



## **Technical analysis of stock prices using Elliot wave theory and Fibonacci number**

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### **ABSTRACT**

The study of technical analysis of stock prices using Elliot Wave Theory and Fibonacci Number focused on percentage analyzing to test the stock prices according to the theory and the actual stock prices. The secondary data of the study gathered from the daily price index summary between 1st January 2009 to 31st December 2011 of SET index, Bank index and three Thai banks which are Bangkok bank(BBL), Siam Commercial bank (SCB) and Kasikorn bank (KBANK). The results of the study shown that there are two errors occurred, the Impulse Waves and Corrective Waves. In conclusion, this research shown that using the technical analysis tools in predicting the stock prices is highly efficient.

*Keywords:* Elliot wave, Fibonacci number, Technical Analysis

*JEL Classification:* G14, G17

## 1. Introduction

Capital Market is an important factor of financial market and economic system. The mechanisms of capital market provide help in financial resources distribution from whom that hold an excess capital and provide them to whom is short in order to make an advantage from the capital. Therefore, Capital market is the center of saving, investment and long-term capital accumulation which gives benefit to private firms, state enterprises and government for their goals.

To make a decision on stock investment, investors need to analyze the data between the returns from their stock investment and the value (price) of the stock at that time and compound them as the price's trend of the stock, to help decision making on investment in the future. The return and the price of the stock may rely on many factors for example, economics situation domestic and other nations, political issues, currency exchange rate between countries, interest rates etc. These factors may affect to investment and also influence the dynamic of stock's prices, to make the best outcome from an investment, it is important to have tools in decision making. One of the tools that commonly used in decision making is stock's price dynamic analysis. There are 3 ways to analyze the data which are fundamental factor analysis, Random walk theory analysis and Technical analysis.

Technical analysis is the method to analyze stock's behaviors by find an appropriate purchase price or buy signal and also find the sale price and Sell signal by analyze from the stock prices, quantities and time period of stock exchange at one moment of time, trend prediction of stock's price in the future. There are many procedure that need to be accomplish which are complex and in details in order to provide and encourage investor in stock selection, they could make an easier decision whether to invest in that securities or not and when will be the appropriate time to earn a highest return from an investment and reduce risk from investment )The Stock exchange of Thailand 2003)

This study focuses on finding the optimal time to make an investment in bank securities portfolio. By the use of SET index, Bank Index and the price of securities from three major banks which are Bangkok bank, Kasikorn bank and Siam commercial bank. Bank securities investment is very attractive for both domestic and foreign investors, since bank has important roles in economics system, represents a large scale business and also is a middleman in capital accumulation for savers to make loan to investors whom in need a capital for their investment lead to an economic growth. Nowadays many large scale commercial banks have a higher ability to make profit according to credit sector and differences from expected interest rates arise, many large scale businesses such as power resource operation companies and commercial banks are very popular among domestic and foreign investors, made stocks in these sectors have a high value of stock exchange annually.

This study focuses on data analysis with Fibonacci number and Elliott wave. Fibonacci number is the numbers which have a characteristic closes to nature status the most, can be calculate by make a summation between the number that nearby, then there will be a set of numbers that keep increasing up to infinity. On the other hand, Elliott wave

theory is the stock price analysis which have wave form, Elliott theory use Fibonacci number to make a wave formation in one cycle movement contain 8 set of waves, 5 set of Impulse Waves and 3 sets of Corrective Waves. Analyze percentage ratio to test the stock prices according to the theory and the price from the real wave by Elliott wave theory along with Fibonacci number. This study can improve investor’s encouragement on the usage of technical analysis tools in make a decision on stock exchange and can be use as a guideline for investors in set up an investment strategy in SET.

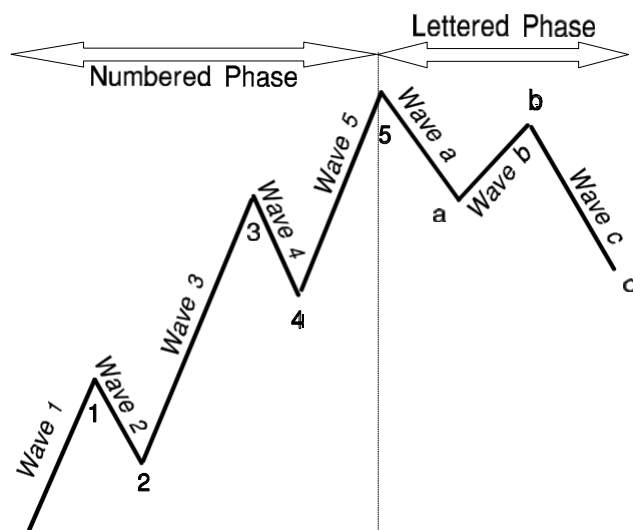
**2. Literature review**

According to the research about technical analysis of stock prices using Elliot Wave Theory and Fibonacci number that may not be directly studied yet, however, these research studies could be compared with some research studies of Somchai Pakkapaswiwat (1980) Patcharanun Patthasoonthorn (1998) Du Toit (1986) Wong (1997). These 4 research studies used the technical analysis. They found that using the technical analysis can make a prediction of flowing of the stock market index and other stocks, however, it depends on the proficiency of each tools.

**3.Theory**

**3.1 Elliott wave theory**

Elliott wave theory was found by Ralph Nelson Elliot. Firstly introduced from Stock price analysis, it referred that the movement of stock price which sometimes seems unpredictable did not occur from randomness but from and that reflect an activities and feeling of human being from an external factors or crowd psychology, that present in the “wave” form in graph’s prices and every moment of stock price movement always follow up with response reaction. There are 5 movements of the Impulse Waves and there are three Corrective Waves as shown in figure 1



**Figure 1.** Fundamental form of Elliott wave

### **3.2 Behaviors of waves**

1<sup>st</sup> wave represented the period of “rebound” from the earlier period of time which depressed investor’s courage to invest, due to the instability of the market. Rebound curve would recover investor’s courage from depressed situation from the past.

2<sup>nd</sup> wave is going down from the 1<sup>st</sup> wave that mentioned in earlier period, which sometime greatly depress investor’s courage in decision making, according to the sense of investors that the price of stock market that rose, it was just a temporary adjustment. There were less than the 1<sup>st</sup> waves.

3<sup>rd</sup> wave is the important period of time that shows the performance of fundamental factors which will encourage investors, the movement of stock’s prices overall will increase and stable. The volumes of stock exchange are outstanding increase. Result from a strong feeling from investors, this wave may continue to expand itself in a longer period of time.

4<sup>th</sup> wave is a lower adjustment wave from the 3<sup>rd</sup> wave which is has more complexity than the 2<sup>nd</sup> wave since it depends on the “push” from the 3<sup>rd</sup> wave. The adjustment of this wave will show the stability of the incoming 5<sup>th</sup> wave. When we consider to volumes of stock exchanges, the volumes is lower than the volume in 3<sup>rd</sup> wave but it is higher than the 2<sup>nd</sup> wave.

5<sup>th</sup> wave is the last wave of impulse wave form before it move into a corrective wave, at that time it is insufficient for fundamental factors to support the wave movement. There are high proportions of profit speculation, and then these short term profit speculation will cause the price to diminish, as we can see from the wave A later. However, if there are the same volumes are equal or more than the 3<sup>rd</sup> wave, it could be a signal for the possibility of the 5<sup>th</sup> wave to expand, especially if the length of the 1<sup>st</sup> wave and 3<sup>rd</sup> wave are the same.

A wave is the first corrective wave that occurs during the market recession. Most of the investors still believe that this adjustment will be just a short term diminishing of the slope before the new rising wave coming.

B wave is an up bound curve from A wave, since many investors started to understand the movement trend of the wave that give a signal that it is the time to sell their stocks and leave the markets. Besides, B wave is the problem solving wave for the investors who fail their decision from the A wave.

C wave is the outstanding corrective wave, which is the moment that investor’s courage reach the lowest point, there will be an increasing of excess supply and most of the stock’s prices will go down, sometimes happen rapidly and dramatically.

### 3.2 Fibonacci Number

Fibonacci is the name for alphabetical order number, named after the founder Leonards Fibonacci. Which was found in the 13<sup>th</sup> century from his study and notification on natural phenomenon, for example, lightening formation, Fruit's shapes and snail's shell texture. He found that these phenomenons have a form which is in common and regular, then he transferred them into mathematical numbers which are 1,1,2,3,5,8,13,21,34,55,89 and so on. These numbers correlate between each, the number that after the one before is the summation between two numbers that started before, for example, 1 plus 2 equal to 3 and 3 plus 5 will be equal to 8. The ratio of the number earlier to the one after, after first 4 numbers will always run close to the ratio equal to 0.618 or 1.618, if there are increasing in an amount of numbers, it will get closer to the ratio 0.618 or 1.618

This ratio later became mathematical numbers which are well known among ancient Grecians and Egyptians mathematician by the name Golden ratio, which is adapted for the music theories, arts, architecture and biology. It also believes that Grecians use this ratio when they built Parthenon which is the gorgeous architecture in Athen and also for Egyptian in the constructed of Pyramid.

## 4. Methodology

### 4.1 Stock's price prediction by using Elliott wave and Fibonacci number

The process of stock's price prediction by using Elliott waves and Fibonacci number can be separate into two steps which are Impulse Waves and Corrective Waves, could be explain as below

#### a. Impulse Waves

1<sup>st</sup> step draw a data graph of the stock's prices of three years terms and identify all of the Impulse Waves that occurred in each year.

2<sup>nd</sup> step indicate the lowest point of the Impulse Waves

3<sup>rd</sup> measure the height of the first wave which is the difference between the lowest and the highest point of the first wave in the first wave.

4<sup>th</sup> use the height to calculate the final price that the final price equal to the highest point of the impulse wave+ (1.618 x the height of the first wave)

#### b. Corrective Waves

1<sup>st</sup> step draw a data graph of the stock's prices of three years terms and identify all of the Corrective Waves that occurred in each year.

2<sup>nd</sup> step indicate the lowest point of the Corrective Waves

3<sup>rd</sup> measure the height of the first wave which is the difference between the lowest and the highest point of the first wave in the first wave.

4<sup>th</sup> use the height to calculate the final price that the final price equal to the highest point of the corrective wave - (1.618 x the height of the first wave)

#### 4.2 Accuracy comparison

Accuracy in stock's price prediction can be measure from )Geographic Mean (as shown below

$$\text{Geomean} = \sqrt[N]{100 \prod_1^N \left| \frac{P - \hat{P}}{P} \right|}$$

Geomean	=	Geometric means of error ratio from prediction
N	=	The number of waves that will be count only Impulse Waves or Corrective Waves(there will be two times of calculation of Geomean, one for impulse wave and one for corrective wave)
P	=	The highest price of each impulse wave or the lowest price of each Corrective Wave
$\hat{P}$	=	Predicted prices

#### 4.3 Research hypothesis

1. An error which occurred during Impulsive Wave's cycle between the real price and the predicted prices from using Elliott wave and Fibonacci number are less than 10% in average for the stock's prices of three commercial banks and in every cycle
2. An error which occurred during Corrective Wave's cycle between the real price and the predicted prices from using Elliott wave and Fibonacci number are less than 10% in average for the stock's prices of three commercial banks and in every cycle. The percentage of the error has to be higher than the impulsive cycle, since there is a higher risk and unpredictable during the price's change in corrective movement, especially in predict the lowest spot of the stock's prices.

#### 5. Data

The data that will be use in this study is the Secondary data, collected from the summaries of daily prices from 1<sup>st</sup> January 2009 to 31<sup>st</sup> December 2011 by Set Index, Bank Index, Bangkok bank's stock (BBL), Kasikorn bank's stock (KBANK) and Siam Commercial bank's stock (SCB).

### 6. Results

The result in table 1 shows that, the Efficiency test of stock price’s prediction daily on the Impulse Waves of SET index with Elliott wave during the year 2009-2011 has an percentage of error indicated by Geomean equal to 7.89 percent (table 6.1) which less than the rate of accepted error at 10 percent.

TABLE 1. The efficiencies of stock price’s prediction daily on the Impulse Waves of SET index with Elliott wave

No.	The lowest of the first wave	The top of the first wave	The height of the first wave	Multiplied by 1.618	Predicted price	Actual Price	Percent error	Average (Geomean)
1	411.26	552.71	141.45	228.8661	781.5761	628.54	24.35	7.89 %
2	562.54	613.66	51.12	82.71216	696.3722	751.85	7.38	
3	668.47	749.41	80.94	130.96092	880.3709	812.63	8.34	
4	721.28	875.07	153.79	248.83222	1123.902	1050.80	7.06	
5	949.09	995.66	46.57	75.35026	1071.01	1109.92	3.51	
6	1010.32	1090.28	79.96	129.37528	1219.655	1144.14	6.60	

TABLE 2. The efficiencies of stock price’s prediction daily on the Corrective Waves of SET index with Elliott wave

No.	The highest of wave 5	The lowest between wave 5 and wave A	The first height of wave A	Multiplied by 1.618	Predicted price	Actual Price	Percent error	Average (Geomean)
1	628.54	570.42	58.12	94.03816	476.3818	562.54	15.32	8.05 %
2	751.85	692.71	59.14	95.68852	597.0215	668.47	10.69	
3	812.63	726.28	86.35	139.7143	586.5657	721.28	18.68	
4	1050.80	990.13	59.66	96.52988	893.6001	949.09	5.85	
5	1109.92	1050.84	59.08	95.59144	955.2486	1010.32	5.45	
6	1144.14	1025	119.14	192.76852	832.2315	855.45	2.71	

The result in table 2 shows that, the efficiency test of stock price's prediction daily on the Corrective Waves of SET index with Elliott wave during the year 2009-2011 has an percentage of error indicated by Geomean equal to 8.05 percent (table 6.2) which less than the rate of accepted error at 10 percent.

TABLE 3. The efficiencies of stock price's prediction daily on the Impulse Waves of Bank index with Elliott wave

No.	The lowest of the first wave	The top of the first wave	The height of the first wave	Multiplied by 1.618	Predicted price	Actual Price	Percent error	Average (Geomean)
1	139.16	205.51	66.35	107.3543	312.8643	241.01	29.81	6.97 %
2	211.59	247.25	35.66	57.69788	304.9479	300.34	1.53	
3	255.45	296.76	41.31	66.83958	363.5996	327.98	10.86	
4	281.38	345.04	63.66	103.0019	448.0419	416.95	7.46	
5	356.85	382.06	25.21	40.78978	422.8498	431.2	1.94	
6	374.69	427.27	52.58	85.07444	512.3444	441.83	15.96	

The result in table 3 shows that, the efficiency test of stock price's prediction daily on the Impulse Waves of Bank index with Elliott wave during the year 2009-2011 has an percentage of error indicated by Geomean equal to 6.97 percent (table 6.3) which less than the rate of accepted error at 10 percent.

TABLE 4. The efficiencies of stock price's prediction daily on the Corrective Waves of Bank index with Elliott wave

No.	The highest of wave 5	The lowest between wave 5 and wave A	The first height of wave A	Multiplied by 1.618	Predicted price	Actual Price	Percent error	Average (Geomean)
1	241.01	214.25	26.76	43.29768	170.9523	211.59	19.21	9.89%
2	300.34	269.33	31.01	50.17418	219.1558	255.45	14.21	
3	327.98	290.88	37.10	60.0278	230.8522	281.38	17.96	
4	416.95	367.24	49.71	80.43078	286.8092	356.85	19.63	
5	431.2	407.3	23.90	38.6702	368.6298	374.69	1.62	
6	441.83	386.93	54.90	88.8282	298.1018	317.16	6.01	



The result in table 4 shows that, the efficiency test of stock price’s prediction daily on the Corrective Waves of Bank index with Elliott wave during the year 2009-2011 has an percentage of error indicated by Geomean equal to 9.89 percent (table 6.4) which less than the rate of accepted error at 10 percent.

The result in table 5 shows that, the efficiency test of stock price’s prediction daily on the Impulse Waves of Bangkok bank (BBL) stock prices with Elliott wave during the year 2009-2011 has an percentage of error indicated by Geomean equal to 8.98 percent (table 6.5) which less than the rate of accepted error at 10 percent.

TABLE 5. The efficiencies of stock price’s prediction daily on the Impulse Waves of Bangkok bank (BBL) stock prices with Elliott wave

No.	The lowest of the first wave	The top of the first wave	The height of the first wave	Multiplied by 1.618	Predicted price	Actual Price	Percent error	Average (Geomean)
1	67	74.5	7.5	12.135	86.635	131.5	34.12	8.98 %
2	105.5	120.5	15	24.27	144.77	135	7.24	
3	111.5	120	8.5	13.753	133.753	160	16.40	
4	144.5	162.5	18	29.124	191.624	169.5	13.05	
5	144	159	15	24.27	183.27	182.5	0.42	
6	149	168	19	30.742	198.742	174.5	13.89	
7	127	148	21	33.978	181.978	158	15.18	

The result in table 6 shows that, the efficiency test of stock price’s prediction daily on the Corrective Waves of Bangkok bank (BBL) stock prices with Elliott wave during the year 2009-2011 has an percentage of error indicated by Geomean equal to 4.39 percent (table 6.6) which less than the rate of accepted error at 10 percent.

The result in table 7 shows that, the efficiency test of stock price’s prediction daily on the Impulse Waves of Siam Commercial bank (SCB) stock prices with Elliott wave during the year 2009-2011 has an percentage of error indicated by Geomean equal to 11.30 percent (table 6.7) which is over the rate of accepted error at 10 percent by a small amount, represented that it is capable for the stock’s price prediction.

TABLE 6. The efficiencies of stock price's prediction daily on the Corrective Waves of Bangkok bank (BBL) stock prices with Elliott wave

No.	The highest of wave 5	The lowest between wave 5 and wave A	The first height of wave A	Multiplied by 1.618	Predicted price	Real price	Percent error	Average (Geomean)
1	131.5	120	11.5	18.607	101.393	105.5	3.89	4.39 %
2	135	128	7	11.326	116.674	111.5	4.64	
3	160	149	11	17.798	131.202	144.5	9.20	
4	169.5	163	6.5	10.517	152.483	144	5.89	
5	182.5	171	11.5	18.607	152.393	148.5	2.28	
6	174.5	155	19.5	31.551	123.449	127	2.80	

TABLE 7. The efficiencies of stock price's prediction daily on the Impulse Waves of Siam Commercial bank (SCB) stock prices with Elliott wave

No.	The lowest of the first wave	The top of the first wave	The height of the first wave	Multiplied by 1.618	Predicted price	Actual Price	Percent error	Average (Geomean)
1	49.25	54	4.75	7.6855	61.6855	80.5	23.37	11.30 %
2	64.25	71.75	7.5	12.135	83.885	91.5	8.32	
3	76.5	80	3.5	5.663	85.663	94	8.87	
4	78.75	83.75	5	8.09	91.84	114	19.44	
5	93	103.5	10.5	16.989	120.489	127.5	1.68	

The result in table 8 shows that, the efficiency test of stock price's prediction daily on the Corrective Waves of Siam Commercial bank (SCB) stock prices with Elliott wave during the year 2009-2011 has an percentage of error indicated by Geomean equal to 11.87 percent (table 6.8) which is over the rate of accepted error at 10 percent by a small amount, represented that it is capable for the stock's price prediction.

TABLE 8. The efficiencies of stock price’s prediction daily on the Corrective Waves of Siam Commercial bank (SCB) stock prices with Elliott wave

No.	The highest of wave 5	The lowest between wave 5 and wave A	The first height of wave A	Multiplied by 1.618	Predicted price	Actual Price	Percent error	Average (Geomean)
1	80.5	71.25	9.25	14.9665	56.2835	64.25	12.40	11.87 %
2	91.5	81.75	9.75	15.7755	65.9745	76.5	13.76	
3	94	81.5	12.5	20.225	61.275	78.75	22.19	
4	114	103	11	17.798	85.202	93	8.38	
5	127.5	118.5	9	14.562	103.938	96.75	7.43	

TABLE 9. The efficiencies of stock price’s prediction daily on the Impulse Waves of Kasikorn bank (KBANK) stock prices with Elliott wave

No.	The lowest of the first wave	The top of the first wave	The height of the first wave	Multiplied by 1.618	Predicted price	Actual Price	Percent error	Average (Geomean)
1	40.75	56.25	15.5	25.079	81.329	74	9.90	5.80 %
2	62	75.25	13.25	21.4385	96.6885	90.5	6.84	
3	76.25	88	11.75	19.0115	107.0115	102.5	4.40	
4	83.5	95.25	11.75	19.0115	114.2615	130.5	11.08	
5	103.5	118	14.5	23.461	141.461	144	6.36	

The result in table 9 shows that, the efficiency test of stock price’s prediction daily on the Impulse Waves of Kasikorn bank (KBANK) stock prices with Elliott wave during the year 2009-2011 has an percentage of error indicated by Geomean equal to 5.80 percent (table 6.9) which is which less than the rate of accepted error at 10 percent.

The result in table 10 shows that, the efficiency test of stock price’s prediction daily on the Corrective Waves of Kasikorn bank (KBANK) stock prices with Elliott wave during the year 2009-2011 has an percentage of error indicated by Geomean equal to 11.31 percent (table 6.10) which is over the rate of accepted error at 10 percent by a small amount, represented that it is capable for the stock’s price prediction.

TABLE 10. The efficiencies of stock price's prediction daily on the Corrective Waves of Kasikorn bank (KBANK) stock prices with Elliott wave

No.	The highest of wave 5	The lowest between wave 5 and wave A	The first height of wave A	Multiplied by 1.618	Predicted price	Actual Price	Percent error	Average (Geomean)
1	74	62.75	11.25	18.2025	44.5475	62	28.15	11.31 %
2	90.5	80.75	9.75	15.7755	64.9745	76.25	14.79	
3	102.5	96	6.5	10.517	85.483	83.5	2.07	
4	130.5	113.5	15	24.27	89.23	103.5	13.79	
5	144	124.5	19.5	31.551	92.949	104.5	11.05	

## 7. Discussion and Conclusion

The technical analysis of stock prices using Elliot wave theory and Fibonacci number to test the stock prices according to the theory and the prices from an actual wave from Elliot wave and Fibonacci number found that the values of means during the upturn cycle for SET, BANK, Bangkok bank's stock (BBL), Kasikorn bank's stock (KBANK) and Siam Commercial bank's stock (SCB) the error terms is less than 10 percent in average or a little bit over which could be accepted. The means values during the downturn cycle are less than 10 percents.

Therefore, The Elliot wave have efficiency in stock's price prediction. Investors should have an outstanding goal of investment and one of the most important factors that could make them success in investment is fix the time duration for their investment such as short, medium or long term investment. Then the suggestion from the research represented that the technical analysis tools are efficient and they could be a guideline for further investment strategies improvement in the future.

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