Underinsurance in Malaysia: The Application of the Monte Carlo Simulation

(Terkurang-Insurans di Malaysia: Aplikasi Kaedah Simulasi Monte Carlo)

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ABSTRACT

This study seeks to estimate the extent of underinsurance among Malaysian families in 2012. Underinsurance is quantified by the extent to which the citizens in a country are inadequately covered by the life insurance protection. To measure underinsurance, we use the concept of the life insurance protection gap as proposed by Swiss Re (2004). The mortality protection gap is the difference between the resources needed and the resources available. The resources needed refer to the resources the surviving dependents require for income replacement, debt repayment and other major expenses. The resources available refer to those resources actually available to the dependents from financial assets, social security and life insurance coverage. The data collected are simulated using the Monte Carlo simulation process. Statistical analysis of the results of the simulation runs indicates that, on average, the extent of underinsurance in Malaysia is about RM500,000 per household.

Keywords: Underinsurance; protection gap; life insurance; Monte Carlo simulation

ABSTRAK

Kajian ini bertujuan untuk menganggar tahap terkurang-insurans dalam kalangan keluarga Malaysia pada tahun 2012.Terkurang-insurans diukur melalui tahap rakyat sesebuah negara tidak dilindungi oleh insurans hayat yang mencukupi.Untuk mengukur terkurang-insurans, kami menggunakan konsep jurang perlindungan insurans hayat seperti yang diperkenalkan oleh Swiss Re (2004). Jurang perlindungan mortaliti adalah perbezaan diantara sumber yang diperlukan dan sumber yang ada. Sumber yang diperlukan merujuk kepada sumber yang diperlukan oleh tanggungan yang masih hidup untuk penggantian pendapatan, pembayaran hutang dan perbelanjaan besar yang lain. Sumber yang ada merujuk kepada sumber yang boleh diperoleh oleh tanggungan daripada asset kewangan, keselamatan sosial dan perlindungan insurans hayat. Data yang dikumpul disimulasi menggunakan proses simulasi Monte Carlo. Analisa statistik keatas hasil larian simulasi menunjukkan bahawa, pada puratanya, tahap terkurang insurans adalah lebih kurang RM500,000 bagi setiap keluarga.

Kata kunci: Terkurang-insurans; jurang perlindungan; insurans hayat; simulasi Monte Carlo

INTRODUCTION

The premature death of the primary wage earner and the resulting financial consequences cause many people to face major personal loss exposure. Adequacy of life insurance coverage, in this case, is a very efficacious way of dealing with such loss exposure. Life insurance benefits an individual's personal financial planning in many ways like debt repayment, wealth replacement, savings creation, and income replacement (Black & Skipper 2000). As indicated by the Chartered Life Underwriters (CLU), mortality protection (i.e. life insurance protection) aims to preserve and sustain the dependents current living standards at the demise of the main wage earner (Swiss Re 2004). The mortality protection gap quantifies the extent to which families are insufficiently covered, or underinsured, in the event of the death of the primary breadwinner.

Whilst allowing for a better penetration of the insurance markets, life insurance provides a comparatively low-cost solution in closing the mortality gap. The life insurance sector of Malaysia received more than 67% of the insurance industry premium income in 2012. The demand for life insurance continues to stay low in Malaysia as compared to neighboring countries, despite the improvement of the insurance density, which are premiums per capita, and the penetration rate, which are premiums as a percentage of GDP over time. In 2012, the per capita spending on life insurance was RM850 (USD330), which is much lower than other developed Asian countries, and lower than the worldwide average of USD373. The per capita premium of Singapore in 2012 was seven times that of Malaysia, whereas Japan and Hong Kong had a per capita premium twelve times higher. Life insurance penetration was calculated to be 3.08% of Malaysia's GDP, which is again lower than the world average of 3.69%. This

clearly shows that the life insurance market of Malaysia is still considerably under-penetrated. The huge untapped insurance market can be explored maximally by improving the mortality protection gap.

This study aims to examine and explore the extent of the life insurance protection gap, or underinsurance, in Malaysia. The mortality protection gap is often a true reflection of the potential demand for life insurance coverage.This study also aims to quantify and highlight the degree of mortality protection gap in the primary breadwinners of the Malaysian households.Although prior studies have identified the extent of protection gap in many different countries, little is known regarding underinsurance in Malaysia. Hence, this research seeks to bridge this gap in the literature by contributing to the understanding of underinsurance in this country. This study also seeksto impart the background information of the Malaysian life insurance marketplace for a better understanding of the specific characteristics of the Malaysian life insurance environment.

It is timely to thoroughly investigate the extent of the protection gap in Malaysia. The degree of protection gapreveals the probable economic difficulties faced by the dependents at the death of the breadwinner of the family. A family may not be able to maintain its present living standards after the death of the main breadwinner due to insufficient life insurance protection. Moreover, they may not be able to pay off mortgages and debts, and to pay for their children's education. Insurance deals with the mortality gap quite effectively, therefore, it is imperative that the insurance companies understand the extent of the gap so as to be able to take preemptive steps to encouraging the purchase of life insurance.

Malaysian life insurance market, which includes the family takaful market, is pretty much under-tapped. The highest penetration rate achieved by the Malaysian insurance industry on life insurance plans was 41% in 2012. As is clear from the per capita life insurance premium expenditures for Singapore, Japan, and South Korea in recent years (these being more than 7 times higher than those of Malaysia), Malaysian demand for life insurance is quite low when compared with other developed Asian markets. Given the relatively low insurance market penetration, and the fact that the demand for life insurance protection increases with the mortality protection gap, this study will present vital information for both the insurance companies and the policymakers to help develop and support the insurance industry of Malaysia.

THE LIFE INSURANCE ENVIRONMENT OF MALAYSIA

One of the factors of resources available when it comes to estimating the mortality protection gap is life insurance. The sums insured for life insurance policies are used to measure this factor.The sums insured for the life insurance sector from 2000 – 2012 are displayed in Figure 1. The sums insured in force increased by 11.43%
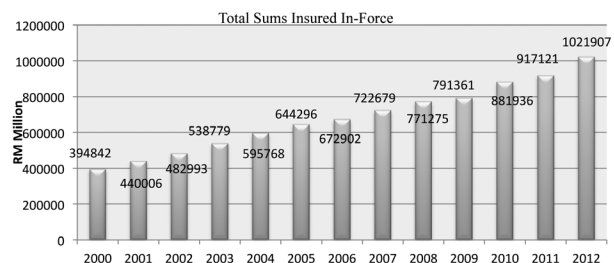

FIGURE 1. Total sums insured in force for life insurance
Source: Insurance Annual Reports and http://www.bnm.gov/insurance, 2000-2012.

in 2012 from the previous year, whereas the annual growth rate during the last ten years was 7.83%.

The growing per capita and per member of employment sums insured clearly indicates the importance of life insurance as an integral component of the financial system. The average insurance protection utilized by every individual of a country is shown by the per capita sums insured. In Malaysia, the per capital sums insured grew at the rate of 63.7% - from RM12,374 in 2003 to RM34,877 in 2012. As is clear from Figure 2, there was an increase in the sums insured per employment member in the same period as well from RM53,878 to RM80,465. One of the resources available to help the dependents to preserve their standards of living at the untimely death of the policyholder is the sums insured for life insurance. The buying of life insurance protection is the fastest and cheapest method to close the mortality gap.

In 2012, the premium income of the life insurance sector made up 67.7% of the entire insurance industry premium, coming to about RM24,902.5. While the average annual growth rate of the Malaysian economy in the past decade was 5.09%, the annual growth rate of the premium income of life insurance was measured to be 8.84%. Due to the global financial crisis of 2007 to 2011, the growth rates fluctuated a lot despite the positive growth in the premium income oflife insurance, with life insurance being a vital method for saving in the long-term, and as an option for alternate investment – this can be seen in Figure 3. Despite this, the life insurance market is predicted to achieve a 7.5% compound annual growth rate (CAGR) in the years 2012 to 2016 (Research and Markets 2012).
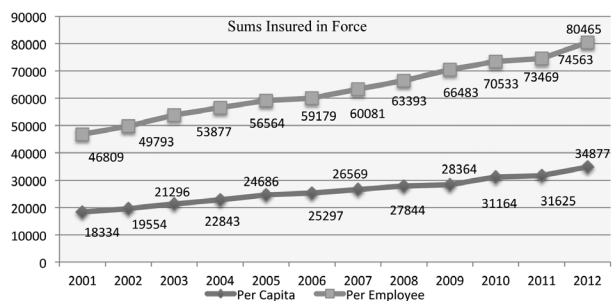

FIGURE 2. Sums insured in force for life insurance – per capita and per member of employment.
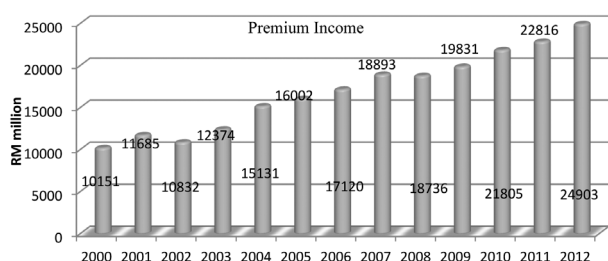*Source:* Insurance Annual Reports and http://www.bnm.gov/insurance, 2000-2012.

FIGURE 3. Premium income for life insurance
Source: Insurance Annual Reports and http://www.bnm.gov/insurance, 2000-2012

The rise in the per capita premium expenditure (or insurance density) is also proof of the growth of the life insurance market of Malaysia. The premium per capita has grown by 73.8% over a period of ten years – Figure 4 shows how it increased from RM489 to RM850 in 2003 to 2012 respectively. Similarly, the premium per member of employment also increased by 50.2% during the same time – in 2003 it was RM1,237, whereas in 2012 it rose to RM1,957. The annual average premium per capita of the working population as well as the total population was RM1,793 and RM759 respectively over the period of the previous five years.
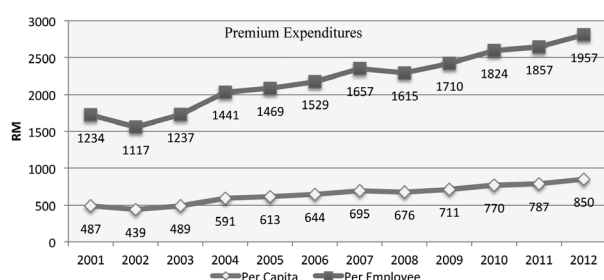

FIGURE 4. Premium expenditures for life insurance – per capita and per member of employment
Source: Insurance Annual Reports and http://www.bnm.gov, 2000-2012

The demand for life insurance is still low in Malaysia especially in comparison with the other more developed Asian countries, despite an improvement in the insurance density (premiums per capita) and the penetration rate (premiums as a percentage of GDP). In 2012, the per capita spending on life insurance was RM850 (USD 330), which is much lower than the worldwide average of USD373. During the same year, the per capita premium of Singapore was recorded as USD2,472, of South Korea as USD2,785, Taiwan as USD3,760, Hong Kong as USD4,025, and Japan as USD4,143. Equally, the life insurance penetrationof Malaysia in 2012 is comparatively lower than the neighboring countries' penetration rateat 3.08% of the country's GDP. Figure 5 and 6 depict that the average penetration rate of the world was 3.69% in 2012. It is clear from these indicators that the Malaysian life insurance market has substantial opportunities for growth.
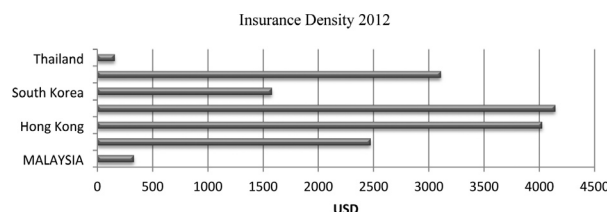

FIGURE 5. Life insurance density (life insurance premiums per capita) for Malaysia and selected Asian countries.
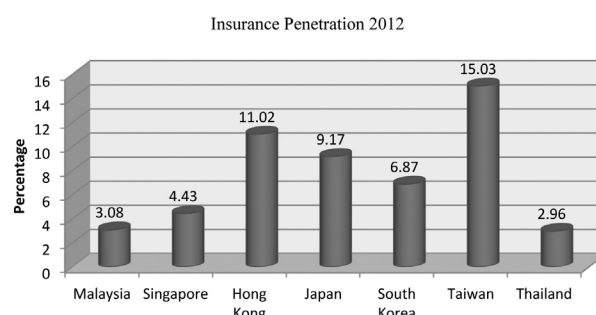*Source:* Sigma: World Insurance 2012, Swiss Re.

FIGURE 6. Life insurance penetration (life insurance premiums as a percentage of GDP) for Malaysia and selected Asian countries.
Source: Sigma: World Insurance 2012, Swiss Re.

Market penetration is defined as 'the ration of the number of policies in force as a proportion to the total population' (Insurance Annual Report 2001). The life insurance market penetration rate went up to 40.75% from 31.5% from 2000 to 2008. The penetration rate has stayed at about 41% since then, with it being 41.22% in 2012 (LIAM 2013).A steady increase is expected in the market penetration, due to a rise in consumer confidence in life insurance, as well as government backed tax relief on life insurance produces, thus growing the life insurance sector.
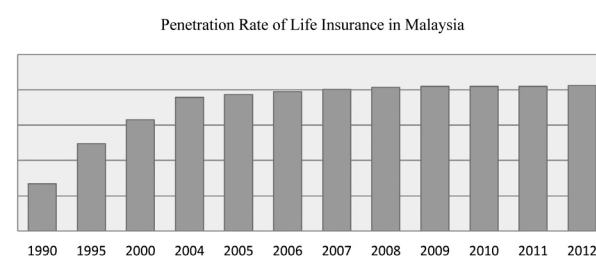
FIGURE 7. Market penetration of life insurance (in percentage).
Source: Insurance Annual Reports and http://www.bnm.gov, 1990-2012.

LITERATURE REVIEW

Death of the family's primary breadwinner can give rise to overwhelming emotional and financial suffering for families. Black, Skipper and Black (2015) suggest that the most important way of managing the financial consequences resulting from the premature death of the breadwinner is possibly through the purchase of life insurance. The authors argue that if life insurance is

purchased in sufficient amounts, the death benefit may replace the wage earner's future income after his death. Mortality protection gap, or underinsurance, arises when life insurance protection is not adequately purchased.

According to Lewis (1989), the main function of a life insurance is to maintain the standard of living of a family following the untimely death of the breadwinner. Thus, the ideal amount of life insurance protection to be purchased is a function of the income of the breadwinner and some other factors including the number and the characteristics of the dependents. Beck and Webb (2003) suggest that life insurance plans encourage long-term savings and the reinvestment of sizable sums in the public and private sector developments, hence have become an important tool to manage income risk for individuals and families. Lin and Grace (2007) discover a significant relationship between financial vulnerability and the total amount of life insurance purchased. According to Swiss Re (2015), protection gap demonstrates the true financial hardship that dependents could encounter following the death of the family breadwinner. It is also a call for insurers to engage appropriate measures in ensuring adequate protection is accessible by all insureds. Large protection gap also signifies the vast business opportunities that exist for the insurance industries.

The definition of protection gap most widely used is provided by Swiss Re (2004). The report defines underinsurance or mortality protection gap as "the difference between the resources needed and the resources that would be available in order to sustain the dependent's living standards after the primary wage earner dies". Swiss Re (2004, 2011) suggest that the resources required are measured by the income needed for maintaining present standard of living for the dependents, major expenditure such as education and retirement needs, and also taxes and debts obligation. The resources available can be represented by the social security income for the survivor, financial assets such as savings, bonds and stocks, and most importantly, life insurance coverage in force. Life Insurance Association of Singapore (2012) indicates that the resources needed refer to the amount of money required by a dependent to maintain a reasonable standard of living and to pay off debts, whereas the available resources refer to savings and insurance coverage. The Geneva Association (2014) defines protection gap as "the gap between the amount of insurance that is economically beneficial and the amount of insurance actually purchased". CH and Cie (2012) explain that the protection gap is computed as "the difference between the present value of income needed to maintain survivors' current living standards plus the amount required to meet debt obligations, and the present value of the sum of future social security payments to survivors, life insurance proceeds and a certain portion of financial assets."

There are numerous determinants of underinsurance. Swiss Re (2015) suggests that, in advanced market, an access to extensive social security benefits and public health insurance may result in lower demand for insurance. In many Asian emerging markets, among the main factors that contribute to underinsurance are perceived lack of affordability, low insurance and risk awareness, regulatory and social barriers, as well as limits to insurability. CH and Cie (2012) suggests that the factors preventing customers from purchasing life insurance in the Mainland China is misperception regarding the benefits of life insurance and the trustworthiness of the insurance industry. The Geneva Association Report (2014) argues that underinsurance reflect relatively low levels of risk awareness and risk culture of the populations at large.

METHODOLOGY

DEFINITION OF PROTECTION GAP

The mortality protection gap can be defined as the difference between the resources needed and the resources that would be available in order to sustain the dependent's living standards after the primary wage earner dies (Swiss Re 2004). The resources required by the dependents to replace income, repay debt, and other expenses are what are termed as resources needed. Whereas the resources that are available to the surviving dependents are the resources available; these include any social security benefits, all financial assets like savings etc., and life insurance protection like medical insurance, or sums insured for life insurance, as well as accumulated savings.

Essentially, the mortality protection gap measures the degree to which there is insufficient coverage for families where the primary wage earner dies. Furthermore, it can also be used as a measure of the level of underinsurance among the citizens in a country. Mortality gap is defined by Swiss Re (2004)[1] in the following words:

"Life assurance protection gap is computed as the present value of future income required to maintain dependents' current living standard, plus the amount needed to meet debt obligations, minus the sum of the present value of future social security payments to survivors plus life insurance proceeds, plus one-half of financial assets."

A formula representing mortality gap functional relationship is given below, keeping in mind the recent work of Swiss Re (2011):

Mortality Protection Gap = Resources Required − Resources Available (1)

Mainly life insurance and savings make up the readily available resources. Keeping in mind the mortality gap formula given above, the conceptual framework of this study can be represented in the following way:

Mortality Protection Gap = Income Needed to Maintain Standards of Living − Savings − Life Insurance (2)

Adopting the Swiss Re (2004) proposed mortality gap function, the resources required involve the following:

1. Income needed for maintaining present standard of living for the dependents including the spouse,
2. Major expenditure needs like university education and retirement needs, and
3. Charges and obligations, such as taxes and debts.

The resources available comprise the following:

1. Social security income for the survivor,
2. Investments and other financial assets like savings, bonds, mutual funds, and/or stocks, and
3. Any coverage within the ambit of employee benefit plans and life insurance coverage.

Published by Swiss Re (2011), the Mortality Protection Gap: Asia Pacific 2011 study found that in Malaysia, the protection gap has undergone an increase from 2000 to 2010, with its value being around USD380 billion as per reports in 2010. It would, thus, be appropriate to investigate the level of underinsurance in Malaysia so that insurers and policymakers can get useful data that will help them formulate new plans to close the gap.

This study has, for the first time, local researchers studying mortality protection gap for Malaysia. This study differs from the methodology used by other studies, like the Mortality Protection Gap: Asia-Pacific 2011, or gap studies of other countries like Singapore, in that it adopts a simulation process, called Monte Carlo analysis. Monte Carlo simulation, as opposed to deterministic analysis or a single-point estimate, offers many possibilities with respect to the outcomes and the probabilities of their occurrence. Like the Swiss Re conducted protection gap studies, this research looks at the possible gap amid the employed population with dependents. This step is vital so that it is ensured that the research includes the population segment that is economically active and which is financially capable of purchasing insurance. Not only does the study apply the Monte Carlo simulation, it also analyzes the mortality gap for heads of family belonging to the following three groups: 1. Those covered by life insurance, 2. Those covered by life insurance including medical insurance, and 3. Those not covered by either of these two. The methodology of this research is discussed in detail in the topics that follow.

The current mortality gap study gives a useful primary platform necessary for a broader construction of the degree of the protection gap in Malaysia despite not being exhaustive. Family takaful plans, along with life insurance, also provide mortality protection and have an effect on the assessment of the gap, however, they are not included in the current research, but can be useful for future studies. The protection gap could also differ if income of the other family members is taken into consideration.

Official statistics like data on repayment of debt, and data related to salary based on age group could not be obtained for the study, and are one of the major limitations thereof. This means that the actual degree of the mortality gap of Malaysia may differ slightly from that projected in the current study.

CONCEPTUAL FRAMEWORK

Mortality protection gap, which may also be called protection gap or life insurance protection gap or, simply, underinsurance, is defined as the difference between the resources needed to maintain average living standards and the resources available. Usually, the available resources include life insurance and savings (Figure 8).
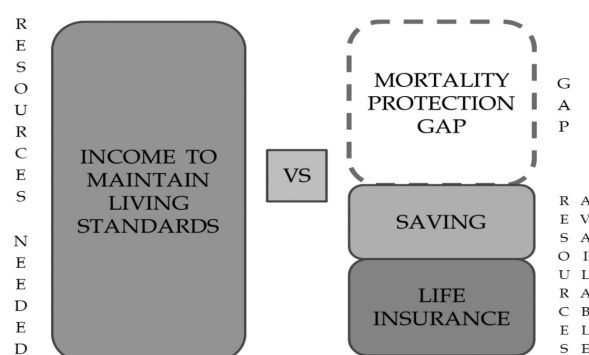

FIGURE 8. Conceptual framework of the mortality protection gap

The above framework is similar to Equation (2) in which the resources needed are equal to the resources available plus the protection gap. The resources needed are the income required to maintain the living standards of surviving dependents, while the resources available comprise savings and life insurance protection.

Table 1 shows the classification of resources available and resources needed based on the Swiss Re (2011) proposal related to mortality gap function.

TABLE 1. Resources needed and resources available

Resources Needed	Resources Available
Basic expenses	EPF Savings
Retirement	Personal savings
Debt	Insurance protection

There are three elements of resources needed:

1. Basic expenses – income or money needed to sustain the present living standard for the dependents, including the spouse,
2. Retirement expenses – money or income required for any retirement needs, and
3. Debt repayment expenses – income required to pay off debts like mortgages.

There are three elements of the resources available as well:

1. Employees Provident Fund (EPF) savings – income that comes from social security,
2. Personal savings – financial resources and possessions, and
3. Life insurance protection – individual medical and life insurance.

The level of the mortality protection gap projected in this research approximates the level of underinsurance the population experiences.

DATA

The data included in the study was attained through various sources, as shown in Table 2.

TABLE 2. Data sources

Variable	Sources of Data
Basic expenses	Household Expenditure Survey Malaysia 2009/2010,
Personal savings	Annual Statistics Reports
Debt repayment	Financial Stability & Payment System Reports, BNM
Retirement expenses	EPF Annual Report 2012, Annual Statistics Reports
EPF Savings	EPF Annual Report 2012
Life and medical insurance	LIAM and Annual Insurance Reports of BNM

THE RESOURCES NEEDED

Basic Expenses   The first element of resources needed is the money or income needed to sustain the current living standard for the dependents after the main breadwinner dies. Basic needs expenses are used to represent these resources. As per the Household Expenditure Survey Malaysia 2009/2010, basic needs include the following items: food, drinkables, tobacco, clothes, shoes, housing and furnishing, education, health, transport, recreation services and culture, communication, restaurants and hotels, etc.

The main breadwinner of the family normally caters to these basic needs, as long as they have employment, and, in case of their death before they reach the age of retirement, the dependents still require these needs to be met. Supposing that usually workers choose to retire when they turn 60, the required amount of basic needs is represented by "the present value of yearly basic expenses until age 60 at any age of death".

This relationship can be described in the equation below:

$$
\begin{array}{ll}
\text{Required Amount} & = \text{Present Value of Yearly} \quad (3) \\
\text{of Basic Needs} & \quad \text{Basic Expenses until Age 60,} \\
& \quad \text{at Any Age of Death}
\end{array}
$$

Retirement Expenses   The resources required to pay for the retirement needs are the second element of the resources needed. The EPF contributions of the employee measure this element, these being the largest retirement expense for Malaysians. This study only takes the contributions made by employees under consideration for retirement expenses because they are deducted from the monthly salary of the employees, usually amounting to 11% of the basic salary.

Employees make their EPF contributions throughout the period they are employed, i.e. until they retire, though they may die before they reach that age. Supposing an employee decides to retire when they turn 60, the required amount for retirement needs can generally be expressed as "the present value of yearly retirement expenses (EPF contributions) until age 60 at any age of death".

The equation that describes the above relationship is given below:

$$
\begin{array}{ll}
\text{Required Amount} & = \text{Present Value of Yearly} \quad (4) \\
\text{of Retirement Needs} & \quad \text{Retirement Expenses until} \\
& \quad \text{Age 60, at Any Age of Death}
\end{array}
$$

Debt Repayment Expenses   The third element of resources needed is income needed for debt repayment, or debt repayment expenses as this study terms it. Supposing that usually the repayment of debt needs to be made by the retirement age of employee, i.e. 60 years, and supposing that the employee may die before they reach that age, the required amount of debt repayment needscan be shown as:

$$
\begin{array}{ll}
\text{Required Amount of} = & \text{Present Value of Yearly} \quad (5) \\
\text{Debt Repayment} & \quad \text{Debt Repayment Expenses} \\
\text{Needs} & \quad \text{Until Age 60, at Any Age of} \\
& \quad \text{Death}
\end{array}
$$

THE RESOURCES AVAILABLE

EPF Savings   The first element of resources available is social security and resources obtained therefrom. An employee's EPF accumulated savings represent this variable. By the end of 2012, there were 13,585,007 members of the EPF, with 6,389,080 contributing to the Fund actively (EPF Annual Report 2012). The EPF contributions have increased by 11.45% (RM46,178 billion) in 2012, with the membership increase. Employee contributions are 11%, whereas employer contributions are anywhere between 12 to 13%.

Usually, the employee will continue to pay into their EPF funds until they attain the age of retirement, usually 60, though they might die before that. So, if a person dies

at a certain age or lives to reach the age of retirement, the EPF savings can be represented by this equation:

EPF Savings   =   Accumulated EPF Savings   (6)
at the Age of Death

Personal Savings   The second element of resources available is the extent of personal savings. Usually an employee will save a set portion of their salary constantly whilst being employed, until they turn 60 (or retire), though they might die before that. So, if a person dies at a certain age or lives to the age of 60, the personal savings can be expressed as:

Personal Savings = Accumulated Personal   (7)
Savings at the Age of Death

Life Insurance Protections   Life insurance is the third element of resources available. This study measures life insurance coverage through sums insured for the individual life insurance and medical insurance protection. Generally, death benefit comprises of the sums insured for the life insurance policy which is paid to the beneficiary in the event of death to the policyholder. So, no matter what age the individual dies, in case of their death, the amount of insurance payable to the beneficiary is shown as follows:

Life Insurance   =   Sums Insured of All Policies   (8)
Protection   Owned by the Individual

DATA ANALYSIS

STUDY ASSUMPTIONS

Adapting the assumptions used in previous studies such as in the Singapore Protection Gap Study (2012), a few assumptions were used as a base for the analysis done by this study:

1. Employed people were used as samples for the research,
2. On average, each household consists of 5 people (3 children and 2 parents),
3. Only the head of the household contributes to the household income,
4. Interest rate is 4%,
5. Personal savings of the household included not just the savings in banks, but also those in other financial institutions like Amanah Saham Bumiputera (ASB), and Tabung Haji,
6. The youngest employee age was 20 years old,
7. Maximum working age was deemed 60 years, or the age of retirement,
7. The most likely, minimum and maximum amount of salary per month based on age group are defined in Table 3:

TABLE 3. Salary assumptions

Age	Most likely	Minimum	Maximum
20-24	1000	900	3500
25-29	1500	900	12000
30-34	2500	900	16000
35-39	3000	900	20000
40-44	3200	900	30000
45-49	3500	900	30000
50-54	3500	900	30000
55-59	3500	900	30000
60-64	3200	900	30000

DEVELOPMENT OF MODEL

Life insurance protection gap has been calculated by taking the present value of future income required to maintain dependents' current living standard, minus the present value of future social security and life insurance proceeds (Swiss Re 2004). The specification of the net present value (NPV) can be rewritten as:

$$\text{Net Present Value (NPV)} = \sum_{i=1}^{n} \frac{P_i}{(1+r)^i}$$

where: r = Discount Rate; n = Period of Discount; P = Payment.

In view of the present value specification, and as mentioned previously, the total resources needed have been modeled in the following way:

1. The present value of yearly basic expenses until age 60 at any age of death
2. The present value of yearly retirement expenses (EPF contributions) until age 60 at any age of death
3. The present value of yearly debt repayment expenses until age 60 at any age of death

In addition, the total resources available are modeled in the following way:

1. The accumulated EPF savings at the age of death
2. The accumulated personal savings at the age of death
3. The sums insured payable to a beneficiary in the event of death of the policy owner

Also, as mentioned before, the framework for the mortality protection gap is:

Protection Gap = Total Resources Needed – Total Resources Available

The protection gap value shows the amount of insurance coveragea household needs or should get to ascertain that the dependents would be able to sustain

a reasonable living standard after the death of the main breadwinner.

MONTE CARLO SIMULATION

As stated before, the current study uses the Monte Carlo simulation to consider the input variations. The Monte Carlo simulations are computer generated and give a wide range of probable results and the probabilities of their occurrence in an empirical model that has specific coefficient values as well as an error term distribution. Values are randomly sampled from specified probably distributions during Monte Carlo simulations. Many probable results within the assumed distribution are created by randomly generating values from the assumed distribution. Among other things, common probability distributions include normal, lognormal, uniform, triangular and discrete. Certain data was suitably represented by the triangular probability distribution in the current study. Therefore, there is a need to define the minimum, most likely and maximum values for the probability distribution.

Approximately 5,000 samples were generated in this study, with the result being probability distribution of possible outcomes. It is clear that Monte Carlo simulation provides probabilistic results, which is to say that possible outcomes and the probability of the occurrence of these outcomes are shown in these results. As this study generated 5,000 possible values of input for the present value of resources needed and accumulated values of resources available, just as many (i.e. 5,000) possible values of protection gap were found. The protection gaps that resulted have been shown in distributions form.

PROBABILITY DISTRIBUTIONS OF THE SIMULATED VARIABLES

DISTRIBUTIONS OF AGE

The descriptive statistic of the age of the Malaysian employed population is illustrated in Table 4. The statistics indicate that most individuals are in their 20s or 30s. Table 4 also shows the age distribution being minimum at 20, median at 34, maximum at 60, and average at 35. This study uses age distribution to calculate the protection gap. The present value of basic needs, the present value of retirement expenses, the present value of debt expenses, the EPF savings, the personal savings and the total sums insured are computed based on the same age distribution.

TABLE 4. Summary statistics of age

	Age
Mean	35
Median	34
Maximum	60
Minimum	20

DISTRIBUTIONS OF RESOURCES NEEDED

Thedescriptive statistics of the simulated components for the resources needed, i.e. the present value of basic needs, the present value of retirement expenses and the present value of the debt repayment expenses are shown in Table 5.

TABLE 5. Summary statistics for resources needed

	Present Value of		
	Basic Needs	Retirement Needs	Debt Repayment
Mean	373,529	125,516	307,453
Median	397,381	100,086	235,271
Max	637,302	489,120	1,285,051
Min	206	208	545

As per Table 5, the mean, median, maximum and minimum values for the basic expenses borne by the dependents in the event of the breadwinner's death are, respectively, RM374,000, RM397,000, RM637,000 and RM206. Table 5 also shows that the mean, median, max and min value for the present value of retirement expenses are calculated to be RM125,000, RM100,000, RM489,000 and RM208, respectively. The debt expenses which the dependents have to bear once the breadwinner dies were less than RM500,000. The mean, median, max and min value for the present value of debt repayment expenses are, respectively, around RM307,000, RM235,000, RM1,285,000 and RM545.

DISTRIBUTIONS OF RESOURCES AVAILABLE

The distributions of the simulated components for the resources available, which is to say the EPF savings, personal savings, life and medical coverage are described in Table 6.

TABLE 6. Summary statistics of the resources available

	EPF Savings	Personal Savings	Life Insurance Sums Insured	Medical Insurance Sums Insured
Mean	63,437	19,923	81,606	61,524
Median	50,259	10,102	74,628	67,071
Max	139,069	157,217	196,443	67,071
Min	6.469	0	10,295	42,223

As shown in Table 6, the mean, maximum and minimum values are around RM63,000, RM139,000 and RM6,000 respectively.The statistic also shows that the working population of Malaysia has comparatively small personal accumulated savings. The average savings amount to around RM20,000, whereas the highest personal savings amounted to around RM158,000.The mean, median, max and min value for life insurance protection

comes to be about RM81,000, RM75,000, RM196,000, and RM10,000 respectively. About RM62,000 and RM67,000 are calculated to be the mean and median of sums insured for medical protection. Whereas, the minimum and maximum amounts of medical coverage sums insured were recorded as RM42,000 to RM67,000 respectively.

RESULTS

The estimated results of the protection gap, which are based on the previously presented mortality protection gap specification, are given below. As mentioned previously, a range of possible outcomes and probabilities of their occurrence are provided through the Monte Carlo simulation that this study has used.

This paper investigates the mortality gap for three primary breadwinners of household: (1) individuals who are covered by life insurance and also medical insurance (2) individuals who are covered by life insurance only, and (3) individuals who are not covered by either life or medical insurance. Tables 7 – 9 present the results for each category.

The sum of the protection gap of families where the main wage earner is covered by life and medical insurance with the probabilities of the occurrence of the gap is shown in Table 7. The per family average protection gap for such families was calculated to be RM553,000. This amount demonstrates the average protection gap for families whose main wage earner is covered by life and medical insurance, as generated by the mortality protection gap formula (see Equation 1) and applying the Monte Carlo simulation process. There is high probability (94%) for an average family to be underinsured. The largest protection gap, about RM681,000 per family, was found to be among those where the breadwinner was between the age of 26 and 35, with the second largest gap (RM677,000) found in families with a breadwinner aged between 36 to 45 years.

Families with the main breadwinner being younger than 25 years had a relatively lower protection gap recorded at RM468,000. As the likelihood of having a protection gap for such families is 1, they are statistically almost always underinsured. Whereas families where the main breadwinner is between 46 to 55 years had a gap of RM325,000 which is the lowest. A very high number of families where the breadwinner was more than 55 years old, had a negative protection gap, meaning they had enough reserves to sustain their present living standards even if the death of the main breadwinner occurs, with only 14% being underinsured.

The mortality protection gap of families where the main breadwinner had the protection of life insurance only and not medical insurance is shown in Table 8. In such cases, the average protection gap per family was approximately RM642,000. It was found that the protection gap for this group, across all ages, was larger when compared with those where both life and medical coverage were obtained. Families where the primary wage earner was less than 25 years old, the average protection gap per family was calculated to be around RM562,000, whereas the protection gap for families where the wage earner was between 26 to 35 years was the largest, around RM776,000.

The second largest gap of RM769,000 per family was found in the group where the primary breadwinner was between 36 and 45 years old, with a slightly lower gap of

TABLE 7. Protection gap of individuals covered by life and medical insurance

Age Group	15-25	26-35	36-45	46-55	56-65	TOTAL
Mean	468,089	681,498	677,127	324,530	-120,346	553,033
Median	436,395	653,972	620,389	270,948	-121,913	494,017
Prob (Gap>0)	1.00	1.00	0.99	0.87	0.14	0.94

TABLE 8. Protection gap of individuals covered by life insurance only

Age Group	15-25	26-35	36-45	46-55	56-65	TOTAL
Mean	561,862	775,506	768,722	393,140	-50,511	641,532
Median	530,880	745,565	709,059	337,310	-54,534	583,607
Prob (Gap>0)	1.00	1.00	1.00	0.95	0.31	0.96

TABLE 9. Protection gap of individuals not covered under life or medical insurance

Age Group	15-25	26-35	36-45	46-55	56-65	TOTAL
Mean	642,728	856,003	850,930	475,884	35,535	723,137
Median	610,912	827,723	792,063	417,913	19,509	661,057
Prob (Gap>0)	1.00	1.00	1.00	0.99	0.60	0.98

RM393,000 per family in those where the wage earner was 46 to 55 years old. A majority of families where the main wage earner was more than 55 years had enough resources to sustain their present lifestyle even after the unexpected death of the wage earner, with only around 31% of them experiencing some protection gap. This conclusion implies that if the sums insured for current life insurance are increased, or if more life or medical insurance is purchased, the mortality gap can easily be reduced.

It is clear from Table 9 that, across all age groups, families where the main wage earner was not insured through any life or medical policy had a much larger average gap than those where at least one such policy covered the main wage earner. The mean protection gap for all ages for such families is found to be RM723,137 , which is much higher compared to the gap of RM553,033 for families with life and medical policy (see Table 7), and RM641,532 for families with life policy (Table 8). It is clear that buying life and medical insurance would help to close the protection gap. The findings also show that there is a certain degree of underinsurance found among wage earners across all age groups. In this category, none of the age groups had enough resources to enable the dependents to sustain their present lifestyle if the main breadwinner dies. The amount of underinsurance where wage earner was between 26 to 45 years was found to be highest (i.e. around RM850,000).

The findings also imply that with a probability of 1, families in this category where the wage earner is between 15 to 45 years are certain to experience underinsurance, with the possible protection gap ranging from about RM642,000 to RM856,000. As for the other age groups (46-65years old) the probability of experiencing underinsurance is also relatively high, ranging from 0.60 -0.99. Families with the main wage earner between the age of 26 to 35 had a protection gap as high as RM856,000, with the gap being almost as high (RM851,000) for families where the main breadwinner was 36 to 45 years old. The average gap was around RM643,000 for families where the main wage earners were between 15 to 25 years old, while the protection gap of families where the head was 46 to 55 years old was RM476,000. The likelihood of experiencing some protection gap for families where wage earners are 56 to 65 years old was calculated to be 0.60. The protection gap figures demonstrated in Tables 7, 8 and 9 clearly show that buying life and medical insurance would significantly close the gap.

CONCLUSION

The mortality protection gap measures the extent to which families are underinsured following the death of the primary wage earner. The findings of this study suggest that many Malaysian households are substantially underinsured. The considerable size of the protection gap is worrying since many dependents may not be able to maintain a reasonable lifestyle in the event of the death of the primary breadwinner or they may even be driven into poverty.

This study examined the potential mortality gap in 2012 among primary breadwinners of the households who were either insured under life and medical insurance, or not insured. The average protection gap for families whose primary wage earner was covered by life and medical insurance was RM553,000 per family. Families whose primary wage earner was only covered by life policy and not medical policy had a slightly higher gap, at RM642,000 per family. The average protection gap for the group headed by a breadwinner who was not covered by either life or medical insurance was largest, at about RM723,000 per family. However, based on the assumption of this study that each household in Malaysia consists of 5 members (parents and 3 children), the average mortality gap for each member of a family was about RM100,000 to RM150,000. This amount is quite far from the per capita sum insured in Malaysia, which is about RM34,000. Thus, the findings of this study clearly suggest that purchasing life insurance can provide solutions to close the protection gap. In addition, an assumption was also made that the income of the household was generated by one primary breadwinner. The true extent of the protection gap may be smaller if the spouse of the primary breadwinner was also in employment.

The protection gap was further estimated according to the age group of the breadwinner. The families whose wage earner was between 26 to 55 years old had a sizeable protection gap compared with other age groups. This is evident given that many breadwinners of this age group were typically at the phase when their financial obligations reached their peak in terms of dependents' support, mortgage repayment, savings creations and others. The study also found that the younger families whose primary breadwinner was under 25 years old had a relatively high probability of being underinsured. This finding suggests that the purchase of insurance among individuals below the age of 25 is not encouraging enough although the premium rates for this age group would be relatively low. Proactive measures must be taken to increase insurance awareness among the individuals of this age group to take advantage of the favorable premium rates. This study also found a fairly large proportion of families headed by a breadwinner above 55 years old and covered by life and medical insurance who had sufficient resources to maintain the current standard of living in the event of the death of the main breadwinner.

The results of this study are expected to provide an indicator for the industry to move forward in achieving the targeted penetration rate of 75% by 2020 under the Economic Transformation Plan. The sizeable mortality gap of RM100,000 to RM150,000 for each member of a family found in this study, coupled with the penetration rate of life insurance, which remains low at 41%, provide evidence that there is still a large untapped life insurance

market in Malaysia. Hence, proactive measures must be taken by the insurance companies and the government to increase insurance awareness among the population. Agents' performance must be frequently monitored and enhanced to ensure professionalism in their services. The knowledge of the sensitivity of life insurance demand based on the age group is expected to be helpful to the insurance companies in developing new products or in adopting new marketing strategies. The findings of this study can also be useful to the policymakers for the formulation of public policies regarding adequate life insurance coverage to reduce protection gap in future generations. In light of government support through incentives by means of tax relief for life insurance and the liberalization measures undertaken to stimulate the growth of the insurance industry, there exists a vast potential for growth in the life insurance market.

ENDNOTES

[1]   Swiss Reinsurance Company Ltd, generally known as Swiss Re, is a reinsurance company based in Zurich, Switzerland. Founded in 1863, it is the world's second-largest reinsurer, operating through offices in more than 25 countries. The Swiss Re Group is a leading wholesale provider of reinsurance, insurance and other insurance-based forms of risk transfer.

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