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An Analysis of Determination for Life Insurance Premiums: The Concept and Practice of Conventional and Islamic Life Insurance (Family Takaful)

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Abstract

This paper aims to analyze the distinction of premium setting rates by taking into account the risk taken by conventional and Family Takaful. This study employed the Net Single and Annual Level Premium formula, and the data were analyzed using a numerical simulation. We found that the conventional and Takaful insurance systems utilize similar methods in the calculation of insurance premium when considering pure risk faced by the participant or insured. However, both systems have their own unique characteristics. The conventional and Family Takaful utilize historical data, such as mortality rate, expected return rate, expected costs and expected amount of claims. The conventional insurance is calculated to mitigate or minimize the risk of the insurance company against an amount of claim faced in the future as long as the insurance is enforced until the contract ends. On the other hand, the Family Takaful is intended to share fair value among participants in determining benevolence through *Tabarru* premium. Every participant must pay for *Tabarru* premium to support one another so that there is sufficient amount to cover unexpected claims among them and to uphold mutual fund as evidence for the sense of mutual co-operation and brotherhood among participants.

Keywords: Conventional and Islamic life insurance (Family Takaful); premium; rate making; *Tabarru* and *Mudarabah*

Introduction

The major objective of life insurance contract is to provide benefits with regards to survival or premature death of individuals. Risk can be generally defined as a condition under uncertainty and it sometimes can be unpredictable. The providing of risk protection against a form of pure risks, such as the premature death is extremely important and plays a crucial role in life insurance policy (Bacinello et al., 2009). In a natural phenomenon, people are exposed to all kinds of risks in their daily lives. It may be expected and some of them are unforeseen (Khorsid, 2004). Risks may happen in one's life, properties, or business ventures. Risks influence the lives of individuals and can give devastating and shattering effects. Consequently, the individuals become vulnerable (Matsawali et al., 2012). People purchase an insurance policy to transfer and minimize her/his risk to the insurance company

especially when they know that they would be facing the uncertainty of loss in the future. They agree to pay compensation to the insurance company as a protection agreement known as an insurance premium. In the agreement, the insurer will be paid a sum of money if insured faced losses, such as accident, injury or premature death and it would be paid as long as the insurance policy is in-force position (Zhou and Wu, 2008).

The primary idea regarding insurance comes from the Babylonians and their civilizations around of 4000 - 3000 B.C. through the contract of *Bottomry* (Cohen, 1995). The development of insurance practice in the current era originated from two civilizations namely the Babylonians civilization around 4000 – 3000 B.C. and ancient Arab tribes about 570 A.C. The insurance practices of both civilizations now have been distinguished to become two systems known as the conventional and Islamic insurance systems. The main purpose of both insurance systems is to create and uphold the value of solidarity and responsibility among the parties involved in accordance with the principle of mutual cooperation (Qureshi, 2011). However, there is a great difference in the practice of the conventional insurance system in the views of Islamic teachings. The practice of conventional insurance has elements prohibited by sharia namely *riba*, *gharar*, and *maysir* (Pillsbury, 1998).

Nowadays, the practice of insurance through "*Bottomry Contract*" obtains a substantial recognition in the common law, as recent years have witnessed a rapid development in this area. Such a rapid development might have resulted from the rapid growth of the lawful system in the field of commerce and trade. Conversely, in the Islamic law, the main idea of insurance originated from the practice of ancient Arab tribal custom before 570 A.C through the doctrine of al 'Aqilah. It was a common practice among ancient Arab tribes that, if any tribe member is killed by another tribe member then an heir of the victim would receive an amount of blood money as a compensation for the close relatives of the killer. It obtained recognition under Islamic law based on the agreement of the Holy Prophet Muhammad (S.A.W) within one of his verdicts against a woman from the tribe namely *Huzail*. Therefore, the main idea of 'Aqilah was that the tribes of ancient Arab had to be prepared to make a financial contribution on behalf of the killer to compensate the heir of the victim such readiness to make a financial contribution which has resemblance with the premiums in the practice of insurance. While the payment of compensation to the heir of a victim under the system of al 'Aqilah could be similar to the indemnity in the insurance practice now, it is a form of monetary protection for the beneficiaries against inevitable affliction, such as the premature death of the victim (Klingmuller, 1969).

In the main view of the conventional insurance system, insurance minimizes risk or transfers risk from customers (e.g. individual or company) by sharing the uncertainty (risk) to the large group of customers (Sabbir, 2002). Edward (2004) states that insurance constitutes the contract whereby the individual (insured) agrees to pay compensation or costs of purchasing a specific agreement (premium) to the insurance company (insurer) with sum of money or value to cover loss from particular events, such as premature death, injury, illness, accident, permanent disability and other unforeseen circumstances. Currently, Islamic insurance presents an alternative to the conventional insurance, in the form of resistance by Muslim Ummah. For Muslims, Islam is a complete way of life that endeavors to wholly build the structure of human life and culture. Muslims hold that Islam is a religion based on peaceful coexistence with fellow man through maintenance of stable and conservative societies. In other words, Islam cares for the unfortunate members and this makes a Muslim community capable to thrive and free from crime, bitterness, and sadness (Khorsid, 2004).

The practice of Takaful is extremely different with the conventional insurance. The policy of Takaful based on the concept of *Tabarru* originates from the word "*Tabarru'a*" which means contribution, donation, or charity. The simple meaning of *Tabarru* is the intention of the unilateral declaration, which is considered as a contract under Islamic law (Khorsid, 2004) and *Mudarabah* is a mutual financial transaction between two parties with a profit and loss sharing. The transaction must be free from the elements that are prohibited and unlawful in the eyes of the sharia (Naseer Yassin and Jamil Ramly, 2011). The model of Islamic insurance (Takaful) is based on the divine principles of solidarity and mutual co-operation as stated by Allah (s.w.t) in the Holy Qur'an (Surah Al-Maidah verse 5:2); "... and help you one

another in righteousness and piety". The model of Takaful life insurance is based on the Shari'a principles whereby the insurance policy does not involve the forbidden elements in the teachings of Islam, such as usury (*riba*), uncertainty (*gharar*) and speculation (*maysir*).

Further, in the insurance company, the rate of premium insurance plays an important role, where it is based on the concept of pooling or sharing of loss. Black and Skipper (2000) state that the sharing of loss, in turn, involves the accumulation of a fund from amounts paid by insured to provide benefits for the unfortunate few who suffer loss, where to establish the amount to be charged by the insurer to the insured must start with some ideas as to likelihood of loss for the group. The likelihood of losses in life insurance is shown by mortality table. Mortality table represents a record of mortality observed in the past and is arranged to show the probabilities of death and survival at each age separately. It shows a hypothetical group of individuals beginning with a certain age and traces the history of the entire group year by year until all have died. Harrington and Niehaus (2004) state that a basic principle of insurance pricing is: if insurers are to sell coverage willingly, they must receive premiums that: i) is sufficient to fund their expected claim and administrative expenses; and ii) provides an expected profit to compensate for the charge of obtaining the capital necessary to support the sale of coverage.

The premium level that is just sufficient to fund the insurer's expected costs and provide insurance company owners with a fair return on their invested capital is known as the fair premiums. Ciurel (2000) confirms that insurance premiums must be adequate, which means that for a group of contracts, the money collected from policyholders, plus the interest earned on the investment of these amounts, shall be sufficient to pay all promised amounts and cover the insurance company expenses; insurance premiums must be equitable, that risk must consider each person insured; insurance premiums should not be excessive compared to the sums insured. Rejda (2008) states that rate of premium for life insurance policy is based on two underlying concepts namely mortality and interest. However, there are three variables is the expense factor that is the amount of the company adds to the cost of the policy to cover operating costs of selling insurance, investing the premiums, and paying claims. Mortality in life insurance is based on the sharing of the risk of death by a large group of people. The amount at risk must be known to predict the cost to each member of the group. Mortality tables are used to give the company a basic estimation of how much money is needed to pay for death claims each year. By using a mortality table, the insurer can determine the average life expectancy for each age group. The rate of interest is the second factor used in calculating premium that is interest rate earnings. Companies invest the premiums in bonds, stocks, mortgages, real estate, and etcetera and assume that they will earn a certain rate of interest on these invested funds.

This paper focuses on the aspect of rate setting for life insurance premium. As revealed by Bacinello et al., (2009) risk is extremely important and plays a crucial role in life insurance policy. It means that if the insurance company cannot precisely and accurately predicts a total risk then the insurance company would be facing a large problem such as low premium income and insolvency (Bankruptcy). Besides that, this study would be investigating a determination model of premium for the Islamic life Insurance (Family Takaful). It aims to certify that between conventional life insurance and Family Takaful extremely different.

Material and Methods

This study employed quantitative analysis to determine the method used in the two types of insurance namely conventional and Islamic insurance. Almost all life insurance products are actuarially created by calculating the relationships of mortality, interest, and expense, and the financial values resulting from each based on time. This study considered at length net single premium formulas for insurance and annuities due, under the standard assumptions of the survival function between integer ages, when there is a periodical premium per year (Bower et al., 1986). The calculation relates to the death benefits payable and benefits payable if insured is still alive until the insurance contract ends.

Basic models for the setup of premium insurance are statistical and financial approach is applied through random variable (Dione and Harrington, 1991). It analyzes the total monetary amount of claims arising from an insurance pool during a specified reporting period (e.g., one year). The total amount of claims is the sum of the expenses for claims of the individual's exposure units comprising the pool. First, we calculate following basic statistical concept by probability, lifetime, and expectation. Assuming that individual born simultaneously denotes and followed until death, then it can be written where, $x = 0, 1, 2, \dots, n$. l_x is the number of lived aged x or alive at birthday x . Then the number of dying between ages $x, x+1$ is:

$$d_x = l_x - l_{x+1} \tag{3.1}$$

Now, allowing the age-variable x to take all real values, not just whole numbers, treat $S_x = l_x / l_0$ as a piecewise continuously differentiable non-increasing function called the survivor or survival function. Then for all real x is:

$$S(x) - S(x+t) \tag{3.2}$$

Then the fraction of the initial cohort that fails between time x and $x + t$ such as bellow:

$$\frac{S(x) - S(x+t)}{S(x)} = \frac{l_x - l_{x+1}}{l_x} \tag{3.3}$$

The equation 3.3 is the fraction of those alive at exact age x who fail before $x + t$.

The common sense is applied to relative frequency but require formal axioms when used more generally. Probabilities are numbers between 0 and 1 assigned to subsets of the entire range of possible outcomes in the examples, subsets of the interval of possible human lifetimes measured in years (Slud, 2001). The life-table data and the mechanism by which members of the population die are summarized first through the survivor function $S(x)$ which at integer values of x agrees with the ratios. Note that $S(x)$ has values between 0 and 1, and can be interpreted as the probability for a single individual to survive at least x time units. Since fewer people are alive at larger age, $S(x)$ is a decreasing function of x , and in applications $S(x)$ should be piecewise continuously differentiable (largely for convenience, and because any analytical expression which would be chosen for $S(x)$ in practice will be piecewise smooth).

By definition, $S(0) = 1$. Another way of summarizing the probabilities of survival given by this function is to define the density function as the (absolute) rate of decrease of the function S .

$$f(x) = -\frac{dS}{dx}(x) = -S'(x) \tag{3.4}$$

Then, by the fundamental theorem of calculus, for any ages $a < b$, P (life aged 0 dies between ages a and b) would be such as $l_a - l_b / l_0$ or can be written as follow:

$$S'(a) - S(b) = \int_a^b (-S'(x))dx = \int_a^b f(x)dx \tag{3.5}$$

The very helpful geometric interpretation is that the probability of dying within the interval $[a,b]$ is equal to the area under the curve $y = f(x)$ over the x -interval $[a, b]$. Note also

that the 'probability' rules which assign the integral $\int_A f(x)dx$ to the set A (which may be an interval, a union of intervals, or a still more complicated set) obviously satisfies the first two of the bulleted axioms displayed.

The calculation of premium also includes the element of discount factor. Discounting is a technique used to compare costs and benefits that occur in different time periods. It is a separate concept from inflation and is based on the principle that, generally, people prefer to receive goods and services now rather than later. This is known as 'time preference'. For individuals, time preference can be measured by the real interest rate on money lent or borrowed. Amongst other investments, people invest at fixed, low-risk rates, hoping to receive more in the future (net of tax) to compensate for the deferral of consumption now. These real rates of return give some indication of their individual pure time preference rate. Society as a whole also prefers to receive goods and services sooner rather than later and to defer costs to future generations. This is known as 'social time preference'; the 'social time preference rate' (STPR) is the rate at which society values the present compared to the future. The discount factor formula can be written as below:

$$v^n = \frac{1}{(1+r)^n} \tag{3.6}$$

Where, discount factor denotes by v^n , and r is interest rate or return rate. The present value of the future death benefit is called net single premium (NSP).

The model used to setup rate of net premium insurance standardly applied in insurance can be written as below:

$$NSP = \omega \left(\frac{dx}{Lx} \right) (v^n) \tag{3.7}$$

Where ω denotes the sum of insurance coverage planned by the insured or insurer must be protected if insured facing of loss. L_{x+1} is the number of the policyholder live until the time period of the contract and $L_x=0$ denoted as the number of the policyholder live while the installment of insurance. It can be called probability death of the policyholder. The v^n is known as a discount factor. Present value of level annuity due formula can be written as below:

$$PVA_{Due} = \varphi_{it} \frac{1 - (1+r)^{-n}}{r} (1+r) \tag{3.8}$$

where, φ_{it} is periodical payment i.e \$1, r denotes rate would be included per period, n is a time of payment (number of periods).

The rate setting of net single premium payment is based on three main assumptions, namely, premiums are paid at the beginning of the policy year, second death claims are paid at the end of the policy year, and the death rate is uniform throughout the year. After we have obtained the value of net single premium, the following equation (3.7) and (3.8) can be created to calculate Net annual single premium level annuity due such as below:

$$NALP = \frac{\omega \left(\frac{dx}{Lx} \right) (v^n)}{\varphi_{it} \frac{1 - (1+r)^{-n}}{r} (1+r) - n} \tag{3.9}$$

or can be written in form as:

$$NALP = \frac{NSP}{PVLAD - n} \quad (3.10)$$

The description of the above formula is if the premiums are paid for life, the premium is called a whole life annuity due and if premiums are paid for only a temporary period, the premium is called a temporary life annuity due. This paper highlights the above formula and derivation of the formula related. Where the basic principle of the rate setting of the insurance premium is statistical and financial technique, it is based on present and future value formula. Following the formula, we attempt to investigate the differences of rate making applied in conventional life insurance and Family Takaful by using Matlab R2015 for simulation. The mortality table in this study applies CSO 1980 Indonesia life table.

Results and Discussion

The rate setting of life insurance premium is used by conventional insurance company to consider the amount of insurance coverage. It is multiplied by the number of insured alive at the end of the insurance period and the expected value of interest rate to obtain the expenditure must be paid by the insured as agreed to pool risk in a large group of people. It is usually known as a discount factor that functions to get the present value of future cash flow. The premium formula applied by the conventional insurance company is called Net Single Premium formula. It is a primary technique to determine how much the amount of premium should be paid by the insured to cover expected loss. To achieve the objectives of this paper, we use numerical simulation analysis where the policyholder is assumed to purchase 1 unit exposure, the sum of insurance coverage is \$1000, the time of contract is 10 years, the value of guaranteed rate is 5 percent and the age of the insured is 30 years old.

Fig. 1 (a) shows the rate of premium to be paid at the beginning of the year by insured is \$103 per unit exposure. The redline in the Fig. 1 (a) indicates that the accumulation of the premium should be paid annually by the insured for 10 years to cover the risk that would be faced by the insurer under the insurance product in the future. The green line shows the value of the investment fund after subtracting the expenses, such as a risk premium, administrative and operational cost. We found that the policyholder at the beginning of the year should be expensed at \$53 or 50 percent of premium paid to the insurer would be used to pay a risk premium, administrative and operational costs. Fig. 1 (a) indicates decrement in the expenses that should be expensed by the insurer and bearded by the policyholder from time to time. In this paper, we seek to identify and investigate the distinction of rate making used by the conventional life insurance and Family Takaful to determine the rate of premium.

Fig. 1 (b) shows that the premium insurance to be paid by the insured to the insurer is \$100 per unit exposure. The red line indicates the accumulation of premium paid annually by insured to cover the risk that would be faced in the future. The value of the investment fund after deducted expenses, such as a risk premium, administrating, and operating cost (refer green line) is the accumulation of a fund for investment. Nevertheless, in Takaful, premium is type of compensation that collected by Takaful operator to share risk among participant named *Tabarru* fund. Margin annual premium after deduction of *Tabarru* fund would reduce other costs, such as operational and administrative costs.

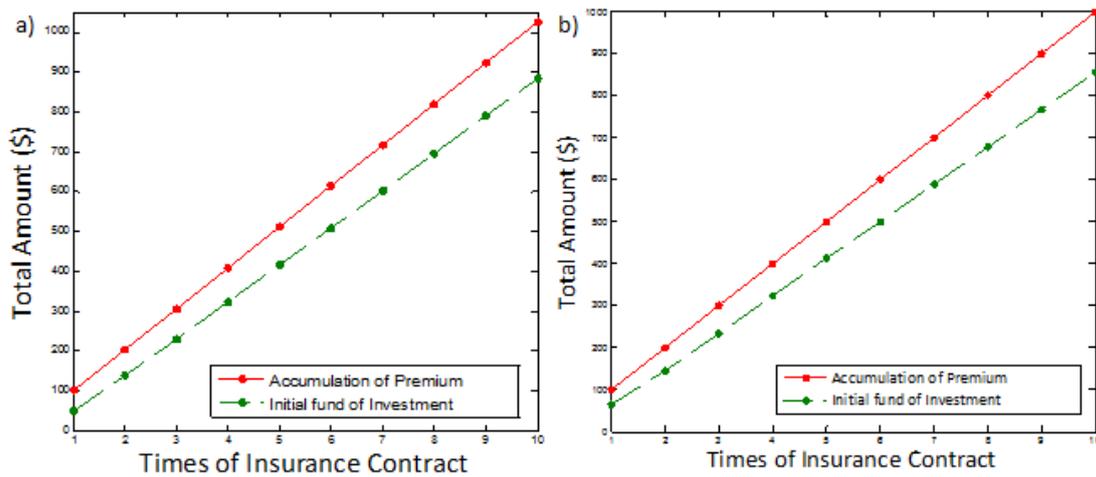


Figure 1. (a) Accumulation Value for premium and an initial fund of investment by Conventional life Insurance and (b) Family Takaful

Since the annual premium is obtained from deducted expenses, it is called participant account - the amount invested by the insurer. Following the description, it is clear that for 10 years contract until maturity, the expenses spent time to time by insured is smaller. At the beginning of the year, insured must be paid high cost including operational cost almost 35 percent or \$35 of the amount of payment until the last year or before insurance ends that is \$11 or 1.1 percent compounding. In summary, the annual premium paid by the insured on Takaful insurance is cheaper compared the conventional that is \$3 (\$103-\$100), although the cost at the beginning of the year is low around 35 percent. In the 9 to 10 years, insured spent \$11 or 1.1 and an overall expense to be paid by the insured is \$145. This cost is greater than the cost in conventional insurance which is \$140 or marginal value of \$5. Takaful insurance has created a different function in the calculation based on the concept of *Mudarabah*. Each charge portion is separated to comply with the *Shariah* in order to be clear in the type of contract.

Fig. 2 (a) demonstrates that the investment returns increase from time to time. At the beginning of the first year, investment fund is only \$50. Towards the end of the year is \$890 or 87 percent from the accumulation of premium received from the insurer. If the insured died before the insurance contract ends or reach the maturity time, his or her beneficiaries would obtain payment as much as the sum of insured coverage added with the accumulation of investment return. If 5 years later, after the death of the insured (premature death) beneficiaries receive 100 per cent of insurance coverage plus investment return compounding \$419 or total amount is \$1,419. Then, if insured is still alive at the end of insurance contract, he or she would receive payment from the insurer as much as investment returns \$890. In this case, we do not include the assumption of investment, here we only involve rate as big as 5 percent or known as guarantee rate. Therefore, we conclude that the total amount paid by the insured to the insurer is \$1,025 for 10 years and insured would receive \$890. This means that the insured loss around \$135 (this value of risk to cover the risk of insured in times of insurance).

Fig. 2 (b) shows that the investment return in Family Takaful increases from time to time. At the beginning of first-year, investment fund is only \$67 and at the end of the year is \$1,032 or 103.2 percent from the accumulation of premium received from the insurer. If the insured died before the insurance contract end or reach maturity time, his or her beneficiaries would obtain payment as much as the sum of insured coverage added with the accumulation of investment return. If 5 years later, the insured died (premature death) beneficiaries receive 100 percent of insurance coverage plus investment return compounding \$455 or total amount earned is \$1,455. Then, if insured is still alive at the ends of insurance contract he or she would receive payment from the insurer as much as investment returns \$1,032. In this case, we do not include the assumption of investment, here we only involve rate as big as 5

percent or known as guarantee rate. Therefore we can conclude that the total amount paid by the insured to the insurer is \$1.000 for 10 years and insured would receive \$1,032. This means the insured earn yield around \$32 (this a share of surplus underwriting and sharing profit from investment fund with pre-agreed is 70 percent for insured and 30 percent for the insurer). Further, the value accumulation and annual investment return by conventional and Takaful insurance can be seen in Fig. 3 (a) and (b).

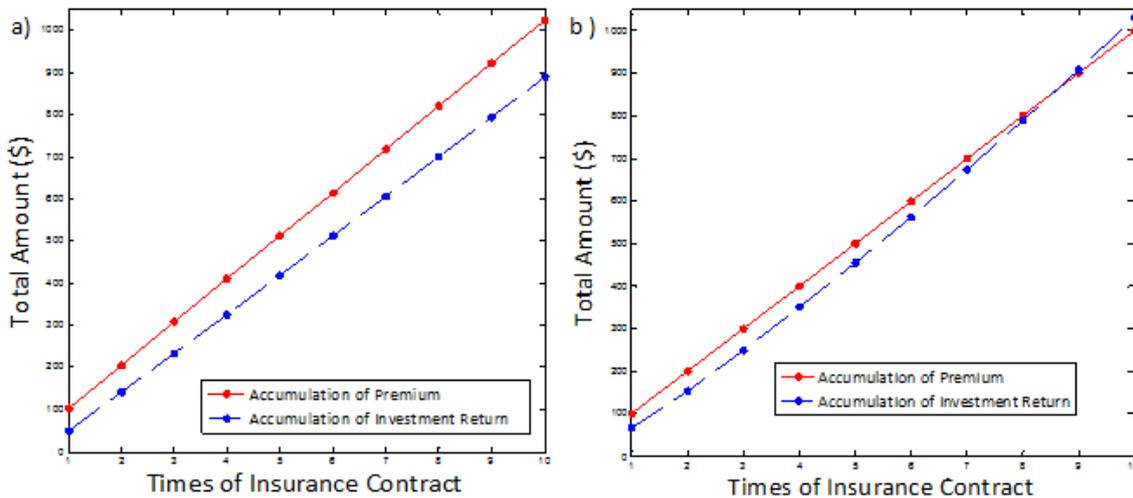


Figure 2. (a) Value of accumulation premium and investment return in conventional life insurance and **(b)** Family Takaful

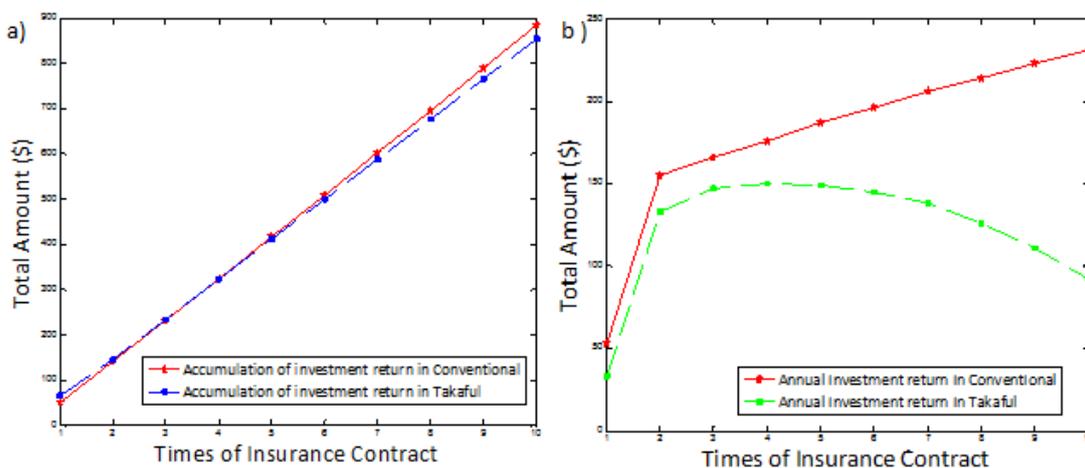


Figure 3. (a) Value of Accumulation investment return in conventional life insurance and Family Takaful and **(b)** Value of annual investment return in conventional life insurance and Family Takaful

Fig. 3 (a) shows the accumulation of investment return in the conventional life insurance increases from for year to year. This differs from Family Takaful although in the first year the value of investment return is higher than conventional life insurance, but to the following year until the maturity of the contract the accumulation investment returns decreases. Fig. 3 (b) shows that annual investment return obtained by the conventional life insurance increases from time to time (see red line). As for the Family Takaful, annual investment return begins in the first year to the second year is very large that is \$33 to \$133,

and then decreases as time goes by. The average annual investment return shared by the conventional life insurance and Family Takaful to the participant or policyholder is \$180.70 and \$122.40 and total investment return earned by the policyholder is \$1,807 for conventional life insurance and \$1,224 for Family Takaful.

The accumulation of expenses by Life Insurance Company is shown in Fig. 4 (a). We can see that in the first year, conventional life insurance has high cost which is \$53, meanwhile Family Takaful only costs \$35. However, after 8 years, the difference in the cost that should be spent by policyholder is only \$1 where the conventional life insurance has accumulation costs worth \$124 and Family Takaful is \$123. The decrease in expenses in the conventional life insurance for the ninth year is \$132 and the last year or at the maturity of the contract is only 140. This cost is lower than the costs by Family Takaful where in the 9th years, it is \$134 and until at the maturity time, it is \$145. Based on the previous figure, we can summarize that although accumulation value for expenses in Family Takaful displays the lowest cost in the first year, but in future more than 7 years it has the highest cost compared to conventional life insurance. The accumulation expenses differ for about \$5.

Fig. 4 (b) shows the annual costs that should be paid by the participants when making insurance plans. The blue-line is the annual charge for conventional life insurance. In the first year, the charge that should be paid by the participant is \$53. Then, for the second year, the charge that should be paid by the participant's extremely declines from \$ 53 to \$ 11. It has a large margin of around \$42.

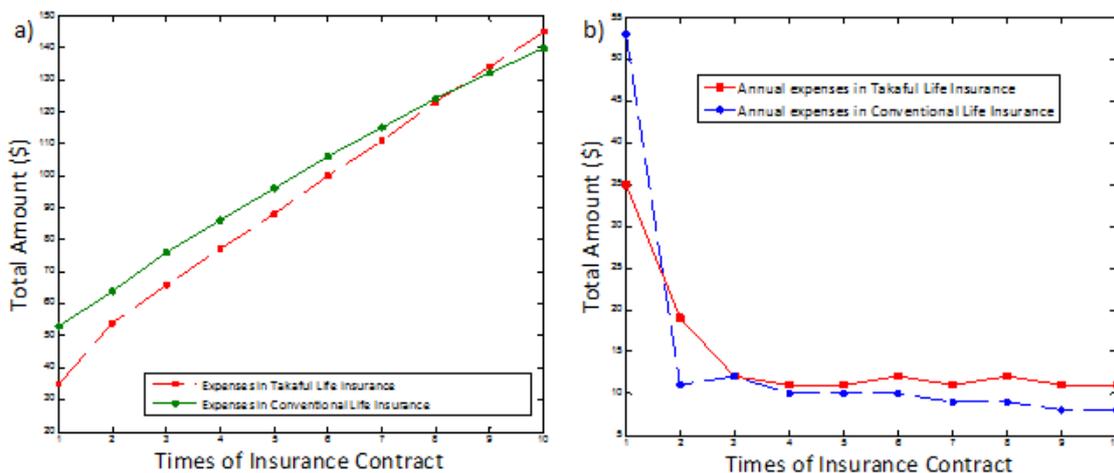


Figure 4. (a) The accumulation expenses for the Conventional life insurance and Family Takaful and **(b)** The annual accumulation expenses for the Conventional life insurance and Family Takaful

This fluctuation occurs because in the first year the insurance company should spend a lot of money for the commission to the agent, and operational and administrative costs. This causes the cost of the first year of conventional life insurance product becomes very large. In the second year, the insurance companies only pay for agents i.e. costs of collecting premiums, operating and administrating costs. It displays the stability in the fluctuation of annual expenses. It is in contrast to Family Takaful where the commission cost is paid to the agent half in the first year and another half in the second year. This strategy increases initial investment fund (see red line) so the annual expenses for Family Takaful is \$35 for the first year, \$19 in the second years, and \$12 in the third year. It shows that the charge fluctuation is stable. Nevertheless, after the third year, the cost of Family Takaful is higher than conventional life insurance where the average expense is \$11.29. Based on the calculation using the same case and numerical simulation, we found that the premium insurance paid is cheaper for Family Takaful, but it has a high cost in operating and administrating compared to conventional life insurance. The investment fund in the Family Takaful gives the best

choice in investment where the guaranteed rate 5% return on investment can be received by insured more from the annual premium paid compared to conventional life insurance. This indicates that the Family Takaful, besides aiming to eliminate forbidden elements that exist in conventional life insurance, also gives a better profit compared to the conventional life insurance.

Conclusion

We found that conventional life insurance and Family Takaful use similar techniques to calculate risk premium (term in conventional life insurance) or *Tabarru* premium (term in Islamic insurance – Family Takaful). Both Islamic and conventional life insurance considers pure risk through mortality risk. However, the calculation carried out in this study certifies that they have different objectives. In the conventional life insurance, the determination of calculation using pure risk or life function from mortality risk intends to count all risks that will be faced by the insurance company to give protection for insurance participant and financial risk of the insurance company. It is different from the Family Takaful where the risk considered is to share fair value in the payment of compensation (*Tabarru* fund) by a participant to the insurance company. The Family Takaful uses contract of *Mudarabah* to eliminate forbidden elements which exist in the practice of conventional life insurance, such as *riba*, *gharar*, and *maysir*. Besides that, it aims to uphold the sense of mutual co-operation, solidarities, and brotherhoods among participant of insurance. This study also confirms that premium insurance charged by the conventional life insurance is higher than Family Takaful. Furthermore, the accumulation and annual investment returns demonstrate that conventional life insurance is higher than the Family Takaful.

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