



An Empirical Study on the Characteristics of High Risk Aversion Behavior in Portfolio Decision Making using Regression Model

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ARTICLE INFO

Article history:

Received 12 February 2015

Accepted 1 March 2015

Available online 28 March 2015

Keywords:

Human behaviour, high risk aversion, return, risk, index tracking, regression model and portfolio selection.

ABSTRACT

Background: Human behavior exhibits different level of risk aversion in decision making process. In portfolio selection, human with high risk aversion try to avoid risk of loss in stock market. Therefore, they aim to minimize the risk of loss rather than maximize the return. Index tracking is portfolio decision making to generate similar return with the benchmark index return. Human with high risk aversion desires to minimize the risk of loss in index tracking. **Objective:** The objective of this paper is to study the characteristics of high risk aversion behavior in portfolio selection for index tracking problem. The portfolio selection is developed for high risk aversion behavior using decision making model with regression approach in Malaysia. In this study, Kuala Lumpur Composite Index is the benchmark index to be tracked. Minimum number of stocks is determined to track the benchmark index which consists of 100 stocks. Besides that, minimum risk of loss is determined for the human behavior with high risk aversion. **Results:** The results of this study indicate that there are only 33 stocks selected in the portfolio to track the benchmark index which consists of 100 stocks with minimum risk 0.3201%. This implies that minimum 33% of benchmark index components are required in index tracking for high risk aversion behavior in Malaysia. **Conclusion:** Human with high risk aversion is able to track the benchmark index in Malaysia using the decision making model with regression approach. The significance of this study is to find out the portfolio selection for high risk aversion behavior is able to generate higher return than benchmark index return with only selecting 33% of index components.

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To Cite This Article: Lam Weng Siew, Saiful Hafizah Hj. Jaaman and Hamizun bin Ismail., An Empirical Study on the Characteristics of High Risk Aversion Behavior in Portfolio Decision Making using Regression Model. *Adv. Environ. Biol.*, 9(7), 17-20, 2015

INTRODUCTION

Human behavior exhibits different level of risk aversion in decision making process. In portfolio selection, human with high risk aversion try to avoid risk of loss in stock market. Therefore, they aim to minimize the risk of loss rather than maximize the return. Index tracking is a portfolio decision making to generate similar return with the benchmark index return [1]. Human with high risk aversion desires to minimize the risk in index tracking. Various decision making models have been introduced and studied to develop the portfolio selection [2-7]. The objective of this paper is to study the characteristics of high risk aversion behavior in portfolio selection using decision making model with regression approach [8]. Minimum number of stocks is determined in tracking the benchmark index. Besides, the minimum value of risk is determined for the high risk aversion behavior in Malaysia. 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:

Bursa Malaysia Kuala Lumpur Composite Index (KLCI) is the leading indicator of the performance of Malaysia stock market which consists of 100 stocks with high capital. In this study, the data consists of weekly price of 54 stocks in KLCI index from January 2003 until June 2008. These 54 stocks are selected in the study since they make up as components of KLCI index consistently within the study period. This study is conducted using the decision making model [8] to develop portfolio selection in order to understand the characteristics of the human with high risk aversion in tracking the benchmark KLCI index.

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Decision Making Model:

Alexander [8] introduced a decision making model in portfolio selection problem that adopts the human behavior with high risk aversion in minimizing the risk. Risk measures the deviation of the portfolio's return compared to the stock market index return. Human with high risk aversion aims to minimize the risk of loss with minimum number of stocks in portfolio selection to track the benchmark index. In this model, regression approach is applied to select the minimum number of stocks from the benchmark index for portfolio construction. Regression is a statistical methods used to describe the nature of the relationship between the variables. There are two steps involved in portfolio selection using the decision making model as shown below.

$$\log(I_t) = c + \sum_{i=1}^n [\beta_i \log(P_{i,t})] + \varepsilon_t \quad (1)$$

$$X_i = \frac{\beta_i}{\sum_{i=1}^n \beta_i} \quad (2)$$

I_t is the benchmark market index, $P_{i,t}$ is the stock price of stock i , β_i is the respective coefficients estimated from the regression, c is the constant, ε_t is the residuals estimated from the regression and X_i is the weight of stock i in portfolio. Equation (1) is the regression model which is applied to select the minimum number of stocks from the stock market index components. $\log(I_t)$ is the dependent variable whereas $\log(P_{i,t})$ is the independent variable. Equation (2) determines the portfolio weights for each stock based on the coefficients estimated from the regression model in equation (1).

Portfolio Performance:

Roll [x] applied variance as a risk measure in index tracking. Variance is the most commonly used as risk measure in portfolio selection [9]. Risk is the standard deviation of the difference between the returns of the portfolio and the returns of the stock market index [10]. The formula for risk is as follows.

$$TE = \sqrt{\frac{1}{T} \sum_{t=1}^T (R_{P_t} - R_{I_t})^2} \quad (3)$$

TE is the risk at time t , T is the number of periods, R_{P_t} is the mean return of the portfolio at time t and R_{I_t} is the mean return of the stock market index at time t .

Excess return is defined as the difference between the portfolio return and the stock market index return. There is only excess return if the return of the portfolio is higher than the return of the stock market index. Excess return is formulated as below.

$$\alpha = r_p - r_I \quad (4)$$

α is the excess return, r_p is the mean return of the portfolio and r_I is mean return of the market index. The performance of the portfolio is compared to the benchmark stock market index in terms of mean return.

Results:

The table 1 below presents the result of decision making model in selecting minimum number of stocks with regression approach using EVIEWS software in this study.

As shown in Table 1, there are 33 stocks selected by the decision making model using regression approach in equation (1). This implies that only 33 stocks are required to track the benchmark KLCI index which consists of 100 stocks. Table 2 displays the portfolio selection using equation (2) based on the result shown in Table 1.

As shown in Table 2, the portfolio selection for high risk aversion behavior consists of minimum 33 stocks with different weights to track KLCI index. Tenaga Nasional Bhd (8.69%) is the most dominant stock whereas Bandar Raya Developments Bhd (0.51%) has the smallest component in the portfolio selection. Table 3 displays the portfolio performance for high risk aversion behavior in Malaysia.

As shown in Table 3, the risk of loss for the portfolio in tracking KLCI index is 0.3201%. The weekly mean return for KLCI index is 0.2191% (annual return 12.0536%) based on the study period. The weekly mean return for the portfolio is 0.2207% (annual return 12.1467%) which is higher than the weekly mean return for KLCI index. This implies that the portfolio constructed for high risk aversion behavior using the decision making model is able to generate higher mean return than KLCI index with excess weekly return 0.0016% (annual return 0.0931%).

Table 1: Stock selection with regression approach.

Independent Variables	Stock	Coefficient
X1	Affin Holdings Berhad	Not selected
X2	Malaysia Airports Holdings Berhad	Not selected
X3	AMMB Holdings Berhad	0.024497
X4	British American Tobacco	0.017451
X5	Padiberas Nasional Berhad	Not selected
X6	Berjaya Sports Toto Berhad	Not selected
X7	Bandar Raya Developments Bhd	0.005086
X8	Chemical Company Of Malaysia	Not selected
X9	CIMB Group Holdings Berhad	0.034190
X10	Dialog Group Berhad	Not selected
X11	Digi.Com Berhad	0.009898
X12	Gamuda Bhd	0.026329
X13	Genting Bhd	0.023308
X14	Guinness Anchor Berhad	Not selected
X15	Hong Leong Bank Bhd	Not selected
X16	IGB Corporation Bhd	0.012233
X17	IJM Corporation Bhd	0.034129
X18	IOI Corporation Berhad	0.044737
X19	Kuala Lumpur Kepong Bhd	Not selected
X20	Kulim (M) Bhd	Not selected
X21	Lingui Development Bhd	0.010392
X22	Lingkarans Trans Kota Holdings	0.033690
X23	Malaysian Airline System Berhad	0.024842
X24	Malayan Banking Bhd	0.076181
X25	Lafarge Malayan Cement Bhd	0.008751
X26	Malaysia International Shipping Corporation Berhad	0.049004
X27	MMC Corporation Bhd	0.008460
X28	Malaysian Pacific Industries Berhad	Not selected
X29	Mulpha International Bhd	0.013676
X30	Oriental Holdings Bhd	0.025779
X31	Public Bank Bhd	0.044857
X32	Petronas Dagangan Bhd	0.022461
X33	Petronas Gas Berhad	0.032499
X34	Plus Expressways Bhd	0.053889
X35	Pos Malaysia Berhad	Not selected
X36	PPB Group Berhad	0.037052
X37	Proton Holdings Bhd	Not selected
X38	Puncak Niaga Holdings Bhd	Not selected
X39	RHB Capital Bhd	0.010059
X40	Shangri-La Hotels (M) Bhd	Not selected
X41	Shell Refining Co (F.O.M.) Bhd	0.013749
X42	Sime Darby Bhd	0.073698
X43	Selangor Properties Berhad	Not selected
X44	SP Setia Bhd	Not selected
X45	Star Publications (Malaysia) Berhad	0.027169
X46	TA Enterprise Berhad	0.006918
X47	Tanjong Public Limited Company	0.016114
X48	Tan Chong Motor Holdings Bhd	0.022806
X49	Telekom Malaysia Bhd	0.067411
X50	Tenaga Nasional Bhd	0.086753
X51	UMW Holdings Bhd	Not selected
X52	Unisem (M) Berhad	Not selected
X53	WTK Holdings Berhad	Not selected
X54	YTL Corporation Berhad	Not selected

Table 2: Portfolio selection for high risk aversion behavior using decision making model.

Stock	Weights (%)
AMMB Holdings Berhad	2.45
British American Tobacco	1.75
Bandar Raya Developments Bhd	0.51
CIMB Group Holdings Berhad	3.43
Digi.Com Berhad	0.99
Gamuda Bhd	2.64
Genting Bhd	2.34
IGB Corporation Bhd	1.23
IJM Corporation Bhd	3.42
IOI Corporation Berhad	4.48

Lingui Development Bhd	1.04
Lingkar Trans Kota Holdings	3.38
Malaysian Airline System Berhad	2.49
Malayan Banking Bhd	7.63
Lafarge Malayan Cement Bhd	0.88
Malaysia International Shipping Corporation Berhad	4.91
MMC Corporation Bhd	0.85
Mulpha International Bhd	1.37
Oriental Holdings Bhd	2.58
Public Bank Bhd	4.49
Petronas Dagangan Bhd	2.25
Petronas Gas Berhad	3.26
Plus Expressways Bhd	5.40
PPB Group Berhad	3.71
RHB Capital Bhd	1.01
Shell Refining Co (F.O.M.) Bhd	1.38
Sime Darby Bhd	7.38
Star Publications (Malaysia) Berhad	2.72
TA Enterprise Berhad	0.69
Tanjong Public Limited Company	1.61
Tan Chong Motor Holdings Bhd	2.29
Telekom Malaysia Bhd	6.75
Tenaga Nasional Bhd	8.69

Table 3: Portfolio performance for high risk aversion behavior in Malaysia.

Portfolio	Number of Stocks	Weekly Mean Return (%)	Risk (%)	Weekly Excess Return (%)
KLCI Index (Benchmark)	100	0.2191	-	-
Portfolio (High Risk Aversion)	33	0.2207	0.3201	0.0016

Conclusion:

This paper discusses about the characteristics of high risk aversion behavior in portfolio decision making. The portfolio selection is developed using the decision making model which adopts regression approach. The results of this study indicate that only 33 stocks are required to track the benchmark KLCI index which consists of 100 stocks with minimum risk 0.3201% in Malaysia. The significance of this study is to find out that the portfolio selection for high risk aversion behavior is able generate higher return (annual excess return 0.0931%) than the benchmark KLCI index with only 33 stocks.

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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