CHAPTER 5

RESULTS AND ANALYSIS

5.1 Introduction

The results of the analysis from the tests outlined in Chapter 4 will be presented here.

5.2 Data Description

The variables which are used in the regression analysis in TABLE 5a is first described in this section. We report the mean values of the variables with the standard deviations in parentheses.

We conclude that the mean statistics for the variables across deductible levels suggest evidence of the hypothesized relationships in the model of insurance market. For instance, the table indicates that the loss frequency increases as the deductibles decline. The loss frequency is calculated as the number of losses divided by the number of exposures (Puelz and Snow, 1994). Besides that, it also exhibits the same trend for the age of individual insured, the older insured more likely to choose a higher deductible compare to the younger insured.

	D = RM 100 – 250	D_1 = RM 251- 500	D_2 = >RM 500
Number of exposures	103	150	92
Number of incurring a loss or claim	20	25	14
Loss frequency	0.1942	0.1667	0.1522
Mean age of automobile	5.41 (3.66)	4.67 (2.98)	5.41 (3.20)
Mean age of individual insured	33.35 (8.62)	36.09 (10.61)	43.51 (9.85)
Mean of cubic capacity	1258.91 (509.76)	1656.57 (410.86)	2492.04 (521.66)

TABLE 5a Summary Statistics for Variables Used In The Model

5.3 Testing For Separation

In this section, we test the hypothesis that equilibrium in the insurance market entails low-risk customers choosing insurance policies with higher deductibles. We would like to consider first the result of the demand function for deductibles, particularly with regard to the effect of risk type on the choice of deductible. The TABLE 5b presents the result of the model 5. The model 5 provides necessary input for model 1 which is why it is discussed first.

Our result shows that the RT variable is statistically significant at five percent level as reported in the TABLE 5b. It means that there is strong relationship between risk type and deductible choice. We conclude that the Malaysian automobile insurance market is in separating equilibrium where high-risk customers or those who filed a claim have an incentive to select the insurance policy with lower deductible. However, low-risk customers or those who have never incurred the loss are more likely to select a higher deductible insurance policy.

These findings are consistent with the market signaling theories developed by Rothschild and Stiglitz (1976), Riley (1979,1985), and Cho and Kreps (1987). They proposed that equilibrium in markets with adverse selection entail separating and occurrence of signaling is possible as through the choice of deductible. It also supports the alternative theories of adverse selection, which suggested by Puelz and Snow (1994) that automobile insurance market entails a separating, adverse selection equilibrium and market signaling. However, our findings are inconsistent with theories of a pooling equilibrium that predicted by Wilson (1977), Grossman (1979), and Hellwig (1987).

A separating equilibrium is important in the insurance market with asymmetric information. This is because the separation of the two insurance contracts to the different types of customers will help insurer to obtain greater expected profits than if only one insurance contract was offered. Therefore, in the Malaysian

automobile insurance market, it is better for insurer to offer several possible insurance contracts and every customer freely chooses the one he most prefers under such situation. To quote, "I have these schedules, one for each of the possible types you can be. So, tell me which is your type, and I will give you your corresponding contract." (Macho-Stadler and Pérez-Castrillo, 1997) However, these possible contracts must be correctly designed and each type of customers must select the contract designed for him. Moreover, it is must be such that each customer obtains greater utility by truthfully revealing his type than by deceiving the insurer. Undoubtedly, the insurance market will perform well if all these conditions are satisfied where the customers choose their most preferred insurance contracts which suit with their behavioural types and the insurer also gains more profits.

In conclusion, we find evidence that the Malaysian automobile insurance market entails separation by risk types in adverse selection equilibrium.

Dependent Variable: $\overline{D}$			
Variable	**Coefficient**		**z- statistic**
RT	-0.1269		-2.71*
Male	0.7283		3.26*
Limit Points			
LIMIT_ 1: C(3)	-0.3819	0.1951	-1.95
LIMIT_ 2: C(4)	1.5319	7.1989	7.19
Akaike info criterion	2.142	Probability(LR stat)	0.004
Log likelihood	-365.529	Schwarz criterion	2.187
Restr. log likelihood	-371.046	Hannan-Quinn criter.	2.159
LR statistic (2 df)	11.034	Avg. log likelihood	-1.059
LR index (Pseudo-R2)	0.015		

* Significant at 5% level

TABLE 5b Results of The Model 5

5.4 Testing For Nonlinearity of The Premium-Deductible Schedule

The hypothesis which need to be tested in this section is that insurers offering nonlinear pricing of insurance coverage in the market. Firstly, we would like to analyze the regression results for model 1. Then we calculate the marginal effect on premium with respect to the deductible choice by applying the information from the model.

Our analysis commenced with the testing of the overall ability of the explanatory variables, that is to explain the dependent variable in the model. This was done by referring to the statistical tests, such as the test of goodness of fit (R^2), and test of the overall significance of regression (F-statistics). The empirical finding for the premium-deductible schedule in model 1 shows goodness of fit of 0.5551 as reported in the TABLE 5c. In other words, 55.51% of the variation of gross premium is determined by the explanatory variables in the model. This value is considered high for cross-sectional data. Based on empirical observation, in cross-sectional data involving several observations, one generally obtains low R^2 because of the diversity of the cross-sectional units.[22]

The F value in the table is 52.4033, which is a measure of significance of the overall significance of the estimated regression, is also a test of significance of R^2.[23] This value is very high. So, at five percent level, clearly this F value is statistically significant. Therefore, the explanatory variables have impact on the dependent variable that is gross premium.

A priori, the gross premium is expected to be negative relation to the age of insured and automobile and positively related to gender dummy. Based on TABLE 5c, it shows that these variables have the expected signs in the model.

[22] Gujarati, Damador N.(2003), "Basic Econometrics", Fourth Edition, The McGraw-Hill Companies Inc. p.260

[23] Gujarati, Damador N.(2003), "Basic Econometrics", Fourth Edition, The McGraw-Hill Companies Inc. p.258

The perage variable is showing the correct sign as expected, although it is not statistically significant at five percent level. The negative value indicates that on average, the premium of insurance decrease if the age of insured and automobile increase, with holding all other variables constant. If the age of insured increase by one year, the premium charge will decrease by RM0.70 since the older driver becomes more experienced in driving than the younger driver. In addition, the older driver is more careful in driving compared to the young driver.

The positive sign for gender dummy is the correct sign as expected. However, it is insignificant at five percent level. The coefficient of Male is quite high which suggests that holding all the other variables constant, on average, the premium charged on male insured is higher than their female counterparts by about RM70.60. This is because the probability of accident for male driver is higher than female driver due to their driving attitudes such as impatient, careless and so on.

Although the age variable is not statistically significant at five percent level, but it has the correct sign as expected. Likewise, the negative coefficient of -128.30 indicates that, if the age of automobile increases one year, the premium charged will decrease by RM128.30 on the average with holding others variables are constant. This is due to when the automobile is getting older, its engine functioning being weakens and driving speed also being slower, thus the probability of accident will be reduced in this sense.

The explanatory variable, cubic is highly significant at five percent level in affecting the gross premium. The positive sign and the coefficient of 0.77 implies that one unit increase in cubic capacity of automobile, on the average the premium will increase by RM0.77 with holding all the variables are constant, or ceteris paribus. It shows that the higher cubic capacity, the higher performance and powerful of automobile, which is preferred by the younger driver, as example: sport car. Therefore, it increases indirectly the probability of accident.

Theoretically, there is negative relationship between premium and deductible. Thus, the signs for deductible variables should be negative in this regression. As expected, both D_1 and D_2 have correct signs. On average, by choosing a higher deductible, namely D_1 and D_2, the premium of insurance coverage will be less than for those who choose a lower deductible. For instance, for those who choose RM251-500 deductible, the premium is lower by about RM293.66 compare with the benchmark category, RM100-250 deductible. Likewise, the premium is lower by about RM121.09 for those who select more than RM500 deductible.

However, the CD_1 and CD_2 interaction variables serve as control variables in the model.

Dependent Variable: P			
Variable	**Coefficient**	**Standard Error**	**t- statistic**
Constant	569.71	421.17	1.35
Perage	-0.70	7.72	-0.09
Male	70.60	163.29	0.43
Age	-128.30	26.06	-4.92
Cubic	0.77	0.28	2.72*
D_1	-293.66	586.55	-0.50
D_2	-121.09	775.56	-0.16
CD_1	0.31	0.38	0.83
CD_2	1.02	0.38	2.68*
R-squared	0.5551	Akaike Info Criterion	17.2580
Adjusted R-squared	0.5445	Schwarz Criterion	17.3583
F-statistic	52.4033	Prob(F-statistic)	0.0000*

* Significant at 5% level

TABLE 5c Regression Results of The Model 1

Our data supports the theory that predict separation by risk type in adverse selection equilibrium in section 5.3, in which the low-risk customers have an incentive to choose higher deductibles. However, this finding is not enough to show they are effectively signal to insurers. Therefore, we are interested in testing for

nonlinear pricing of insurance coverage with respect to deductible choice in order to prove that low-risk customers can effectively signal their risk types to insurers.

The regression results of the model 1 enable us to calculate the values for *B1*, *B2* and *B3* in order to demonstrate that the insurers offer nonlinear pricing for insurance coverage. The estimated values for *B1* and *B2* at sample mean are 258.6511 and 1676.8797 respectively. It indicates that the slope of the premium-deductible schedule increase when one changes from the choice of RM213.5922 in deductibles to RM383.5333 in deductibles. However, the increasing rate is faster when one moves from the RM213.5922 deductible to RM1349.4565 deductible. The value for *B3* is 1926.3978, which measures the change in the marginal premium when one moves from the RM383.5333 deductible to RM1349.4565 deductible.

In conclusion, the insurers offer a nonlinear pricing system since the value for *B3* is different from *B1* and FIGURE 5a shows a nonlinear premium-deductible schedule. In other words, an average premium for insurance coverage charged by insurers varies with the selected deductible and there is market signaling in Malaysian automobile insurance market. This result is consistent with the study carried out by Puelz and Snow (1994), they found evidence of a nonlinear premium-deductible schedule in automobile collision insurance market in Georgia. Besides that, our results also support the market signaling theories developed by Rothschild and Stiglitz (1976), Riley (1979,1985) and Cho and Kreps (1987) which propose that

equilibrium in markets with adverse selection in which signaling of hidden knowledge is possible, as through the choice of deductible, entail separating equilibrium and nonlinear pricing. However, our result is inconsistent with the theories proposed by Pauly (1974) and Schmalensee (1984), with regard to the linear pricing equilibrium in which insurers engage in pure price competition.

On the other hand, the results also show a positive relation between the changes in the premium of insurance coverage with respect to deductible choice. This reflects that low-risk customers have to pay for higher premium when choosing insurance contracts with higher deductible. Hence, the low-risk customers are not compensated by insurers as predicted by market signaling theory by paying lower premium for insurance at lower level of coverage when they purchase the higher deductible insurance policies. Clearly, the insurers in the Malaysian automobile insurance market engage in the nonlinear pricing equilibrium and there is market signaling with cross-subsidization of high-risk customers by low-risk customers. This result supports theory of signaling with cross-subsidization as proposed by Miyazaki (1977).

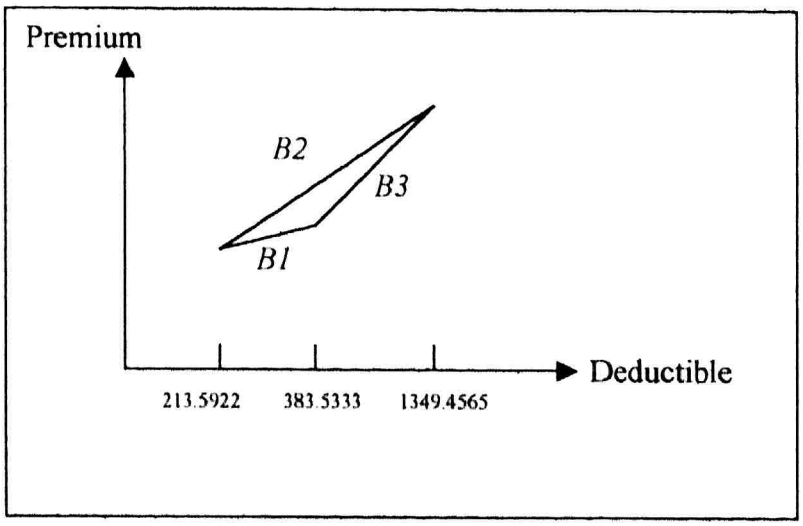

FIGURE 5a Nonlinear Premium-Deductible Schedule

5.5 Summary of Main Findings

The main findings are illustrated in the form of flow chart in FIGURE 5b.

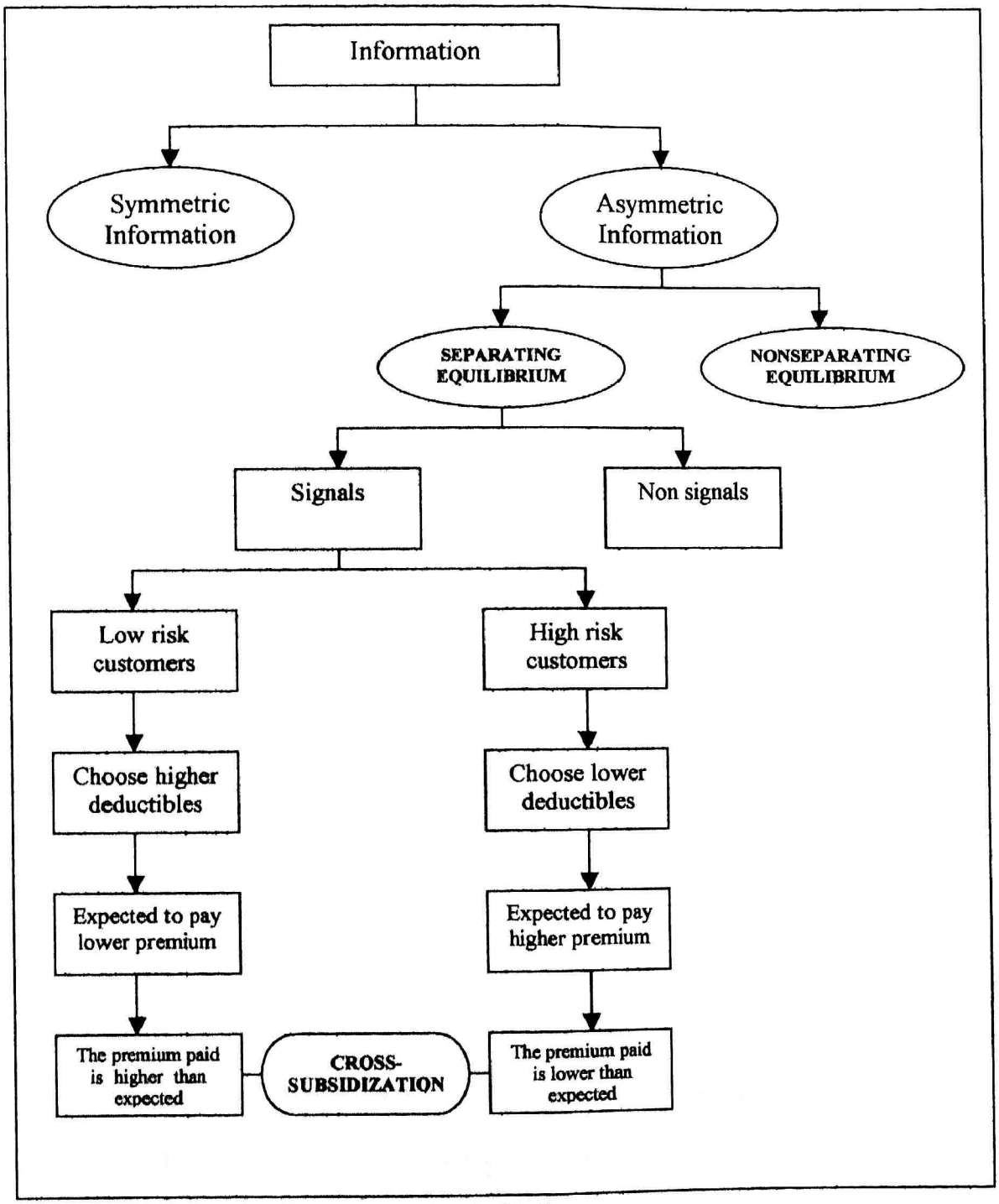

FIGURE 5b Flow Chart: Summary of Main Findings

Generally, the Malaysian automobile insurance market is also facing the problem of adverse selection that occurs in many insurance markets all over the world especially when there is inequality in distribution of information in the markets.

Initially, we consider that there are only two types of customer, characterized by their probability of suffering an accident. Those customers with a low probability of accident will categorize into low-risk group because their claims frequency is low and size of claim is also small. Inversely, high-risk group constitutes those with high probability of accident as they have a higher claim frequency compare to the low-risk group.

Since there is asymmetric information in the insurance market, the insurer is unable to distinguish between the low-risk and high-risk customers. Therefore, it offers the premium-deductible schedule to encourage the customers to select themselves and reveal their own risk types. Our data reveal that the low-risk customers are willing to choose a larger deductible to convey information on their low probability of serious accidents. They want to signal they are good drivers to insurer. However, the high-risk customers prefer lower deductibles. They have no incentives to signal their quality to insurer. Thus, in this sense, the information is generated endogenously by the self-selection mechanism.

Therefore, we conclude that the Malaysian automobile insurance market entails separating, adverse selection equilibrium in each type of contract breaks even individually. The equilibrium implies that different types purchase different insurance policies. It means that the customers' choices of deductibles are significantly affected by their risk types: low-risk customers purchase large deductible insurance policies while high-risk customers purchase low deductible insurance policies.

According to the prediction of market signaling theories, the low-risk customers who choose higher deductibles are expected to pay the lower premium, whereas the high-risk customers are expected to pay the higher premium because they choose lower deductibles. However, in the Malaysian automobile insurance market, the equilibrium with adverse selection does not satisfy this monotonic signaling property. In reality, the actual premium paid by low-risk customers are higher than the expected premium, whereas the actual premium paid by high-risk customers are lower than the expected premium.

Why has this been observed in the Malaysian automobile insurance market?

It is very interesting to find that there is the cross-subsidization of high-risk by low-risk occurs in the Malaysian automobile insurance market. This is due to the fact that all general insurance companies in Malaysia which are the members of PIAM need to follow a standard rating structure known as tariff, which is devised by PIAM

and approved by the Central Bank of Malaysia in order to price their insurance policies. According to Section 144 of the Insurance Act 1996, no licensed general insurer or association of licensed general insurers shall adopt a tariff or premium rates, except with the prior written approval of the Central Bank of Malaysia (Kamaruzaman, 2001). Therefore, the insurer has no right to set its own price of insurance coverage under the restriction of regulation.

From the regulators' perspectives, in price regulated markets, insurance policies tend to be standardized; it is often as much for the convenience of regulators as it is to assist customer choice. Besides that, in the Malaysian automobile insurance, in particularly, it is very easy to obtain premium quotations over the telephone for a set of standardized policies differing primarily by the limits on damages chosen, and this low search cost doubtless contributes to efficient performance of insurance market.