

FORECASTING STOCK PRICES USING GANN MODEL (ANALYSIS STUDY FOR MICROSOFT CORPORATE)

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Abstract

This research aims to apply Gann's theory to forecast the price of stocks being one of the top and most significant technical analysis theories. It is the only theory that links price to time to forecast the market trend and determine the price levels the stock hits in the future, using a set of price and time strategies which were based on precise mathematical, engineering and astronomical principles and foundations. This research starts with a problem of (possibility of forecasting of common stock prices using Gann's theory).The research was conducted on the New York Stock market, which is classified as one of the semi-strong markets, where MSFT was chosen as an intended sample for the period from 2018 to 2022, with weekly and daily closing prices. The research found a number of results, the most prominent of which was the possibility of determining the general trend of the market and determining the price targets that the stock is expected to reach in the future using Gann's theory in markets with semi-strong efficiency.

Keywords: Technical Analysis, Gann's Theory, Time Cycles, Astronomical Footprint

1. INTRODUCTION

Forecasting stock prices in the stock markets is one of the most important issues for companies and investors. Although, investing in common stocks is one of the riskiest types of investment, it generates high returns. As a result, many theories emerged that try to analyze the movement of stocks and forecast the prices that are expected to reach it in the future based on different methods that enable investors to determine the appropriate buying and selling points. This research presents one of the theories of technical analysis, which is based on precise mathematical, engineering and astronomical principles. It links time and price factors in the stock markets to reach more accurate forecasts, which is Gann's theory. The American scientist William D. Gann presented this theory after an extensive study of mathematical, engineering and astronomical sciences, through which he concluded that financial markets move according to these principles. His theory was also based on some natural laws such as the law of vibration, through which he was able to reach highly accurate results.

2. RESEARCH METHODOLOGY

2.1. Research Problem

It has become clear that the price fluctuations of financial assets, especially common stocks, have become one of the most important features of the modern era as a result

of the great development and expansion in the financial sector, as well as the accelerating fluctuations in the global economy, which in turn has created many financial and economic crises, and thus the ambiguity in the future of the prices of those Assets and its impact on investors' decisions. This has generated the need to find modern theories of forecasting in price movements and market trends, especially those that are based on price analysis, time analysis and the relationship between them in order to reach more accurate forecasts of financial assets prices. The most important of these theories is Gann's theory. Here lies the research problem, which can be formulated with the following question: The extent to which Gann's theory can be used to predict the price of financial assets?

2.2. Research Importance

The importance of the research lies in dealing with one of the most important topics in the stock markets, which is the forecasting of common stock prices and using one of the most important theories of technical analysis, which is the Gann theory, which is one of the few theories that dealt with the aspect of forecasting price and time simultaneously and analyzing the relationship between them.

2.3. Research aims

This research is to achieve a set of objectives, which are:

1. Knowledge of the conceptual framework of Gann's theory.
2. Recognize what common stocks are and its movements.
3. Study the possibility of forecasting of financial asset price movements.

2.4. Research hypotheses

The research was based on two main hypotheses:

The first main hypothesis: The possibility of using Gann's theory to forecast the price movements of common stocks at weekly closing prices.

The second main hypothesis: The possibility of using Gann's theory to forecast the price movements of common stocks at daily closing prices.

2.5. Research field and duration

For the purpose of achieving the objectives of the research, Microsoft (MSFT) was chosen as an intended sample for the period from December 17 December 2018 to 27 December 2022, with weekly closing prices, and a verification period from 1 January 2023, to 30 April 2023, as well as the period from 3 November 2022, to 30 December 2022 with daily closing prices, And a verification period from 1 January 2023 to 28 April 2023 to validate the forecasts

3. THE THEORETICAL ASPECT

3.1. The concept of forecasting

The objective of expansion and growth is one of the most important objectives of business organizations, in addition to achieving acceptable rates of profitability, stability and development at the level of the organization and the state with its various organs to achieve an acceptable level of economic welfare for society, since the management main objective is to achieve the objectives that it has set for itself , taking into account current and future available resources and possibilities and the surrounding environment, the management must plan for the achievement of these objective, and therefore no plan can be developed without an accurate scientific forecast of what is intended to be achieved through a specific time-bound perspective. That is, the forecasting process is the basis on which any plan is built It also means speculating or anticipating future outcomes or events before they happen by guessing or studying the past (Nugus,1997:1).Therefore, forecasting has a great and effective role in building future plans which facilitates the future vision of each decision that the management may make. Forecasting is defined as the process of predicting what will happen in the future for a given phenomenon, depending on the trend of the phenomenon in the past, using one of the well-known forecast models (Jessen & Kellner, 2009, 50).

3.2. Forecasting Methods and Techniques

Although there are several alternative methods for carrying out the forecasting process, which have been dealt with in many studies and research in order to determine the most effective, the common division of forecasting methods has been emphasized into two main groups: statistical methods (quantitative) and judgment methods (qualitative). Each method has its own advantages, but work on Integration of the two methods may lead to an improvement in the accuracy of forecasting, but the two most important methods of forecasting in the stock markets are :(Jessen & Kellner, 2009, 55)

3.2.1. Fundamental Analysis

As is known stock market are one of the most volatile markets as a result of many economic and financial factors. As well as the crises the world experiencing from time to time, which greatly affect the movement of prices in these markets (Zheng & Chen,2013:2), As a result, researchers interested in this field have begun to look for methods that enable them to forecast the movement of prices and its future fluctuations. Fundamental analysis is one of these methods that were reached in the thirties of the last century (Isidore, 2018:2). Fundamental analysis focuses on macroeconomic factors and variables, in addition to factors pertaining to the company, such as its financial performance, growth rate, and the field in which the company operates (Petrusheva& Jordanoske, 2016:26). Fundamental analysis is defined as a research method that studies basic financial information to forecast profits, supply and demand, management ability, and other intrinsic matters affecting a stock's market value and growth potential (Thomsett, 1998:2).

3.2.2. Technical Analysis

Technical analysis is one of the methods that are used to forecast future price movements based on past price movements, since the philosophy on which technical analysis is based is that future prices can be forecasted from previous prices (Toms, 2011:20), Therefore, the technical analyst focuses on the movement of stock prices where by studying the movement of previous prices can accurately forecast future stock prices (Joshi, 2022:16). Technical analysis is based on three main assumptions which are: (Muephy, 199:2-4)

- 1) **History repeats itself:** much of the body of technical analysis and the study of market action have to do with the study of human psychology. Chart patterns for example, which have been identified and categorized over the past one hundred years reflect certain pictures that appear on price charts. These pictures reveal the bullish or bearish psychology of the market. Since these patterns have worked well in the past, it is assumed that they will continue to work well in the future because they are based on human psychology that does not tend to change. In other words, it can be said that the key to understanding the future is to study the past.
- 2) **Prices move in trends:** The concept of trend is absolutely essential for technical analysis. The main purpose of charting the price action of the market is to identify trends in the early stages of their development for the purpose of trading in those same directions. There is a corollary to the premise that prices move in trends. A trend in motion is more likely to continue than to reverse. This corollary is, of course, an adaptation of Newton's first law of motion. Another way to state this corollary is that a trend in motion will continue in the same direction until it reverses.
- 3) **Market action discount everything:** the phrase "market action discount everything" forms what is probably the cornerstone of technical analysis. The technical analyst believes that anything that can possibly affect this movement, political, psychological or otherwise it will be reflected in the price of that market. Therefore, all that is required is to study the market movement.

3.3. Gann's theory

This theory is called Gann's theory relative to the American scientist William. D. Gann who was born in Lufkin city in Texas State on 6 June 1878. He was very passionate about astronomy and nature since childhood. Gann came up with his theory by studying astronomy, nature science, mathematics and engineering. He is the first to discover the time cycles in the financial markets and the first to discover the relationship between price and time. After extensive study in this field, Gann discovered a rule that would become the cornerstone of his scientific methodology, a rule he called the "Law of Vibration", which he claimed applied in the natural sciences as well as in the financial field Which we will explain later (Droke,2001:12).

3.3.1. The Foundations of Gann Theory

There are three main factors or foundations of Gann's theory: time, price and pattern.

3.3.1.1. Time Analysis

According to Gann, time is the most important and most influential factor in determining changes in the direction of the markets, as Gann indicated that the price moves according to time. Gann used time cycles to measure time, which is one of the most accurate methods (Hyerczyk,2009:203). Time tells us the age of the trend, i.e. when will the market turn from a bear market to a bull market or from a bull to a bear. When the price reaches the time at which the trend must change, the price will stabilize for a short period, or it may fluctuate in a narrow range, but at the end the trend will reverse because the time has come (Marisch, 1990:8). Gann's theory asserts that every movement in the market is the result of nature's law and a reason that existed long before and could be determined years in advance. Everything moves in cycles as a result of natural law (action and reaction). By studying the past, Gann discovered what cycles are repeated in the future. Gann used many time cycles, including the 100-year cycle, the 60-year cycle, the 50-year cycle, and the 20-year cycle, but the most important cycle is the 10-year cycle, where Gann said it's the cycle that governs market movement (Gann, 1938:46), so we're going to use the 10-year cycle for time forecasting. Gann used the number 12 and the number 52 for time measurement, as the number 12 represents the smallest time cycle in the universe, which is the night-day cycle and the number of months in a year is 12 months, so the time intervals will be every 12 candles, while the number 52 represents the number of weeks in a year (Jacobs, 2012:91). There are some rules governing Gann's theory of the 5-year and 10-year cycles, as follows: (Gann, 1938:195) (Jenkins, 1996:97) (Hyerczyk, 2009:28)

1. A bear cycle often runs 5 years, and forms specific patterns. These patterns are:
 - a) 2 years down, then 1 year up, and 2 years down.
 - b) 3 years down, then 1 year up, and 1 year down.
 - c) 1 year down, then 2 years up, and 2 years down.
 - d) 5 years down

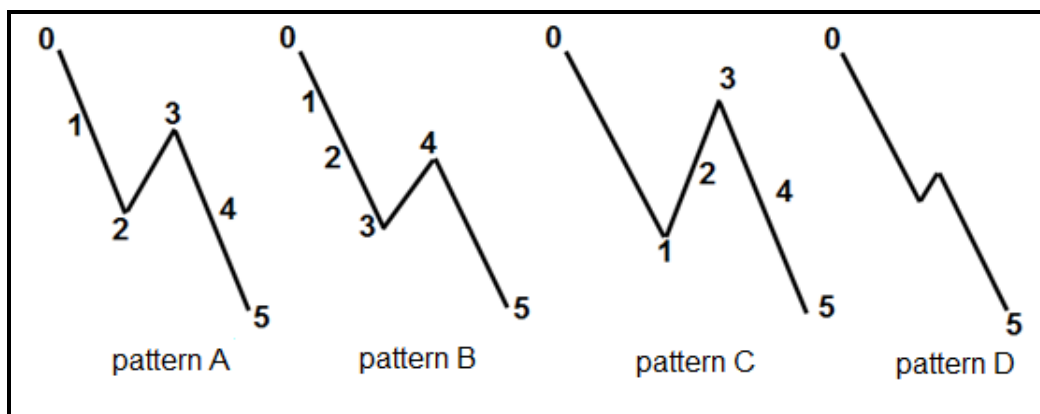


Figure 1: Patterns of the downward 5-year cycle

(Source: the figure is prepared by the authors)

2. A bull campaign generally runs 5 years, and forms specific patterns. These patterns are:

- a) 2 years up, then 1 year down, and 2 years up.
- b) 3 years up, then 1 year down, and 1 year up.
- c) 1 year up, then 2 years down, and 2 years up.
- d) 5 years up.

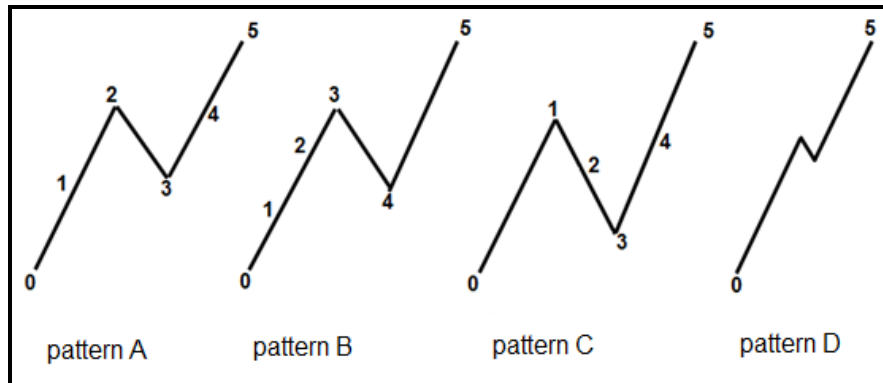


Figure 2: Patterns of the downward 5-year cycle

(Source: the figure is prepared by the authors)

3. The next five years, if the trend is downward, will form a top in the sixth year and another top in the tenth year, meaning that the price will go up from the fifth year to the sixth year, then it will complete a decline to the eighth or ninth year, then it will rise again to the tenth year, As shown in Figure (3)

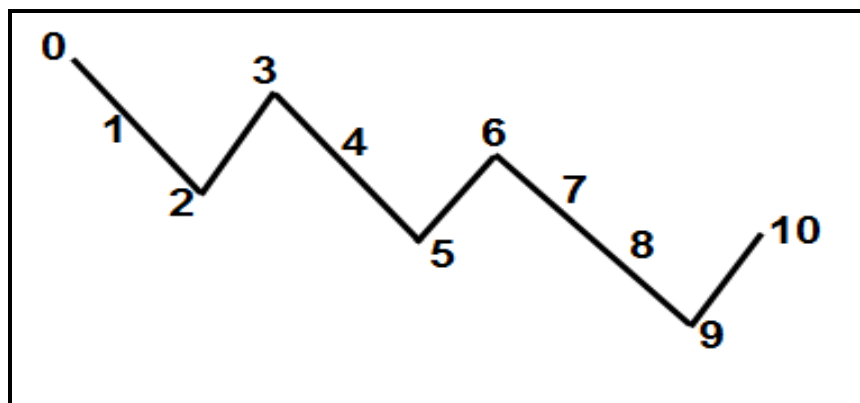


Figure 3: Pattern of the downward 10-year cycle

(Source: the figure is prepared by the authors)

4. The next five years, if the trend is upward, will form a bottom in the seventh year and another bottom in the tenth year, meaning that the price will fall from the fifth year to the seventh year, then it will rise again to the eighth or ninth year, and then it will fall again to form the last bottom in the tenth year As shown in Figure (4).

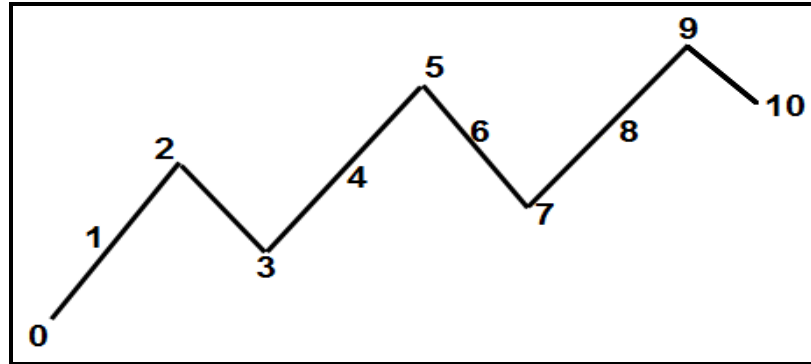


Figure 4: Pattern of the upward 10-year cycle

(Source: the figure is prepared by the authors)

5. Sometimes some fluctuations may occur that lead to a delay in the formation of the top and bottom in the required time.

6. To make sure that the trend will continue to rise, you must wait for the third year. If the price does not break the starting low, this means that the trend will continue to rise, also if the trend is downward. This is in the case of a daily forecast. But if the forecast is weekly, monthly or yearly, we only need two years to be sure.

3.4. The Law of Vibration

One of the most important foundations of Gann's theory is the law of vibration, which is one of the seven cosmic laws on which this universe governed. Gann referred to this law in one of his articles that he wrote, where he said "I soon began to note the periodical recurrence of the rise and fall in stocks and commodities. This led me to conclude that natural law was the basis of market movements. After exhaustive research and investigations of the known sciences, I discovered that the law of vibration enables me to accurately determine the exact points to which stocks or commodities should rise and fall within a given time" (Hyerczyk,2009:203). The law of vibration can be illustrated by the following figure:

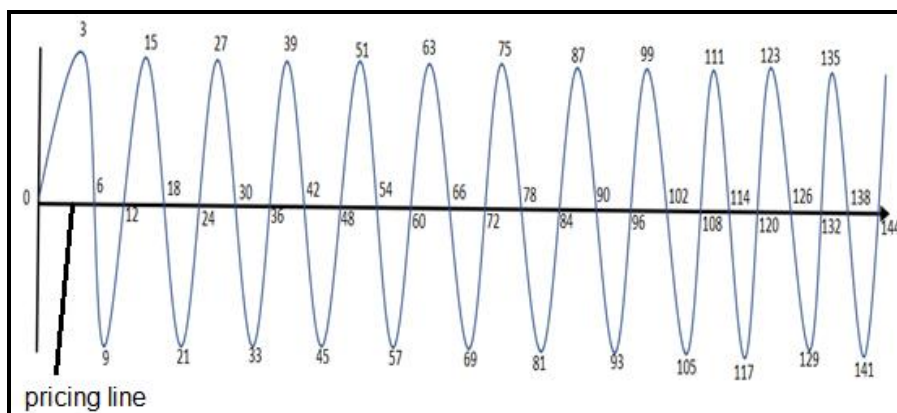


Figure 5: The Law of Vibration

(Source: Arihant, Saurabh, 2018, simple harmonic motion and waves, p: 144)

It is clear from Figure (5) that the distance from the starting point (0) to point 12 represents the first year, and from point 12 to point 24 represents the second year, and so on until the end of the ten years. The arrow extending from the middle indicated in the figure by the pricing line represents the point at which the price closed in each of the years (Gann,1954:330). According to the law of vibration, the change occurs in the upper and lower regions shown in the figure. If the price is at candle 36 (the third year), the change occurs when the price reaches candle 39 or candle 45. For example, if the trend is upward and the price is at candle 36, in order to be sure that the price will continue in an upward trend, we have to wait for candle 39. If it is above the pricing line of the third year, i.e. above candle 36, this means that the trend will continue to rise to the fifth year, i.e. to the candle 60, But if the candle 39 is under the pricing line, we must wait for the candle 45. If it is above the pricing line, this means that the trend will continue in the upward trend until the fifth year. In the event that both candles are under the pricing line of the third year (candle 36), this means that the trend will be bearish. The most important years for applying the law of vibration are the third year, the fifth year, and the seventh year because it represents important points of change in trend (Droke,2001:65). To illustrate this, we will take the following case of Caterpillar stock.



Figure 6: An illustrative case of the work of the vibration law on daily Caterpillar stock

(Source: the figure is prepared by the authors based on the Trading view platform)

It is clear from Figure (6) that the trend was upward, as the price continued to rise for three years without breaking the starting low, and to make sure that the trend will continue to rise to the fifth year as a first step for forecasting, the vibration candles must be monitored, which are candle 39 and candle 45. It was clear from the figure that candle 39 was almost on the pricing line and did not penetrate it, and therefore it cannot be said that the price will go to the fifth year without making sure that the vibration candle 45 is above the pricing line of the third year. We notice that candle 45 was actually above the pricing line of the third year, and thus here we can say that the trend

will continue to rise to the fifth year, indeed, as shown in Figure (2-6), the stock continued to rise to the fifth year.

If we use the number 52 to measure the time cycles, the vibration law will be as shown in Figure (7):

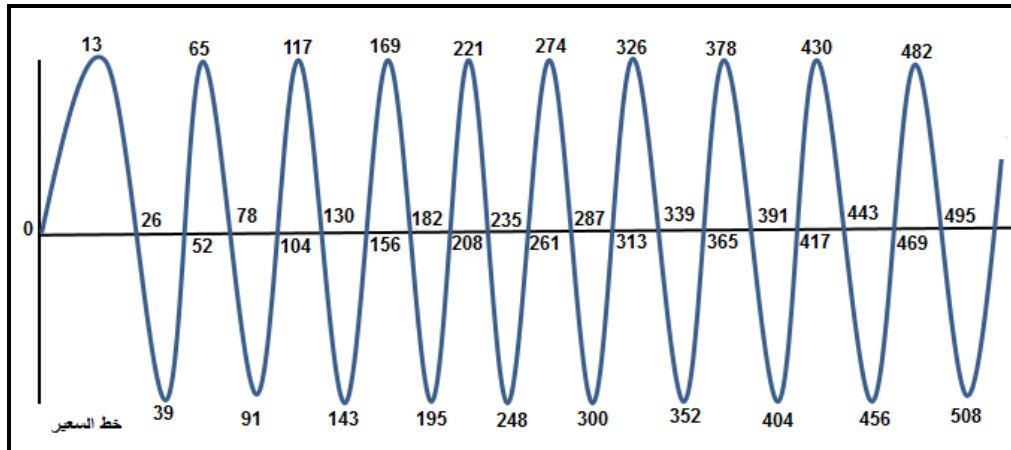


Figure 7: The Law of Vibration

(Source: Arihant, Saurabh, 2018, simple harmonic motion and waves, p: 144)

3.3.1.2. Price analysis

Forecasting Stock Prices is one of the most difficult techniques used in Gann's theory, which is based on precise mathematical foundations and principles. It also relied on some astrological methods to draw and determine price targets. (Ink, 1995:136). In this research we will use the astronomical footprint to analyze the price and determine the price targets.

3.3.1.2.1. Forecasting using astronomical footprint

forecasting using the astronomical footprint is one of the methods used by Gann to forecast in stock markets, as some of the strategies he used depended on the nature of the human body, and he pointed that time cycles and all measurement of angles are represented by the human body. Gann used in this strategy the footprint of both hands, as each person has five fingers in each hand, and this represents the ten-year cycle, which is half of the twenty-year cycle, or two five-year cycles, which represent a quarter of the twenty-year cycle (Gann,1931:1). Figure (8) shows the astronomical footprint of Gann.

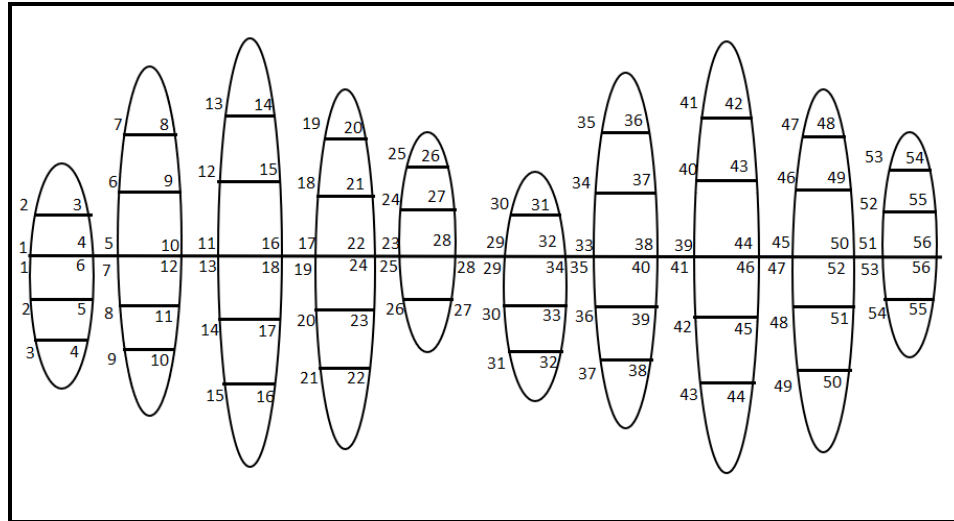


Figure 8: Gann's astrological signature

(Source: Gann, W.D. The human body, 1931, p: 1)

Figure (8) shows from the upper left side the palm of the left hand, which represents a five-year upward cycle, and from the bottom the palm of the right hand, which represents a five-year downward cycle, as well as for the right side of the figure. It is also possible to draw tops and bottoms for another ten years, i.e., to repeat this graph again to determine the tops and bottoms that may occur during the twenty-year cycle in the event that the price continues to rise or fall. In this graph, Gann pointed out the importance of the thumb finger. It is the only finger that contains only two joints, while the rest of the fingers contain three joints, and this had an impact on the market movement according to Gann. If we notice from the above figure that when the market starts to rise from number 1 (thumb finger), it will reach its maximum top at number 13, but in the downward cycle, the price will fall from number 1 to number 15 to have its lowest bottom. And that's what Gann wanted to point out when he talked about the importance of the thumb finger. When the stock takes an upward trend, it will go up by 13 points, but when it goes down, it will go down by 15 points (Gann, 1931:1).

4. THE PRACTICAL ASPECT

4.1. Forecast MicroSoft's stock at weekly closing prices

Figure (9) shows the weekly chart of MSFT stock for the period from 17 December 2018 to 27 December 2022. We used the astronomical footprint to determine the price targets of the stock, noting that the astronomical footprint is used through multiplying in tens, and targets were determined based on the tops of the fingers on the hand. We also used the ten-year cycle for time forecasting, as we used number 52 to determine the time intervals.

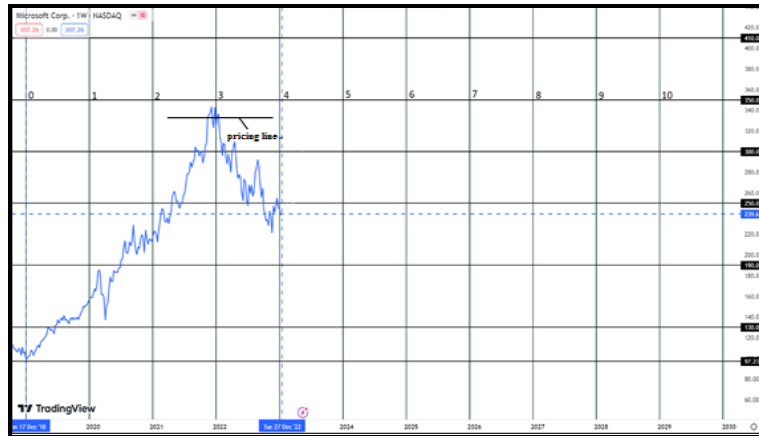


Figure 9: Drawing Gann's grid on the MSFT weekly chart for the period from 17 December 2018 to 27 December 2022

(Source: the figure is prepared by the authors based on the Trading view platform)

It is clear from Figure (9) that the price started to rise from the bottom formed on 17 December 2018 and continued to rise to the third year penetrating the price targets of \$190, \$250, and \$300. Therefore, the price must start falling from the third to the fourth year, and this is confirmed by the vibration law, as we note that the vibration candles for the third year were under the third-year pricing line. As we note, when the price reaches the third year, (Time when trend must change) Price bounced back from price target at \$ 350 down to fourth year, and Price is expected to complete its rise from fourth year to fifth year, which represents the year 2023, meaning that the trend of the 2023 year is expected to be bullish. In order to determine the target from which the price will bounce back, we will draw the price targets from the top formed in the third year, using the bearish footprint, as shown in Figure (3-2)

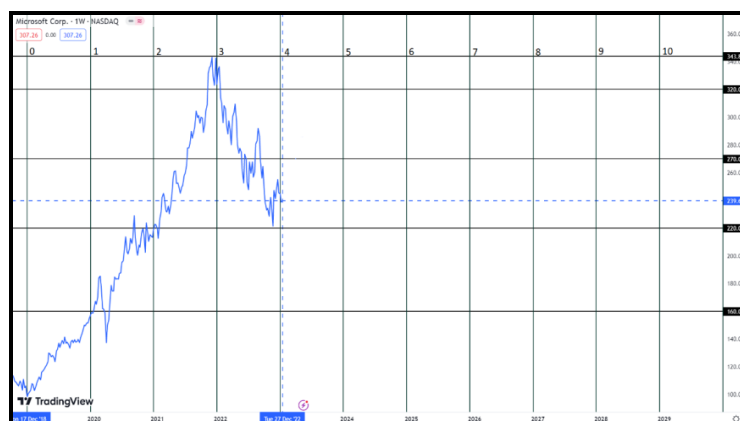


Figure 10: Drawing Gann's grid on the MSFT weekly chart for the period from 17 December 2018 to 27 December 2022

(Source: the figure is prepared by the authors based on the Trading view platform)

We notice, the price started falling from the top of the third year and the first target broke at \$320 and the second target at \$270, since the price achieved the target of \$270 and the time did not come when the trend should change (the fourth year), This means that the price will complete its decline to achieve the target of \$220 and bounce back from it as time tells us that the trend must start to rise from the fourth year to the fifth year. As we notice, the price actually bounced from the target at \$220 near the fourth year, which confirms that the trend will start going up to the fifth year (2023). In the fifth year, the price is expected to bounce back to the seventh year, in the event that vibration candles for the fifth year are under the pricing line To determine the price target from which the price is expected to bounce back when it reaches the fifth year, we will draw the price targets from the bottom formed in the fourth year, as shown in Figure (11).

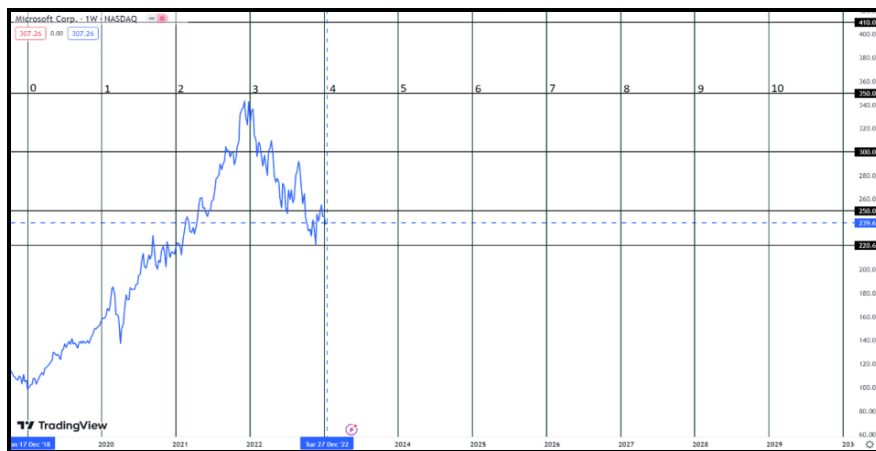


Figure 11: Drawing Gann's grid on the MSFT weekly chart for the period from 17 December 2018 to 27 December 2022

(Source: the figure is prepared by the authors based on the Trading view platform)

The price is expected to bounce back from the price target at \$350 or \$410 when it reaches the fifth year, to start falling to the seventh year, and it cannot bounce back from lower targets than this, because if it bounces back from the target of \$300, it means that the price has entered a bearish cycle and we have to start our analysis from the top of 27 December 2021.

To validate our forecast, we will see the movement of the stock from 1 January 2023 to 30 May 2023, which is about half of the period that we forecasted, as shown in figure (12).

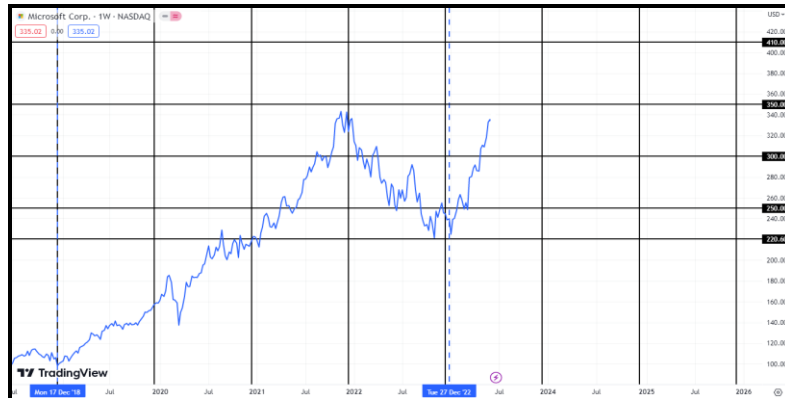


Figure 12: Drawing Gann's grid on the MSFT weekly chart for the period from 1 January 2023 to 30 May 2023

(Source: the figure is prepared by the authors based on the Trading view platform)

We notice from figure (3-4), the trend was actually upward during the first half of the year 2023 and as we expected that the price will break the target of \$300 to achieve the target of \$ 350. If the price broke the target of \$350 and did not reach the fifth year, it will complete its rise to achieve the target of \$ 410 and then start to decline to the sixth and then the seventh year and this proves the validity of the first main hypothesis, which states (The possibility of using Gann's theory to forecast the price movements of common stocks at weekly closing prices).

4.2. Forecast MicroSoft's stock with weekly closing prices

Figure (3-5) shows the daily chart of MSFT stock for the period from 3 November 2022 to 30 December 2022, where we used the astronomical footprint to determine the price targets of the stock by adding 13 points to the bottom and using the 10-year cycle to forecast the time where we used the number 12 to determine the intervals.

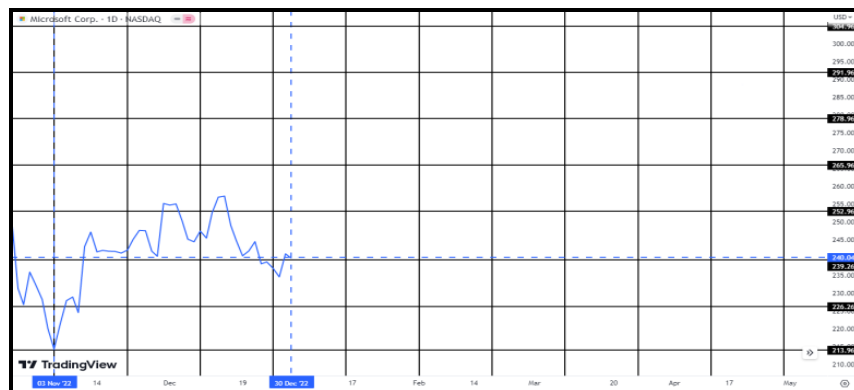


Figure 13: Drawing Gann's grid on the MSFT daily chart for the period from 3 November 2022 to 30 December 2022

(Source: the figure is prepared by the authors based on the Trading view platform)

In the weekly analysis of MSFT's stock, we showed that the trend will be upward during the fifth year, which is 2023. It is clear from the above daily chart that the stock began to form a bottom at the end of 2022, and as we notice, the stock began to rise from the bottom consisting on 3 November 2022 at the price \$214.34 to the second year and from the second year The price started to correct its trend to fall to the third year bouncing back from the target of \$252.96 near the second year and since the vibration candle for the third year was above the pricing line, it means that the trend will complete its rise to the fifth year, and the stock is expected to start falling when it reaches the fifth year bouncing back from the target of \$265.96 or \$278.96 to the seventh year. From the seventh year the stock will bounce back from the target \$ 252.96 or \$ 265.96 to complete its rise to the ninth year in the event that the Vibration candles for the seventh year were above the pricing line, and from the ninth year the price will bounce back to start falling from the target \$278.96 or \$291.96 to the tenth year to have the bottom of the tenth year, and it is expected that the bottom of the tenth year will be at the target \$278.96 or \$265.96. To validate our forecast, we will see the movement of the stock from 1 January 2023 to 30 May 2023, which is about half of the period that we forecasted, as shown in figure (14).

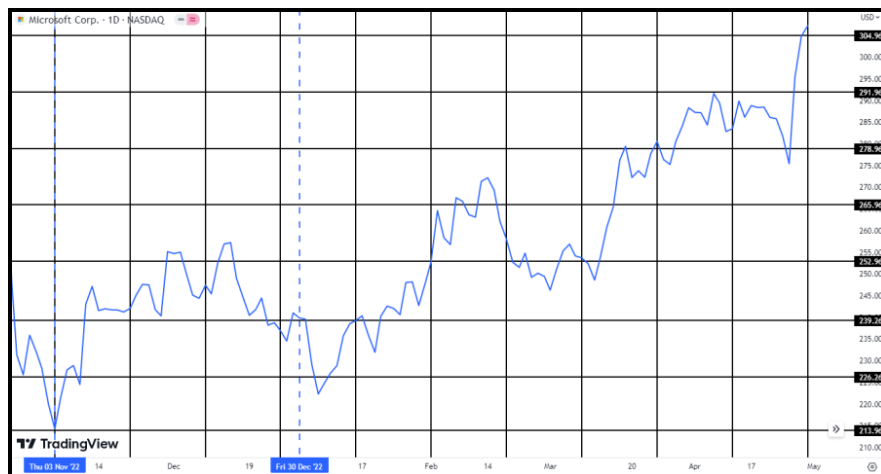


Figure 14: Figure (3-6) Drawing Gann's grid on the MSFT weekly chart for the period from 3 November 2023 to 30 December 2023

(Source: the figure is prepared by the authors based on the Trading view platform)

As we notice from Figure (3-6), the stock took an upward trend from the third year to the fifth year, to achieve the target of \$265.96 near the fifth year, then the stock began to decline to the seventh year, achieving the target of \$252.96, then it completed its rise to the ninth year, achieving the target of \$291.96, to bounce back from it to the tenth year, achieving the target of \$278.96 near the tenth year, to achieve the bottom of the tenth year.

4. CONCLUSIONS

- 1) The Gann theory is considered one of the most important theories of technical analysis by which the trend of the market can be determined by the time factor in addition to determining the price targets that the stock is expected to achieve in the future.
- 2) Gann's theory is the only theory that linked time and price in stock markets to forecast market movement.
- 3) Gann's theory is the only theory that explained the price movement in stock markets resulting from the behavior of investors in these markets by studying the movement of celestial bodies.
- 4) Gann's theory is based on the fact that the general trend of the stock can be determined by the time factor based on the time cycles and determining the prices that the stock will achieve through price strategies based on mathematical, engineering and astronomical factors.
- 5) The Gann model can be an important investment guide that helps investors make their investment decisions and determine entry and exit points from the market correctly and accurately.
- 6) The Gann model, when applied to Microsoft stock, showed that it is able to forecast the trend of the stock's movement by the time factor. It also showed the possibility of forecasting the price levels that the stock will achieve in the future.

5. Recommendations

1. Adopting the Gann model as one of the important technical analysis tools by investors to predict the general trends of stock movement and to determine the price targets that stocks are expected to reach in the future.
2. The need to learn how the Gann model works by investors in stock markets because of the accurate results it provides.
3. The need for investors in the stock markets to realize the importance of the time factor in determining the general trend of stock movement in stock markets.

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