FORECAST KULIM (M) BERHAD SHARE PRICES USING MARKOV CHAIN WITH AND WITHOUT MISSING VALUES

LAI YEE SHAN

THIS THESIS IS PRESENTED TO FULFILL PART OF THE REQUIREMENT TO OBTAIN A BACHELOR OF SCIENCE DEGREE WITH HONOURS

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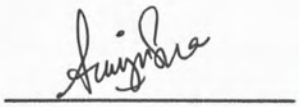

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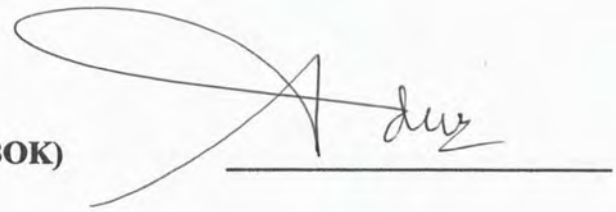

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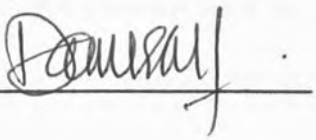

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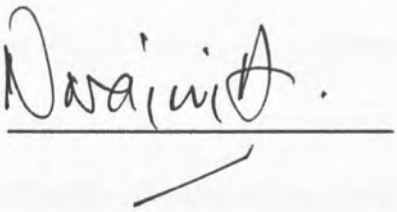

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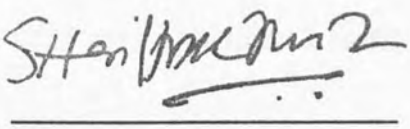

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ABSTRAK

Saham adalah penting hampir dalam semua jenis pelaburan. Oleh itu, adalah penting untuk mengkaji tentang pasaran saham bersama dengan bentuk perubahan harga sesuatu saham. Siri data yang digunakan adalah harga tutup saham Kulim (M) Berhad bermula dari Januari 2000 sehingga Disember 2006. Data untuk tahun 2007 adalah untuk tujuan menguji ketepatan peramalan sampel masa hadapan. Tujuan kajian ini adalah untuk mengimplikasikan kaedah rantai Markov sebagai satu kaedah peramalan. Selain itu, keperluan untuk menganggar data yang tidak tercerap diperhatikan. Data yang tidak tercerap dianggar dengan menggunakan analisis regresi kuasa-dua-terkecil, di mana lengkuk linear, lengkuk kuadratik, dan lengkuk kubik digunakan untuk menganggarkan data tidak tercerap. Peramalan menggunakan rantai Markov ke atas set data dengan data tidak tercerap atau tanpa data tidak tercerap dijalankan dengan pembinaan matrik 5x5, 7x7, 9x9, dan 11x11. Perbandingan adalah dibuat untuk mendapat satu kombinasi terbaik. Hasil kajian menunjukkan bahawa tiada perbezaan dalam hasil ramalan walaupun dengan penganggaran data tidak tercerap. Dalam kajian ini, peramalan menggunakan kaedah rantai Markov adalah tidak berjaya untuk menjangka aliran siri harga saham dalam tempoh yang dikaji.

ABSTRACT

Stocks are a part of nearly any investment portfolio. Hence, it is wise for us to study about stock market and might as well understand the changes in prices. The data series consist of daily share closing prices of Kulim (M) Berhad from January 2000 to December 2006. Remaining daily closing prices for the year 2007 are kept for post-sample accuracy checking. The objective of this study is to apply Markov chain as a forecasting tool. Another objective of this study is to determine the significance of with and without estimating the missing values. Missing values are estimated using least-squares regression analysis, which consists of three methods of curve-fitting specifically the Linear curve, Quadratic curve, and Cubic curve. Each set of data with and without estimating missing values is analysed by using 5-States, 7-States, 9-States, and 11-States Markov chain method. Results show that there are no significant differences in estimating the missing values. Here in this study, Markov chain is not a successful forecasting tool. Forecasted results have not correctly predicted the future trend of KULIM share prices within the sample period of study.

CONTENT

CHAPTER 3 METHODOLOGY

CHAPTER 4 DATA DESCRIPTION

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 PROBLEM OF THE STUDY

According to Faerber (2000), stocks are a part of nearly any investment portfolio. Over the last few decades, the average person's interest in the stock market has grown exponentially. What was once a toy of the rich has now turned into the vehicle of choice for growing wealth. However, most people do not fully understand stocks. A lot of misinformation which is based on get-rich-quick mentality has been thought by those who do not understand stocks. Stocks can create massive amounts of wealth, but they are not without risks.

Hence, it is wise to study about stock market and might as well understand the changes in prices. From this study, a mathematical model to forecast the share prices is built. This study allows the understanding of the pattern of changes in the share prices and factors which affect the share prices changes. Past historical trend need to be observed, before obtaining the forecasted result. Hence, the trend of the ups and downs of the share prices can be recognized. By understanding it, advices and recommendations can be given to investors to reduce the risk in their investments. Mean while, mathematical knowledge can be applied into the real-world problems.

1.2 FORECASTING

Forecasting is a method for estimating future aspects. It is very important for the management of an organization. An organization which is able to foresee will develop appropriate strategies to deal with various kinds of scenario. However, "Perfect accuracy [in forecasting] is not obtainable," warned Brealey and Myers (2002). From the Oxford Advanced Learner's Dictionary (2005), forecasting is to say what you think will happen in the future, based on information that is available now.

According to Hillier and Lieberman (1995), forecasting methods can be divided into two big categories, that is, qualitative and quantitative. These two divisions are based on the availability of the historical data. Qualitative forecasting method is used when historical data is not available while the quantitative forecasting method is used when historical data is available. There are three important qualitative forecasting methods. They are the Delphi technique, scenario writing, and the subject approach. While in the quantitative forecasting method, there are two major categories. One uses the past trend of a particular variable while the other examines the cause-and-effect relationships of the variable with other relevant variables.

According to Robbins and Coulter (2005), many organisations collaborate on forecasts by using Internet-based software known as CPFR, which stands for collaborative planning, forecasting, and replenishment. CPFR offers a standardized way for retailers and manufacturers to use the Internet to exchange data. Each organisation relies on its own data about past sales trends, promotion plans, and other factors to calculate a demand forecast for a particular product. If their respective

forecasts differ by a certain amount (say 10 percent), the retailer and manufacturer use the Internet to exchange more data and written comments until they arrive at a single and more accurate forecast. This collaborative forecasting helps both organisations do a better job of planning.

According to Brealey and Myers (2002), forecasting cannot be reduced to a mechanical exercise. Naïve extrapolation of fitting trends to past data is of limited value. It is because the future is not likely to resemble the past, hence planning is needed. To supplement their judgement, forecasters rely on a variety of data sources and forecasting methods, for example, forecasts of the economic and industry environment may involve the use of econometric models which take account of interactions between economic variables. In other cases the forecaster may employ statistical techniques for analyzing and projecting time series. Brealey and Myers (2002) also states that forecasts of demand will partly reflect these projections of the economic environment, but they must also be based on formal models that marketing specialists have developed for predicting the buyer behaviour or on recent consumer surveys to which the firm has access.

Forecasting is important in making decision in the economic sector such as the production sector, import-export, marketing, and during inspection processes. Forecasting is needed for two general reasons: anything that is yet to happen is unsure and whatever consequences that happened from the decision made will not be too much of an impact until it really did happen. Predictions about the future have to be done in every decision making. Usually, an accurate forecast will increase the efficiency in the decision making process where reduces risks of losses or mistakes.

1.3 STOCKS

According to Eakins (2002), stock is a share in the ownership of a company. Stock represents a claim on the company's assets and earnings. The more stock one acquires, the greater the ownership stake of one in the company becomes.

There are two main types of stocks according to Eakins (2002), that is the common stock and the preferred stock. Majority of stock issued is in the form of common stock. It represents ownership in a company and a claim on a portion of profits. Over the long term, common stock yields higher returns than almost every other investment, but also the most risk. There are many compelling reasons why investors should invest in common stocks, where according to Faerber (2000), for one, people are living longer and are going to need money for retirement, and for medical and other expenses. Consequently, they are going to have to save more and invest it in assets that earn satisfactory rates of return to fund these increasing expenses.

With preferred shares according to Eakins (2002), investors are usually guaranteed a fixed dividend forever. In the event of liquidation, preferred shareholders are paid off before the common shareholder. It is also callable. It means that the company has the option to purchase the shares from shareholders at anytime for any reason.

According to Kok and Goh (1995), the Bursa Malaysia (formerly known as the Kuala Lumpur Stock Exchange – KLSE) is the only stock market in Malaysia. The Bursa Malaysia plays a pivotal role in the economic development of the country.

Its importance has been acknowledged by the government with the establishment of the Securities Commission to oversee the sound development of the securities industry in Malaysia.

Kok and Goh (1995) states that a stock market index is often constructed to measure the performance of the overall stock market or a sector of the market. According to them, there are a number of organisations which have constructed stock indices in Malaysia. Bursa Malaysia itself has constructed the widely followed Composite Index, the all-share Emas Index, the various sectored indices for the industrial, finance, properties, tin, plantations and hotel sectors, the Second Board Index, and the various indices for the four sub-sectors of consumer products, industrial products, construction, and trading services in the industrial sector.

There are numerous stock indices in the Bursa Malaysia. Here in this study, a specific share is to be studied, that is the Kulim (M) Berhad shares where according to Bursa Malaysia, its symbol is **KULIM** with a stock code of **2003**.

1.4 KULIM (M) BERHAD

From KULIM's Annual Report (2006), it is known that the history of Kulim (M) Berhad ("KULIM" or "the Group") began over 70 years ago with the incorporation of Kulim Rubber Plantations Ltd (KRPL) in United Kingdom on 4 July 1933. The year 1947 marked the Group's humble beginning with an operation of 190 hectares of rubber plantation in the state of Johor, Malaysia. On 16 July 1970, KRPL changed its

name to The Kulim Group Limited (KGL) and was listed on the London Stock Exchange (LSE).

From KULIM's Annual Report (2006), KULIM was incorporated on 3 July 1975 as a public limited company and on the 14 November 1975, was listed on the Main Board of the Kuala Lumpur Stock Exchange (KLSE) (now known as Bursa Malaysia). KGL became a subsidiary of KULIM, in accordance with a Scheme of Arrangement carried out under Section 206 of the United Kingdom Companies Act, 1948. The purpose of the Scheme was to transfer to KULIM the assets and liabilities of KGL, after the necessary divestment of its United Kingdom interests.

The corporate structure of KULIM is shown in Table 1.1, where the percentage is the equity percentage received by KULIM. Table 1.1 provides information in the corporate relationships of companies and or subsidiary companies with Kulim Group.

To read the table, taking the Quick Service Restaurants (QSR) business as example, QSR Brands Bhd. is 57% owned subsidiary of Kulim Group, while QSR Ventures Sdn. Bhd. is wholly owned subsidiary of QSR Brands Bhd. Pizza Hut Holdings (Malaysia) Sdn. Bhd. is wholly owned subsidiary of QSR Brands Bhd. as well. Pizza Hut Restaurants Sdn. Bhd., Multibrand QSR Holdings Pte Ltd, and Pizza Hut Singapore Pte Ltd are wholly owned subsidiary of Pizza Hut Holdings (Malaysia) Sdn. Bhd. KFC Holdings (Malaysia) Berhad is 45% owned subsidiary of QSR Brands Bhd.

Table 1.1: Corporate structure of Kulim Group as at 31 December 2007.

	Equity %	Corporate Name
Plantations and Support	100%	Kulim Plantations (Malaysia) Sdn. Bhd.
	100%	Ulu Tiram Manufacturing Company (Malaysia) Sdn. Bhd.
		100% EPA Futures Sdn. Bhd.
	100%	Mahamurni Plantations Sdn. Bhd.
		100% Pembangunan Mahamurni Sdn. Bhd.
		100% United Malayan Agricultural Corporation Berhad
	100%	Selai Sdn. Bhd.
	100%	EPA Management Sdn. Bhd.
		90% Edaran Badang Sdn. Bhd.
		100% Panquest Ventures Limited
	94%	Kumpulan Bertam Plantations Berhad
	51%	New Britain Palm Oil Limited
		100% Dami Australia Pty Ltd
		50% PT Dami Mas Sejahtera
		100% New Britain Nominees Limited
		80% Guadalcanal Plains Palm Oil Limited
	60%	Kulim TopPlant Sdn. Bhd.
	75%	JTP Trading Sdn. Bhd.
	30%	Asia Green Environmental Sdn. Bhd.
Manufacturing	91%	Natural Oleochemicals Sdn. Bhd.
		100% Natural Soaps Sdn. Bhd.
		55% Dubois-Natural Esters Sdn. Bhd.
		100% Natural Alcohols Sdn. Bhd.
		100% Natural Wax Sdn. Bhd.
	100%	Skellerup Industries (Malaysia) Sdn. Bhd.
		100% Skellerup Foam Products (M) Sdn. Bhd.
		100% Skellerup Latex Products (M) Sdn. Bhd.
	100%	Kulim Energy Sdn. Bhd.
		51% Nexsol (Malaysia) Sdn. Bhd.
	49%	Nexsol (Singapore) Pte Ltd
Quick Service Restaurants	57%	QSR Brands Bhd.
		100% QSR Ventures Sdn. Bhd.
		100% Pizza Hut Holdings (Malaysia) Sdn. Bhd.
		100% Pizza Hut Restaurants Sdn. Bhd.
		100% Multibrand QSR Holdings Pte Ltd
		100% Pizza Hut Singapore Pte Ltd
		45% KFC Holdings (Malaysia) Berhad
Others	100%	Kulim Limited
	51%	Pristine Bay Sdn. Bhd.

Source: *http://www.kulim.com.my/html/corp_info.aspx*

1.5 OBJECTIVES OF STUDY

This study involves studying the trend of historical share prices, and hence produces a forecast for future investments. There are a few of mathematical processes done in this study to obtain an accurate forecast.

The objectives in this study are:

a. To determine the best estimation for the missing values of the data.
b. To apply Markov Chain as a forecasting tool.
c. To forecast one day ahead of KULIM's share price.
d. To compare the forecasted result from different dimensions of transition matrices.
e. To determine the significance of estimating the missing values.

1.6 SCOPE OF STUDY

Daily share prices of KULIM from January 2000 until December 2006 is analysed in this study. The remaining daily share prices for the year 2007 are kept for comparison purpose with the forecasted result. All historical prices are taken from *Yahoo! Finance* website (http://finance.yahoo.com/q/hp?s=2003.KL) which is linked from the Bursa Malaysia official website (http://www.bursamalaysia.com/website/bm/). According to the Bursa Malaysia, the symbol of KULIM share is KULIM while its stock code is 2003.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

In this study, we are to forecast the share prices of Kulim (M) Berhad. There are various methods to forecast. While in this chapter, few past researches regarding of forecasting methods and research of the Markov chain will be studied. In section 2.2, past research of forecasting method is studied while in section 2.3, past research of Markov chain will be studied.

2.2 PREVIOUS RESEARCH IN FORECASTING

According to Robbins and Coulter (2005), forecasting techniques fall into two categories: quantitative and qualitative. Quantitative forecasting applies a set of mathematical rules to a series of past data to predict outcomes. Qualitative forecasting, in contrast, uses the judgement and opinions of knowledgeable individuals to predict outcomes.

From the work of Yuksel (2007) with the title of *An integrated approach to hotel demand*, the lodging industry, because of the structure of the business, is sensitive to fluctuations in demand. This applies into the stock market, which is also

sensitive to the supply and demand of that particular stock. This is called the volatility of the stock market. According to Tae (2007), accurate volatility forecasting is the core task in the risk management in which various portfolios's pricing, hedging, and option strategies are exercised. Tae (2007) also stated that prior studies on stock market have primarily focused on estimation of stock price index by using financial time series models and data mining techniques.

Since the method used in this study is Markov chain, which deals with probability, let us look into the past research of probability forecasting. From the work of Abramson and Clemen (1995) with the title *Probability Forecasting*, the need for probabilistic forecasts emerges from a simple fact: the future is uncertain. Most forecasts, appear deterministic and, even more, are assumed to be deterministic by the clients and bosses who requested them in the first place.

According to Abramson and Clemen (1995), virtually every professional forecaster is aware that the uncertain components of his or her forecasts – the stochastic perturbations, the error bands, and often even the variance – are generally ignored. Only the central tendencies (i.e., mean, median, or mode) are heard and remembered. There is a question which appears, that is, what to do about uncertainty. Abramson and Clemen (1995) attempt to cast their net wide and to convince researchers whose primary interest in uncertainty that they should look at forecasting, while simultaneously trying to convince researchers whose primary interest is forecasting to look at uncertainty.

In Yuksel's work (2007), Analytical Hierarchy Process (AHP), was created to solve multi-criteria decision making problems. It was adapted to predict competitive behaviour. This competitive behaviour is also implied in the stock market. According to Yuksel (2007), there are two groups which had used AHP in forecasting. The first used AHP directly for forecasting using the judgements of experts while the second used AHP to adjust forecasts.

Belton and Goodwin (1996), however, investigated that AHP is not as useful for forecasting when directly used judgements as the input. It could, however, be useful for adjusting forecasting results obtained with other methods. In this situation, AHP can provide new interpretations and offer a wider perspective.

According to Yuksel (2007), the most suitable way to maximize forecasting accuracy is to integrate quantitative and qualitative methods for forecasting. The first consideration in selecting a quantitative method should be its accuracy. Forecasting adjustments with a qualitative method can then be used to overcome the limits and disadvantages of the quantitative methods being used.

2.3 PREVIOUS RESEARCH IN MARKOV CHAIN

According to Ledauphin *et al.* (2006), Markov chain models are based on the estimation of a transition matrix which states the probability that the assessment of a product changes from one category to another. According to them, in their work with the title "*A Markovian model to study products shelf-lives*" (2006), the advantages of using transition matrices lies in the fact that they give a simple representation of the

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