Abstract:

About 60% of total premium of insurance industry is pertained to life policies in the world; while the life insurance total premium in Iran is less than 6% of total premium in insurance industry in 2008 (Sigma, No 3/2009).

Among the reasons that discourage the life insurance industry is the problem of adverse selection. Adverse selection theory describes a situation where the information asymmetry between policy holders and insurers leads the market to a situation that the policy holders claim losses that are higher than the average rate of loss of population used by the insurers to set their premiums (Rothschild and Stiglitz, 1976).We will examine the existence of adverse selection in Iranian Life Insurance Market.

Following the assessment of the effect of risk aversion on Life Insurance demand, we discuss the effect of psychological factors as well as economic factors such as the education, occupation, sex, age, income, wealth of household and other factors on life insurance demand

Key Words: Life Insurance, Risk aversion, Advantageous Selection, and Adverse Selection.

Chapter 1

Introduction to Risk Aversion and adverse selection

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; adverse selection has played an important role in economic theory. 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, 1979; and Relay, 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 , Adverse selection is potentially present in many markets .In this paper We will examine the existence of adverse selection in Iranian Life Insurance Market.

Rothschild and Stiglitz's (1976) research on adverse selection is a seminal article for numerous studies that have augmented or tested their theoretical predictions. Their model represents a competitive market for insurance, focusing on health insurance, in which there are two types of individuals: those who are at high risk of being sick and those who are at low risk, the identity of which remains unknown to insurance companies. When consumers are healthy, they pay out premiums to the insurance company and when they are sick, they receive payments from the insurance company. Regardless of health status, every consumer's optimal state of the world would be to have their expected incomes to be equal when they are healthy and when they are sick.

An important form of asymmetric information between consumers and insurers is adverse selection. Adverse selection occurs when there is an asymmetry of information in the insurance market. This asymmetry of information usually means that buyers have a higher knowledge of their

insurance risk than insurance sellers. This difference leads the insurance company to be uncertain of the probability of occurrence of the insured event that any particular customer faces. So, the type of policy will also have significant effect on the extent of adverse selection.

For example, we expect higher level of adverse selection in short-term life insurance policy than whole-life insurance. The Risk Aversion level of individuals has a considerable effect on their demand for life insurance. Investigation on buyer's behavior of life insurance plays a key role on the marketing and promoting the life insurance.

The extent of adverse selection is also affected by age, sex, income, wealth, occupation, current health status and the size of policy applied for. It seems that the extent of adverse selection declines over time as people can better guess their health situation for the next year than for many years later. The insurance companies try to calculate the premium on the basis of the expected loss of insured, but usually the insured's have more information about their risk compared to the insurance companies. Thus the insurance company cannot distinguish between the risk levels of individuals. Consequently, Companies offer only one type of contract to all.

In this Thesis, we will try to collect the data from the insured's (the individuals who bought insurance). These data will be collected through questionnaires. Investigating the questionnaires filled out by about 500 insureds (the individuals who bought insurance), and analyzing their characteristics, will result in assessing the existence of adverse selection.

1.2. Relevance and importance of the thesis subject:

The Risk Aversion level of individuals has a considerable effect on their demand for life insurance. Investigation on buyer's behavior of life

insurance plays a key role on the marketing and promoting the life insurance.

The insurance companies try to calculate the premium on the basis of the expected loss of insured, but usually the insureds have more information about their risk compared to the insurance companies. Thus the insurance company cannot distinguish between the risk levels of individuals. Consequently, Companies offer only one type of contract to all. So, if the customers of the insurance companies are low risk individuals (but, with high level of risk aversion) , obviously, lower reserves are needed to be held for compensating the losses imposed to the companies , so companies benefit from the situation and normally extra financial resources could be left for investment.

As a result, determining the Risk Aversion level of customers and existence of adverse selection or advantageous selection in the life insurance market leads to the life insurance companies' insightful considerations regarding their financial circumstances.

Shortly speaking, in this research we want to examine the effect of risk aversion on the demand for life insurance and show whether adverse selection exists in Iranian Life Insurance market or not.

1.3. Theoretical foundation(s) of the thesis:

Risk Aversion means a willingness to pay to eliminate risk. If it is assumed that the low-risk individuals are also sufficiently risk averse, they will value insurance so highly that it will be worthwhile for them to buy it even at a price higher than their actuarial fair rates (Mahdavi, 2006).

We pursue two main objectives in this research:

1. Determining the degree of correlation between Risk Aversion and the demand for life insurance.

2- Examining the existence of adverse selection or advantageous selection in Iranian life Insurance Market.

By applying Logistic Regression model and Dummy Variable Regression , we estimate the relationship between Risk Aversion and the parameters of the demand for life insurance . We will examine whether the independent variables of risk aversion parameters (x_i) have significant effect on the dependent variable Y_i (the demand for life insurance).

The null hypothesis of H_0: $\beta=0$ states that the risk aversion level of individuals doesn't have significant effect on the demand for life insurance.

We also will examine the existence of adverse selection or advantageous selection in Iranian Life Insurance Market. In fact, when the individuals with high level of risk aversion (in other words, low risk individuals) demand more of life insurance services than the individuals with high level of risks, the Advantageous Selection will occur in Insurance Market; reversely, when the high risk individuals demand more of life insurance services than the low risk individuals (in other words, individual with higher level of risk aversion), the Adverse Selection will occur in Life Insurance Market.

1.4. Main hypothesis of the thesis:

1-The demand for life insurance has a positive correlation with the level of risk aversion.

2- The Iranian life insurance market faces with advantageous selection situation.

1.5. What is the risk aversion?

The concept of risk aversion is one of the most important concepts in the theory of decision making under uncertainty. It seems that measuring the risk aversion level has an important role on the demand for life insurance. By simple explanation Risk Aversion is the inverse of risk tolerance. Risk averse is defined as the behavior of a trader to stay away from risky trading practices, even if those have high chances of profits. Risk averse traders prefer low risk, often low profitable, products to trade. Risk aversion is seen in trading of all products including stocks, bonds, funds, options, futures and currencies.

When trading, risk adverse traders often stick to government securities, index funds, low-risk currency pairs, long-term options, and stable price commodities and futures. Although seems simple and less followed, risk aversion is the major factor for major market changes.

Following risk aversion strategy only does not produce any major profit to traders. Many successful traders practice risk aversion strategy to trade in difficult market conditions, and as a portfolio diversification method. Risk aversion trading strategies are also good for novice traders. In fact a risk adverse investor prefers certainty to risk, and low risk to high risk (EMMETT G.VAGHAN, 1997).

1.6. Adverse selection theory

In insurance market, adverse selection results from the asymmetric information between the insured and insurers. The insureds are heterogeneous with respect to their expected loss and have more information than the insurance company, which is unable to differentiate between risk

types. Naturally, the high- risk individual has no incentive to reveal his true risk, which is costly to observe by the insurer.

Adverse selection occurs when there is an asymmetry of information in the insurance market. This asymmetry of information usually means that buyers have a higher knowledge of their insurance risk than insurance sellers. This difference leads the insurance company to be uncertain of the probability of occurrence of the insured event that any particular customer faces.The conventional theory of adverse selection contains the following assumptions:

(1) The difference in exposure to risk: People differ in the level of exogenously determined risk exposures. For simplicity, we consider that people 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: Adverse selection occurs when the individuals' beliefs about their mortality and their true rates are positively correlated. If not, there will not be a systematic difference between policyholders' and population's mortality rates and hence no adverse selection occur.

(3) No relationship between the level of risk aversion and riskiness: In other words, there's no way to claim whether high-risk individuals are less risk averse than low-risk individuals and vice versa.

(4) Customers know more about their riskiness than the insurers and efficiently use their information against the insurers (Mahdavi, 2006).

1.7. Advantageous selection theory

When the individuals with high level of risk aversion (in other words, low risk individuals) Demand more of life insurance services than the

individuals with high level of risks, the Advantageous Selection will occur in Insurance Market.

The theory of Advantageous selection contains the following assumptions:

1) The difference in exposure to risk.
2) Negative correlation between the level of risk aversion and riskiness.
3) Effectiveness of Precautionary Efforts.

The remainder of this thesis is organized as follows. Chapter 2 delivers the empirical literature. Chapter 3 describes the data and variables and logistic model. In Chapter 4 we perform the empirical analysis and explain the test in detail. Chapter 5 concludes. The definition of the variables, descriptive statistics and tables with estimation coefficients appear in Appendix.

Chapter 2

Literature Review

2. Literature Review

The concept of risk aversion is one of the most important concepts in the theory of decision making under uncertainty. It seems that measuring the risk aversion level has an important role on the demand for life insurance.

An important consequence of asymmetric information between consumers and insurers is adverse selection .There is substantial empirical literature examining adverse selection in insurance markets. However, there is conflicting evidence on the presence of adverse selection;

Despite this straightforward understanding from the conventional theory of insurance demand under asymmetric information, this theory is not supported by most of the empirical works. There are many empirical evidences that appear to conflict with the standard theory of adverse selection in insurance market.

The literature on topic can be categorized as following:

2.1. The literature on the problem of Asymmetric information:

One prominent source of information asymmetry in an insurance market is weak or nonexistent underwriting, which can lead to severe problems of adverse selection (high vs. low) when there is asymmetric information regarding risk types. Also it can arise if information asymmetry leads to problems of moral hazard (Arnott and Stiglitz, 1988).

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 levels of risk the amount of insurance purchased (Chiappori and Salanié, 2000).

Chiappori and Salanié provide a survey of existing empirical studies that have implemented this test for asymmetric information.

They show that when observationally identical individuals are offered a choice from the same menu of insurance contracts, higher risk individuals will buy more insurance. The intuition is straightforward.

Since, at a given price, the marginal utility of insurance is increasing in risk type, higher risk individuals will choose to purchase more insurance than lower risk individuals who face the same set of options. Of course, this prediction, and any empirical test based on it, applies conditional on the characteristics of the individual observed by the insurance company and used in setting insurance prices.

They define here our notation. Let i = 1, . . . , n denote individuals. The term X_i is the set of exogenous variables for individual i (these variables will be constants and dummy variables in their application).

Also, let w_i denote the number of days of 1989 in which individual i was insured. They now define two 0 and 1 endogenous variables:

y_i =1 if i bought (any form of) comprehensive coverage (a TR contract) ;

y_i =0 if i bought only the minimum legal coverage (an RC contract);

z_i =1 if i had at least one accident in which he was judged to be at fault; otherwise (no accident or i not at fault) it is zero.

These definitions call for two remarks. First, there are many different comprehensive coverage contracts on offer, with (say) different levels of deductible. Ideally, these contracts should be treated separately and not bundled together as we do here. However, this would greatly complicate the model. 15Second, we separate accidents in which the insured is at fault and those in which he is not. The reason is that if the insured has an accident in which another driver is to blame, any information on his risk type may not be conveyed.

Also, they do not exploit the further information linked to drivers who had several accidents in 1989; again, there are very few of these cases. They now set up two probit models, one for the choice of coverage and one for the occurrence of an accident. Let ε_i and η_i be two independent centered normal errors with unit variance. Then

$$y_i = 1(X_i\beta + \varepsilon_i > 0)$$

and

$$z_i = 1(X_i\gamma + \eta_i > 0).$$

They first estimate these two probits independently, weighing each individual by the number of days under insurance w_i. Then they can easily compute the generalized residuals $\acute{\varepsilon}_i$ and $\acute{\eta}_i$. For instance, $\acute{\varepsilon}_i$, is given by

$$\hat{\varepsilon_i} = E(\varepsilon_i|y_i) = \frac{\phi(X_i\beta).y_i}{\Phi(X_i\beta)} - (1 - y_i).\frac{\phi(X_i\beta)}{\Phi(X_i\beta)}$$

Where ϕ and Φ denote the density and the cumulative distribution function (cdf) of N(0, 1). Now define a test statistic by

$$W = \frac{(\sum W_i\varepsilon_i'\eta_i')^2}{\sum(W_i^2\varepsilon_i'^2\eta_i'^2)}$$

The general results in GouriCroux et al. (1987) imply that under the null of conditional independence Cov (ε_i, η_i) = 0, W is distributed asymptotically as a $\chi^2(1)$. This provides them with a test of the symmetric information assumption.

To implement this procedure, they first need to choose what exogenous variables to include in X_i. The most contentious variable here is the past driving record, as represented by the bonus/malus coefficient (defined above). If we exclude this variable, then we neglect some of the insurer's information and our test will be biased. If we include it, it may also be biased since this variable is likely to be correlated with η_i.

As indicated above, their solution is to focus in a first step on drivers who have no past driving record, or "beginners.

Their main finding is that, although unobserved heterogeneity on risk is probably very important, there is no correlation between unobservable riskiness and contract choice. In other words, when choosing their automobile insurance contracts, individuals behave as though they had no better knowledge of their risk than insurance companies. This interpretation is fully consistent with the view generally shared by French automobile insurers, namely that the information at the company's disposal is extremely rich and that, in most cases, the asymmetry, if any, is in favor of the company.

Feng Gao, Michael R. Powers, Jun Wang (2008) in their paper, Using data from China's individual health-insurance market, They studied the problem of information asymmetry. Their 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.

They 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.

They introduced a simple one-period theoretical model of the health-insurance market. Next, they described the data and methods to be used in the present study.

They extended 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 buyers in a health-insurance market type 1 and type 2 each with the same increasing and concave-downward utility function, U (.). Furthermore, let W_i , π_i ,M_i , and L_i denote, respectively, the initial wealth level, probability of illness, medical loss amount (given that illness occurs), and non-medical loss amount (given that illness occurs) for a buyer of type i .

They assumed 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 buyer, are Less likely to contract illnesses requiring medical treatment; likely to expend greater medical resources once they have contracted illnesses, and 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 policies, 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

$$E(U(\tilde{w}_i)) = \pi_i U\left(w_i - M_i - L_i + (A_i + B_i) - p_j(A_j + B_j)\right) + (1 - \pi_i)U\left(w_j - p_j(B_j + A_j)\right)$$
$$= \pi_i U\left(w_i - M_i - L_i + (1 - p_j)(B_j + A_j)\right) + (1 - \pi_i)U\left(w_i - p_j(B_j + A_j)\right)$$

over j. Then, under certain regularity conditions, 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 coverage – than low-risk buyers, but less insurance – in the sense of a lower medical-coverage policy limit.

Hence, the market possesses characteristics of both adverse and advantageous selection specifically; each buyer's and seller's equilibrium strategy is constrained to be a "best response" to those of the other buyers and sellers, as follows:

Condition (i) implies that each low-risk buyer prefers policy X to policy Y;

Condition (ii) implies that each high-risk buyer prefers policy Y to policy X;

Condition (iii) implies that no seller can tempt a low-risk buyer to move to any new policy for which the seller does not lose money; and

Condition (iv) implies that no seller can tempt a high-risk buyer to move to any new policy for which the seller does not lose money.

Condition (i) follows from the fact that $\pi_1 < \pi_2$ and $M_1 > M_2$ (i.e., a low-risk buyer invariably would prefer to pay the lower premium rate $P_X = \pi_1$ for M_1.

units of medical coverage than to pay the higher premium rate $P_Y = \pi_2$ for $M_2 < M_1$ units of medical coverage), whereas conditions (iii) and (iv)

follow from the well-known result that risk-averse buyers always purchase full coverage if it is available at an actuarially fair price.

Although condition (ii) is not always true, it is clearly satisfied for parameter values such that $M_1 / M_2 \geq \pi_2 / \pi_1$.

Although conceptually simple, their theoretical model is sufficiently rich to describe the mechanics of a health-insurance market characterized by both adverse selection and advantageous selection; Briefly, under the reasonable assumptions that wealthier buyers are less likely to contract illnesses requiring medical treatment, and more [less] likely to expend medical [non-medical] resources once they have contracted illnesses, the model shows that higher-risk (and therefore less-affluent) buyers tend to purchase less basic insurance coverage because of their lower medical loss amounts, but more additional coverage because of their greater nonmedical losses.

Thus, a buyer's level of wealth and loss amounts are important factors in determining insurance demand – even in the case of CARA – and so any unobservable heterogeneity of wealth and loss amounts among buyers can lead to both adverse selection and advantageous selection.

The existence of asymmetric information has a profound effect on the functioning of insurance markets, especially in developing economies (see Chen, Powers, and Qiu, 2008).However, relying solely on empirical analyses of relationships between risk level and insurance amount does not necessarily lead to correct conclusions.

In fact, when significant differences exist 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.

Their analysis of China's health-insurance market reveals that the limit of basic insurance purchased by buyers with more ex-post claims is lower, but that these same buyers tend to purchase additional insurance more frequently. This is explained very well by our theoretical model.

Thus, although the finding of advantageous selection appears to contradict the prediction of the standard model, their analysis is consistent with information asymmetry. While the full ramifications of the coexistence of advantageous and adverse selection are not clear, it seems unlikely that such markets can flourish over the long term. Therefore, from the perspective of market stability alone, China's domestic insurance companies should strengthen their abilities to gather and analyze underwriting information, and government regulators may be helpful in this effort.

An additional issue meriting government attention is the observation that less-affluent buyers have a higher probability of illness, while these same Individuals are less able to afford private insurance. This potential weakness in the private financing of health care may support the consideration of government subsidies.

2.2. The literature focusing on Risk Aversion:

Meza and Web (2001) in their paper stated that in addition to precautionary effect that explains the negative correlation between insurance demand and risk level, heterogeneous optimism also supports this negative correlation: high risks are more optimistic about the events to be improbable, so they purchase less insurance.

They offer two justifications for the positive correlation between insurance purchase and precautionary activity. The first follows from

heterogeneous Wealth and lays the foundation for the particular form of heterogeneous tastes that constitutes our second justification.

Suppose, first, that everyone has the same opportunity to lower the probability of a given financial loss through undertaking preventative effort. In the two-state case, the expected utility of an insured individual i is

$$EU_i(F_i, y_i, \lambda_i, w_i) = P(F_i)U(w_i - y) + \big(1 - P(F_i)\big)U(w_i - D + \lambda_i) - F_i \qquad (1)$$

Where W_i is the person's wealth, D is the gross loss, y is the insurance premium, and λ_y , $\lambda > 0$, is the net of premium payout in the event of loss.

F_i is a binary-choice variable that affects the probability of loss in the same way for all individuals. If Fi = 0, the probability of avoiding the loss p (F_i) is P_0, but if $F_i = F^-$, the probability rises to P_F .

The wealth-dependent part of the utility function exhibits decreasing absolute risk aversion. This standard assumption implies that the marginal rate of substitution between y and λ_y falls with wealth. Given the magnitude and probability of loss, lower insurance coverage is therefore chosen by wealthier individuals. The increase in expected utility from taking precautions is

$$\Delta_i = (P_F - P_o)\Big(U(w_i - y) - U\big(w_i - D - \lambda_y\big)\Big) - F_o \qquad (2)$$

It follows from decreasing absolute risk aversion that if insurance coverage is partial, ($D - \lambda_y > y$), then $\partial\Delta_i / \partial W_i < 0$.

According to this formulation, there may be a wealth threshold above which Precautions are not taken. Moreover, if administrative costs or other reasons lead to high loading factors, wealthy individuals may prefer to be

uninsured. Now consider a reinterpretation involving differences in preferences.

Intuitively, more timid types may lower their risk exposure through increased insurance purchase and greater precautionary effort. However, the concept of a pure change in risk aversion is ambiguous; changing the curvature of the utility function alters its height almost everywhere, and the issue is; where should the pivot occur?

In general, results are ambiguous, but suppose that the utility function of individual i is $U_i = U(\alpha_i + W) - F_i$, where α_i is an individual-specific parameter making taste differences formally equivalent to wealth differences.

In what follows they analyze market equilibrium in the heterogeneous taste formulation. Similar results apply for the heterogeneous wealth case.

Assume two types of individual, T and B, both equally wealthy. Bs have a high and so exhibit "bold" behavior, while Ts are more "timid," reflecting a low a.

For simplicity, but without affecting the qualitative results, we now suppose the special case that at sufficiently high $\alpha + W$, the utility function becomes linear and Bs are in this zone of risk-neutrality with respect to income. In the relevant range, the utility functions are

$$EU_i(F_i, y_i, R_i, w) = P(F_i)U_i(w - y) + (1 - P(F_i))U_i(w - D - S_y) - F_i \quad , \; i = T.B \quad (3)$$

Where U_B is linear and U_T is strictly concave and $W - y > W - D + \lambda y$ are the wealth levels in the good and bad states.6 given the formulation in (3), the gain in expected utility from taking precautions is