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Adverse selection or advantageous selection? Risk and underwriting in China's health-insurance market

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ABSTRACT

Using data from China's individual health-insurance market, we study the problem of information asymmetry. Our preliminary results appear to contradict standard-model predictions, showing that higher-risk buyers are more likely to purchase "additional" insurance than lower-risk buyers, but that they also tend to purchase lower limits of "basic" insurance coverage. We therefore develop a theoretical model to capture the effects of buyers' wealth levels and loss amounts, and show empirically that these effects, in the context of asymmetric information, lead to the coexistence of adverse selection and advantageous selection in China's health-insurance market.

1. Introduction

Since the seminal work of Arrow (1963) and Akerlof (1970), the problem of asymmetric information has become a major focus of modern economic research. In the insurance sector, much theoretical work has shown that the existence of information asymmetry can result in diminished market efficiency or even market failure (see, e.g., Rothschild and Stiglitz (1976), Wilson (1977), and Riley (1979)). However, the empirical study of asymmetric information in insurance is still rather limited, and the question of how serious this problem is in real-world markets remains unresolved. In the present work, we analyze the economic impact of asymmetric information in China's individual health-insurance market.

One prominent source of information asymmetry in an insurance market is weak or nonexistent underwriting, which can lead to severe problems of *adverse selection* (see Rothschild and Stiglitz (1976)). In this context, insurance companies have little or no ex-ante information regarding their buyers' risk types, and so, if there is only one type of policy contract, it must be priced according to the average level of risk of all buyers in the market. In a market with two types of buyers – high-risk and low-risk – this pricing system leads immediately to the exiting of low-risk buyers, and so insurance becomes the exclusive domain of high-risk buyers.

To reduce the impact of adverse selection, insurance companies can offer a menu of contracts with different prices and deductibles or limits targeted at different types of applicants. In a market with high-risk and low-risk buyers, two policy contracts are necessary to achieve separation between high- and low-risk applicants. If equilibrium exists, then the high-risk buyers will purchase full insurance at an actuarially based (high) price, whereas the low-risk buyers will purchase partial insurance at an actuarially based (low) price. Consequently, there will be a positive correlation between the risk types (high vs. low) and the amount of insurance purchased (high vs. low) when there is asymmetric information regarding risk types. A positive correlation also can arise if information asymmetry leads to problems of moral hazard (Arnott and Stiglitz, 1988). These observations motivate the standard "positive-correlation" test for the existence of information asymmetry; that is, to look for positive correlation between the buyer's level of risk and the amount of insurance purchased (Chiappori and Salanié, 2000).

Interestingly, the presumed positive correlation between risk level and insurance amount has not received strong support from recent empirical studies of the insurance market. For example, in the context of automobile insurance, Puelz and Snow (1994) constructed a two-equation model to test data from the US state of Georgia and concluded that the data support the existence of adverse selection. On the other hand, Chiappori and Salanié (2000) found no evidence of adverse selection or moral hazard in the French market for automobile insurance. Dionne et al. (2001) replicated the work of Puelz and Snow (1994) with

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some methodological extensions, and found that residual adverse selection is not present when appropriate risk classifications are used. In a similar manner, results from health-insurance markets are also mixed. Riphahn et al. (2003) found that high-risk buyers are more likely to acquire supplemental (“add-on”) insurance by examining German health-care and insurance survey data. However, Cardon and Hendel (2001) found no evidence of informational asymmetry in the US market because the link between insurance choice and health-care consumption can be explained by other observable factors. Cawley and Philipson (1999) also rejected the presence of asymmetric-information by comparing mortality statistics of insureds and non-insureds, and showed that people who purchase insurance tend to have lower mortality rates.

On the surface, our preliminary analysis of China’s health-insurance market produces similar contradictions. In China, most health-insurance contracts contain both “basic” and “additional” insurance coverages. The basic component provides reimbursement for the insured’s medical expenses up to a discretionary limit, whereas the additional component – which cannot be purchased independently of the basic component – pays for primarily non-medical expenses (not covered by the basic insurance) up to a fixed limit. By examining the relationships between both (1) *the limit of basic insurance purchased* and the rate of ex-post claims, and (2) *the decision to purchase additional insurance* and the rate of ex-post claims, we find that buyers who eventually made more insurance claims tended to have purchased lower limits of basic insurance, but were more likely to have purchased additional insurance. Whereas the latter result appears to support the standard model, the former result appears to oppose it. However, as will be explained, these seemingly contradictory results are actually entirely consistent with each other, as well as with the presence of asymmetric information in the insurance market.

Essentially, we will argue that confounding issues of heterogeneous wealth levels and loss amounts[1] must be addressed before any proper test of asymmetric information can be carried out, and that the failure to account for such heterogeneity may explain why some of the previous literature rejected the presence of asymmetric information. More specifically, our theoretical analysis shows that when there are significant differences among the wealth levels and loss amounts of buyers, lower-risk individuals actually may purchase *more* insurance – exhibiting the phenomenon of *advantageous selection* – because higher loss expenditures, as well as higher risk levels, tend to increase the demand for insurance.

Our empirical study of asymmetric information in China’s health-insurance market reveals that buyer heterogeneity may cause the market’s equilibrium characteristics to differ markedly from those of the standard model of adverse selection. Hence, researchers should treat the results of the “positive-correlation” test with caution to avoid inappropriate judgments. Our analysis also provides a useful benchmark for evaluating economic development in China’s medical and health-insurance sectors. The fact that less-affluent buyers tend to have a higher probability of loss[2] and greater demand for additional insurance indicates that, from a social-welfare perspective, the national government may want to encourage efforts to increase insurance availability for this segment of the population.

In the following section, we introduce a simple one-period theoretical model of the health-insurance market. Next, we describe the data and methods to be used in the present study. In the subsequent section, our empirical results and analysis of China’s health-insurance market are presented. Finally, we offer several concluding observations.

2. Theoretical model

In the standard one-period model of information asymmetry in insurance, buyers are assumed to be heterogeneous with regard to only their risk types (e.g., high-risk vs. low-risk; see Rothschild and Stiglitz (1976)). As discussed above, this assumption implies that the amount of insurance purchased and the probability of loss (measured either ex-ante or ex-post) will be positively correlated in equilibrium. However, if unobservable buyer heterogeneity also exists with regard to wealth levels and loss amounts, then the nature of market equilibrium is likely to be quite different, and a positive correlation between insurance purchased and loss probability may be neither a necessary nor a sufficient condition for information asymmetry. In the following analysis, we extend Rothschild and Stiglitz (1976) original one-period model by introducing unobservable heterogeneity with regard to wealth levels (and consequently loss amounts) to account for the possible coexistence of adverse selection and advantageous selection in an insurance market with asymmetric information.

For simplicity, let there be two different types of buyer in a health-insurance market – type 1 and type 2 – each with the same increasing and concave-downward utility function, $U(\cdot)$. Furthermore, let W_i, π_i, M_i, and L_i denote, respectively, the initial wealth level, probability of illness,[3] medical loss amount (given that illness occurs), and non-medical loss amount (given that illness occurs) for a buyer of type i. We assume that these quantities are known to the buyer but unobservable by insurers, and that $W_1 > W_2$, $\pi_1 < \pi_2$, $M_1 > M_2 > 0$, and $0 = L_1 < L_2$. These assumptions correspond to the realistic scenario in which wealthier buyers, as compared to poorer buyers, are: (1) less likely to contract illnesses requiring medical treatment, (2) likely to expend greater medical resources once they have contracted illnesses, and (3) likely to expend few (if any) non-medical resources once they have contracted illnesses (because they are afforded sick days and other disability benefits by their employers).

Given the above formulation, it can be shown that, for certain parameter values, a separating equilibrium exists in which insurers provide two types of policy, X and Y, with (per-unit) premium rates P_X and P_Y, coverage limits B_X and B_Y of (basic) medical coverage, and coverage limits A_X and A_Y of (additional) non-medical coverage. Letting $\tilde{W}_i$ denote the final wealth level for a buyer of type i, the buyer’s optimization problem is to maximize

$$\begin{aligned} E\left[U\left(\tilde{W}_i\right)\right] &= \pi_i U\left(W_i - M_i - L_i + \left(B_j + A_j\right) - P_j\left(B_j + A_j\right)\right) \\ &\quad + \left(1-\pi_i\right) U\left(W_i - P_j\left(B_j + A_j\right)\right) \\ &= \pi_i U\left(W_i - M_i - L_i + \left(1 - P_j\right)\left(B_j + A_j\right)\right) \\ &\quad + \left(1-\pi_i\right) U\left(W_i - P_j\left(B_j + A_j\right)\right) \end{aligned}$$

over j. Then, under certain regularity conditions,[4] type 1 buyers will choose a policy X with $P_X = \pi_1$, $B_X = M_1$, and $A_X = 0$, whereas type 2 buyers will choose a policy Y with $P_Y = \pi_2$, $B_Y = M_2$, and $A_Y = L_2$. This means that high-risk buyers will purchase *more* insurance – in the sense of additional non-medical

[1] A similar observation could be made with respect to heterogeneous risk aversion, but that is not necessary for our argument.

[2] That is, these buyers tend to have a higher probability of at least one illness-related insurance claim, regardless of size, in a given annual period.

[3] It is assumed that a given buyer can have at most one illness during the model’s single time period.

[4] Specifically, (i) $U(W_1 - \pi_1 M_1) \geqslant \pi_1 U(W_1 - (M_1 - M_2) - \pi_2 M_2) + (1-\pi_1) U(W_1 - \pi_2 M_2)$; (ii) $U(W_2 - \pi_2 (M_2 + L_2)) \geqslant \pi_2 U(W_2 - L_2 - \pi_1 M_1) + (1-\pi_2) U(W_2 - \pi_1 M_1)$; (iii) $U(W_1 - \pi_1 M_1) \geqslant \pi_1 U(W_1 - (M_1 - B) - \pi_1 B) + (1-\pi_1) U(W_1 - \pi_1 B)$ for all $B \in [0, M_1)$; and (iv) $U(W_2 - \pi_2 (M_2 + L_2)) \geqslant \pi_2 U(W_2 - (M_2 + L_2 - B - A) - \pi_2 (B + A)) + (1-\pi_2) U(W_2 - \pi_2 (B + A))$ for all $B \in [0, M_2)$ and $A \in [0, L_2)$.