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Soft Computing In The Forecasting Of The Stock Exchange Of Thailand

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Soft computing in the forecasting of the Stock Exchange of Thailand (SET)

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Abstract - **Stock markets are affected by many uncertainties and interrelated economic and political factors at both local and global levels; determining the set of relevant factors for making accurate predictions is a complicated task. This paper analyzes relevant literature on the Stock Exchange of Thailand (SET), according to the categories of techniques used. The research proposes an approach of soft computing on the SET forecasting and exposes the main driving indicators, from the literature, including Dow Jones, Nikkei index, Hang Seng index, Minimum Loan Rate, the value of the Thai baht and the gold price.**

Keywords - **Forecasting, fundamental factors, prediction, soft computing, technical factors, the Stock Exchange of Thailand**

1. INTRODUCTION

Stock marketing forecasting is an interesting and challenging issue for investors and academics. Over decades, many studies on stock markets have been carried out and a wide variety of strategies to predict stock market activity has been developed. Generally, the studies on stock market forecasting focus on two mainly issues: strategies or techniques and the stock market targeted. This study categorized strategies or techniques into soft computing techniques and non soft computing techniques such as economic or statistical strategies. Naturally, each stock market, including the Thai stock market, has its own unique characteristics according to the economic system that it serves. This study focuses on the Stock Exchange of Thailand (SET) and the strategies used in the studies of SET. In addition, the study aims to examine the possibility of applying soft computing to the forecasting of SET.

2. STOCK EXCHANGE OF THAILAND

The characteristics of a stock market targeted by investors should be taken into consideration. As the Thai economic situation differs from those of other countries, it is influence by different factors.

On April 30, 1975, Thai stock market was officially established and named as "The Securities Exchange of Thailand [1]. On January 1, 1991, its name was changed to "The Stock Exchange of Thailand" (SET) [1]. To accommodate investors, SET provides indices including the SET index, SET50 index, SET100 index and the MAI index. The SET index, a composite index, reflects the movement of all common stock prices, excluding the prices of the stocks suspended from trade for more than one year [2]. The SET index is calculated from the following formula:

$$\text{SET Index} = \frac{\text{Current Market Value x 100}}{\text{Base Market Value}}$$

The Base Market Value is the market value of all common stocks on April 30, 1975, which is the base date [2]. To represent only price movements, the calculation of the SET Index is adjusted to eliminate all other effects, according to changes in values of stocks from various events such as public offerings, exercised warrants, and conversions of preferred to common shares [2]. In addition, SET creates a list of companies with regard to large market capitalization, high liquidity and the distribution of shares to minor shareholders [3]. The SET50 index and the SET100 index are composite indices calculated respectively from stock prices of 50 and 100 selected companies from the list [3]. The base dates for calculation of the SET50 index and the SET100 index are August 16, 1995 and April 30, 2005 respectively [3]. The MAI index is based on the same calculation method as that of the SET index, but reflects the price movement of all common stocks on the Market for Alternative Investment (MAI).

3. FUNDAMENTAL AND TECHNICAL ANALYSIS

Generally, fundamental and technical analyses are the main concepts for economic strategies used in stock trading.

Fundamental analysis focuses on evaluation of the proper prices of stocks and the expected returns from those stocks [4, 5]. The analysis is generally based on the factors affecting stock prices. Such factors may be related to the economic environment, industry environment and company circumstances. By using these factors to estimate the proper prices of stocks, investors consider buying stocks when their market prices are lower than their proper prices and they consider selling when the situation is reversed.

In economic environments, both global and domestic economic factors can influence stock prices [5]. Obviously, the exchange rate, a global economic factor, affects the stock prices of import or export companies [5]. Foreign financial markets also can be a global economic factor. Since countries are linked together, movement on one stock market may have an impact on other stock

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markets. For example, the Australian economy and stock market are closely related to the American economy and stock market, which was shown by the saying that "if America sneezes Australia catches a cold" [6] . In terms of domestic economies, there are general factors which explain economic circumstances, such as Gross Domestic Product (GDP), the employment situation, inflation rate, interest rates, and public sentiment [5, 7]. Stock market sensitivity to each factor depends on the economic environment of each country. In industry environments, the life cycle of industry is a key concept [4]. The industry life cycle is divided into three stages: the pioneering stage, expansion stage and stagnation stage [4]. The proper stage for investment is the expansion stage [4]. Company circumstances may be revealed by qualitative analysis and quantitative analysis [4]. Qualitative analysis involves the size of the company, its capital structure, the nature of the product, diversification of the product and the management board [4]. Quantitative analysis relates to financial statements which provide information such as earnings per share (EPS), dividend per share (DPS) and the price earnings ratio (P/E ratio) [4].

Technical analysis studies the history of stocks and changes in of stock prices and volume to find predictable patterns, or future trends of stock prices, to make investment decisions [4]. Although in general stock prices are sensitive to fundamental factors, some investors believe that, if for a certain period a stock market has sluggish responses to change of fundamental factors, they might be able to identify trends in stock prices during that period [5]. A guideline for most technical analysis is the Dow Theory [5]. This theory considers three trends of stock prices: the primary trend, secondary or intermediate trend, and tertiary or minor trend [5]. The primary trend is the movement of stock prices over long periods of time, several months or years [5]. The intermediate trend is the movement of stock prices over several weeks or months, lasting shorter than primary trends [4]. The minor trend represents the movement of stock prices during a day, which has little significance in stock trends [4, 5]. Besides the Dow Theory, moving averages are also used to predict stock prices [5]. For example, comparing a moving average of stock prices over the past several months with the current price of the stock, if the stock price is higher, then the stock price might be expected to fall [5].

4. SOFT COMPUTING

Soft computing can be traced back to the 1990s [8]. There are some early works such as a 1965 paper on fuzzy sets and a 1973 paper on complex system and decision processes by Lotfi Zadeh [8]. In 1994, the same author published the concept of soft computing [9]. Soft computing is related to techniques that attempt to imitate human abilities as a rationale for approximate answers rather than exact answers [8]. The main difference between conventional computing, called hard computing, and soft computing is that soft computing deals particularly with imprecision, uncertainty and approximation, while hard computing underlies precision, certainty and exact solutions [8] . Generally, the three main areas in soft computing are fuzzy logic, neural networks and probabilistic reasoning [10]. Commonly, Bayesian networks and genetic algorithms are included in Probabilistic Reasoning [8].

5. ANALYSIS OF STRATEGIES USED

5.1 Analysis by Non-soft Computing

In generally, conventional economic forecasting methods base on statistical techniques such as regression, maximum likelihood functions [18].

In 1996, Tantinakom investigated economic factors influencing in the Thai stock market [11]. His study was based on daily data from July 4, 1994 to June 28, 1996. The economic factors used were based on both fundamental factors and technical factors included trading value, trading volume, interbank overnight rate, inflation, net trading value of investment, value of the Thai Baht, price earning ratio, the Dow Jones Index, the Hang Seng Index, the Nikkei Index, Straits Times Industrial Index, and Kuala Lumpur Stock Exchange Composite Index. By using a multiple regression method, the study showed that the statistically significant influences on the SET were the price earning ratio, the Straits Time index and the net trading value of foreign investment. These factors moved in a similar direction to the SET Index [11]. In addition, the value of the Thai Baht was statistically significant in its influence on the SET index, but moved in the opposite direction [11].

By using the Ordinary Least Squares for the regression specification, Khumyoo (2000) also analyzed factors impacting on the prices of stocks trading in the SET [12]. This study was based on monthly data in two periods: from January 1994 to December 1995 and from January 1996 to December 1999. The author found that the statistically significant factors on stock prices in the first period were the Dow Jones 30 Industrial Index, Hang Seng Index, Nikkei 255 Index, Straits Times Industrial Index, Taiwan Weighted Index, the gold price, the exchange rate between the Japanese Yen and the Thai Baht, the Minimum Loan Rate (MLR), and the oil price. In the second period, the Dow Jones 30 Industrial Index, Hang Seng Index, Nikkei 255 Index, gold price, the exchange rate between the US Dollar and the Thai Baht, the Minimum Loan Rate (MLR), money supply, and inter bank overnight rate were statistically significant on prices of stocks trading on the SET [12]. To investigate the relationships between the SET Index and the United States stock indices including the Nasdaq Index, Dow Jones Index, and the S&P500 Index, Chaereonkithuttakorn (2005) applied the co-integration method and the Grange causality analysis on daily data during the period from January 2, 2003 to February 28, 2005 [13]. This study showed the three United States

indices affected the SET index. However, the SET index had no impact on the United States indices [13].

The major factors affecting the Thai stock market are as follows:

- Dow Jones index
- Nikkei index
- Hang Seng index
- gold price
- Minimum Loan Rate
- the value of the Thai Baht

Since the Thai economy is constantly changing, the factors influencing the Thai stock market may vary over different time periods. It can be seen that even though his study used the same method, Khumyoo (2000) revealed differences in factors influencing the SET in the time periods, January 1994 to December 1995 and January 1996 to December 1999 [12].

5.2 Analysis by Soft Computing Strategies

In complex environments like stock markets, forecasting stock prices or trends may not be needed to derive exact results. Trading stock involves reasoning whether to buy, hold or sell; soft computing techniques may be efficient methods of analyzing the stock market.

In applying soft computing, Rimcharoen, Sutivong and Chongstitvatana (2005) proposed an adaptive evolution strategy (ES) for Thai stock forecasting [14]. This study investigated five possible driving factors on the Thai stock market: the Dow Jones index, Nikkei index, Hang Seng index, gold price and the MLR. The study was based on daily data from January 2003 to December 2004. The results showed that the Hang Seng index and the MLR are the major factors influencing the Thai stock market [14]. The authors found the function to predict the SET index as follow:

$$\begin{aligned} SET(t) = {} & 2.3645 + 5.5208\sin^3[0.3138(t\text{-}1)] - \\ & 1.5430\text{HangSeng}(t\text{-}1) / \\ & (\ \text{-}5.2054\ \text{MLR}\ (t\text{-}1)) + \\ & 2.8360\cos^2[0.6246(t\text{-}1)] * \\ & 4.6811\sin[0.3651(t\text{-}1)] - \\ & 1.5380\cos^3[0.7522(t\text{-}1)] - \\ & 1.1618\cos^3[0.7724(t\text{-}1)] + \\ & 3.3228\sin^3[1.5317(t\text{-}1)] \ - \\ & 2.4620\cos[0.6676(t\text{-}1)] * \\ & 2.3144\ \text{MLR}\ (t\text{-}1) \end{aligned}$$

Where t is time
SET(t) is SET index at time t.

By using only two major terms (-1.5430HangSeng(t)) /(-5.2054 MLR(t)) to plot graph against SET(t), the authors assert that the SET index can be reasonably explained . Figure 1 and Figure 2 show SET index plot against the two major terms, using data from January 2003 to December 2005 and from January 2005 to December 2006 respectively. Figure 3 shows the 10-days simple moving average of the SET index and (-1.5430HangSeng) / (-5.2054MLR) based on data during January 2005 to December 2006.

It can be implied from these two figures that the SET index can be reasonably described by Hang Seng index and MLR in 2003 and 2004 however, during 2005 to 2006, there are some different movement directions of the SET index and -1.5430HangSeng / -5.2054 MLR. Since data of the first 420 days during 2003 to 2004 was used as training data [14], therefore the terms of (-1.5430HangSeng)/(-5.2054MLR) well explained the SET index in this period.

Generally, the Thai stock market environments keep changing. Using those terms, which were trained by data on periods that was long before the prediction period, to explain the SET index of 2005 and 2006 may not be efficient, as seen in figure 2 and figure 3. This is because recent situations were not used in the developing prediction model.

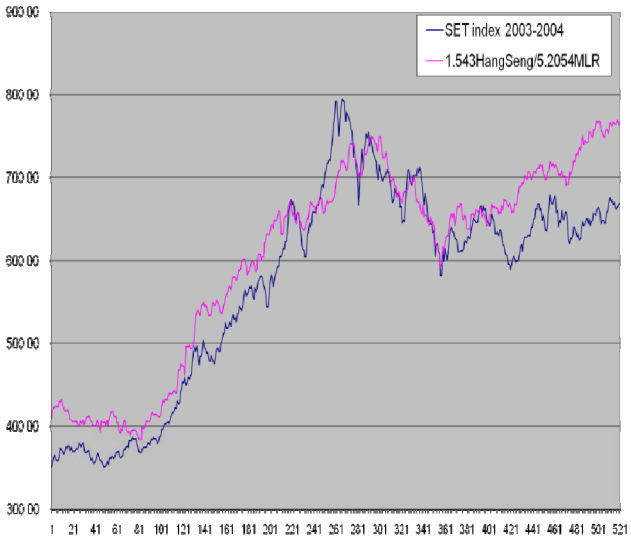

Fig. 1. The graph of SET index 2003-2004 against -1.5430HangSeng / -5.2054 MLR

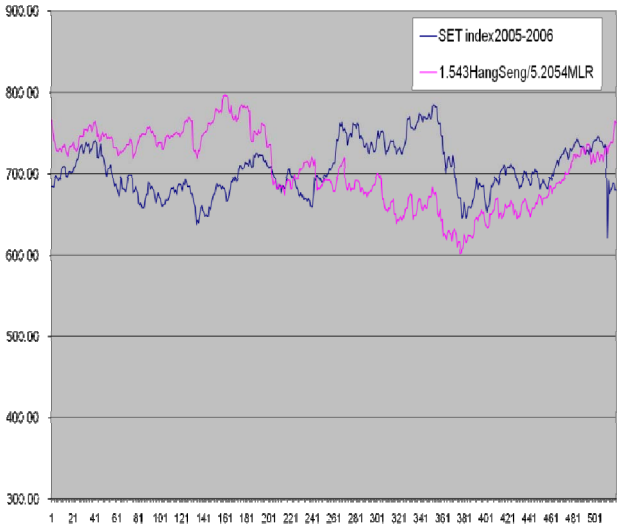

Fig. 2. The graph of SET index on 2005-2006 against -1.5430HangSeng / -5.2054 MLR

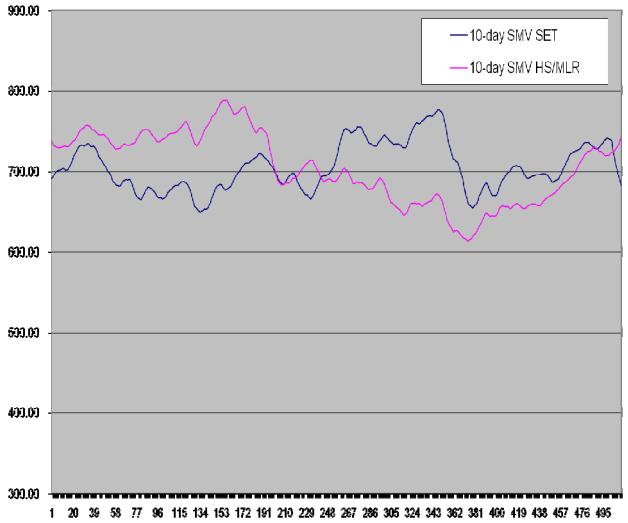

Fig. 3. The graph of 10 day Simple Moving average of SET index on 2005-2006 against 10-day Simple Moving average of -1.5430HangSeng / -5.2054 MLR

The Thai stock market is in an early developing stage, so it has not been targeted by many studies. To gain better understanding of the Thai stock market, soft computing may be applied in a variety of ways. For example, this study suggests that using combinations of different techniques, such as neural networks, fuzzy logic or genetic algorithms to create forecasting models may be worthwhile.

From Rimcharoen, Sutivong and Chongstitvatana's study, the assumption that they used to create forecasting model is based on the five fundamental factors: the Dow Jones index, Nikkei index, Hang Seng index, gold price and the MLR. However, some studies use both fundamental and technical factors for stock forecasting. For example, Tilakaratne (2004) applied neural networks to Australian stock market and discovered a 6-day cycle in this stock market [15]. Technical data such as the open, high, low and close prices in the Australian stock market were used to derive input data [15]. Similarity, Disorntetiwat (2001) proposed a neural network model, which comprised of multiple Generalized Regression Neural Networks (GRNNs) and a gating network to predict ten global stock indices [16]. He used technical data: high of index, low of index, one-day lag of close index, one-week lag of closed index, and closed/current index. His study showed a promising forecasting result for all ten countries.

Previous studies focused on either of fundamental or both fundamental and technical indicators and showed encouraging results. However, using the combination of fundamental and technical factors to analyze stock price behaviors may gain a better understanding than using only fundamental factors. Incorporating fundamental and technical factors may improve the efficiency of prediction.

In comparison of non-soft computing and soft computing techniques, some studies had been done. Refenes, Zapranis and Francis (1994) compared neural networks to classical statistical techniques in forecasting of the APT (arbitrage pricing theory) model [19]. They found that the neural networks were more accurate than the classical statistical techniques. Others researchers [20, 21] also claimed that neural networks have more efficient in comparison with classical statistical techniques in financial time series. However, further research should be done to validate these comparisons.

6. CONCLUSION

As a preliminary step in a larger project to investigate the efficacy of soft computing techniques for forecasting stock prices in SET, this paper has surveyed relevant literature about the Thai stock market. In determining the main factors influencing the SET, both soft computing techniques and non-soft computing techniques were applied. Although driving indicators may vary from time to time, the main indicators include the Dow Jones index, the Nikkei index, the Hang Seng index, the MLR, the gold price and the value of the Thai baht. In addition, soft computing techniques have potential benefits for forecasting the SET and determining the factors which is influence it.

7. RECOMMENDATION

In developing models for stock market forecasting, selection of factors such as input data, time periods for the study, and methodologies are key issues. The stock market targeted for a study is the main consideration for choosing factors or input data. Since stock market circumstances continue to change, factors influencing the stock market vary according to time. Different time periods such as a normal period and a crisis period may have different impacts on the study. Stock forecasting, generally, does not require exact answers and stock data are time series data. Soft computing techniques such as neural networks, genetic algorithms and fuzzy logic are accordingly suitable for stock forecasting.

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