefore be justified by the current state of affairs.

Flat fees in Switzerland

At a first glance, the existence of a public health insurance system financed by flat fees in Switzerland seems to be at odds with the results of this paper. Only public systems with income-related contributions should be observed. A closer look, however, reveals that the Swiss system is not a pure flat fee system. If the flat fee exceeds a certain percentage of household income (between 7 and 10% depending on the canton), then the household receives a transfers financed out of tax revenue which covers the extra premium expenditure. The system is therefore similar to the limited income redistribution regime analyzed in the section on limited income redistribution: the effective contribution rate $\tilde{t}$ for the public health insurance system is between 7 and 10% unless income y is so high that the corresponding transfer would exceed the flat fee F. This is equivalent to an income limit $\tilde{y} = F/\tilde{t}$ and contributions $\tilde{t}y$ if $y \leq \tilde{y}$ and $\tilde{t}\tilde{y} = F$ if $y > \tilde{y}$.[12]

In May 2003, the Swiss population voted on a referendum to increase income redistribution within the public health insurance system. The initiative proposed to abolish flat fees and to switch to income-related premiums without an income limit. The population rejected this initiative by a large majority. This outcome is in line with our result that too much income redistribution may not receive sufficient public support. In particular, this is the case in the presence of moral hazard. Then a majority may oppose more income redistribution, which leads to more public health insurance and therefore more moral hazard.

Public health insurance in the United States

The United States is the only major democracy among the developed countries which does not have a public health insurance system for all its citizens. The Medicaid program covers only the poor and Medicare is restricted to people 65 years of age and older. In 1993, an attempt by President Clinton to establish a national health insurance system failed. The analysis in this paper provides an explanation why this may be the case. First, income inequality is relatively high in the United States compared to other industrialized democratic countries.[13] Therefore, the support for a comprehensive public health insurance program with income-proportional contributions is likely to be low. Furthermore, in the United States, partial premium insurance is available since health insurance is tied to the employer. Therefore, it is not surprising that Medicare is the only comprehensive health insurance program which found support in the political arena. This program sets in once employer-sponsored health insurance ceases to work and covers a period in which premium risk is particularly severe.

Pauly (1994) has argued that a public health insurance system with income- dependent benefits might find more support in the United States than a public health insurance program with uniform benefits. Above it was shown that such a system would yield a first-best risk allocation. However, a constitution which specifies sufficiently well how benefits are to differ according to income will be difficult to draft. A possible alternative is to limit income redistribution to make public health insurance with uniform benefits more attractive to higher income individuals. For example, income could be liable to contributions only up to a certain limit as in Germany. Also a system with flat fees and transfers to low-income households as in Switzerland could be introduced. These measures are compatible with the coverage of premium risk as long as the median voter is still in favor of a positive amount of public health insurance. However, the existence of employer-based health insurance makes it questionable whether even such less redistributive proposals will find enough political support in the United States.

Separating health insurance from income redistribution

Breyer and Haufler (2000) have argued that public health insurance systems should not be financed by contributions linked to income. According to their analysis, shifting income redistribution to the tax system can create two types of efficiency gains. On the one hand, it would be easier to adopt incentive-compatible insurance contracts, for example through the introduction of copayment schemes. On the other hand, income redistribution through the general tax system is likely to be more efficient than redistribution through insurance contributions which are levied only on earnings.

The analysis in this paper suggests that such a proposal might not find sufficient political support if the two dimensions of redistribution are separated completely. In this case, a public health insurance system will ex post only be supported by the sick which leads to a lower level of public health insurance in a majority voting equilibrium. Ex ante this would be against the interest of all those who value the premium insurance provided by the public system. Thus, a reform may need to preserve the essential linkage between the two dimensions of redistribution to be politically feasible. This excludes a complete shift to a public system financed by flat fees unless the system or individual contributions are tax subsidized.

Conclusion

This paper has shown that in the absence of markets to insure premium risk, a public health insurance system with contributions linked to income may be preferred by everyone to a pure market system and a public health insurance system financed by flat fees. Even the rich may be in favor of such a system at the constitutional stage because it yields a positive level of public health insurance in a majority voting equilibrium and therefore insures premium risk. In particular, a system with limited income redistribution may receive public support. It is more likely to be backed by the rich and can cope better with moral hazard. This paper therefore provides an explanation why public health insurance systems that combine redistribution from the rich to the poor and from the healthy to the sick are likely to exist and to be politically stable in a democracy. Finally, the analysis indicates that a proposal to separate health insurance from income redistribution might not be politically feasible.

Acknowledgements

I thank Max Albert, Friedrich Breyer, Jobst Leikeb, Normann Lorenz, Achim Wambach, Stefan Zink and participants at seminars at the Universities of Konstanz, Sheffield and Tübingen for helpful comments and suggestions.

Notes

1. See Breyer and Haufler (2000) and Wagstaff, van Doorslaer, et al. (1999)
2. On the use of constitutional economics in positive economic theory, see Buchanan (1987) and Voigt (1997).
3. In sections *The Model and Analysis of Regimes* it is assumed that the probability μ_i is exogenous. In section *No public health insurance system* we allow for moral hazard with respect to the health status.
4. For a detailed description and analysis of the premium risk problem, see Kifmann (2001, 2002).
5. Note that we do not have to consider that pl-types will buy supplementary insurance, since it is more expensive than public health insurance if condition (7) is met.
6. If condition (7) is met, pl-types never buy additional health insurance, i.e. $\hat{m}^*_{pl} = 0$.
7. For illustrative purposes, condition (7) which is necessary for condition (9) is considered separately.
8. With ρ as the price for public health care, the first-order condition for pl-types is $u'(y_p - \rho g)(-\rho) + \pi_l v'(g) = 0$. Hence $\frac{dg}{d\rho} = -\frac{u''(y_p-\rho g)\rho g - u'(y_p-\rho g)}{u''(y_p-\rho g)\rho^2 + \pi v''(g)} < 0$.
9. The lower contour of area B to the left of the intersection of $\Delta EU_r^{\mathrm{IP}} = 0$ and $f(.)$ shows $\Delta EU_r^{\mathrm{LIR}} = 0$ for $\tilde{y}$ equal to the minimum value needed to guarantee that pl-types vote for public health insurance. From Equation (22) we obtain $\tilde{y} = [y_p(\bar{\pi} - (1-\lambda)\pi_l)]/(\lambda\pi_l)$. Above the contour $\Delta EU_r^{\mathrm{LIR}} > 0$ holds. At the intersection of $\Delta EU_r^{\mathrm{IP}} = 0$ and $f(.)$, we have $\tilde{y} = y_r$ which leads to $\Delta EU_r^{\mathrm{LIR}} = \Delta EU_r^{\mathrm{IP}} = 0$. Conditions (7) and (22) coincide, which implies that function $f(.)$ is also fulfilled.
10. For a description and analysis of the German private health insurance system, see Kifmann (2002).
11. See Gruber (2000) for a review of the job lock-in problem.
12. This similarity between the German and Swiss system has first been pointed out by Breyer (2002).
13. See Atkinson, Rainwater and Smeeding (1995) and Gottschalk and Smeeding (1997).

References

Atkinson, A., Rainwater, L., & Smeeding, T. (1995). *Income distribution in OECD countries.* OECD: Paris.

Blomqvist, A., & Horn, H. (1984). Public health insurance and optimal income taxation. *Journal of Public Economics*, *24*, 353–371.

Breyer, F. (1995). The political economy of rationing in social health insurance. *Journal of Population Economics*, *8*, 137–148.

Breyer, F. (2002). Einkommensbezogene versus pauschale GKV-Beiträge—eine Begriffsklärung. *Schmollers Jahrbuch*, *122*, 606–616.

Breyer, F., & Haufler, A., (2000). Health care reform: Separating insurance from income redistribution. *International Tax and Public Finance*, *7*, 445–461.

Buchanan, J. (1987). Constitutional Economics. In J. Eatwell (ed) *The new palgrave* (Vol. 1, pp. 588–595). London/Basingstoke: Macmillan.

Cochrane, J. (1995). Time-consistent health insurance. *Journal of Political Economy*, *103*, 445–473.

Cremer, H., & Pestieau, P., (1996). Redistributive taxation and social insurance. *International Tax and Public Finance*, *3*, 281–295.

Epple, D., & Romano, R., (1996). Public provision of private goods. *Journal of Political Economy*, *104*, 57–84.

Gottschalk, P., & Smeeding T., (1997). Cross-national comparisons of earnings and income inequality. *Journal of Economic Literature*, *35*, 633–687.

Gouveia, M. (1997). Majority rule and the public provision of a private good. *Public Choice*, *93*, 221–244.

Gruber, J. (2000). Health insurance and the labor market. In A. J. Culyer and J. P. Newhouse (eds.), *Handbook of health economics*. (Vol. 1a, pp. 645–706). Amsterdam: Elsevier.

Kifmann, M. (2001). Premium risk and managed care. *Journal of Risk and Uncertainty*, *22*, 277–293.

Kifmann, M. (2002). *Insuring premium risk in competitive health insurance markets.* Tübingen, Germany: Mohr Siebeck.

Pauly, M. (1994). Avoiding the mistreatment of bad risks in a democracy: Universal health insurance from a constitutional perspective. *Constitutional Political Economy*, *5*, 307–318.

Pauly, M., H. Kunreuther, & Hirth, R., (1995). Guaranteed renewability in insurance. *Journal of Risk and Uncertainty*, *10*, 143–156.

Petretto, A. (1999). Optimal social health insurance with supplementary private insurance. *Journal of Health Economics*, *18*, 727–745.

Rochet, J. C. (1991). Incentives, redistribution and social insurance. *Geneva Papers on Risk and Insurance Theory*, *16*, 143–165.

Usher, D. (1977). The welfare economics of the sozialization of commodities. *Journal of Public Economics*, *8*, 151–168.

Voigt, S. (1997). Positive constitutional economics: A survey. *Public Choice*, *90*, 11–53.

Wagstaff, A., van Doorslaer, E., et al. (1999). Equity in the finance of health care: Some further international comparisons. *Journal of Health Economics*, *18*, 263–290.