

Investigation on Relationship between Human Behavior and Portfolio Selection Problem in Malaysia using Decision Making Model

Lam Weng Siew, Saiful Hafizah Hj. Jaaman and Hamizun bin Ismail

School of Mathematical Sciences, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia

ARTICLE INFO

Article history:

Received 12 February 2015

Accepted 1 March 2015

Available online 28 March 2015

Keywords:

Human behaviour, risk aversion, decision making model, priority, risk, return and portfolio selection.

ABSTRACT

Background: Different level of risk aversion is important to understand the human behavior. In portfolio selection, the human behavior exhibits different level of risk aversion in finding a trade-off between maximizing the return and minimizing the risk of loss. The human with low risk aversion aims to set the first priority in maximizing the return. On the other hand, the human with high risk aversion desires to set the first priority in minimizing the risk of loss. **Objective:** The objective of this paper is to study the relationship between the human behavior and portfolio selection problem in Malaysia. In this study, the decision making model is applied in portfolio selection to reflect the human behavior towards different level of risk aversion. The objective function of the decision making model is to find a trade-off between maximizing the return and minimizing the risk of loss according to the priority. The portfolio selection is developed for the human with low and high risk aversion. Besides that, the portfolio performance for the human with low and high risk aversion is compared in terms of mean return and risk. In this study, the data consists of weekly price of 23 stocks in Malaysia market from January 2010 until December 2013. **Results:** The results of this study indicate that the human with low and high risk aversion give different portfolio selection and portfolio performance in Malaysia. This is because the human with different level of risk aversion sets different priority between minimizing the risk of loss and maximizing the return. **Conclusion:** In conclusion, the human with different level of risk aversion gives different portfolio selection and portfolio performance in Malaysia. The significance of this study is to understand the relationship between the human behavior and portfolio selection problem in Malaysia. This study helps the fund managers to select the suitable portfolio according to their level of risk aversion.

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To Cite This Article: Lam Weng Siew, Saiful Hafizah Hj. Jaaman and Hamizun bin Ismail., Investigation on Relationship between Human Behavior and Portfolio Selection Problem in Malaysia using Decision Making Model. *Adv. Environ. Biol.*, 9(7), 6-10, 2015

INTRODUCTION

The level of risk aversion is important in understanding and predicting the human behavior. In portfolio selection, the human behavior exhibits different level of risk aversion in finding a trade-off between maximizing the return and minimizing the risk of loss [1]. The human with low risk aversion aims to set the first priority in maximizing the return. On the other hand, the human with high risk aversion desires to set the first priority in minimizing the risk of loss. Various decision making models have been introduced and studied to develop the portfolio selection [2-7]. Other than portfolio selection, the human behavior has been analyzed with different level of risk aversion in insurance demand [8], investment in education [9] and occupational choice [10, 11]. The objective of this paper is to study the relationship between the human behavior and portfolio selection problem in Malaysia. In this study, the decision making model is applied in portfolio selection to reflect the human behavior towards different level of risk aversion. The portfolio selection is developed for the human with low and high risk aversion in Malaysia. Besides that, the portfolio performance for low and high risk aversion is compared in terms of mean return and risk. The rest of the paper is organized as follow. The next section describes the data and methodology. Section 3 discusses about the empirical result of the study. Section 4 concludes the paper.

Data and Methodology:

In this study, the data consists of weekly price of 23 stocks in FTSE Bursa Malaysia Kuala Lumpur Composite Index (FBMKLCI) from January 2010 until December 2013. These 23 stocks are selected in the

Corresponding Author: Lam Weng Siew, School of Mathematical Sciences, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, 43600 UKM, Bangi, Selangor, Malaysia.
E-mail: alexlam522@yahoo.com

study since they make up as components of FBMKLCI index consistently within the study period. This study is conducted using the decision making model [3] to reflect the human behavior towards different level of risk aversion in Malaysia.

Decision Making Process:

Canakgoz and Beasley [3] introduced a decision making model in portfolio selection problem that adopts the human behavior towards finding a trade-off between minimizing the risk of loss and maximizing the return. In this model, the human behavior is measured with two different levels of risk aversion according to their priorities. The decision maker has to set the priority between minimizing the risk of loss and maximizing the return. Human with low risk aversion aims to put the first priority in maximizing the return before minimizing the risk of loss. On the other hand, human with high risk aversion desires to put the first priority in minimizing the risk of loss before maximizing the return. Figure 1 and Figure 2 show the flow of decision making process for low risk aversion and high risk aversion respectively.

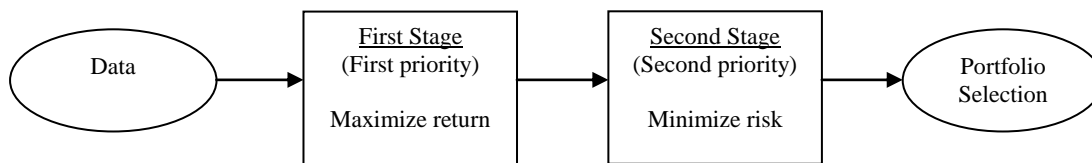


Fig. 1: Flow of decision making process for low risk aversion.

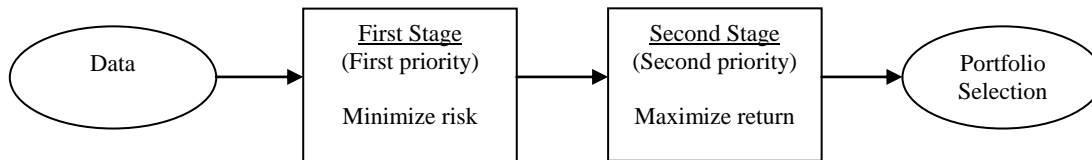


Fig. 2: Flow of decision making process for high risk aversion.

In this model, regression approach is applied in portfolio selection problem to generate higher return than stock market index with minimum risk of loss. When a linear regression is performed on the return from the portfolio against the return from the index, the ordinary least-square estimates, $\hat{\alpha}$ and $\hat{\beta}$, for the intercept and slope respectively of the regression line are given as below.

$$\hat{\alpha} = \sum_{i=1}^N w_i \hat{\alpha}_i \quad (1)$$

$$\hat{\beta} = \sum_{i=1}^N w_i \hat{\beta}_i \quad (2)$$

w_i is the weight of stock i in the portfolio, $\hat{\alpha}_i$ and $\hat{\beta}_i$ are the ordinary least-squares regression intercept and slope respectively when regression is performed on the returns from stock i against the index returns. $\hat{\alpha}$ represents the excess return of portfolio over the index return whereas $\hat{\beta}$ represents the risk of loss in achieving the index return. In order to generate higher portfolio return than index return with minimum risk, the decision makers have to find a trade-off between maximizing the return (maximize $\hat{\alpha}$) and minimizing the risk of loss (minimize $|\hat{\beta} - 1|$) according to their priorities. Human with low risk aversion aims to set the first priority in maximizing the return before minimizing the risk of loss, i.e.

$$\text{First maximize } \hat{\alpha} \text{ and then minimize } |\hat{\beta} - 1|. \quad (3)$$

On the other hand, human with high risk aversion aims to set the first priority in minimizing the risk of loss before maximizing the return, i.e.

$$\text{First minimize } |\hat{\beta} - 1| \text{ and then maximize } \hat{\alpha} \quad (4)$$

Decision Making Model for Low Risk Aversion:

The decision making model for human with low risk aversion is formulated in two stages as below.

First stage:

$$\text{Maximize } \hat{\alpha} \quad (5)$$

Subjects to

$$\sum_{i=1}^N z_i = K \quad (6)$$

$$\sum V_{iT} x_i = C \quad (7)$$

$$w_i = \frac{V_{iT} x_i}{C} \quad (8)$$

$$\sum_{i=1}^K w_i = 1 \quad (9)$$

$$L_i z_i \leq w_i \leq U_i z_i \quad (10)$$

$$z_i \in [0,1] \quad (11)$$

$$x_i, w_i \geq 0 \quad (12)$$

Second stage:

$$\text{Minimize } |\beta - 1| \quad (13)$$

Subjects to

$$\hat{\alpha} = \alpha^{opt} \quad (14)$$

and Constraints (6) to (12)

Decision Making Model for High Risk Aversion:

The decision making model for human with high risk aversion is formulated in two stages as below.

First stage:

$$\text{Minimize } |\beta - 1| \quad (15)$$

Subjects to

$$\sum_{i=1}^N z_i = K \quad (16)$$

$$\sum V_{iT} x_i = C \quad (17)$$

$$w_i = \frac{V_{iT} x_i}{C} \quad (18)$$

$$s \sum_{i=1}^K w_i = 1 \quad (19)$$

$$L_i z_i \leq w_i \leq U_i z_i \quad (20)$$

$$z_i \in [0,1] \quad (21)$$

$$x_i, w_i \geq 0 \quad (22)$$

Second stage:

$$\text{Maximize } \hat{\alpha} \quad (23)$$

Subjects to

$$\hat{\beta} = \beta^{opt} \quad (24)$$

and Constraints (16) to (22)

K is number of stocks in the portfolio, L_i and U_i are the lower and upper bounds of the investment proportion respectively on stock i , V_{iT} is the price of one unit of stock i at time T , x_i is the number of units of stock i in the portfolio, C is the total amount invested at time T , w_i is the weight of each stock invested.

$\hat{\alpha} = \alpha^{opt}$ is the optimal value obtained in the first stage model for human with low risk aversion. $\hat{\beta} = \beta^{opt}$ is the optimal value obtained in the first stage model for human with high risk aversion.

Portfolio Performance:

Variance is applied as risk measure in portfolio selection [12]. The portfolio performance is measured in terms of mean return [4] and risk of loss [13] that formulated as below.

$$r_p = \sum_{i=1}^N r_i w_i \quad (25)$$

$$TE = \sqrt{\frac{1}{T} \sum_{t=1}^T (R_{pt} - R_{It})^2} \quad (26)$$

R_{pt} is the mean return of the portfolio at time t , R_{It} is the mean return of the benchmark index at time t , r_p is the mean return of the portfolio, r_i is the mean return of stock i , w_i is the weight of each stock in the portfolio.

Results:

Table 1 presents the portfolio selection for human with low and high risk aversion using decision making model.

Table 1: Portfolio selection for human with low and high risk aversion.

Portfolio (Stocks)	Low Risk Aversion (Weights %)	High Risk Aversion (Weights %)
Axiata Group Berhad	-	1.00
Malayan Banking	25.59	34.91
Maxis Berhad	1.00	-
Petronas Dagangan Berhad	32.19	13.13
Petronas Gas Berhad	1.00	1.00
Public Bank Berhad	5.22	35.00
Sime Darby	35.00	14.96

As shown in Table 1, the human behavior with different level of risk aversion gives different portfolio selection. For the human with low risk aversion, Sime Darby (35.00%) is the most dominant stock in portfolio selection whereas Maxis Berhad (1.00%) and Petronas Gas Berhad (1.00%) are the smallest components in portfolio selection. For the human with high risk aversion, Public Bank Berhad is the largest component in portfolio selection whereas Axiata Group Berhad (1.00%) and Petronas Gas Berhad (1.00%) are the smallest components in portfolio selection. Table 2 displays the comparison of portfolio performance for the human behavior towards low and high risk aversion.

Table 2: Comparison of portfolio performance for the human with low and high risk aversion.

Level of Risk Aversion (Portfolio)	Weekly Mean Return (%)	Risk (%)
Low	0.2846	0.9548
High	0.2585	0.7314

Based on Table 2, the human with low risk aversion generates higher weekly mean return (0.2846%) at higher risk of loss (0.9548%). This is because the human with low risk aversion aims to maximize the return at highest priority. On the other hand, the human with high risk aversion generates lower weekly mean return (0.2585%) at lower risk of loss (0.7314%) because the human with high risk aversion desires to minimize the risk of loss at highest priority. In summary, the human with different level of risk aversion gives different portfolio selection and portfolio performance in Malaysia.

Conclusion:

This paper studies the relationship between the human behavior and portfolio selection problem in Malaysia. The portfolio selection is developed for the human with low and high risk aversion by using decision

making model. The results of this study indicate that the human with low and high risk aversion give different portfolio selection and portfolio performance in Malaysia. This is because the human with different level of risk aversion sets different priority between minimizing the risk of loss and maximizing the return. The significance of this study is to understand the relationship between the human behavior and portfolio selection problem in Malaysia. This study helps the fund managers to identify the suitable portfolio selection according their level of risk aversion.

ACKNOWLEDGEMENTS

This study is supported by National University of Malaysia's Research Grant Code: FRGS/1/2013/SG04/UKM/02/6.

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