CHAPTER II

THEORETICAL BACKGOUND AND PREVIOUS RESEARCH

A. Theoretical Background

1. Indonesian Stock Exchange

Indonesia Stock Exchange (**IDX**) or in Indonesian **Bursa Efek Indonesia** (**BEI**) is a stock exchange based in Jakarta, Indonesia. It was previously known as Jakarta Stock Exchange (JSX) before its name changed in 2007 after merging with Surabaya Stock Exchange (SSX). As of 28 June 2010, the Indonesia Stock Exchange had 341 listed companies with a combined market capitalization of $269.9 billion. (Bloomberg). Currently opens from 9:30 a.m. to 4:00 p.m. local time, but since March 2011 will makes rehearsal opens since 9:00 a.m. at the weekends when the bourse closed and will be fully implemented at July 1, 2011. The plan to open trading 30 minutes earlier is to accommodate trading hours of neighboring countries (http://www.thejakartapost.com/news/2011/02/16/idx-set-“rehearse”-new-trading-hours.html)

a. History

Originally opened in 1912 under the Dutch colonial government, it was re-opened in 1977 after several closures during World War I and

World War II. After being reopened in 1977, the exchange was under the management of the newly created Capital Market Supervisory Agency (*Badan Pengawas Pasar Modal*, or Bapepam), which answered to the Ministry of Finance. Trading activity and market capitalization grew alongside the development of Indonesia's financial markets and private sector - highlighted by a major bull run in 1990. On July 13, 1992, the exchange was privatized under the ownership of Jakarta Exchange Inc. As a result, the functions of Bapepam changed to become the Capital Market Supervisory Agency. On March 22, 1995 JSX launched the Jakarta Automated Trading System (JATS). In September 2007, Jakarta Stock Exchange and Surabaya Stock Exchange merged and named Indonesian Stock Exchange by Indonesian Minister of Finance. The current location of the Indonesian Stock Exchange is located in the IDX building in the Sudirman Central Business District, South Jakarta, near the current site of the Pacific Place Jakarta. (Wikipedia)

b. Stock Indices

Two of the primary stock market indices used to measure and report value changes in representative stock groupings are the Jakarta Composite Index and the Jakarta Islamic Index (JII). The JII was established in 2002 to act as a benchmark in measuring market activities based on Sharia (Islamic law). Currently, there are approximately 30 corporate stocks listed on the JII.(Asean Law

Association, Indonesian Legal System, 2004). The FTSE/ASEAN Indices were launched by the five ASEAN exchanges (Singapore Exchange, Bursa Malaysia, The Stock Exchange of Thailand, Jakarta Stock Exchange, and The Philippine Stock Exchange) and global index provider FTSE on September 21, 2005. The indices, covering the five ASEAN markets, are designed using international standards, free float adjusted, and based on the Industry Classification Benchmark (ICB). The indices comprise FTSE/ASEAN Benchmark Index and FTSE/ASEAN 40 tradable index. The FTSE/ASEAN 40 index is calculated on a real-time basis from 9:00 a.m. and the closing index is calculated at 6:00 p.m. (Singapore time). The FTSE/ASEAN benchmark index is calculated on end-of-day basis.

Besides Jakarta Composite Index and JII, IDX also has four (4) more types of index, namely Individual Index, Sector Stock Price Index, LQ 45 Index, Main Board and Development Board Indices. (http://www.idx.co.id/MainMenu/Education/IndeksHargaSahamObligasi/tabid/195/lang/en-US/language/en-US/Default.aspx)

c. LQ 45

LQ 45 is a stock market index for the Indonesia Stock Exchange (IDX) (formerly known as Jakarta Stock Exchange). LQ 45 is a market capitalization of the 45 most liquid stocks and large capitalization value that is an indicator of liquidation. LQ 45 using the 45 stocks that

selected based on liquidity of stock trading and adjusted every six month. (Darmadji, 2001, p. 95-96).

The LQ 45 index consists of 45 companies that fulfill certain criteria, which is:

a. Included in the top 45 companies with the highest market capitalization in the last 12 months
b. included in the top 45 companies with the highest transaction value in a regular market in the last 12 months
c. Have been listed in the Indonesia Stock Exchange for at least 3 months
d. Have good financial conditions, prospect of growth and high transaction value and frequency

It is calculated semi-annually by research & development division of Indonesia Stock Exchange. (Factbook 1997, Jakarta Stock Exchange)

Components of LQ45, which are the companies that always in LQ45 during 2000-2010.

Table 1
Companies always in LQ45 during 2000-2010

No	Company	Symbol
1	Astra Agro Lestari, Tbk	AALI

No	Company	Symbol
2	Aneka Tambang (Persero), Tbk	ANTM
3	Astra International, Tbk	ASII
4	Indofood Sukses Makmur, Tbk	INDF
5	Indosat, Tbk	ISAT
6	Telekomunikasi Indonesia, Tbk	TLKM
7	United Tractor, Tbk	UNTR

Source: IDX 2000-2010

2. Closing Price

Closing Price is the final price at which a security is traded on a given trading day. The closing price represents the most up-to-date valuation of a security until trading commences again on the next trading day. Most financial instruments are traded after hours (although with markedly smaller volume and liquidity levels), so the closing price of a security may not match its after-hours price. Still, closing prices provide a useful marker for investors to assess changes in stock prices over time - the closing price of one day can be compared to the previous closing price in order to measure market sentiment for a given security over a trading day. (Investopedia)

3. **Dividend per Share**

DPS is the amount of dividend that a stockholder will receive for each share of stock held. It can be calculated by taking the total amount of dividends paid and dividing it by the total shares outstanding. (Investorworld). A payment made out of a firm's earnings to its owner in the form of either cash or stock that expressed in terms of dollar/share. (Ross, Westerfield and Jordan, 200).

4. **Fuzzy Inference System**

The fuzzy inference system is a popular framework based on the concepts of fuzzy set theory, fuzzy if-then rules, and fuzzy reasoning. It has found successful applications in a wide variety of fields. (Jang, Sun, and Mizutani, 2008.)

5. **Neuro-Fuzzy**

Neuro-fuzzy refers to combinations of artificial neural networks and fuzzy logic. Neuro-fuzzy was proposed by J. S. R. Jang. Neuro-fuzzy hybridization results in a hybrid intelligent system that synergizes these two techniques by combining the human-like reasoning style of fuzzy systems with the learning and connectionist structure of neural networks. (Wikipedia)

6. Price to Earning Ratio

The Price to Earning ratio of a stock is as measure of the price paid for a share relative to the annual net income or profit earned by the firm per share. (Wikipedia). PER measure the amount of the investor are willing to pay for each dollar of the firms earning. The higher PER, the greater the investor confidence in the firm's future is. (Gitman, 1997)

7. Trade Volume

The number of shares or stocks traded during a given period, for a security or an entire exchange also called volume. Trading volume is such an important indicator for you because it tells you how significant a price shift is. (Investoword)

8. Trapezoidal Membership Function

The trapezoidal curve is a function of a vector, x, and depends on four scalar parameters *a*, *b*, *c*, and *d*, as given by

$$f(x;a,b,c,d)=\begin{Bmatrix} 0, & x\le a \\ \frac{x-a}{b-a}, & a\le x\le b \\ 1, & b\le x\le c \\ \frac{d-x}{d-c}, & c\le x\le d \\ 0, & d\le x \end{Bmatrix} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Or, more compactly, by

$$f(x;a,b,c,d) = \max\left(\min\left(\frac{x-a}{b-a},1,\frac{d-x}{d-c}\right),o\right) \quad \text{.....(2)}$$

The parameters *a* and *d* locate the "feet" of the trapezoid and the parameters *b* and *c* locate the "shoulders".

(http://www.mathworks.com/help/toolbox/fuzzy/trapezodialmf.html) searched on 12 February 2011

9. Triangular Membership Function

The Triangular MF block implements a triangular-shaped membership function. The parameters a and c set the left and right "feet," or base points, of the triangle. The parameter b sets the location of the triangle peak. **Triangular**: This is formed by the combination of straight lines. The function is name as "trimf" .We considers the above case i.e. fuzzy set Z to represent the "number close to zero". So mathematically we can also represent it as

0 if x<-1

$\mu z(x) = x + 1$ if $-1 \leq x < 0$ (1.4) ……(3)

$1 - x$ if $0 \leq x < 1$

0 if $1 \leq x$

(http://www.mathworks.com/help/toolbox/fuzzy/triangularmf.html)

searched on 07 December 2011

10. Mean Absolute Deviation

$$MAD = \frac{1}{n}\sum \left| Yt - \hat{Y}t \right| \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Where: n= Number of time period

Yt= an observed value of y

$\hat{Y}t$ = the value of y that is predicted using the estimation quotation

MAD as a measure of dispersion, this is the average of the absolute values of the differences between observations and the mean. In forecasting, a criteriation for measuring the fit of an estimation equation to an actual time series. The best fit model is one having the lowest MAD. (Weiers, 2002)

11. Mean Square Error

$$MSE = \frac{\sum (Yt - \hat{Y}t)^2}{n} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Where: n= Number of time period

Yt= the value of y that is predicted using the estimation quotation

$\hat{Y}t$ = an observed value of y

MSE in forecasting, a criterion for measuring the fot of an estimation equation to an mean value for MSE. (Weiers, 2002)

12. Mean Absolute Percentage Error

$$\mathrm{M} = \frac{1}{n}\sum_{t=1}^{n}\left|\frac{A_t - F_t}{A_t}\right| \quad \text{.....(6)}$$

Where: n= Number of time period

A_t is the actual value

F_t is the forecast value.

MAPE is the average of all the percentage error for a given data set in without regard to sign. It is one measure of accuracy commonly used in quantitative method forecasting. (Wilson and Keating, 2002).

13. Mean Percentage Error

$$\mathrm{MPE} = \frac{1}{n}\sum_{t=1}^{n}\frac{f_t - a_t}{a_t} \quad \text{.....(7)}$$

Where: n= Number of time period

A_t is the actual value

F_t is the forecast value.

MPE is the average of all of the percaentage error for a given data set. This average allow positive and negative percentage error to cancel one another. Because of this, it is sometimes used as a measure of bias in the application of forecasting method

14. Time series method

Time-series methods make forecasts based solely on historical patterns in the data. Time-series methods use time as independent variable to produce demand. In a time series, measurements are taken at successive points or over successive periods. The measurements may be taken every hour, day, week, month, or year, or at any other regular (or irregular) interval. A first step in using time-series approach is to gather historical data. The historical data is representative of the conditions expected in the future. Time-series models are adequate forecasting tools if demand has shown a consistent pattern in the past that is expected to recur in the future. For example, new homebuilders in US may see variation in sales from month to month. But analysis of past years of data may reveal that sales of new homes are increased gradually over period of time. In this case trend is increase in new home sales. Time series models are characterized of four components: trend component, cyclical component, seasonal component, and irregular component. Trend is important characteristics of time series models. Although times series may display trend, there might be data points lying above or below trend line. Any recurring sequence of points above and below the trend line that last for more than a

year is considered to constitute the cyclical component of the time series—that is, these observations in the time series deviate from the trend due to fluctuations. The real Gross Domestics Product (GDP) provides good examples of a time series tat displays cyclical behavior. The component of the time series that captures the variability in the data due to seasonal fluctuations is called the seasonal component. The seasonal component is similar to the cyclical component in that they both refer to some regular fluctuations in a time series. Seasonal components capture the regular pattern of variability in the time series within one-year periods. Seasonal commodities are best examples for seasonal components. Random variations in times series is represented by the irregular component. The irregular component of the time series cannot be predicted in advance. The random variations in the time series are caused by short-term, unanticipated and nonrecurring factors that affect the time series. (Hiray, 2008)

15. ANFIS

One of the most important Fuzzy systems is the adaptive Fuzzy neural inference systems (ANFIS). In such systems, the inference Fuzzy system uses neural networks to compensate for the weak points of Fuzzy reasoning. Their major advantage is that they can use neural networks learning ability, and prevent the expensive consumption of time for adjusting the rules of inferential motor in the Fuzzy reasoning system. In practice, there is no restriction in the functions of adaptive networks-nodes, unless they need to be

derivative. The only structural limitation of network shapes is their being feed-forward. In contrast to these minor limitations, adaptive networks usage has increasingly and widely developed in practical fields. (Jandaghi and Tehrani, 2010)

B. Previous Research about Adaptive Neuro-Fuzzy Inference System

Previous research related to financial ratios has been carried out, such as research conducted by Pei-Chann Chang (2007). The researches, conducted by "Chang & Chen", for forecasting Taiwan Stock exchange price deviation, "Takagi and Sugeno" fuzzy system was used. This model forecasts stock price deviation with higher and positive reliance. In addition, in the researches carried out by Afolabi & Olatoyosi (2007). Some of the techniques such as fuzzy Logics, Neuro – fuzzy networks and Kohonen's Self – organizing plan were used for forecasting stock price. The results demonstrated that the deviation in Kohonen Self – Organizing plan was less than the other techniques.

Another study conducted by Gholamreza Jandaghi (2010), entitled *"Application of Fuzzy-neural networks in multi-ahead forecast of stock price"*. The study said that, investment by purchasing stock-share constitutes the greater part of economic exchanges of countries and a considerable amount of capital is exchanged through stock markets in the whole world. National economies are strongly influenced by the operation of stock markets; in addition, stock market as an available means for investment is of special importance for both investor and the receiver of investment. The most important part of this business is to obtain

more profits through estimating future stock prices. This research with a probe in a sample of the whole population of the study involves the data and financial record of SAIPA auto-making company, which is a member of Iranian stock, aims at the prediction of stock price. The prediction was done by the two linear and nonlinear models for one ahead and multi ahead in stock price by using exogenous variable of stock market cash index, and the results show the preference of nonlinear neural-Fuzzy model to classic linear model and verify the capabilities of Fuzzy-neural networks in this prediction.

Another research, which was conducted by Quek (2005), which entitled *"Predicting the Impact of Anticipator Action on U.S. Stock Market—An Event Study Using ANFIS (A Neural Fuzzy Model)"*. In the area of using "ANFIS" and neuro- fuzzy network for forecasting investors' measures in the U.S. Stock Exchange Trade, was studied. The model was successful for predicting stock price in the U.S. Stock Exchange. In addition, in Marcek (2005) research, which entitled *"Stock price forecasting: Autoregressive modeling and fuzzy neural network"*. Box Jenkis analysis was introduced in time series analysis.

The utilization of auto regression model in forecasting stock price has previously been explained and following that, fuzzy – regression model and neuro – fuzzy network as two substitute methods for auto regression model for forecasting stock price are demonstrated. (Abasii and Abouec, 2009)

C. Hypothesis and Development

The Original hypothesis from the main journal:

Does "ANFIS" forecast IRAN KHODRO's stock price behavior at Tehran Stock Exchange?

However in this research have limitations, and one of them is not use Artificial Neural Network system, therefore the research use Fuzzy Inference System. Based on the previous research, the writer sees that yet there is no research that specifically proves whether there is a significant result between Fuzzy Inference System with the stock price forecasting behavior in LQ45. Therefore, the writer tried to find out if there is a significant impact between stock price forecasting according to the FIS with stock price in LQ45. To prove this, the writer developed a hypothesis to be tested in this study as follows:

Ha: Fuzzy Inference System forecast stock price on the companies listed in LQ45