

Adverse Selection of Voluntary Health Insurance Scheme

Proposed by the Hong Kong Government

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Abstract

In response to increasing public health expenditure, the Government of Hong Kong Special Administrative Region (HKSAR Government) published a consultation document in October 2010 proposing a government-regulated "Voluntary Health Insurance Scheme". The present study conducts game theoretic analysis and reveals that, under specific information structure, the implementation of such a proposal would result in adverse selection in medical insurance market, resulting in outcomes in opposition to the government's intention.

Keywords

Health Insurance, Medical Financing, Game Theory

1. Introduction

Medical services in Hong Kong are segmented into public and private sectors. The public sector is financed by public funds, with citizens paying a proportion sufficiently low to render health care virtually free under most circumstances (Note 1). The private sector is profit-oriented. Since 1996, total medical and health care expenditure has accounted for 4.5%-5.6% of Hong Kong's gross domestic product. Approximately half of which has been covered by the public sector (Note 2).

According to the basic principles of economics, the demand for free services has no limit (although healthy individuals tend not to visit doctors). The public health sector cannot allocate medical services by market principle (e.g., highest valued "customers" get the service). Thus non-price competition is inevitable, with long waiting times as part of the non-monetary costs (Note 3). The aging population in Hong Kong creates an increasing demand for medical services, leading to an increase in the Hong Kong Government's medical expenditure. The pressure for the HKSAR government to reform medical financing has been mounting.

In contrast, the private medical sector offers rapid services that the public sector cannot provide. If a patient is covered by medical insurance and their medical expenses do not exceed the coverage limit, they can avoid the exceptionally long waiting times of public medical services. If policyholders' medical bill exceeds their coverage limits, the remaining balance is covered by themselves. Many of them may return to the public health sector.

2. Medical Insurance and Adverse Selection

If a person's health status is unknown by an insurance company, only those who anticipate their health to deteriorate will purchase insurance policies. This will create pressure for premiums to rise. However, higher premiums will deter healthy individuals from purchasing insurance policy. This information asymmetry between insurance companies and potential policy holder predicts that only those with relatively poor health would be willing to become medical insurance policy holders. However, insurance companies might not be willing to offer any policy at all (Note 4). This situation is a typical example of "adverse selection". Similar phenomena are observed in used car market (Note 5) and credit rationing (Note 6).

Contrary to the prediction of adverse selection, the fact that a medical insurance products still exists in the market indicates that medical insurance is still profitable. This is resulting from insurance companies' capacities to deal with the problems created by asymmetric information between insurance companies and policyholders, alleviating the negative impact of adverse selection. Here are some typical measures implemented by insurance companies:

- a) Health declaration: In principal, diseases that a policyholder has or has had should be declared or the insurance company may refuse compensation in the future claims, regardless of whether the declaration is related to the claims or not.
- b) Waiting periods: Specific diseases are not compensated and may even lead to exclusion within a period after the policy comes into effect. In contrast, compensation can be claimed only if an individual is diagnosed with one of these specific diseases after the waiting period has elapsed.
- c) Exclusion: Insurance companies may refuse to cover policyholders in relation to specific diseases such as pre-existing chronic illnesses. Alternatively, patients who have received large amounts of compensation within the previous year may be excluded during policy renewal for the relevant diseases.
- d) Refusal of policy renewal: Medical insurance policies are renewed every year and insurance companies have the right to refuse policy renewal; for example, a company can refuse if a policyholder has received a large amount of compensation within the previous year.
- e) Loading increases: Insurance companies may increase loadings during policy renewal.
- f) Compensation limits: An upper limit is set for very category of medical insurance compensations.
- g) Deductibles: Also known as "excess", this is the amount to be paid by a policyholder when he or she claims compensation.

Because of these restraints, some people such as those with chronic illnesses and older people cannot purchase medical insurance or are charged with higher premiums.

3. Brief Introduction to the Proposed “Voluntary Health Insurance Scheme”

In October 2010, the Food and Health Bureau (FHB) published “My Health My Choice”, the second phase of the public consultation document for health care reform, wherein it was recommended that “public funding should remain the main funding source for health care supplemented by private funding”. “Supplemented” refers to the public paying to register for the government-regulated voluntary medical insurance plan (referred to in the document as “Voluntary Health Insurance Scheme”, hereinafter referred to as “VHIS”) (Note 7). VHIS differs from the medical insurance provided by the current market in the following manners:

- a) No one will be refused for the insurance and are guaranteed lifetime policy renewals.
- b) Pre-existing conditions will be covered (Note 8) but subject to waiting periods and a time-limited reimbursement with an upper limit.
- c) High-risk groups are insured through a “High-Risk Pool” (HRP) (Note 9). The premium limit in the HRP with high-risk loading is three times the amount of the “published premium” (Note 10).
- d) A no-claims bonus of up to 30% of the published premiums is provided (Note 11).
- e) The government has earmarked HK\$ 50 billion to support health finance reform. The document suggested allocating this money for the claims of the HRP, to provide no-claims bonuses for new participants, and provide incentives for people to save money that can be used for premium payments when they are old (i.e., aged 65 years older) (Note 12).

The scheme is open for voluntary participation, with the government promising that members of the public who do not participate still have access to public medical services. The Hong Kong Government aims to reduce their burden on medical services and increase the proportion of private services through arrangements similar to universal health care insurance.

4. VHIS Game Theoretic Analysis

4.1 Insurance Companies and Policyholders

Game theoretic analysis reveals that, under simple information asymmetry, the government’s proposal will result in adverse selection, defeating the original purpose of the government. High-risk groups, older people, and individuals with pre-existing conditions can be summarized as those with higher than average morbidity rates hence more likely to claim insurance compensation. Currently the insurance industry alleviates the impact of adverse selection through the arrangements like health declaration, waiting period, exclusion, loading, excess, etc. listed above. The government views these measures as “problems”. The government’s proposal amount to including individuals who will definitely claim in the insurance pool.

In the following game, insurance companies and potential policyholders are players. There are two

types of potential policyholders. N_1 represents those with illnesses and N_2 represents those who are healthy. There were N individuals in total such that $N = N_1 + N_2$, all of whom know whether they themselves are ill or healthy. However, the insurance companies know only the probability of a potential policyholder being ill or not, which is $1/N$. They are unaware of each specific individual's health status. In other words, there is 1 out of N individuals is ill. But the insurance companies do not know the identity of this person. The model is expressed in the following game tree:

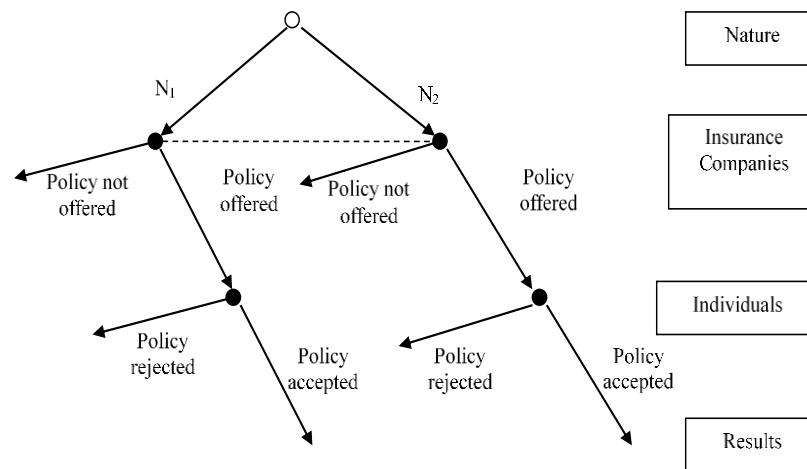


Figure 1. The Game between Insurance Companies and Potential Policyholders. Specific Health Status of Individual Potential Policyholders Unknown to Insurance Companies

In this game, “Nature” first determined who will be the ill (N_1) and the healthy (N_2) individuals. Then the insurance companies decided whether to provide insurance to the N individuals. Since the insurance companies did not know the health status of the N individuals (i.e., who is in N_1 and N_2), to show this property of information, a dashed line links the two knots at the move by insurance companies. However, the insurance companies know that:

$$\frac{N_1}{N_1 + N_2} = \frac{N_1}{N} = \frac{1}{N}$$

The insurance companies do know that one out of N individuals is ill, i.e., $N_1 = 1$. Then, in the next move, N_1 and N_2 individuals decide whether to accept the policy provided by the insurance companies. Each policyholder has to pay a premium P in order to be insured. Each will receive a compensation I if he or she becomes ill. If all the N individuals purchase insurance policies, the payoff for the insurance company will be profit π :

$$\pi = PN - I$$

If the insurance market is perfectly competitive, π will be zero, which implied:

$$PN - I = 0$$

$$\Rightarrow P = \left(\frac{1}{N}\right) I$$

In other words, individual premium is equal to the probability of illness multiplied by the compensation. In this case it is actuarially fair insurance.

The next move is for the potential policyholders to decide whether to accept insurance policy at premium P or not. For the only individual in N_1 , the payoff of illness is K_1 :

$$K_1 = I - P$$

For each individual in N_2 , the payoff of illness is K_2 , which is:

$$K_2 = -P$$

Those in N_1 , without insurance policy, uses public medical services when ill. For the simplicity of analysis, we assume the value of public services is I , i.e., the same as insurance compensation, although the patients were not required to pay.

The following payoff matrices list the payoffs for those N_1 , N_2 , and insurance companies playing different strategies:

Table 1. Payoff Matrix of Those in N_1 and Insurance Companies

		N_1	
		Policy accepted	Policy rejected
Insurance Companies	Policy offered	$([I-P], [PN-I])$	$(I, 0)$
	Policy not offered	$(0, 0)$	$(I, 0)$

Table 1 shows that for those in N_1 , the strategy “policy rejected” is strongly dominant. The insurance companies would not provide insurance because if only N_1 individuals were insured, the payoff will be negative. We can see that the payoff for the insurance companies is

$$\pi = PN_1 - I$$

Because N_1 (equal to 1 in this illustration) is less than N , PN_1 was lower than I , denoting that the insurance company lost money. Consequently, the equilibrium of this game is (policy rejected, policy not offered). The insurance companies choose not to offer policy to N_1 .

Table 2. Payoff Matrix of Those in N_2 and Insurance Companies

		N_2	
		Policy accepted	Policy rejected
Insurance Companies	Policy offered	$(-P, 0)$	$(0, 0)$
	Policy not offered	$(0, 0)$	$(0, 0)$

Table 2 shows that for those N_2 , the strategy “policy rejected” was weakly dominant. Insurance policy is a waste of money because those in N_2 know they are perfectly well and will not get any compensation. Thus, those in N_2 are not going to apply for insurance policy.

4.2 The Effect of Upper Limit on Compensations

The government proposed that pre-existing conditions would be insured subject to waiting periods and time-limited upper limits on compensations. Assume that the upper limit on compensation is I and those with pre-existing chronic illnesses will claim compensation in the future (thereby obtaining I). The premium is P^* which is less than I . The gaming tree is as follows:

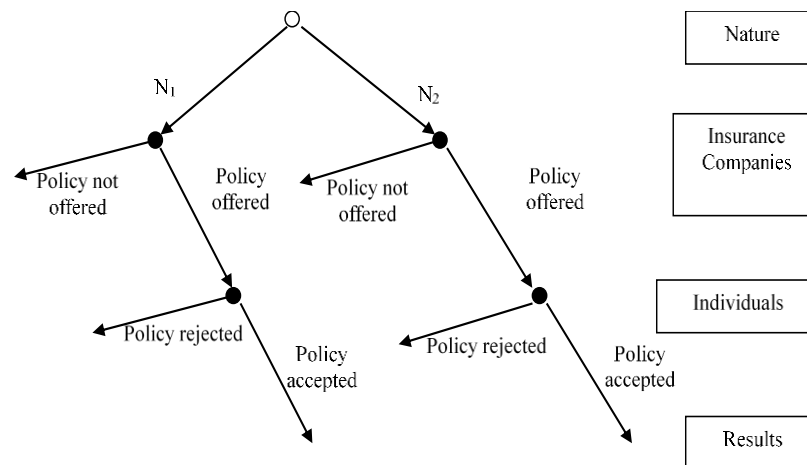


Figure 2. The Game between Insurance Companies and Potential Policyholders, with Coverage on Pre-Existing Conditions and Upper Limit on Compensations

Saying that pre-existing conditions ought to be covered (with restrictions) implies that the pre-existing conditions are known to insurance companies. Hence the insurance companies know who belongs to N_1 and N_2 . Therefore, the dashed line between N_1 and N_2 is no longer here.

For N_1 , only part of the game is required examination:

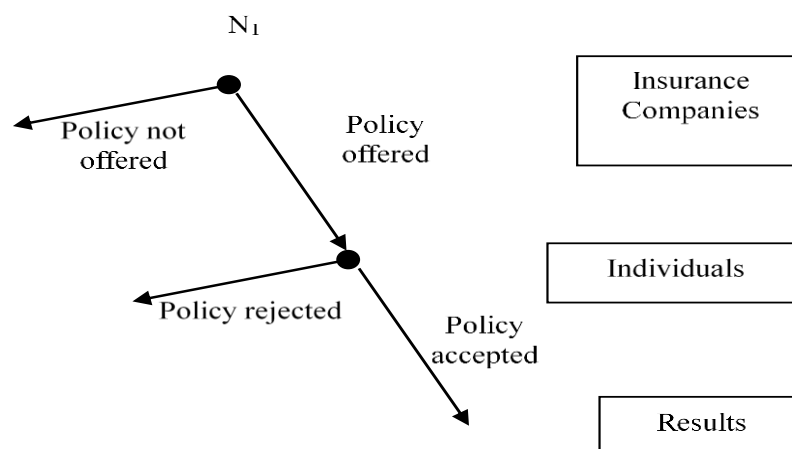


Figure 3. The Game between Insurance Companies and Those with Pre-Existing Conditions

The payoff matrix is as follows:

Table 3. Payoff Matrix of Those in N_1 and Insurance Companies, When Pre-Existing Conditions are Covered

		N_1	
		Policy accepted	Policy rejected
Insurance Companies	Policy offered	$([I-P^*], [P^*N_1-I])$	$(I, 0)$
	Policy not offered	$(0, 0)$	$(I, 0)$

For those in N_1 , the strategy “policy rejected” is strictly dominant, indicating that whether the insurance companies offer policy is inconsequential. Using public health care was more cost-effective. This result demonstrates that the upper compensation limit does not increase the willingness to be insured among individuals who is ill, nor could the insurance companies provide profitable policies.

The payoff matrix of N_2 is as follows:

Table 4. Payoff Matrix of Those in N_2 and Insurance Companies, When Pre-Existing Conditions are Covered

		N_2	
		Policy accepted	Policy rejected
Insurance Company	Policy offered	$(-P^*, 0)$	$(0, 0)$
	Policy not offered	$(0, 0)$	$(0, 0)$

For those belongs to N_2 , the strategy “policy rejected” is weakly dominant. Since they know their own health statuses, N_2 individuals are not going to seek for insurance coverage, irrespective of whether the insurance companies offer them policy or not.

4.3 Higher Premiums for High-Risk Individuals

The government propose to cover high-risk individuals in VHIS. However, the premium is limited to three times of the published premium. Let compensation be I and the published premium was

$$P = \frac{I}{N} = \frac{I}{N_1 + N_2}$$

which is actuarially fair. According to the government’s proposal, the premium for the high-risk group is:

$$3P = \frac{I}{N} = \frac{3I}{N_1 + N_2}$$

In our analysis, it is assumed that higher premiums would receive more compensation without an upper limit. If uninsured, those in N_1 (obviously high-risk individuals belong to N_1) will be back to the public sector and obtained an equivalent of I medical services. Similar to the previous discussion, only the interaction between N_1 and the insurance companies required examination because N_2 individuals were not insured.

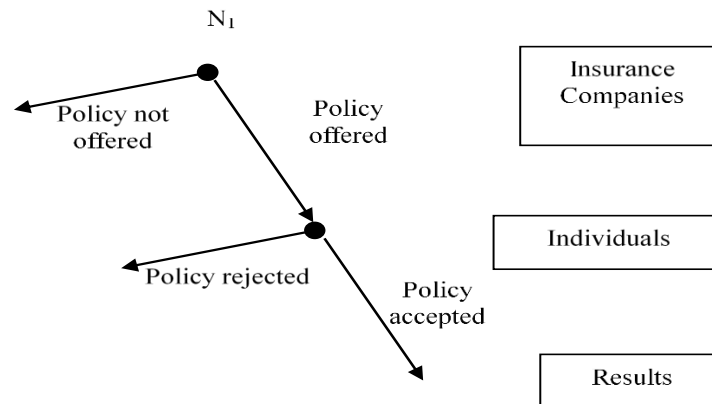


Figure 4. The Game between Insurance Companies and High-Risk Individuals

The payoff matrix is as follows:

Table 4. Payoff Matrix of Those High-Risk Individuals and Insurance Companies

		N_1	
		Policy accepted	Policy rejected
Insurance Companies	Policy offered	$([I-3P], [3P*N_1-I])$	$(I, 0)$
	Policy not offered	$(0, 0)$	$(I, 0)$

For those in N_1 , the strategy “policy rejected” is strictly dominant, indicating that whether the insurance companies offer insurance policy is inconsequential. Using public medical care is more cost-effective for them. Eventually, a premium limit of three times the published premium did not increase willingness for individuals with illness to be insured, nor could the insurance companies provide profitable policies. In addition, older people (usually identified as high-risk) may not have sufficient funds to pay for the premiums and deductibles when claiming for compensation. Therefore, it is doubtful whether there is incentive for them to obtain voluntary medical insurance at all.

5. Conclusion

Similar to other economic models, the model in this study was excessively abstract, which resulted in the following extreme conclusions: Everyone will choose public medical services instead of using private medical services by participating in VHIS. However, this model doesn’t explain why half of all medical services (in terms of value) are provided by the private sector, while numerous insurance companies are providing an extensive range of medical insurance policies.

Part of the explanation could be product differentiation. The medical services provided by private and public sectors are not the same. For example, the excessive waiting time in public sector, resulting from lower than equilibrium pricing, makes a big difference (Note 13). Individuals who value time efficiency and can afford the extra expenses will shift to the private sector for medical services. The same applies

to those with medical insurance policies.

Another difference between public and private health care is medication. Since 2005, the Hospital Authority implemented the “Drug Formulary” system and stipulated that patients must purchase drugs at their own expense if using “Self-Financed Items (SFIs) with Safety Net” in the Drug Formulary (Note 14). These “SFIs with Safety Net” are mostly novel drugs that, while more expensive, are also more effective and may have far-reaching implication on well-being of the patients. In other words, public medical services might be perceived as “inferior” to private medical services. Such differentiation contributes to the incentives for patients to switch to private medical services.

Unsurprisingly, private medical services still have markets and medical insurance companies still have clients. Still, it is worth noting that even individuals with medical insurance cannot rely entirely on private medical services mainly because of the costs involved. Policyholders must pay for deductibles in most compensation claim cases. Moreover, most insurance compensations have an upper limit. Therefore, when major medical conditions exhaust compensation, policyholders have no choice but to return to the public health care system. This frequently occurs among older people and patients with chronic illnesses.

The insurance industry welcomes the government’s proposal. It could be explained by the HK\$ 50 billion for the high-risk pool, which will provide no-claims bonuses to some policyholders and subsidizing compensation for high-risk groups. The government also proposes to promote medical insurance with a saving element. All these are favorable to the insurance industry.

As previously mentioned, the upper limit on compensations for high-risk groups, and premium of three times of the published premium for high risk people did not reduce the incentive for people to choose public medical services. However, in reality, some high risk groups will be insured if the VHIS is implemented. There are always people whose risk is high enough that it is beneficial to purchase VUIS. With government’s subsidies, insurance companies will not lose from these policies. An upper limit on compensations is tantamount to forcing policyholders to be underinsured. Three times higher premium and upper limit on compensation will result in the rapid exhaustion of insurance compensation. Eventually the policyholder will return to public medical services. In the process, the insurance companies profit and the public sector pays the bill. Therefore, the government’s proposal does not reduce the proportion of the government’s medical expenses (up to HK\$50 billion) but merely changes the allocation of expenditure. Without VHIS, government health care workers and suppliers are paid by the government. With VHIS, insurance companies and private hospitals and health care staff receive payments.

The government’s suggests to promote medical insurance with a saving element, similar to a whole life plan. The higher premiums by policyholders when they were young enabled the insurance companies to invest, enabling policyholders to pay a relatively low premium when getting older. As insurance companies are profit-seeking organizations, part of the investment return belongs to the insurance companies. The financial benefits to the insurance companies is comparable to those derived from

Mandatory Provident Fund (MPF) (Note 15).

The government's consultation documents did not specify the objectives to be achieved by the VHIS or whether to increase the proportion of private medical services through the VHIS. However, the models in this study indicated that under specific conditions, many people would still use public health services. If this is the government's objective, the chance of it being met is minimal.

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Notes

Note 1. The Hospital Authority website lists the latest public hospital service charges but does not mention costs for surgery visits or unspecified drugs (<http://www.ha.org.hk/haho/ho/adm/102116c.htm>).

Note 2. See “Medical Financing Sources” (Tables 2.1 and 2.2; Figures 2.1-2.5) in the documents from the Food and Health Bureau website (http://www.fhb.gov.hk/statistics/download/dha/cn/tf2_0607.pdf).

Note 3. In their reply to the members of the Legislative Council regarding the waiting times of public medical services in 2008, the government stated the following: “Of the more than 680,000 new cases registered in 2007 and 2008, almost 590,000 cases (86%) had waiting times of less than 1 year. Among these, more than 230,000 cases (34% of the total number of new cases) had waiting times of less than 2 weeks, whereas approximately 150,000 cases (23%) had waiting times of 3-8 weeks. Based on these figures, approximately 57% of new cases were treated within 8 weeks...” These figures indicated that

43% of the new cases had to wait for at least 2 months. Data source: <http://www.info.gov.hk/gia/general/200812/17/P200812170155.htm>

Note 4. Another aspect of this matter is that although insurance companies offer products with affordable premiums, claiming compensation is extremely difficult.

Note 5. Akerlof (1970).

Note 6. E.g., Bierman et al. (1993, Ch. 19).

Note 7. FHB (2010, p. iv).

Note 8. “Pre-existing conditions” refer to chronic diseases suffered before a person was insured.

Note 9. Conceptually, the HRP is a reinsurance mechanism with a financial source that is part of the policy income and reinsurance premiums transferred to the pool. The Hong Kong Government indicated that if the pool is not self-sufficient, the government will consider injecting capital (FHB, 2010, p. 30).

Note 10. The consultation document does not define “published premiums”. They should refer to premiums in the premium table set for “Approved Health Insurance” and “Standard Health Insurance” established by the authority. In summary, “Standard Health Insurance” is a health insurance scheme where “Approved Health Insurance” meets the government’s standards of protection. “Approved Health Insurance” is a private sector-provided health insurance scheme approved by the government that meets the standards of “Standard Health Insurance”. The government proposed that the future premiums for “Approved Health Care” and “Standard Health Care” should be subject to government regulations.

Note 11. For items 1-4, see FHB (2010, p. viii).

Note 12. FHB (2010, p. 33).

Note 13. In the FHB’s written reply to the members of the Legislative Council regarding cataract surgery in public hospitals in January 2010, they mentioned that “the average waiting time for cataract surgery in Hospital Authority hospitals is 36 months” (<http://www.info.gov.hk/gia/general/201001/27/P201001270149.htm>).

Note 14. For “Drug Formulary”, see <http://www.ha.org.hk/hadf/welcome.html>

Note 15. In summary, the “Mandatory Provident Fund Schemes Ordinance” stipulates that all working individuals and their employers are required to deposit 5% of their income (10% for self-employed individuals) into government-approved MPF providers (privately owned) with an upper limit of HK\$ 2000 per month. The MPF providers charge 2% of the total assets annually as management fees. According to the Mandatory Provident Fund Schemes Authority website, until December 2009, “the net asset value of all MPF schemes passed the HK\$ 300 billion mark”, indicating a management fee income of more than HK\$ 6 billion. See http://www.mpfa.org.hk/tc_chi/abt_mpfs/abt_mpfs_mil/abt_mpfs_mil.html for more details. Failure to pay for the MPF is a criminal offense that can incur a fine or even imprisonment.