

BEHAVIOR OF SHARE PRICES BY USING FIRST ORDER MARKOV CHAIN MODEL

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**PERPUSTAKAAN -
UNIVERSITI MALAYSIA SABAH**


**THIS DISSERTATION IS SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENT IN OBTAINING THE DEGREE OF
BACHELOR OF SCIENCE WITH HONOURS**

**MATHEMATICS WITH ECONOMICS PROGRAMME
SCHOOL OF SCIENCE AND TECHNOLOGY
UNIVERSITI MALAYSIA SABAH**

2012

DECLARATION

I hereby declare that this dissertation is my own original work except for citations, quotations and summaries, which have been duly acknowledged.



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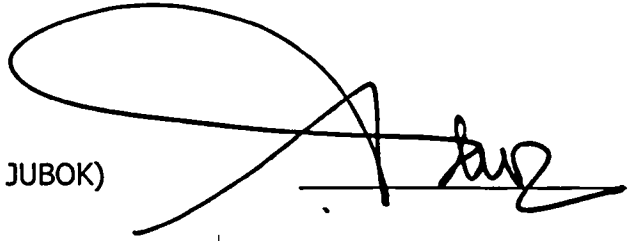
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1. SUPERVISOR

(PROF. DR. ZAINODIN HAJI JUBOK)

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ACKNOWLEDGEMENT

In this study of research, I would like to extend many thanks to my supervisor, Prof. Dr. Zainodin Haji Jubok who always patient to guide us along this study. He helped me a lot throughout this project, from the initial idea to the final idea. This thesis would have been impossible without his constant support, innovative ideas and endless assistance. He has taught me more than I ever expected and helped me accomplish more than I ever imagined. Under his supervision, it make me to be grow more and learn how to working under the stress. Although the process is tough but he did not give up us or refuse to share his knowledge to us but continuous and try to led us to the right path. I would like to extend my gratitude and deepest thanks again to my supervisor for guiding me along this study. Thank you!

Besides, I would like to thank to Mr. Yong Enn Lun who help me examined my project 1 and provided a wealth structural and technical suggestions, greatly improving the final version. Next, the one who never been forgotten is Madam Noraini Abdullah who examined my final year project. Thank you very much!

Furthermore, I would like to thank my coursemates from the Programme of Mathematics with Economics who are helping me and sharing their knowledge and opinion to me along this study. Their ideas and comments which are contributed me a lot in my study and shall not I forget. Thanks.

Finally, I would like to say thanks and gratitude to my beloved family members for their endless encouragement and mentally support for me along this period of time. Their support is a boosting energy for me and that is why I can stand so long. Thanks for everything!

ABSTRACT

In this modern era, fluctuation economic growths make people worry with their future. Therefore, investment acts as an essential role in life for overtaking such crucial problems and aid in development in a nation. Invest in stocks is one of ways for investment. Hence, technique of forecasting has been proposed for investors as a guideline for analyse the behavior of shares and to maximum their profits. Markov chain is a stochastic process and a kind of forecasting method which will be implemented in this study. Five years historical data from the Finance Yahoo and The Star Business for AirAsia Berhad had been collected to estimate missing value by using polynomial order 9 and to forecast. In order to forecast the share prices, matrix of order 3×3 , 5×5 , 7×7 and 9×9 is built. Next, transition probabilities for different dimension of matrices are constructed by using the method of equal interval, equal probability and standard deviation. Probability forecasting is done by applying the state probability vector from ten criteria and transition probability matrix. Lastly, (Mean Absolute Percentage Error) MAPE is used to test the forecast ability in order to obtain the best model for forecasting. As results of this study, method of standard deviation is the best method compare with the method of equal interval and equal probability. Besides that, matrix 3×3 from method of stand deviation has obtain the lowest MAPE which is 8.60% when applying with the first condition of initial probability vector which is using duration of five years data.

SIFAT HARGA SAHAM DENGAN KAEDAH RANTAI MARKOV PERINGKAT PERTAMA

ABSTRAK

Pada zaman moden ini, perubahan ekonomi yang berbagai menyebabkan kalangan masyarakat merisaukan masa hadapannya. Oleh itu, pelaburan memainkan peranan yang penting dalam menangani masalah ini dan dalam pembangunan negara. Pelaburan dalam harga saham adalah salah satu jenis pelaburan. Maka teknik bagi ramalan harga saham telah diperkenalkan bagi pelabur untuk menganalisis sifatnya dan memaksimumkan keuntungan. Rantai Markov adalah merupakan proses stokastik malah juga sebagai sejenis kaedah ramalan. Lima tahunan data AirAsia Berhad telah direkod dari laman web Finance Yahoo dan The Star Business bagi tujuan meramal kehilangan data dengan menggunakan polynomial darjat 9 dan juga meramal data. Untuk tujuan meramal harga saham, matriks 3×3 , 5×5 , 7×7 dan 9×9 telah dibina. Seterusnya, matriks peralihan bagi berbeza matriks dimensi telah dibina melalui kaedah kesamaan selang, kesamaan kebarangkalian dan selang perbezaan sisihan piawai. Ramalan kebarangkalian telah diselesaikan melalui menggunakan vector kebarangkalian dan kebarangkalian peralihan matriks. Akhirnya, purata peratusan ralat muklat (MAPE) digunakan bagi menguji keupayaan ramalan bagi mendapat model yang terbaik. Kesimpulannya, kajian ini didapati bahawa kaedah selang perbezaan sisihan piawai adalah kaedah terbaik berbanding dengan kaedah kesamaan selang dan kesamaan kebarangkalian. Malah matriks 3×3 daripada kaedah selang perbezaan sisihan mencapai nilai MAPE yang terendah iaitu 8.60% semasa mengguna syarat pertama bagi vector kebarangkalian iaitu menggunakan tempoh masa lima tahun.

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LIST OF SYMBOLS

$+$	Addition
$-$	Subtraction
$=$	Equivalent to
Σ	Summation
\in	Member of
Π	Phi
$<$	Smaller than
$>$	Greater than
\leq	Smaller or equal than
\geq	Greater or equal than
μ	Mean
σ	Standard deviation

CHAPTER 1

INTRODUCTION

1.1 Overview

In this modern era, people are facing a lot of financial problems such as not enough money saved for retirement or children education fees; pay thousand dollars of debt on credit card and growing budget saving. These are all the hottest issues which most of the people are facing and suffered due to the cost of living is getting higher and higher. Moreover, money depreciation also causes the living cost to rise as our wages is not growing. However, the truth now is, unless you are a firmly financial conscious household or a people who have a strong foundation of financial then you may overcome these problems easily.

Therefore, to overcome these problems some of the people are started to work another job to cover the high expenses. Wealth can be made in short term which depend to the skills that people have. So, people are starting to invest for changing their life more comfortable. This is because investment is one of the easiest ways for them to gain more profit. There are several types of investment such as properties, business, shares and saving plans. Buying share as their investment can make them gain profits in the shortest times. In fact, money and stock market have become essential assets. According to Pattern (1993), Stock market is vary all the times and is fluctuation which is out of the control by people. If people want to get more familiar with the stock market environment indeed they need the knowledge in investment as fundamental such as knowledge in forecasting. If the people do not know the knowledge of forecasting, they might be making a wrong decision when choosing a stock.

Missing value on the no transaction days, Saturday, Sunday and public holiday are playing an important and which will affect the persistent of the forecast result. Evidently, Bermudez *et al.* (2009) said that estimating missing value played an essential role in getting a persistence forecasting. While Zhang & Zhang (2009) mentioned the persistence of investment performance is a topic of perennial interest to investors. Besides, forecasting method is used to determine the future price and mean absolute percentage error (MAPE) is applied so that investors may know how accuracy the forecasting is and have an idea on how to choosing a right stock for their investment.

1.2 Bursa Malaysia

According to Bursa Malaysia (2011), Bursa Malaysia is an exchange holding company and function as a fully integrated exchange and also including the complete range of exchange-related services. Besides that, Bursa Malaysia today also is the largest stock exchange in Asia with just under 1000 listed companies where providing a global range of investment choices to the public. All the companies either list on Main Market or ACE Market in Bursa Malaysia Securities Berhad.

Based on the Bursa Malaysia (2011), the Singapore Stockbrokers' Association was the first formal securities business organization in Malaysia which established in 1930. In the day of time, 1937, it was re-registered as the Malayan Stockbrokers' Association. In 1960, The Malayan Stock Exchange was established and the public trading of shares introduced. In 1973, the Stock Exchange of Malaysia and Singapore was divided into the Kuala Lumpur Stock Exchange Berhad and the Stock Exchange of Singapore due to currency interchange ability between Malaysia and Singapore ceased. On 14th April 2004, Kuala Lumpur Stock Exchange Berhad was changed to Bursa Malaysia Berhad resulted from the case of demutualization exercise with the purpose of to stronger our competitive position and to be more customer-driven and market-oriented. Then, Bursa Malaysia was listed on the Main Board of Bursa Malaysia Securities Berhad on 18th March 2005.

From Bursa Malaysia (2011), on the 5th October 2007, Bursa Malaysia is achieved an excellent performance by getting the certifications for conformance to the ISO 9001:2000 Quality Management System and ISO 14001:2004 Environmental Management. By growing up the Malaysian capital market and enhancing global competitiveness, Bursa Malaysia is playing an important role to maintaining an efficient, secure and active trading market for local and global investors.

1.2.1 Stock and Stock Market

According to Pattern (1993), stock is an instrument that represents an ownership position or equity in a company and representing the percentage share of its assets and profits of the company's claims. Ownership in the company is determined by the number of shares a person owns divided by the total number of shares outstanding. Shareholders are providing a proportional voting right in certain company decision but in commonly shareholders with a small portion of stocks are not have the chance to making any influence in the company right. Besides that, not every company has issuing stocks to the public because of they do not want to share their company ownerships with other shareholders. The purpose of issuing stock is to rise up a company capital from the investors to expand instead of borrowing money from bank or called as debt financing. All the shareholders get in return for their money is the hope that the shares will be worth more some days. Stocks can be divided into two categories which are preferred stock and common stock. Preferred stock is typically pays regular dividends to the investors while the common stock represents ownership of a company and may offer more rights and privileges.

Ologunda & Elumilade (2006) mentioned that stock market is a loose network of economic transaction for the trading of company stock and derivative at an agreed price which also can be known as equity market. Besides that, it can bring a large profit or monetary gains as well as devastating losses in short-term investment vehicle. Stock market plays an important role for a company to raise their capital as a source. It gives the permit for those businesses to be officially publicly traded and do expansion by selling their ownership shares in public. The liquidity of the stock market exchange gives the ability to quickly and easily sell securities to traders. Hence, it became an advantage of investing in stock which compared to others less

liquidity investment. Stocks market can be divide into two groups as well which is primary market that investors have the priority to buy a newly issued security and secondary market is an action market where investors can sell shares through brokers to others investor. Ologunda & Elumilade (2006) also stated that the primary market is concerned with the initial insurance of securities. The issue can be taken by of any following forms such as offer for subscription, sales, by introduction, private placement and right issue. While Pattern (1993) mentioned secondary market is defined as a market where the investor trade previously issued securities without the involvement of the issuing companies.

Truly to understand the behavior of the share market, you will be more easily gain more profit but it also can be intimidating if you are losing a huge amount of money when the time you invest. Besides, Schmeling (2009) founded that investor sentiment also will affect the stock market return. When investor sentiment is high, future stock market return tend to be lower and vice versa.

1.3 Background of AirAsia Berhad

According to AirAsia (2010), within the space of five years, Asian budget carrier AirAsia has grown quickly and helping to shake up the airline business in the region. With its fleet of 100 aircraft and flies to more than 65 destinations in 18 countries from hubs in Malaysia, Thailand and Indonesia in 31st December 2010 with low fare.

Moreover, AirAsia (2010) stated that Dr Tony Fernandes founded the AirAsia Berhad which is the leading low cost carrier (LCC) in Asia and connected in the provision of air transportation services. Besides that, AirAsia is holding on the perception with everyone can fly and to every destination as they can. By making the low fare model possible therefore AirAsia has implemented few key of strategies which are emphasize in safety, high aircraft utilization, low fare and no frills, streamline operations, lean distribution system and point to point network for achieving the target.

Through out of this, today, AirAsia (2010) mentioned that AirAsia has flow over 100 million guests across the region and continues to create more extensive route network through its associate companies. In year of 2011, Chiang Mai and Medan as new hubs in Thailand and Indonesia are added by the company respectively. Its subsidiaries are AA International Ltd, which is an investment holding company; AirAsia Go Holiday Sdn Bhd, which is engaged in tour operating business; AirAsia (Mauritius) Limited, which is engaged in providing aircraft leasing facilities to Thai AirAsia Co. Ltd; Airspace Communications Sdn Bhd, which is a media owner with publishing division; Aras Sejagat SdnBhd, which is a special purpose vehicle for financing arrangements required by the Company, and Asia Air Limited, which is engaged in the provision and promotion of AirAsia Berhad's in-flight food to the European market.

1.4 Forecasting

Forecasting is a very important process in doing an evaluation. From the forecasting process we can determine our individual perception and decision is correct or accurate with the actual value. Hence, forecasting is playing an important role for everyone in making decision.

According to Ibrahim (2010), stock prices have a border and as a predictor need to have a timely forecast and in generally, it is accurately measured. In contradiction, the data on rival output predictors such as money supply and other macroeconomic variables are available only with some lags and are normally subject to revisions. Maybe is the major downside of stock prices which may contain too much noise. In addition, Ibrahim (2010) also mentioned changes in stock prices may also reflect the firm's risk. Hence, it shows that forecasting is very important in doing investment.

Hyndman (2006) mentioned that forecasting is a common tool in business from making decisions or guideline for a long-term strategic planning. Moreover, forecasting is also getting the accuracy from the predicting and gives all the information available regarding on historical data and knowledge of any future that

might affects the forecast behavior. Forecasting is playing an important role in a company. Hence, organization is developing a forecasting system to predicting the uncertainty and it requires forecasting method to apply with identify the problem.

1.5 Purpose of Study

The purpose of this study is to forecast the behavior of the share prices in order to analysis based on the trend. The analysis can be underlining the behavior of the trend and as a guideline for traders when making their own decision.

1.6 Problems Statement

Nowadays, many people are tending to gain money from stock market either in short-term or long-term investment but the problems they facing with is how to invest in share and how to gaining the maximum profit in their investment. Some of them are trusted on their investment consultant but at the same time they need to observe on what the shares them choosing on. Due to the lacking of knowledge of forecasting and evaluation on the share market trend and behavior, they may be end up with a wrong decision on making choice and end up with a huge losing.

Moreover, the problems lies in each individual and investor when trading shares is in deciding when is the golden time to get into the market or sell their share. They cannot predict how much the price is likely to change. According to White (1994), statistics show that over long period an investment in shares outperforms all others investments including property. However, shares are a kind of investment which is risky. The greater the reward, the greater the risk is. There is always risk whichever decision being made. The investor must be prepared for the fact that part of his total investment is certain to be lost. Therefore, investor should only buy shares with money which he or she affords to lose. However, if the person knows the trend of a share prices, then he or she has a high probability to maximize and minimize losing.

Hence, in this research we will look into the share's trend and its behavior that is AirAsia Berhad by using Markov chain to solve these problems. Eventually, it will be perfect guidance for investorsto making their decision in the future.

1.7 Objectives

This research is mainly to look into the behavior share prices for AirAsia Berhad for a period of time. Hence, the objectives of this research are as below:

- i. To identify the accuracy for Markov chain model.
- ii. To identify the superior sensitivity of different dimension matrices.
- iii. To compare the effectiveness of the method standard deviation with the method of equal interval and equal probability.
- iv. To identify the best dimension of matrix for forecasting.
- v. To identify the best method for forecasting.

1.8 Scope of Study

In this study, we will focus on the share prices for AirAsia Berhad. Daily historical prices were collected from 1st September 2006 to 31st August 2011 total of five years. The closing share prices for AirAsia Berhad were chosen in this study. The historical share prices are including the missing values which are allocated in Saturday, Sunday and the day is no transaction.

1.9 Limitation of Study

With the existing of the missing for the Saturday, Sunday and the day of no transaction it occurred of no transaction in stock exchange. It had brought obstruction for forecasting process and not persistent prediction. Hence, it is a limitation. Although this problem is cannot be prevent from the daily transaction but it may solve by getting the missing value with the polynomial order 9. Besides that, Goodwin & Wright (2010) mentioned that when a system has relation with the fundamental changes it will cause problem. Markov chain is a mathematical forecasting tool which is not considering the fundamental changes in economics. Hence, if the changes in the economics appear, the persistent of the forecasting effect is affected.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Many of researchers have come out with the prediction for the share prices behavior and market's efficiency and indeed every study is come out with a new insight on the market behavior. Hence, in this study, we will get into how to forecast share prices which is currently important among the traders or investors from choosing their right decision. In this case, we will review on the paper of forecasting and revise how the researchers use their way for doing the forecasting. Besides that, we are interest to look at those researchers who use the application of Markov chain to predict the behavior of the share prices. Besides, the forecast ability of the model is playing an important role in this study. Therefore, we are referring on previous researchers' work how to test on the accuracy of the forecast data with the actual data indeed to getting the best result.

2.2 Stock Prices Prediction by Using Polynomial

Assaleh *et al.* (2011) conducted a predicting stocks price using polynomial classifiers with the case of Dubai Financial Market. The purpose of this research is researcher uses to present two prediction models for predicting securities' price. The two models which were developed using back propagation feed forward neural networks and using polynomial classifiers (PC).

On the other hand, Assaleh *et al.* (2011) mentioned that recently predicting stock prices accuracy is the most challenging task for all traders and investors. There are four approaches for forecasting or predicting stock prices which are fundamental analysis approach, technical analysis approach, time series forecasting and machine learning. These approaches may be done in sole or combination and each of the approaches has own merits as well as limitation. For stock price prediction, historical prices of the stocks is the input and in the formed of a sequence of feature vectors where its corresponding output is the future price of the stock. The purpose of this is for learning different market situations and various price patterns in the various market bear or bull market and consolidating market.

2.3 Research on Missing Value

Missing value in generally is named as the missing observation or indicated as no transaction in stock market. According to Bermudez *et al.* (2009) missing value playing an important role in obtaining a model for forecasting and hence it cannot be neglected. There are various techniques in solving the missing values in a time series data. This crucial fact is commonly ignored and the data are typically analyzed as if there were no missing data.

On the other hand, Bermudez *et al.* (2009) said that the prediction of time series with missing values should be dealt effectively to achieve accurate analysis and dependable forecasting result with precisely. The formulation of Holt's model with expectation and maximization (EM) algorithm is used in solving the missing data problem and only appropriate when the given data is incomplete or there are existences of missing values. At last, they had come out a result that the prediction using the complete data series is slightly better than the estimation with the existence of missing data.

2.4 Research on Markov Chain Model

Based on Tan & Yilmaz (2002) research, they mentioned that Markov chain based tests have been commonly used in analysis of statistical properties of various economic time series and it is used in stock markets and foreign market sensitivity or efficiency. Moreover, it also needs the transformation from a continuous state space into a discrete state space sequence. If the only the time-dependency and homogeneity properties of a time series are highlighted then the observations can be aggregated into a finite number of states and further investigation can be proceed by using the state space. There are pros by using Markov chain based tests which are there is a trade-off between gaining more information about the structural properties of the time series and do not required an extensive set of assumptions about the distribution, homoscedasticity, serial correlation and so forth. Markov chain can be used to detect possible changes in the behavior pattern of the stock return over time. A significant break in the time series behavior of stock returns would generate rejection of the stationary of the transition probability matrix. Due to this, testing for the stationary of the transition matrix plays an essential role for the validity of Markov chain based random walk tests. Besides that, Tan & Yilmaz (2002) also said that if the transition matrix is not stationary through time, then the Markov chain will losing the power of prediction. Hence, for the order of dependence and test random walk would appropriate for those sub- sample periods where the stationary matrix cannot be rejected.

Meanwhile, Shamshad *et al.* (2005) said that the probability of the given condition for Markov process is possible to be deducted from information about the preceding conditions. Moreover, Markov chain represents a system of element making transition from one state to another over time. Markov chain of the first order is one for which each next state depends only on immediately preceding one. The order of the chain gives the number of time steps in the past influencing the probability distribution of the present state which can be greater than one. In addition, Shamshad *et al.* (2005) also mentioned that the Markov chain modeling approach has been frequently used in for synthetic generation of rainfall data.

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