Modeling Premium Growth in the Malaysian Motor Insurance Industry

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ABSTRACT

The motor insurance industry came into the limelight since the enforcement of mandatory motor insurance coverage in 1959 This paper uses a modeling technique to ascertain the various components and parameters that affect the change in premiums received by the entire industry, or a segment of it. Once these components & parameters are identified, the actual growth of new premiums can be derived by extrapolating the components and parameters in one or more expressions (or commonly referred to as a formula). These expressions could be useful in forecasting the future market dynamics of the motor insurance industry.

ABSTRAK

Industri insurans motor telah menjadi perhatian ramai sejak insurans motor diwajibkan kepada pengguna-pengguna jalan raya dalam tahun 1959 Kertas kerja ini merupakan kajian menggunakan teknik pemodelan untuk menentukan komponen dan parameter yang memberi kesan ke atas perubahan jumlah premium yang diterima oleh keseluruhan industri insurans motor atau sesuatu segmen darinya. Setelah komponen dan parameter ini dikenalpasti, pertumbuhan premium baru yang sebenar boleh didapati dengan mengekstrapolasi komponen & parameter ke dalam ungkapan (juga dirujuk sebagai formula). Ungkapan ini amat berguna bagi meramalkan pasaran dinamik bagi industri ini di masa depan.

INTRODUCTION

The motor insurance industry in Malaysia is at a crossroad, facing a myriad of problems. The problems facing the motor insurance industry are deep and complicated. The seriousness of the problem can be seen from the claim ratios for motor insurance policies for the past three years, which stood at 144.0%, 198.6% and 173.11% for 1989, 1990, and 1991, respectively. Many factors are suggested for the root causes of these problems. Among others, fraud and an antiquated system of premium structure for motor insurances are

identified as the major causes (Fong 1990; Peng 1992). With the vehicle population growing at double digit rates in recent years, the current crisis is expected to worsen if appropriate remedies are not taken.

The Road Traffic Act 1958 requires all vehicles using the public roads be protected under the motor insurance coverage. According to Gibson (1990), motor insurance has always been considered as a "grudge purchase" because of its mandatory law Arising from this feelings, community criticism is not uncommon whenever there is an increase in premium or deterioration in standard of service expected from the insurance industry

An owner of a vehicle is required by law to have at minimum, the "Act Only" coverage. It gives protection to the insured against claims involving bodily injuries to a third party, arising from the use of the insured's vehicle. Other types of motor policies available in market are:
1. Third party policy
2. Third party, fire & theft policy
3. Comprehensive policy
The third party policy covers bodily injury and property damage of a third party On the other hand, the third party, fire & theft policy not only provides third party protection but also safeguards against losses due to fire and theft to the insured's vehicle. The comprehensive policy offers a far wider scope of protection, including bodily injuries, among others, to the insured.

This paper is a preliminary study undertaken by the authors on the market dynamics of insurance industry in Malaysia. In this paper, we are concerned with finding a technique for estimating the various components of change in the total premium received by the industry, or by a segment of the industry These components include new premium caused by new vehicles, provision for no claim discount for existing vehicles, complete loss of vehicles, and for a segment of the industry, the flow of premium from other segments of the industry due to customer switching. Understanding the behavior of the various components and interaction among them are important for the study of the market dynamics of the industry

While it is true that these changes may be obtained by data collection, such approach may be impractical or too costly Currently, the data available are in the form of aggregates, where the components are not separated. Thus, modeling seems to be the only viable approach for studying these components of change.

This paper is organised as follows. In the next section, the expressions relating the various components that effect the change in total insurance premium are presented. This is followed by the techniques used for estimating the parameters in the expressions. Finally, we apply this approach to the data for 1986-1991 and discuss the results.

MODELING PREMIUM GROWTH

To study the changes in total premium for the entire industry, or a segment of the industry, it is necessary to identify the different components in the system that affect these changes. Historical data for these components of change may not be readily available, and are sometimes too costly to be maintained. A theoretical framework to obtain estimates of some of the components is thus useful.

ANNUAL CHANGE IN TOTAL PREMIUM FOR THE INDUSTRY

The main increase in premium for the *entire* industry is caused by the increase in new vehicles that require insurance coverage. Two factors are causing the reduction of total premium for the industry, namely, the *complete* loss of some of the insured vehicles and the provision for No Claim Discounts (NCD's) for existing insured vehicles. The NCD's are structured according to four categories of vehicles: (1) private cars, (2) commercial cars, (3) motorcycles, and (4) motor trades. The NCD structures for the various categories are given in Table 1. As can be seen from the table, the rates of discount are quite high. Therefore, the NCD's are the major causes of premium reduction. Note that the premium may also increase when the insureds who currently enjoy NCD's made claims.

TABLE 1. NCD structures

Number of consecutive preceding years no claims were made	(1) Private cars	(2) Commercial cars	(3) Motor-cycles	(4) Motor trades
One	25%	15%	15%	25%
Two	30%	20%	20%	30%
Three	38.5%	25%	25%	38.5%
Four	45.0%	25%	25%	38.5%
Five or more	55.0%	25%	25%	38.5%

To illustrate how the No Claim Discount works, suppose the premium for a policy is A_0 and NCD rate for year one is x_1. The premium in year one, say A_1, will therefore be $(1-x_1)A_0$. In the following year, if no claims were made, the insured is entitled to a discount rate of x_2. Therefore, the premium for year two is given by

$$A_2 = (1 - x_2)A_0 = \frac{(1 - x_2)}{(1 - x_1)} A_1 \tag{1}$$

The reduction in premium is thus given by

$$A_1 - \frac{(1 - x_2)}{(1 - x_1)} A_1 = \frac{(x_2 - x_1)}{(1 - x_1)} A_1$$

However, if a claim is made, then the premium in the following year will be

$$A_2 = A_0 = \frac{1}{(1 - x_1)} A_1 \tag{2}$$

Therefore, the premium increases by $\dfrac{x_1}{(1 - x_1)} A_1$. In general,

the premium decreases in year i by $\dfrac{(x_i - x_{i-1})}{(1 - x_{i-1})} A_{i-1}$ if no claims

are made, and increases by $\dfrac{x_{i-1}}{(1 - x_{i-1})} A_{i-1}$ if claims are made.

Let A^t denote the total annual premium for the industry in year t with an annual new premium growth rate of α^t. Let τ^t be annual premium decline rate caused by total loss of vehicles for the industry in year t. Furthermore, let $\beta^t(k, x_i)$ be the proportion of the total premium in year t for vehicles of category k that are allowed NCD rate x and θ_k be the proportion of the total premium originated from vehicle of category k. Denote the probability that an insured in category k making a claim by p_k. We can then relate the total annual premium in year t for the entire industry with the total premium for year t-1, as follows:

$$A^t = (1 + \alpha^{t-1} - \tau^{t-1} - \sum_{k=1}^{4} \theta_k \sum_{j} \frac{x_j - x_{j-1}}{1 - x_{j-1}} (1 - p_k)\beta^{t-1}(k, x_{j-1}) +$$

$$\sum_{k=1}^{4} \theta_k \sum_{j} \frac{x_j}{(1 - x_j)} p_k \beta^{t-1}(k, x_j) A^{t-1} \tag{3}$$

where $x_j > x_{j-1}$ are the NCD rates.

ANNUAL CHANGE IN TOTAL PREMIUM FOR A SEGMENT OF THE INDUSTRY

Let P_i^t be the total annual premium for segment i of the industry in year t, where a segment may consist of one or more company. The annual change

in premium for segment ı of the industry can be expressed as

$$A_1^t = (1 + a_i \alpha_1^{t-1} + \delta_1^{t-1} - b_1 \tau^{t-1} -$$

$$\sum_{k=1}^{4} \theta_k \sum_j \frac{x_j - x_{j-1}}{1 - x_{j-1}} (1 - p_k) \beta^{t-1}(k, x_{j-1}) + \sum_{k=1}^{4} \theta_k \sum_j \frac{x_j}{(1 - x_j)} p_k$$

$$\beta^{t-1}(k, x_j) A_1^{t-1} \tag{4}$$

where a_i is the portion of the industry's total new premium that is captured by segment ı, and b_i is the portion of the industry's reduction in total premium due to loss vehicles covered by segment ı. An important parameter in expression (4) is δ_i^t, which is the portion of the premium for segment ı that is gained from other companies not in segment ı, less the portion of the total premium that is lost to other companies not in segment ı. A positive δ_i^t thus indicates that there are more premiums flowing into segment ı than flowing out, and vice-versa. Therefore, δ_i^t is a measure of effectiveness of segment ı in enhancing its share of the premium. The parameters p_k, $\beta_i^t(k,x)$ and θ_k are interpreted similarly as their counterparts in expression (3).

Note that expressions (3) and (4) may be adjusted for inflation. However, this is not considered in this paper.

PARAMETER ESTIMATIONS

Expressions (3) and (4) provide us with a framework to examine in more detail each individual component in the change of premium. Rather than viewing the total premium in an aggregate form, we can now look at the interactive effects of the components.

While in theory all the parameters in expressions (3) and (4) can be obtained through data collection, the process may be costly and impractical. For the purpose of our analysis, some of the parameters have to be estimated through theoretical means.

### ESTIMATING θ_K, THE PORTION OF PREMIUM ORIGINATED FROM VEHICLE OF CATEGORY K

The proportion of the premium for year t contributed by policies for vehicles of category k, θ_k, can be estimated using the proportion of registered vehicles for that category recorded by the Road Safety Council 1991. The percentage of premium obtained from motor trade and motorcycles are very small compared to private cars and commercial vehicles (MII 1988) and are

therefore omitted from the study. Since the total registered vehicles is a cumulative sum of all existing vehicles, the proportions vary very little from year to year. In this study, we take the average for the years under studied, that is 1986-1991. The ratio of private cars to commercial cars is found to be 4.25:1. With the *average premium* of a commercial policy estimated as 1.75 that of the average premium for a private car policy, we estimate θ_1 and θ_2 to be 0.71 (or 71%) and 0.29 (or 29%), respectively.

PROPORTION OF NCD

For each category of vehicles, the proportion of the premium eligible for various rates of discount, $\beta^i(k,x)$ and $\beta_i^i(k,x)$ can be estimated by modeling with a Markov process (Ross 1985). Since motor trades and motorcycles are omitted, only the proportions for private cars and commercial vehicles are estimated. The different NCD rates are the states in the Markov process. If a policy has no discount for a year but is eligible for a 25% discount the following year, it is said to have made a *transition* from the "0%-state" to the "25%-state", and so on. The transition diagrams for the Markov process representing the two types of ACT coverage are depicted in Figure 1.
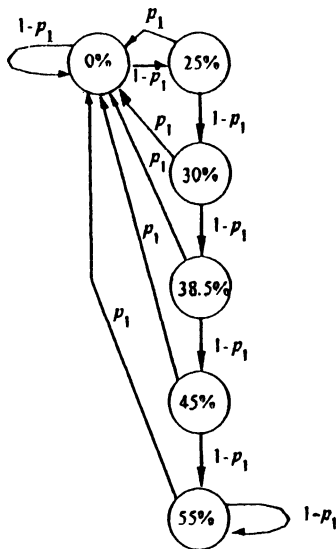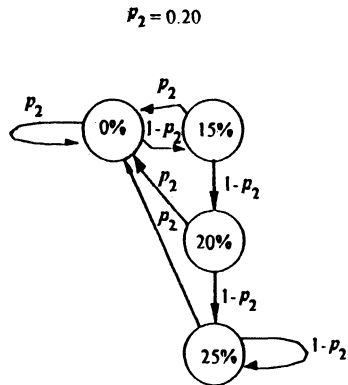

FIGURE 1. Transition Diagrams

In equilibrium, the *steady-state prababilities* represent the expected proportion of the premium that are eligible for various rates of discount. To obtain these probabilities, the transition probabilities (p_1 and p_2 in Figure 1) need to be estimated. Assuming that accidents reported and recorded by the Traffic Safety Council will result in claims, we then can use the reported accident rates as estimates for the probabilities that a claim is made. Since a policy will not receive any discount if a claim is made, therefore p_1 and p_2 can be estimated with the *accident rate* for private and commercial vehicles, respectively

Based on the report issued by the Traffic Safety Council, the accident rates for the years 1986-1991 are quite stable. Therefore, the average accident rates are used, where $p_1 = 0.044$ and $p_2 = 0.20$ (Traffic Safety Council). Using these values, the steady-states probabilities for the Markov process can be obtained (Ross 1985) for each discount rate. Based on the Markov process, the estimates for $\beta^t(k,x)$ and $\beta_i^t(k,x)$ are given in Table 2. Since these values are the state probabilities in *equilibrium*, therefore they are the same for every year. These proportions are also assumed to be the same for the entire industry and for any segment of the industry

TABLE 2. $\beta^t(k,x)$ and $\beta_i^t(k,x)$

(a) Private Cars

Rates of Discount	0	25%	30%	38.5%	45%	55%
Proportion	0.044	0.042	0.040	0.038	0.036	0.80

(b) Commercial Vehicles

Rates of Discount	0%	15%	20%	25%
Proportion	0.02	0.16	0.13	0.51

FINDINGS AND DISCUSSION

Over the years 1986-1991, there are 51-56 insurance companies of different sizes operating in Malaysia, offering ACT policy as one of their products. Distribution of the premium among these companies is shown in Table 3.

As can be seen from Table 3, the motor insurance market is increasingly dominated by a few larger companies. In fact, the combined market shares of the three largest (in term of total premium received in 1991) companies in

TABLE 3. Distribution of premium among companies

Companies with share of premium	1986	1987	1988	1989	1990	1991
Above 20%	0	0	0	0	1	1
Above 10% but less than 20%	0	0	1	3	1	2
Above 5% but less than 10%	7	7	7	4	5	3
Above 1% but less than 5%	17	15	12	8	5	5
Less than 1%	31	32	36	40	39	41
Total	55	54	55	55	51	52

Sources: Compiled from Director General of Insurance (DGI) Report,
     Bank Negara Malaysia, 1986-1991

ACT policies increases from 16.86% in 1986 to 57.92% in 1991. The decline in the number of companies with market shares between 1-10% is accompanied by the increase in small companies with very small share (less than 1%) of the total premium.

GROWTH IN NEW PREMIUM

As noted before, the net change in the total annual premium is affected by several components of change. If we omit the component of total loss vehicles, then the actual growth of new premium for the entire industry can be obtained by using expression (3). The percentage growth in the total premium adjusted for the NCD for years 1985-1991 are shown in Table 4. Overall, the adjusted growth in premium after adjusted for NCD's is about 3% higher than the net change in premium.

TABLE 4. Growth in total premium for the industry

Total gross premium for 1985 = MR 119.70 Million

	1986	1987	1988	1989	1990	1991
Net change (%) in annual premium	0.04	0.08	0.00	0.00	0.30	0.21
Actual annual growth (%) adjusted for NCD	0.07	0.11	0.03	0.03	0.33	0.24

PREMIUM GROWTH FOR A SEGMENT

The estimate for the growth in new premium is used in expression (4) for modeling the change in premium for a segment of the industry. Since we assume that all companies will have the same proportion of the various NCD's, the share of the total premium attributed to segment i in year t can be used as an estimate for a_i and the share of the new premium belonging to segment i can then be calculated. Again, if we omit the component of total loss vehicles, then the net flow of premium into segment i can be found. The net flow of premium into segment i indicates the competitiveness of the segment. A positive net flow represents the gain in market share. Non-zero flow suggests that the market is not static. On the contrary, it indicates an active switching of customers from one segment of the industry to another.

For example, let's divide the industry into two segments; one with companies constituted in Malaysia and the other with companies constituted outside Malaysia. From 1987 onwards, no company that is originally constituted in Malaysia has been reconstituted in Malaysia. However, out of the six companies offering ACT coverage in 1987, only four continue to offer ACT coverage in 1991. The remaining two have withdrawn from this sector of the industry. Table 5 shows the net flow of premium expressed as percentages of the total premium received by the segment. It is evident that the segment comprises of companies constituted outside Malaysia is losing market share to those constituted in Malaysia, to a large extent due to the switching of the customers. It is interesting to note that the share of the premium from companies constituted outside Malaysia that have withdrawn from the market does not remain in this segment of the market.

TABLE 5. Net flow of premium for companies constituted outside Malaysia

	1987	1988	1989	1990	1991
Share of new premium (Million of Ringgit)	2.59	1.77	1.57	1.59	1.88
Net Flow (Million of Ringgit)	-3.97	-1.44	-2.50	-2.00	-1.65
Net flow in percentage of segment's total premium	-91%	-32%	-71%	-71%	-54%

Another example is to have the three industry leaders in 1991 in one segment, and the rest of the industry in the other. The three companies

having the largest shares of the premium in 1991 are Mercantile, Malaysian National Reinsurance Berhad (MNRB) and People's. These three companies received 57.92% of the total premium paid in 1991. Here, we are interested in the net flow of premium into or out of the segment consisting of the three companies. As indicated by the results in Table 6, there are active flows of premium into and out of this segment of the market. The large net flow of premium into these companies since 1990 is making these companies the dominating insurers.

TABLE 6. Net flow of premium for the group of three companies

	1987	1988	1989	1990	1991
Share of new premium (Million of Ringgit)	8.74	13.28	13.34	16.46	38.59
Net Flow (Million of Ringgit)	0.55	-7.02	-6.51	25.13	5.6
Net flow in percentage of segment's total premium	2%	-20%	-16%	31%	5%

CONCLUSION

This paper presents an approach for modeling the growth in premium for the motor insurance industry in Malaysia. This approach may be useful in the future study of the market dynamics of the industry. Of particular interest is the nature of competition and competitive equilibrium in the motor insurance industry in Malaysia. It is hoped that such modeling approach will help in having a more profound understanding of the industry so that is can be better managed and regulated.

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