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Unbiased gender premium rates: A study on Mortgage Reducing Term Assurance (MRTA)

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ABSTRACT

Insurers priced insurance products based on the risk of the insured. As at current, gender is used as one of the main risk rating factors in premium pricing. The premium price may differ from one another as male and female tends to have different levels of risks. However, this practice has raised concerns towards the equal treatment of men and women in the insurance pricing. Moreover, since this issue had also become the heated debate in the European country it is interesting to investigate on the implication of using unbiased mortality rate in Malaysia. Therefore, this paper will be discussing on the practice of using unbiased mortality rate in insurance pricing. This paper is focused on the construction of unbiased mortality rate and profit testing for Mortgage Reducing Term Assurance (MRTA). Results have shown that the unbiased mortality rate could be implemented in Malaysia as it does not incur extra losses to the insurer.

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INTRODUCTION

In general, insurance premium rates are priced based on different gender. This is a normal practice used in insurance companies worldwide, where certain insurance policies charged higher premium rates for women and certain insurance policies charged higher for men, depending on the costs of the product. Among the reason that contributes to the price difference in insurance pricing are the different rates in accident risk, morbidity risk, mortality risk and longevity risk.

Price discrimination in insurance pricing has been recognized as a global issue and Malaysia is not exceptional. However, the recent development in Europe shows that insurance industries should stop price discrimination practices due to gender-based. The current practice has been criticized by various parties as insurance companies should provide the same treatment between men and women. Among the arguments are 'fairness' in pricing and gender discrimination that leads to introducing the unisex or unbiased gender premium rates in the actuarial pricing. With this new approach, the premium charged for the insurance policies will not be based on gender.

Since the European countries have currently moved towards unisex pricing rather than gender-based pricing, the aim of this study is to identify the

implications of this pricing practice in Malaysia by investigating using the deterministic profit testing and determining whether this practice should also be implemented in Malaysia or otherwise.

Literature Review:

History of Premium Pricing:

Insurance and Takaful products are designed to protect individuals from unexpected loss that may occur. Therefore, the prices of the products are set based on the costs of the products, which may vary from one another. This may include the uncertainty factors concerning the precision of probability estimates which is an important factor when setting the price of an insurance (Hogarth, Kunrethter, 1988).

Actuaries would suggest that the premiums on insurance policies are charged based on the gender and the levels of risks or uncertainties of an event that may occur. This results from different risk rates such as in accident risks, mortality risks, morbidity risks and longevity risks. However in justifying the price, insurers holds on to a principle known as "actuarial fairness", where the insured would pay a price that is equivalent to the risk he or she would poses from the insurance pool (Deborah S. Hellman, 1997). This method of pricing justifies the practice of risk rating as mentioned earlier. For example, a person with poor health is expected to pay a higher

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premium compared to a person with a good health for health insurance products. This may raise concerns towards those categorized in higher risk group as they are expected to pay a higher premium.

Apart from that, utility theory is used as a tool to provide a perception into decision making in the face of uncertainty. It is viewed as decision makers' preferences for various distribution outcomes (Embrechts, 1997). Other than that, the price of the insurance should also consider on the requirements of the company, in order to maintain its solvency and maximize the expected profits.

In contrast with premium pricing under Takaful products, the contract is based on the Islamic commercial profit-sharing principle, called as al-Mudharabah. However, this principle is not included in any Conventional insurance products. Therefore, the calculations for premium pricing between Conventional and Takaful products are different.

Use of gender in premium pricing:

It is noted that men and women pay different premium rates for different insurance policies. It is charged depending on the level of risks of each product. The level of risk of an insurance policy can be determined through information on gender, age, smoking status family history and others. This information does influence the premium pricing and gender can be said to be one of the main risk factor considered in the actuarial calculation. This is because, different insurance products has different levels of risks between males and females and this is proven by statistical reports which show that there are significant differences between genders such as mortality risks, morbidity risks, accident risks and longevity risks (Oxera, 2011).

For products such as life insurance, women are expected to pay less compared than men; whereas for annuities, men are expected to pay less compared than women. This is due to the level of risks each gender holds, where women are reported to live longer than men that lead to women paying less for life insurance policies. In contrast with annuities, since women tend to have higher life expectancy, they received lower monthly payments compared than men for the same amount of pension as it is expected to pay for a longer period of time for women (Curry and O'Connell, 2004). Due to this price difference in insurance products, it is argued that men and women ought to be treated equally and should be given the same benefits.

It has been argued that gender-based pricing may lead to misallocation especially among customers as it is possible for them to get more than one insurance if they are able to buy at a lower price than its true cost (Booth, 2002). The European Court of Justice (ECJ) has announced on banning the use of gender as a factor in calculating the premium rates and benefits of the insurance products starting January 2013 (Warth, 2011; Webersinke, 2011).

This is in order to prevent any gender discrimination and that people received equal treatment irrespective of their gender. Therefore, insurance companies needs to introduce unisex rating or unbiased gender premium rates that eradicates gender as one of the risk factors. However, previous researches have argued that this decision is inefficient and gender should not be eliminated from the risk classification as gender is a characteristic that cannot be changed by an individual (Dennon, 1988).

Curry and O'Connell (2004) have argued that different life expectancies for men and women are irrelevant as there is a considerable overlap in the ages when men and women die. The European Commission also argued that age is the main important risk factor for life expectancy and that gender is not the main determining factor (SOAI, 2004). In line with this, using unisex pricing rates is considered relevant and thus it has introduced in European countries and is effective by January 2013.

If unisex pricing rates or unbiased gender premium rates are used in the insurance policies, this means that gender is eliminated as a risk classification (Gupta, A., 1989). Men and women are then able to pay the same premium price and receive the same benefit for the same insurance policy. By applying this approach, there will be no issue on gender discrimination and that man and women both are treated equally. Therefore, the difference in mortality risks, longevity risks, morbidity risks and accident risks that is gender-based is ignored and the premium rates is calculated based on a unisex rate or unbiased gender rates, which is a blend of men and women's rate.

Previous researches showed that by using a unisex or unbiased gender premium rates in premium pricing could lead to adverse selection and changes in consumer demand (Webersinke, A., 2011; Oxera, 2011; Gaudecker, H.M., and Weber, C., 2006; Woodfield, A.E., 2004; Booth, R.A., 2002). Thus, there could be an increase in the number of consumers with higher risks especially men for life insurance and women for annuities. Therefore, any subsequent changes in Malaysia must be implemented in a proper way by considering the advantage and disadvantages of the unbiased gender premium pricing.

In a global business environment, Malaysian insurance and Takaful industry may also be affected by the movement of unbiased gender premium pricing. By having this consideration, it is important to study on the current pricing implementation in Malaysia. It becomes more interesting, as Malaysia implements dual system that is Conventional insurance and Takaful.

Methodology:

Mortality table is normally calculated separately for male and female. However, this study will construct a mortality table that does not depend on

the gender. The data requires for this study is the raw data on a group of male and female lives starting at age 0 and the number of deaths in year x . The data used to construct an unbiased mortality table is based from the data from Department of Statistics, Malaysia. Later, a profit testing analysis is performed by focusing on Mortgage Reducing Term Assurance (MRTA) product.

Construction of an unbiased mortality table:

This research starts with the construction of a complete life table using Heligmann Pollard Method for mortality rates of male and female. Then, the construction of unbiased mortality table is done by adding the percentage of male business times male lives to the percentage of female business times female lives. (Gupta, 1989; Johansen, 1987).

The unbiased mortality table consists of the number of male and females lives in the original group, the number of male and females lives in the group age x , the number of deaths in year x , the probability that (x) survives n years and the probability that (x) dies before age x . Following that, this research employs deterministic profit testing to determine the expected return to the insurer.

Deterministic Profit Testing For Mortgage Reducing Term Assurance:

To measure the expected return to the insurer, this paper will use the profit testing technique. The investment rate return will be calculated at the end of each year and the value will be compared between the model that uses male, female and unbiased mortality rates. The details of the projected cash flow will be discussed further in this section.

Annual Installment:

Firstly, the annual installment will be calculated in order to estimate the claim later. The appropriate values for the various mortgage related factors provided in the assumptions section. The level annual installments obtained by using the equation below:

$$I = \frac{C}{a_{\overline{n}|i_m}}$$

I = Instalment rate

C = Mortgage Amount

n = Policy term

i_m = Interest rate

Then, the projected cash flow will be conducted

i) The per policy expenses of 120 are assumed to be incurred at the very beginning.

ii) Year 1 i. The insurer charges a profit-tested single premium of 950.00

iii) There is a commission of 40% on this premium

iv) Claim = The mortality charges are obtained using

$$q_x = I * a_{\overline{n}|}$$

q_x = Mortality rate at age x

I = Installment Rate

$a_{\overline{n}|}$ = Annuity rate

v) Investment Income = (Premium – Claim) * Investment Income

vi) Cash Flow = Premium -Expense-Commission - Claim + Invest Income

vii) Reserve= Expected Present Value (Expenses) + Expected Present Value (Benefit)

$$\text{Reserve} = \sum_{k=0}^{n-t-1} e^{*(v^{k+1} * P_{x+t})} +$$

$$\frac{I(1+i_m)}{i_m} (A_{\overline{x+t:n}|i_x} - v_{im} * A_{\overline{x+t:n}|i_j})$$

$$= \sum_{k=0}^{n-t-1} e^{*(v^{k+1} * P_{x+t})} +$$

$$\frac{I(1+i_m)}{i_m} (\sum_{k=0}^{n-t-1} v_{ix}^{k+1} * P_{x+t} * q_{x+t+k} - v_{im} * \sum_{k=0}^{n-t-1} v_{ij}^{k+1} * P_{x+t} * q_{x+t+k})$$

e = Renewal expenses

$$v = \frac{1}{1+i}$$

$$P_x = 1 - q_x$$

i_m = Interest Rate (Mortgage)

i_x = Interest Rate (Statutory Reserve)

viii) Delta R is obtained using

$${}_t P_x * {}_t V - {}_{t-1} P_x * {}_{t-1} V(1+i_x)$$

Where,

${}_t V$ = Reserve at year t

i_x = Interest rate (Statutory Reserve)

ix) Profit = Cash Flow – Delta Reserve

x) Made the product strain free from year 2 onwards by reviewing the reserve each year, which mean make profit at year 2 onward equal to zero

$$\Pi_t = CF_t - {}_t \Delta V$$

Π_t = Profit at year t

CF_t = Cash flow at year t

$${}_t \Delta V = {}_t P_x * {}_t V - {}_{t-1} P_x * {}_{t-1} V(1+i_x)$$

The strain free profits for the product will have the following signature

$$\{-120, \mu_1, 0, 0, 0, 0\}$$

where μ_1 is the reduced profit emerging for year 1 which enables the setting up of an adequate equalization reserve that will serve to avoid future strain. We then have the investment rate return, irr from the product given by:

$$-120 + \mu_1 * (1+irr)^{-1} = 0$$

$$irr = \frac{\mu_1}{120} - 1$$

Assumptions:

In this study, the cash flow on Takaful Operator is measured by using a simulation coded using Microsoft Excel. The amounts of the fund are

obtained and will be displayed in the table. There are many factors that must be taken into consideration to enable us to calculate an amount of fund in sufficient. The project begins with making decision to make the assumptions about the value as follows:

Age	30	
Gender		
Amount	100000	
Term	5	
Frequency	12	
Interest Rate	0.1	pa

For Cash flow Projections

Management Expenses:

Initial	120	
Renewal	30	
Commission:		
Initial	40	%
Renewal	0	%
Interest Rate	0.05	pa

Profit Criterion

IRR 20

For Statutory Reserve Projections

Management Expenses:

Renewal	30	
Commission:		
Renewal	0	
Interest Rate	0.035	%

RESULTS AND DISCUSSION

Unbiased Mortality Rate:

The figure shows the mortality rate of M9903. The unbiased mortality result had been computed by using the method explained earlier.

Profit Testing:

From the simulation that been constructed, these are the results of the profit from those three mortality rate that been tested. The results are shown below:

Table 4.1: The Tables on Unbiased Mortality Rate.

Age	M9903		Unbiased
	q_x (Female)	q_{x-2} (Male)	
30	0.001030	0.001020	0.001025
31	0.001020	0.001020	0.00102
32	0.001020	0.001030	0.001025
33	0.001020	0.001050	0.001035
34	0.001030	0.001090	0.00106
35	0.001050	0.001150	0.0011

Table 4.2: The Tables on Profit Testing Results.

	M9903		
	qx (Female)	qx-2(Male)	Unbiased
Profit	15.54	13.11	14.32
IRR	19.69%	17.89%	18.79%

From the results, the mortality rate that gives the highest amount of profit to insurer is female mortality rate which are 19.69%. Since women are expected to live longer than men statistically, the mortality risk for female is lower compared to male. Therefore, this results the profit for female is lower than male. For male mortality rate the profit emerge from the model is 17.89%. Whereas, for unbiased mortality rate the profit value is 18.79%.

Apart from that, the results also show that the value of profit using unbiased mortality is between the male and female rate. The value is reduced by 0.9% of the profit income from female mortality rate. On the other hand, the profit under male mortality rate is increased by 0.9%. This shows that the amount that the insurer have to compensate for female loses are also 0.9%. Therefore, this is an advantage for the insurer as they have do not have to compensate any extra loses when using the unbiased mortality rate. However, this value is also depends on the ratio of the insured gender. In this study, we only assume that the ratio for male and female insured is 50:50. This results may differ if a higher number of males or females are being insured.

Conclusion:

The results of the profit testing would give an impact to the insurance industries in Malaysia if there are any huge changes between using unisex and unbiased gender premium rates, especially if the company faces loss. The decision in introducing the new unbiased gender rates in Malaysia for both conventional and Takaful operators is also based on the potential impact of the insurance market. It does not only changes its premium payments, but also the development of any new products in the future.

Based on the results, the unbiased premium rate are suitable to be implemented in Malaysia as it does not incur extra loses to the insurer. It is hoped that the results of this research would enlighten a better pricing policy, specifically by including having gender-neutral as one of the factor in pricing. The results of this study could also be used by academicians to review the product design of insurance products that has been implemented in Malaysia.

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