UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

OPTIMUM PORTFOLIO VISUALISER FOR RISKY ASSETS USING MEAN-VARIANCE MODEL

P11M19

RUQAYYAH BINTI APANDI (2017412828)
NUR SUHAILAH BINTI MOHD BAKHTIR (2017412762)
NUR FATINI BINTI RAMLI (2017412788)

Report submitted in partial fulfilment of the requirement
for the degree of
Bachelor of Science (Hons.) Mathematics
Faculty of Computer and Mathematical Sciences

JULY 2019

ACKNOWLEDGEMENTS

First of all, thanks to Allah S.W.T for the given opportunity and His blessing so that the three of us was able to complete this final year project just in time. Even though there were a lot of difficulties and challenges that we have to face in order to complete this final year project, in the end, our group managed to complete it, and we are sincerely grateful for this. We would like to express our deepest appreciation to our beloved supervisor Mohd Azdi bin Maasar, who gave us countless help such as encouragement, stimulating the best suggestions and helped us to complete our final year project thoroughly, especially in writing this report. He also gave us the chance to consult with him every week to make sure that we understand every single thing that he explained and properly guide us on how to conduct this final year project. Next, we are highly grateful and indebted to Dr. Mat Salim Selamat as our MSP660 lecturer for his guidance and support. During the class session, he gave us many useful information which helps us in completing this final year project. Meanwhile, a special gratitude towards our families for their support in terms of physically, mentally and financially to help us in completing this final year project. Last but not least, we want to thank each one of us for giving the best commitment and teamwork in completing this case study. Every single effort is much appreciated. Thank you.

ABSTRACT

This research focuses in minimising the risk using mean risk model that was first introduced by Markowitz (1952) for solving portfolio selection problem. Thus, a variance is used as a risk measure in this project. The scenario returns were obtained based on the historical monthly returns from FBMKLCI. The mean-variance model and data set are being implemented in Microsoft Excel and there are different level of target returns which the optimal portfolios are evaluated. Hence, the purpose of this study is to optimise portfolio of risky assets under different level of target return using mean-variance model. Next, to validate in-sample portfolios obtained using the out-of-sample analysis. The in-sample result shows that diversification allows us to reduce the risk of the portfolio without sacrificing potential returns and it also shows that the lower the target return, the lower the risk and the higher the target return, the higher the risk. Based on the out-of-sample analysis, when the expected realised return is low, it will give a low realised risk, when the expected realised return is medium, the realised risk will also be medium and when the expected realised return is high, the realised return is also high. Consequently, to develop user interface as an optimal portfolio visualiser. The user interface design is used to visualise the composition of portfolios and realised returns in graphicâs view to help the user quickly absorb and interpret the presented result after they have entered the specific target return. Generally, based on the results that we obtained, we can conclude that mean-variance is applicable and widely used, as the method is easy to be calculated, but only favorable at low target return. If we were to design this study again, there are several changes that we would make. Most importantly we would go for a longer time period in order to create more scenario returns, include other types of data set, not only from FBMKLCI and to include more methodological work on how to robustly capture the impact and outcomes of different kind of risk measure in optimisation portfolio such as value-at-risk and also conditional value-at-risk.

Contents

Acknowledgements **i**

Abstract **ii**

1 INTRODUCTION **1**

1.1 Introduction 1

1.2 Problem Statement 4

1.3 Objectives 5

1.4 Scope Of The Project 5

1.5 Definition Of Terms And Abbreviations 6

1.6 Significance And Benefit Of The Project 7

2 LITERATURE REVIEW **8**

2.1 Portfolio Optimisation of Risky Asset 8

2.2 Risk Measure 9

2.2.1 Variance 9

2.2.2 Value-at-Risk (VaR) 9

2.3 Comparison of Risk Measures 10

3 METHODOLOGY **12**

3.1 Objective functions and constraints involved 12

3.2 Data collection 12

3.3 Simulating the scenario of monthly returns 12

3.4 Formulation of risk measure and optimisation model of mean-variance 13

3.5 Implementation of mean-variance using in-sample analysis 14

3.6 Validation of results using out-of-sample analysis 15

3.7 Build the user interface using Visual Basic 15

4 COMPUTATIONAL RESULTS **17**
4.1 Objectives and Data Set 17
4.2 In-sample Analysis 17
    4.2.1 Composition of Portfolios 18
    4.2.2 Comparison Between Risk Level and Target Return 19
4.3 Out-of-Sample Analysis 19
4.4 User Interface 21

5 CONCLUSION **24**

A Appendix of the In-Sample analysis **26**

B Appendix of the Realised Return **29**

References **33**