



*E.C.O Collage of Insurance*

**Allameh Tabatabai University**

***Evidence of Adverse Selection in Iran's  
Supplementary Health Insurance Market***

Submitted in partial Fulfillment of the Requirements

For the Degree of MS in Actuarial Science

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*Dedicated to My Dear Sister*

*Masoumeh*

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## *Abstract*

Rothschild and Stiglitz (1976) introduced existence of information asymmetry in the insurance sector. Asymmetric information occurs in insurance market when the policyholder is assumed to know more about her (his) risk level to insurers.

Two main consequences of asymmetric information problems were introduced by Arrow (1963), as moral hazard and adverse selection. Existence of adverse selection problem in insurance market is one of the important cases that have always been considered by insurers. Two types of individuals are assumed in insurance market, low risk individuals and high risk individuals. Based on this assumption, adverse selection theory states that high risk individuals demand the insurance service more than low risk individuals. The adverse selection problem leads to increase in premium which leads to exiting of low risk individuals. Thus, adverse selection problem faces insurance company with situation that policyholders claim losses which are higher than the average rate of loss of population.

There are many important factors that they affect arising losses. It seems that policyholders' characteristics, such as age, gender, education level, marital status and occupation type are effective factors in their risk level.

Obviously, supplementary health insurance is one of the main branches of insurance. This insurance provides coverage for medicine, visits to the doctor or emergency room, hospitalization, medical examinations and other medical expenses. Existence and development of supplementary health insurance is very important in each insurance industry.

Using collected data from questionnaires among practitioner individuals, the presence of adverse selection problem in Iran's supplementary health insurance market is tested. Two logistic regression models are estimated in order to determine the effect of individual's characteristics on decision to purchase supplementary health insurance coverage and loss occurrence. This research will use the correlation between claim occurrence and decision to purchase supplementary health insurance to test the existence of adverse selection in health insurance market. If there is a statistically significant positive correlation between them then existence of adverse selection is confirmed in this market.

Since there is positive correlation between loss occurrence and decision to purchase supplementary health insurance coverage, the hypothesis of existence of adverse selection in Iranian supplementary health insurance is accepted.



*Chapter 1:*

*Introduction*

*&*

*Literature Review*

## ***1.1. 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 such as Rothschild's and Stiglitz's paper (1976), Wilson's paper (1977) and Riley's paper (1979) have shown that the existence of information asymmetry can result in diminished market efficiency or even market failure.

Arrow (1963) is one of the authors who proposed the existence of asymmetric information. He introduced two main consequences of asymmetric information problems, moral hazard and adverse selection. Each of these problems has a different impact on insurance operations. In most theoretical models, the asymmetry is relative to the level of risk: the buyer is assumed to know better either her (his) claim probability, or the (conditional) distribution of losses incurred, or both.

Moral hazard is a situation in which one party in a transaction has more information than another. Moral hazard occurs when the contract outcome is partly under the influence of the policyholder or when the insurer is unable to observe, the policyholder's behavior about risks. More broadly, moral hazard occurs when the party with more information about its activities or intentions has a tendency or incentive to behave inappropriately from the perspective of the party with less information.

Moral hazard arises because an individual or institution does not have the full responsibility of its activities. In insurance markets, moral hazard occurs when the behavior of the insured party changes in a way that raises costs for the insurer.

Economists make a distinction between two kinds of moral hazard. If the policyholder behaves in such a way that the probability of loss occurrence increases, there will exist ex-ante moral hazard. In other words, insured behaves in a more risky manner, resulting in more negative consequences that the insurer must pay for. For example, after purchasing automobile insurance, some may tend to be less careful about locking the automobile, thereby increasing the risk of theft for the insurer. Another kind of moral hazard, ex-post, happens when the policyholder tries to compensate the loss in a more expensive way than it is required. In this case, as insurance coverage increases the policyholder does ask the insurer to pay for most of the negative consequences of risk.

Adverse selection is another special case of information asymmetry. The adverse selection theory contains the following assumptions:

(1) The difference in exposure to risk: People differ in the level of exogenously determined risk levels. We assume that individuals are divided into two groups of risk levels, high- and low-risk groups.

(2) Positive correlation between self-perceived risk level and real risk level

(3) No relationship between the level of risk aversion and riskiness

(4) Customers know more about their riskiness than the insurers and efficiently use their information against the insurers.

Adverse selection happens because of hidden characteristics of policyholder. It arises when one party - generally, the insured - has better information than the other party - generally, the insurer - about some exogenous parameters, relevant to the contractual relationship. Adverse selection can also concern an insured's behavior or the amount of losses.

Adverse selection has two particular sources:

- 1) Agents have better knowledge of their risks
- 2) They have better knowledge of their own preferences.

According to the adverse selection theory individuals can be divided into two groups of risk levels; low-and high risk individuals. Based on this assumption, the adverse selection theory states that high risk individuals demand the insurance service more than low-risk individuals. Any individual's informational advantage concerning risk characteristics then could influence her (his) insurance demand and in a way, the insurance profits.

Instead of the assumption that individuals differ in the level of exogenously determined risk level that determines the insurance demand, if we concentrate on the assumption that high risk-averse individuals are more likely both to try to reduce hazard by purchasing insurance and taking precautionary efforts, the result will be different. In other words, people who buy more insurance tend to be more safety conscious and thus are more inclined to undertake precautionary efforts. Inversely, less risk-averse individuals are less likely to buy insurance voluntarily, and they are the ones most likely to place themselves deliberately in dangerous situations. Consequently, in this setting, the selection effect will be advantageous to the market as insurers end up with a lot of cautious low-risk individuals who are likely to pay for precautionary effort. This selection is called advantageous selection.

The advantageous selection theory contains the following assumptions:

- (1) The difference in risk aversion
- (2) Negative correlation between the level of risk aversion and risk level
- (3) Effectiveness of precautionary efforts.

The advantageous selection and the effects of advantageous selection for the operation of insurance markets has been one of the most actively research topics in insurance in recent years. The selection based on risk aversion has been called advantageous selection, if high risk averse individuals demand insurance service more than low risk averse individuals.

Health insurance is one of the main and attractive policies for every insurance company. The facts influencing the accuracy of operation in these products have been the problems that insurance companies have been facing. Asymmetric information and its consequences is an example of these phenomena that affects the health insurance operation as well as other kinds of insurance policies. Generally supplementary health insurance products have been classified into two main categories: individual supplementary health insurance and group supplementary health insurance.

This study tests the presence of adverse selection in Iran's supplementary health insurance market, testing models of asymmetric information involve unobservable actions or types that are typically not observable to the insurer. This research hypothesized that there is considerable adverse selection in Iran's supplementary health insurance market.

The research is going to answer a series of questions few important of which are:

Is there considerable adverse selection in Iran's supplementary health insurance market?

Is there advantageous selection in Iran's supplementary health insurance market?

What is the main cause(s) of the likely adverse selection in Iran's supplementary health insurance?

This chapter addresses the relevance and importance of the thesis topic and then will go through the literature review of the subject. Chapter two, titled theoretical foundation, deals with basic model of adverse selection and demand models for wealth. The third chapter introduces generalized linear model, logistic regression model and positive correlation test. Finally, in the last two chapters, we will apply the results of chapter three on collected data by some questionnaires that are distributed among practitioner individuals for a given period and will test adverse selection in supplementary health insurance.

## ***1.2. Relevance and importance of thesis subject***

Existence of adverse selection in insurance market worries the insurers, because in this situation policyholder's claim losses are higher than the average rate of loss of population used by the insurer to set their premium. Actually receivable amount by insurer (premium) is less than payable amount (occurred loss) by insured.

To cope with the adverse selection problem insurance companies increase the premium. The consequence of increasing the premium will be that the low-risk individuals gradually drop out of the market. This leads to a further increase in price, and hence the lowest remaining risks cancel their insurance contract; leading to another increase in price, and so insurance companies become the exclusive domain of high-risk individuals. Also existence of asymmetric information can hinder the efficient operation of insurance market and this leads to decreases in the

real demand for insurance services in the insurance company. Eventually “adverse selection” may lead to the collapse of the 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. Underwriting is the process of classifying risk levels of insured in order to determine different premium levels to different risk groups. The underwriter determines who is high risk individual and who is not and then decides about the amount of premium to ask for from different risk levels.

The main responsibility of an underwriter is to guard against adverse selection problem. If insurance companies have little or no ex-ante information regarding their buyers’ risk types, then there is only one type of policy contract. Consequently policy contracts must be priced according to the average level of risk of all buyers in the market. Then this pricing system, leads immediately to the exiting of low-risk buyers. In other words, this pricing system intensifies adverse selection problem. So, to reduce the impact of adverse selection, insurance companies should 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 distinction 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. In this situation, the effect of adverse selection becomes weak in insurance market. Therefore, insurance companies should strengthen their abilities to gather and analyze underwriting information to cope with adverse selection problem.

### ***1.3. Literature Review***

The effects of asymmetric information on the efficient operation of insurance markets has been among the most actively research topics in insurance and economic theories, starting from the work of Rothschild and Stiglitz (1976). Existence of adverse selection is important because it is one of the main justifications for public intervention in areas such as insurance markets. On the other hand, many researches on insurance markets have long emphasized on the importance of advantageous selection in insurance markets in recent years.

To test whether asymmetric information (adverse selection and moral hazard) exist in the real world; many empirical studies have used data from specific insurance markets. They mostly supported the idea of existence of asymmetric information and its effects on insurance market. Some other papers, however, have found no evidence of information asymmetry. Also to test the existence of advantageous selection in insurance market, many empirical studies have been done in various insurance markets. The results of these studies were the same as the results of testing of asymmetric information.

Asymmetric information has been a major concern for the modern economic models of insurance pioneered by Arrow (1963) and Pauly (1974). The classic equilibrium models developed by Rothschild and Stiglitz (1976) and Wilson (1977) assumed that potential insurance buyers have one-dimensional private information regarding their risk type. Based upon their suggestion, if the adverse selection problem exists in the insurance market and is settled on a separating equilibrium, then the high risk buyers will choose high coverage while the low risk buyers will choose low coverage.



Following Shavell (1979) many theoretical papers have shown that adverse selection and moral hazard are essential in the insurance market. On the basis of Shavell (1979) and Rothschild and Stiglitz (1976) it is generally believed that the occurrence of the risk and the choice of the coverage are positively correlated. On the other hand, Shavell (1979) showed that the insured with high coverage have less incentive to make efforts to avoid the risk.

A review of the theoretical and empirical literature on asymmetric information (especially adverse selection) and advantageous selection in health insurance market and others is provided in the following section.

### ***1.3.1. Empirical Works on Health Insurance Markets***

Many empirical papers have studied the existence of asymmetric information in health insurance markets. However the evidence on adverse selection in health insurance markets is contradictory.

#### ***1.3.1.1. Evidence of existence or non-existence of asymmetric information in health insurance***

Marquis and Phelps (1987) analyzed the data from a questionnaire regarding the hypothetical purchase of supplementary insurance and they found adverse selection in insurance market. Also Marquis (1992), in a study of data from the RAND Health Insurance experiment, observed that individuals who select more generous health insurance plans are more likely to have large health expenditures. This matches the empirical prediction of a positive correlation between risk type and insurance coverage under asymmetric information.

Cameron et al. (1988) reported adverse selection in an Australian sample. They tested for adverse selection by estimating health care demand and then performing

a Hausman specification test for the endogeneity of the insurance status. They identified a statistical dependence between the error terms in the insurance and the health care demand equations. This correlation suggests adverse selection or at least the presence of variables unobservable to the researcher that determine both insurance choice and health care consumption.

Wolfe and Goddeeris (1991) estimated a health care utilization equation using a longitudinal sample of individuals of more than 65 years old purchasing supplementary insurance (supplementing Medicare) in the Medigap market. They used self-reported health and self-reported expenditure measures the latter including total medical bills for hospital, physician and prescription expenditures, inclusive of any amount paid by insurance. They found that respondents, with better self-reported health more likely to purchase supplementary private insurance and also incurred higher expenditures on hospital stays, physician care and prescription drugs. They concluded that there is adverse selection in the Medigap market, but they judged it economically not significant.

Ettner (1997) using MCBS 1991, found the evidence of variation in the probability of purchasing private insurance by health status. She also observed that medicare beneficiaries with supplementary policies have higher total medicare and physician expenditures than those with employer-provided policies, even after controlling for observable differences. She interprets this as evidence of adverse selection under the assumption that selection in employer provided coverage is random.

Cardon and Hendel (2001) estimated a structural model of health insurance and health care choices using data on single individuals from the National Medical Expenditure Survey. In their structural model they assumed that individuals have

identical preferences. They explored that estimated price and income elasticities, as well as demographic differences, can explain the expenditure gap between the insured and the uninsured. Thus they judged the impact of adverse selection to be economically insignificant. Cardon and Hendel (2001) found no evidence of adverse selection in the U.S employer-provided health insurance market.

Buchmueller and DiNardo (2002) observed that community rating did not induce adverse selection by comparing the health insurance markets of three states: New York, Pennsylvania, and Connecticut. Since community rating is antithetical to risk rating, their results suggested that there might be other factors other than risk classification that can reduce adverse selection if there is adverse selection in the health markets.

Finkelstein and McGarry (2004) found that, in the Long Term Care Insurance (LTCI) market, the insurance companies' actuarial model generates a prediction that is more highly correlated with subsequent nursing home use than the individual's reported self-assessment. They concluded that the actuaries are more accurate, however, it is not relevant to the issue of asymmetric information; as long as the individual has residual private information conditional on the menu of choices offered by the insurance company, asymmetric information can operate in the insurance market as in the theoretical models. They then found that individual does have residual private information about his risk type. Regardless of what set of controls for insurance company risk classification or measurement of the individual's beliefs is used, these beliefs are positive and statistically significant predictors of subsequent nursing home utilization. These results represented a key finding of their paper: based on the insurance company's risk classification, individuals still have private information that predicts their subsequent nursing home use.

Liu (2005) tested asymmetric information using NAIC<sup>1</sup> InfoPro databases of Long Term Care Insurance Reports and Life and Health Reports. Actually he tested whether risk classification can effectively mitigate adverse selection in this market. Liu (2005) supplied evidences that risk classification on insurer's intention can effectively mitigate adverse selection. He also found that insurers in the Long Term Care Insurance (LTCI) market can correctly anticipate the ex-post claim costs, which means there is no asymmetric information (mainly adverse selection) in LTCI market.

Finkelstein and McGarry (2006) studied selection based on multi-dimensional private information in the long-term care (LTC) insurance market. Using the AHEAD data, they obtained a negative correlation between LTC coverage in 1995 and use of nursing home care in the period between 1995-2000. They showed that people who are more risk averse are both more likely to own LTC insurance and less likely to enter a nursing home-consistent with advantageous selection based on risk aversion. On the other hand, Finkelstein and McGarry (2006) found that subjective risk assessment is positively correlated with both LTC coverage and nursing home use in 1995-2000, this suggested the presence of adverse selection based on private information about risk type.

Olivella and Hernandez (2006) performed a test of adverse selection in the U.K, using the British Households Panel Survey. In England, private medical insurance is mostly used for hospitalizations. Their test compared the probabilities of hospitalization of employees who had received private medical insurance as a fringe benefit, and those who had bought it directly. Since the benefits offered by corporate policies are very similar to those offered by individually purchased

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<sup>1</sup>. National Association of Insurance Commissioners