CHAPTER 3

RESEARCH METHODOLOGY

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3.1 Introduction

The purpose of this study is to determine and analyze the actual return on investment for the Malaysian Employees Provident Fund. First, the marked-to-market return for the Malaysian EPF will be calculated. Second, the effect of alternative assets on the portfolio return in two different circumstances will be tested. The first scenario is under the constraints of the EPF's investment rules and regulations, while the other scenario is without any constraints from the EPF's investment rules and regulations. The Modern Portfolio Theory was used to calculate the asset allocation for each asset class. The t-test was used to test the significance level between a pension fund portfolio with zero alternative asset allocation and a pension fund with various alternative target allocations. Finally yet importantly, a set of alternative investment models for the EPF based on Optimal Portfolio under different types of stock market trends will be prepared.

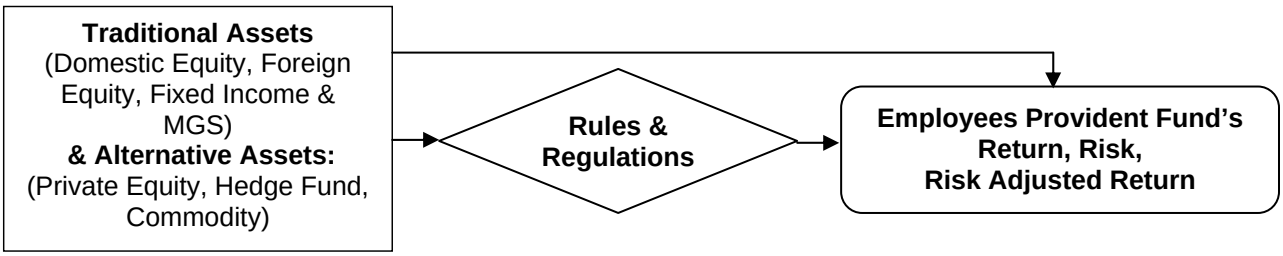
3.2 Research Methods

3.2.1 Research Design/Theoretical Framework

Based on the related theories and literature presented in the previous chapter, a framework has been developed to investigate the relationship among portfolio assets and portfolio return, risk and risk-adjusted return (see Figure 3.1).

Figure 3.1:

Research Framework



Traditional assets and alternative assets are the independent variable, and the EPF's return, risk and risk-adjusted return are the dependent variable. The allocation of assets will explain the variance in the return, risk and risk-adjusted return of the EPF. The rules and regulations, the moderating variable, have a strong contingent effect on this relationship. The presence of rules and regulations will develop different EPF asset allocations and indirectly affect the EPF's return and risk.

3.2.2 Research Hypothesis

Based on the findings from previous studies, this study attempts to investigate the relationship between alternative asset classes, return, risk and risk-adjusted return of the portfolio. Therefore, the following hypotheses are formulated:

Hypothesis 1

H_0: A return of zero allocation in alternative investment has no difference from the return of a pension plan in various alternative target allocations.

H_1: A return of zero allocation in alternative investment is different from the return of a pension plan in various alternative target allocations.

Hypothesis 2

H_0: An increase of alternative target allocation will not affect the investment risk.

H_1: An increase of alternative target allocation will affect the investment risk.

Hypothesis 3

H_0: A Sharpe Ratio of zero allocation in alternative investment has no difference from the Sharpe Ratio of a pension plan in various alternative target allocations.

H_1: A Sharpe Ratio of zero allocation in alternative investment is different from the Sharpe Ratio of a pension plan in various alternative target allocations.

Hypothesis 4

H_0: An increase in alternative target allocation will not increase the portfolio's return.

H_1: An increase in alternative target allocation will increase the portfolio's return.

Hypothesis 5

H_0: An increase in alternative target allocation will not reduce the portfolio's risk.

H_1: An increase in alternative target allocation will reduce the portfolio's risk.

Hypothesis 6

H_0: An increase in alternative target allocation will not increase the portfolio's risk-adjusted return.

H_1: An increase in alternative target allocation will increase the portfolio's risk-adjusted return.

3.2.3 Data Gathering Method

The study used secondary data, which is quarterly data for the stock markets of Malaysia, Asia Equities Index, Private Equity Index, Commodity Index, Hedge Fund Index, and Fixed Income Index. All data was obtained from Bloomberg and KWSP Strategic Planning Department. The data period under this study is from January 1997 to December 2008:

1. Domestic Equity: KLSE index,
2. Asia Equity: MXFEJ INDEX (MSCI All-Country Far East Free ex-Japan Index) is a free float-adjusted, capitalization-weighted index of the stock markets of China, Hong Kong, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand.
3. Private Equity: Cambridge Associates LLC US Private Equity Index established by Cambridge Associate LLC (CA) to monitor investment made by venture capital and other alternative asset partnership. Index calculated based on data compiled from 760 US private equity funds, including fully liquidated partnerships, and formed since 1986. This is used as a market benchmark by Wellesley Endowment.

4. Commodity: PAL2MALY Index (Malaysia Palm Oil Board Crude Index) is the main group for investment in the commodity or plantation market in Malaysia.
5. Hedge Fund: Credit Suisse Tremont Hedge Fund, which contains monthly data on 14 different hedge fund indexes. This is a source of data used by Chan et al. (2007).
6. Fixed Income: Two Years and Ten Years MGS or equivalent consists of long-term government bond index. Also, JP Morgan Global Aggregate Bond Index, which is the most widely used international benchmark.

The period under review will be divided into three sub-periods that explain three different types of market trend. The first sub-period is from 1997 to 2000, the second sub-period is from 2000 to 2004 and, lastly, the third sub-period is from 2005 to 2008. The first sub-period is categorized as a bear market, occurring from 1997 when the global stock market crashed due to the economic crisis in Asia. During the second sub-period, the economy recovered and a bull market began, resulting in increasing investor expectations and confidence. The third sub-period is considered a fluctuating market.

3.2.4 Instruments and Scales

This study utilizes Statistical Package for Social Sciences (SPSS), which provides sophisticated data and statistical analysis, as well as performing some techniques such as cross-tabulation, t-test, chi square test, etc. Overall,

this study uses quarterly data; this is because data for private equity is only provided every quarter year.

3.2.5 Data Analysis for Selected Employees Provident Data

The Employees Provident Fund has been facing serious constraints, which include that the investment portfolio is mandated to have at least 70% invested in MGS and fixed income and that investment in domestic equities cannot exceed 25%. As a provident fund, the EPF's equity investments are not being marked-to-market, which means the EPF does not measure the fair value of accounts that can change over time, such as their assets and liabilities. However, although the EPF has adopted the 'marked-to-market' approach for its short-term equity investment portfolios it is not deemed appropriate for long-term investments. Marked-to-market aims to provide a realistic appraisal of an institution's or company's current financial situation. Problems can arise when the market-based measurement does not accurately reflect the underlying asset's true value. This can occur when a company is forced to calculate the selling price of these assets or liabilities during unfavourable or volatile times such as a financial crisis. For example, if the liquidity is low or investors are fearful, the current selling price of a bank's assets could be much lower than the actual value. The result would be a lowered shareholders' equity.

The EPF has not been required to invest on a portfolio basis. There has been no benchmarking or evaluation of the performance of the EPF's investment portfolio against the appropriate market benchmark. Instead, the EPF's

performance has been evaluated in relation to an absolute target return that is not related to how the market has performed on trends in interest rates. Further, the dividends declared are based on the income earned and on realized gains or losses and not on unrealized gains or losses.

This study adopted R. Thillainathan's (2003) opinion, the EPF's performance should be benchmarked and evaluate the performance of its portfolio in relation to the performance of the market and not in relation to an absolute target return. Therefore, the annualized return and standard deviation of the EPF for 1997 to 2008 were calculated using the performance of each existing asset class, instead of using the annual dividend rate.

In this study, the performance of KLSE, foreign equity, MGS and fixed income were evaluated and used to calculate the EPF's return, standard deviation and Sharpe Ratio.

3.2.6 Data Analysis for Asset Allocation and Portfolio Optimization

The purpose of this study is to investigate whether alternative assets will increase the EPF's return, risk and risk-adjusted return, respectively. Commodities, hedge funds and private equity will be selected as alternative assets, each of these assets has desirable individual risk-return characteristics and fit together to create an efficient portfolio based on their correlations.

In order to obtain the asset allocation for each asset class, an optimal portfolio was computed with all the asset classes, comprising domestic equity, foreign equity, commodity, hedge fund, private equity, MGS and fixed income, to generate the highest expected return for each given level of risk or the minimum risk for each given level of return for both conditions, with the constraints of the EPF's investment rules and regulations and without the constraints of the EPF's investment rules and regulations.

This study used Business Spreadsheets Portfolio Optimization (formerly Excel Business Tools), which provides proper built Excel templates that can calculate the optimal capital weightings for a basket of investments that give the highest returns for least risk. The model was designed to be applied in either financial instrument or business portfolio.

This Portfolio Optimization model is based on the theory developed by Harry Markowitz in the 1950s. The theory is based on the efficient market hypothesis where the optimal portfolio can be found graphically as a tangent to the risk-free rate. The efficient frontier represents a set of portfolios that has the maximum rate of return for every given level of risk or the minimum risk for every level of return. The optimal portfolio is the efficient portfolio that has the highest utility for a given investor. The existence of a risk free rate is the major factor in the development of the Markowitz portfolio model, it is an asset with zero variance, which is zero correlation with all other risky assets.

By using this program, based on the correlation of historical returns, product weightings were then generated to find the combination with the highest return for lowest risk. Risk is subject to historical return volatilities. The combination was determined by finding the optimal Sharpe Ratio, which is equal to the portfolio's return less the risk-free rate and then divided by the standard deviation of returns.

The first step was inputting the required data into the Input Sheet, data including historic observation periods, historic price data, risk free rate and minimum and maximum constraints for each asset. Once the inputs have been established, the optimization process is run by the program. This process runs random iterations of portfolio weightings and runs Monte Carlo simulations of portfolio returns. During this process, covariance is calculated for each individual assets' standard deviation and followed by a generated matrix of correlation statistics between each assets. Upon running the optimization process, the assets' weightings will be shown in a pai chart.

In determining the new asset allocation for EPF portfolio after adding alternative assets, this study has adopted the following asset allocation process, aiming for an alternative pension fund portfolio that provides the best return-risk. There are different ways to determine the allocation of asset based on different scenarios. The following calculation of asset allocation is characteristic under the constraints of the pension fund rules and regulations, by imposing constraints on certain assets:

Step 1: Traditional assets' return were inserted into mean-variance optimizer of which minimum and maximum limits of particular assets being set to calculate the optimal weightage for each asset. This step was repeated for every 5% target allocation.

Step 2: Alternative assets' return was then inserted into a mean-variance optimizer to calculate the optimal weightage for each asset.

Step 3: With the new weighting for each asset, the new allocation of every individual assets were then derived respectively based on their overall proportion in the portfolio. The alternative assets' weightage was calculated based on 5%. The asset allocations for traditional assets were calculated up to 95% based on the optimal weightage obtained from Step 1. This step was repeated for every 5% target allocation.

The second scenario served as a conventional method for calculating the new asset allocation for pension funds without rules and regulations. Asset allocation is calculated based on the following steps:

Step 1: Alternative assets' return was inserted into a mean-variance optimizer to calculate the optimal weightage for each asset.

Step 2: The assets' weightage was then calculated based on 5% for each of the alternative assets. The asset allocations for traditional assets were then altered up to 95% based on the existing actual EPF asset allocation. This step was repeated for every 5% target allocation.

3.2.7 Data Analysis for Selected Data Using the Sharpe Ratio

This study analyzed the data and generated return and standard deviation for each asset class. Further, the relation between return and risk was investigated by examining the risk-adjusted return using the Sharpe Ratio. The Sharpe Ratio is a return-to-risk calculated as the average portfolio return premium divided by the standard deviation of the return premium.

In the study adopted by Robertson and Wielezynski (2008), they used return on 90-days T-Bills as a risk-free benchmark. They found that pension funds investing in alternative assets generate higher returns and have significantly higher standard deviations. They examined whether risk and return offset each other by examining risk-adjusted return as measured by the Sharpe Ratio.

Davis (2002) used the Sharpe Ratio to differentiate portfolios invested in international investment, which reflected wider diversification into assets such as real estate, liquidity and loans. He defined it as the real return as a proportion of the standard deviation. Research also shows that in Australia, Sweden and the US, the global portfolio has a higher Sharpe Ratio than the actual portfolio. While in Canada, Japan and Switzerland it is virtually the same. However, the Sharpe Ratio for portfolios in Chile and Singapore are higher for the actual portfolio than the global portfolio.

3.2.8 Data Analysis For Asset Classes Correlation

This study uses the correlation matrix to test the relationship between domestic equity, foreign equity, private equity, hedge fund, commodity, MGS and fixed income, ranging from -1.00 to +1.00. Correlation coefficient (r_{ij}) was used, which is a measure of the relationship: $r_{ij} = \frac{COV_{ij}}{\sigma_i \sigma_j}$. A value of +1 indicates a perfect positive linear relationship and means the returns for the two assets move together in a completely linear manner. Whereas a value of -1 indicates a perfect negative relationship between the two return indexes.

3.2.9 Data Analysis For Selected Data Using the t-test

The paired sample t-test is a statistical technique that is used to compare two population means in the case of two samples that are correlated. The paired sample t-test in this study was used before and after adding alternative assets into that portfolio.

To calculate the paired sample t-test, one first has to set up the hypothesis. The null hypothesis assumes that the mean returns of both portfolio samples are equal. The alternative hypothesis in paired sample t-test assumes that the means of the two portfolios are not equal. In most cases in the paired sample t-test, the significance level is 5%. The parameter is calculated by using formula: $t = \frac{\bar{d}}{\sqrt{s^2/n}}$.

Where d bar is the mean difference between two samples, s^2 is the sample variance, n is the sample size and t is a paired sample t-test with n-1 degrees of freedom.

In addition to looking at the t-value, df and two-tail significance, the correct way to determine significance is to consult the critical t-tables and use the degrees of freedom. However, significance can also be determined by looking at the probability level (p) specified under the heading “two-tail significance”. If the probability value is less than the specified alpha value, then the observed t-value is significant, or the mean of the two paired samples are not equal.

For instance, the first step is to compare mean investment returns of EPF with an alternative asset allocation of 5 percent with no alternative asset allocation. Then proceed with 10 percent alternative asset allocation, 15 percent, 20 percent until 100 percent with uniform increases of 5 percent.

3.3 Summary

This chapter covers the research methodology that was utilized for this study. The data analysis for various assets included the Sharpe Ratio, correlation and optimization. Six research hypotheses were created to study the comparison in return and risk between pension fund without alternative asset allocation and pension fund with various alternative asset allocation.

In the following chapter, the findings of the research will be discussed.