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CLUSTER OF THE GOLDEN RATIO IN THE FIBONACCI SEQUENCE-AN ANALYTICAL STUDY ON THE DOW JONES INDEX

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Abstract
The aim of this research is to analyze the golden ratio cluster in the Fibonacci platform, as this platform is considered one of the most important platforms used in technical analysis, and the ground of it is price discovery or price prediction to attract or sell. In addition, the gold ratio and Fibonacci numbers have attracted the benefit of mathematicians. Artists, architects, sculptors and musicians for centuries, the golden ratio was associated with ancient Greek arts and architecture, and the Fibonacci series was discovered, which is linked to the golden ratio. The current study used the Dow Jones Index as a sample for analysis. It is worth noting that the Dow Jones Index is considered one of the most important global indicators used in technical analysis and price discovery. The current study has reached a set of conclusions, the most important of which is that the Fibonacci platform helps and contributes greatly in providing results that help investors in Make buying and selling decisions due to the accurate and quick recommendations it provides.

Introduction

The golden ratio and Fibonacci numbers have attracted the attention of mathematicians, artists, architects, sculptors, and musicians for centuries. The golden ratio has been associated with ancient Greek art and architecture, and the Fibonacci sequence was discovered which is closely related to the golden ratio. These two phenomena have created a fairly extensive literature (Basak, 2022: 1092).

The golden ratio and Fibonacci numbers are closely related concepts. Fibonacci numbers are sequential numbers with specific mathematical properties. In the Fibonacci sequence, a number is divided by the previous number, the resulting fraction approaches the golden ratio, and if we continue, it gradually approaches the golden ratio each time; Finally, the golden ratio refers to the limit number in the Fibonacci sequence (Prokopakis, et.al, 2013:19), The advantages of the Fibonacci sequence extend widely throughout nature, but there is one part where the importance of the sequence is most apparent, which is the possibility of predicting

stock market prices through it. The most famous investment system that relies on the Fibonacci sequence is Elliot Wave Theory. But this great theory was not used due to the complexity of some of the matters associated with it. On the other hand, three other applications were used based on the Fibonacci sequence. These applications worked to explain the decline in the stock prices of some companies, and they also explained sudden changes in stock trends, and predicted price trends, i.e. Technical analysis (Ivanova, 2019:2). (Ivanova, 2019:2). Therefore, technical analysis is one of the important tools for investment analysis, and it was part of financial practice dating back to the nineteenth century (Atmeh & Dobbs, 2006:120). Technical analysis is one of the applications of the efficient financial market, and is used for the purpose of predicting future trends in stock prices by studying data. Previous prices and searching for specific patterns that can be used to predict stock prices (Melton, et.al, 2017: 200), Usually, there is a set of technical indicators that attempt to give a future perspective on the development of the market according to what appears on the price tables. The technical indicator consists of a formula that is usually applied to the prices and volume of stocks. The resulting values are drawn and then analyzed in order to provide a point of view on the price development (Gorgulho,et.al,2011:14073).

2. The golden ratio:

The golden ratio, which is called in English Golden Ratio, is also known by many other names, such as the Golden Mean, the Greek letter Phi, the Golden Section, and many other names, all of which indicate one meaning, which is a ratio between two numbers that is approximately equal. 1.618, which is usually written with the Greek letter phi (Φ) (Pletser, 2017:1).

The golden ratio is known as a mathematical ratio, used in several disciplines, such as design, art, drawing, physics, biology, astronomy, etc. The golden ratio exists when there is a line, and it is divided into two parts, where when the result of dividing the longer part by the shorter part, it equals the sum of the longer part. The shorter part, divided by the longer part, which equals an irrational number, as follows: (Négadi, 2015:262)

$$\varphi = \lim_{i\to\infty} \frac{F_i}{F_{i-1}} = \frac{1+\sqrt{5}}{2} \approx 1.618$$

Ratios in general have been used in architecture and the arts since ancient times. As for the golden ratio, it was used by many mathematicians and philosophers, such as Phidias, Plato, Euclid, and Leonardo da Vinci. The history of the golden ratio is estimated at approximately 500 years BC (Rivier ,2016:2).

It was pointed out that Pythagoras was the one who discovered the golden ratio and that through him the true knowledge of this ratio began to be understood. “It is believed that the Greek philosopher Pythagoras discovered the concept of harmony while listening to the different sounds produced when blacksmiths’ hammers hit their anvils” (Thapa&Thapa,2018:191)

Markowsky (1992) distinguishes between the terms “golden mean” and “golden ratio”. The "golden mean" was used in classical times to mean "avoiding excess in either direction." On the other hand, the term “golden mean” is used to denote the golden ratio on various occasions.

This confusion may have led people to conclude that the "golden mean" was used in classical times to denote the golden ratio (Markowsky, 1992:3).

3. Fibonacci sequence:

The Fibonacci sequence was named after Leonardo Albissi, known by his Latin name (Fibonacci). This scientist knew this sequence in a book of his called (Libri Apache) that he published in 1202 (Douady & Couder, 1996:255).

The Fibonacci sequence is a set of numbers that begins with a digit, followed by a digit, and continues based on the rule that each digit (called a Fibonacci number) is equal to the sum of the previous two numbers.

The numbers in the Fibonacci sequence are determined through a recursive relationship

$$F_{(n)} = F_{(n-1)}\, F_{(n-2)}$$

$$\text{So: } n \geq 3$$

$$F_{(2)} = 1 \quad \text{and} \quad 1 = F_{(1)}$$

The Fibonacci sequence can be written as 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233,…. (Judy, 2006:544)

One of the most popular experiments dealing with the Fibonacci sequence is his experiment with rabbits. Fibonacci placed a male and female rabbit in a field. Fibonacci postulated that rabbits live infinitely, and every month a new pair of male and female is produced. Fibonacci asked how many rabbits would be created in a year? Following the Fibonacci sequence, the population of rabbits was perfectly determined – 144 rabbits. Although the rabbit sequence is unrealistic, it allows people to relate a highly developed series of complex numbers to logical and understandable everyday thought (Brousseau, 1969:526).

Fibonacci numbers have been used in analyzing financial markets, in strategies such as Fibonacci retracement, and in computer algorithms such as the Fibonacci search technique and Fibonacci stack data structuring. It also appears in biological arrangements, such as tree branches, the arrangement of leaves on the stem, the tip of the fruit of a pineapple, the opening of an artichoke, the uncurling fern, the arrangement of a pine cone, and others (Douady & 6Couder, 1996:25).

The advantages of the Fibonacci sequence extend widely throughout nature, but there is one part where the importance of the sequence is most apparent, which is the possibility of predicting stock market share prices through it. The most famous investment system that relies on the Fibonacci sequence is Elliot Wave Theory, but this major theory was not used due to the complexity of some of the matters associated with it. In contrast, three other applications based on the Fibonacci sequence were used. These applications worked to explain the decline in prices. Shares of some companies, sudden changes in stock trends, and forecast price trends (Ivanova, 2019:2).

4. The relationship between the golden ratio and the Fibonacci sequence

Fibonacci numbers and the Golden Ratio can be found in almost all areas of science, and appear when self-organizing processes are in effect and/or expressing minimal energy configurations. Many non-exhaustive examples have been provided in biology, physics,

astrophysics, chemistry, technology, technical analysis in financial markets, etc. (Pletser, 2017:1).

The golden ratio and Fibonacci numbers have attracted the attention of mathematicians, artists, architects, sculptors, and musicians for centuries. The golden ratio has been associated with ancient Greek art and architecture, and the Fibonacci sequence was discovered which is closely related to the golden ratio. These two phenomena have created a fairly extensive literature but studies have mainly focused on documenting where we encounter them in the human body, in nature, in plants, in art, architecture, economics, sociology, religious books, botany, psychology, astronomy, and physics. , mathematics, and evolutionary approaches (Basak, 2022: 1092).

Historical records and methods related to the golden ratio included both qualitative and quantitative data. Although the golden ratio and Fibonacci numbers require careful mathematical observations and calculations to discover their nature, both phenomena have also been subject to philosophical discussions in art, science, and stock price forecasting (Shank, 2002:78).

The golden ratio and Fibonacci numbers are closely related concepts. Fibonacci numbers are sequential numbers with specific mathematical properties. In the Fibonacci sequence, a number is divided by the previous number, the resulting fraction approaches the golden ratio, and if we continue, it gradually approaches the golden ratio each time; Finally, the golden ratio refers to the marginal number in the Fibonacci sequence as shown in the following formula: (Prokopakis, et.al, 2013:19).

$$\lim_{n\to\infty} \frac{F(n+1)}{F(n)} = \varphi.$$

These Fibonacci numbers have an interesting feature: each number in the sequence is equal to the sum of the previous two numbers: (Sigalotti & Mejias, 2006:522)

1
1 + 1 = 2
1 + 2 = 3
2 + 3 = 5
3 + 5 = 8
5 + 8 = 13
8 + 13 = 21, and so on.

These numbers go to infinity, which is also called the Fibonacci series. Another interesting thing about Fibonacci numbers is when you divide one number in the series by the number before it and as the sequence increases,; You will get a number that is very close to one and the other (see Table II), that is, it seems to be close to the limit that starts with (1.618) and is known as the golden ratio (Markowsky, 1992:5).

Table (1) The first (30) numbers of the Fibonacci sequence

$\frac{F_{n+1}}{F_n}$	$\frac{F_{n+1}}{F_n}$
$\frac{1}{1} = 1.000000000000000$	$\frac{1597}{987} = 1.618034447821682$
$\frac{2}{1} = 2.000000000000000$	$\frac{2584}{1597} = 1.618033813400125$
$\frac{3}{2} = 1.500000000000000$	$\frac{4181}{2584} = 1.618034055727554$
$\frac{5}{3} = 1.666666666666667$	$\frac{6765}{4181} = 1.618033963166707$
$\frac{8}{5} = 1.600000000000000$	$\frac{10946}{6765} = 1.618033998521803$
$\frac{13}{8} = 1.625000000000000$	$\frac{17711}{10946} = 1.618033985017358$
$\frac{21}{13} = 1.615384615384615$	$\frac{28657}{17711} = 1.618033990175597$
$\frac{34}{21} = 1.619047619047619$	$\frac{46363}{28657} = 1.617859510765258$
$\frac{55}{34} = 1.617647058823529$	$\frac{75025}{46363} = 1.618208485214503$
$\frac{89}{55} = 1.618181818181818$	$\frac{121393}{75025} = 1.618033988670443$
$\frac{144}{89} = 1.617977528089888$	$\frac{196418}{121393} = 1.618033988780243$
$\frac{233}{144} = 1.618055555555556$	$\frac{317811}{196418} = 1.618033988738303$
$\frac{377}{233} = 1.618025751072961$	$\frac{514229}{317811} = 1.618033988754323$
$\frac{610}{377} = 1.618037135278515$	$\frac{832040}{514229} = 1.618033988748204$

Source: Omotehinwa, T. O and Ramon, S.O, International Journal of Computer and Information Technology, (ISSN: 2279 – 0764), Volume 02– Issue 04, July, 2013, p:635.

5. Dow Jones index analysis

First: Determine Fibonacci levels

In order to draw the Fibonacci indicator correctly, Leonardo Fibonacci mentions the importance of searching for the main top and bottom according to the time period, so we started using this tool at different time periods (time-frame) (15M, 30M, 1H, 4H, 1D) in order to search for levels. Cluster) for the Dow Jones index.

Figure (1) Fibonacci retracement levels

Source: MT4 trading platform

We have added different Fibonacci retracement lines to the Dow Jones price chart above

We notice in Figure (1) the price rebound at the golden ratio (61.8) on May 30 and August 26, 2022, which in turn represents resistance levels.

The idea is simple to extract the support and resistance levels in the indicator. If the price is in the down direction, the Fibonacci retracement lines act as support lines, on the other hand, if the price is in the upward direction, they act as resistance lines. Suppose, for example, that the price was in a downward trend and broke the support at the 38.2 correction line. The next support line, which is stronger than the previous one, will be at the 23.6 correction level, and after that it will be at the 0.00 balance line as in Figure (1).

Second: Determine the Golden Ratio Cluster

Cluster levels are determined on the charts in more than one way, such as (Fibonacci, support and resistance levels, technical indicators), but the most widely used method in determining cluster levels is drawing the Fibonacci tool on the price. This method is extracted when two or more levels of Fibonacci lines converge or match. On the price in different time periods, the best of these levels are 38.2, 50, 61.8 and are called Super Cluster – SK. As for the golden ratio cluster, it corresponds to two ratios of 61.8 at the same price in different periods, as shown in the following figure.

Figure (2) Super Cluster – SK

We notice in the first drawing of Figure No. (2) the price at the 61.8 Fibonacci level, while the second drawing shows the price at the 50 Fibonacci levels, and these prices between the two ratios in turn represent the SK Cluster levels.

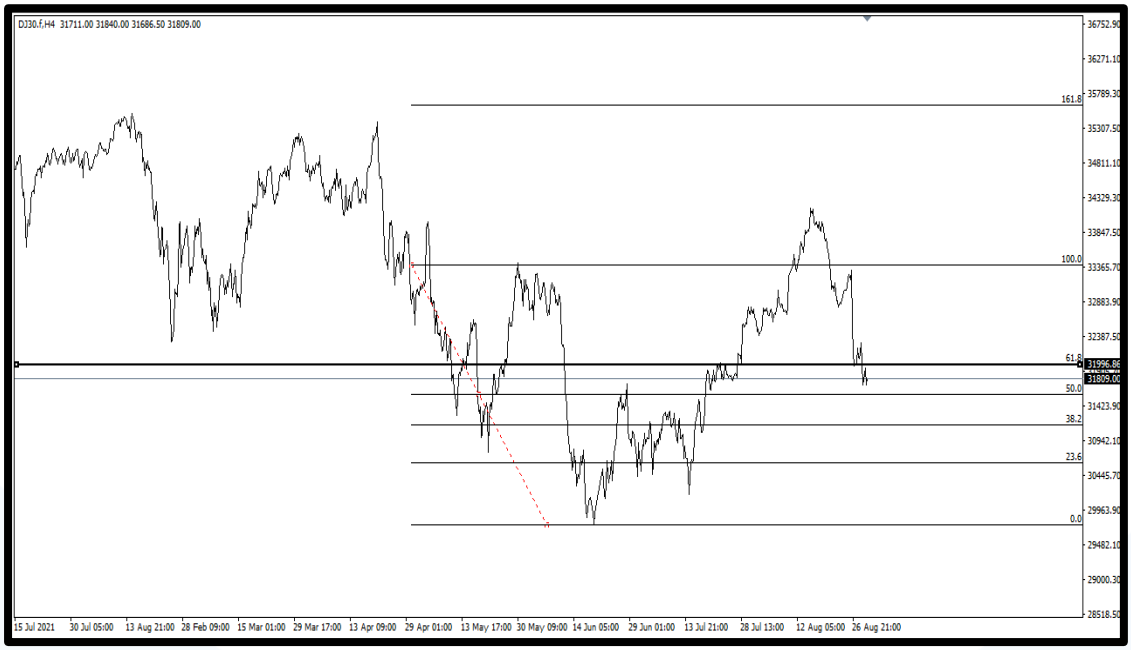

Figure (4) The golden ratio according to the time frame (4H)
Source: MetaTrader 4

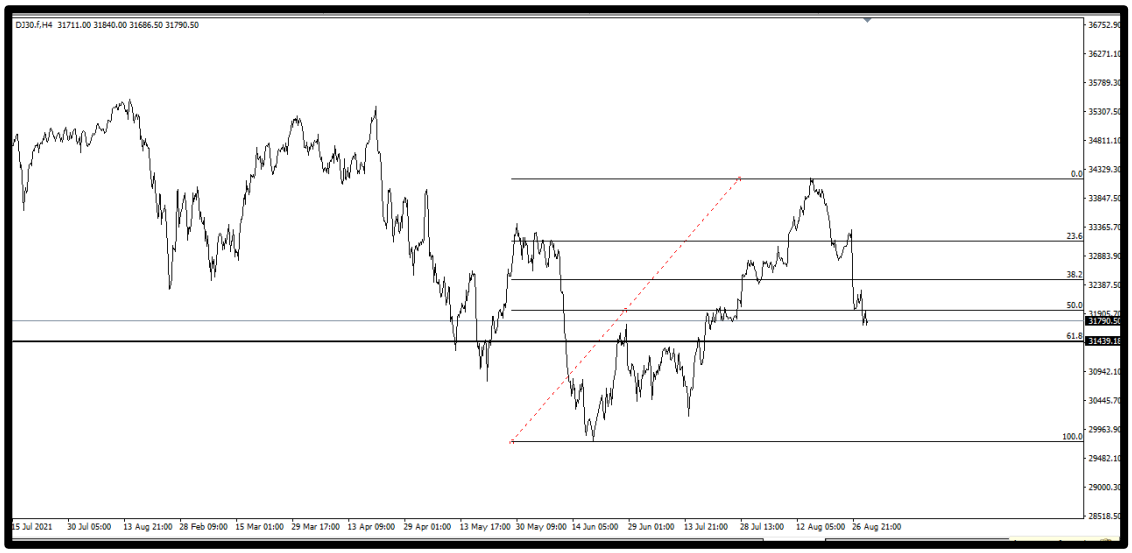

Figure (5) The golden ratio according to the time frame (1H)

Source: MetaTrader 4

From Figure (4-5), we notice that the golden ratio was formed in two different waves, one of which was rising, as in Figure (4), and the other was falling, as in Figure (5).

Figure (6) Golden Ratio Cluster

Source: MetaTrader 4

Table (1) Golden ratio cluster data

date lowest price	date highest price	lowest low	highest high	price f61.8	time frame	Graphical figure
220-6-20	2022-5-30	29750	33400	32026	4H	4
220-6-20	2022-8-16	29750	34187	31439	1H	5
Golden ratio cluster						
		Number of cluster points		Second level		First level
		587 Pip		31439		32026

Conclusions:

This study attempts to analyze the golden ratio cluster in the Fibonacci sequence. The Dow Jones Index platform was used as it is one of the best and oldest platforms used in technical analysis and forecasting market prices for various financial indicators. Through the analysis, the study concluded that prices move according to the Fibonacci ratios regardless of Regarding cluster levels, the reason for this is due to the supports and components that occur at each specific ratio. Therefore, it is recommended to rely on the most efficient ratios in trading, which are 50,61.8,161), which in turn causes prices to rise or fall. The study showed that the Dow Jones index, which represents a large percentage The market is characterized by great fluctuations, so it is preferable to focus on finding cluster levels when correcting the general trend, whether it is bearish or upward. The study found that there is a gap between the main retracement ratios (61.8, 161.8, 50,) and the remaining secondary ratios, so when prices move away from these ratios The possibility of the price trend continuing to rise or fall increases, so it is recommended to stay away from the market, especially if the gap on the time frame is larger. The study provides a set of recommendations for investors who wish to obtain accurate forecasts and consecutive analysis using the sequence, as it helps them obtain profits and target profit rates that are not small.

References

1. Atmeh, Muhannad A. & Dobbs, Ian M., " Technical Analysis and the Stochastic Properties of the Jordanian Stock Market Index Return", Studies in Economics and Finance, Vol. 23 No. 2, 2006.
2. Basak, R. (2022). Golden Ratio and Fibonacci Sequence: Universal Footprints of The Golden Flow. The Turkish Online Journal of Design Art and Communication, 12 (4), 2022.
3. Brousseau A., "Fibonacci Statistics in Conifers", Fibonacci Quarterly (7), 1969.
4. Douady S. and Couder Y., "Phyllotaxis as a Dynamical Self rganizing Process" (PDF), Journal of Theoretical Biology, 178 (178), 1996.
5. Gorgulho, António & Neves, Rui & Horta, Nuno, " Applying a GA kernel on optimizing technical analysis rules for stock picking and portfolio composition" Expert Systems with Applications, 38, 2011.

6. Ivanova, Inga, The Dynamics of Financial Markets: Fibonacci numbers, Elliott waves, and solitons, National Research University Higher School of Economics, December19,2019.https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3506517.
7. Judy, Jones, "Science", An Incomplete Education, Ballantine Books, ISBN 978-0-7394-7582-9, 2006.
8. Livio, M., The Golden Ratio: The story of phi, the world's most astonishing number, Broadway Books, 2008.
9. Markowsky, G., Misconceptions about the Golden Ratio, The College Mathematics Journal, 23(1), 1992.
10. Melton, Michael R. & Nguyen, Xuan (Susan) & Simeone, Michael " Incorporating technical analysis in undergraduate curricula", PSU Research Review, Vol. 1 Issue: 3, 2017.
11. Négadi, T. "A Mathematical Model for the Genetic Code(s) Based on Fibonacci Numbers and their q-Analogues", Neuro Quantology, Vol. 13, Issue 3, 2015.
12. Omotehinwa, T. O. and Ramon S.O., International Journal of Computer and Information Technology (ISSN: 2279 – 0764) Volume 02– Issue 04, July 2013.
13. Pletser, Vladimir, Fibonacci Numbers and the Golden Ratio in Biology, Physics, Astrophysics, Chemistry and Technology: A Non-Exhaustive Review, Technology and Engineering Center for Space Utilization, Chinese Academy of Sciences, Beijing, China, 29 Dec 2017.
14. Prokopakis, E. M., Vlastos, I. M., Picavet, V., Trenite, G. N., Thomas, R., Cingi, C. & Hellings, P. W., The Golden Ratio in facial symmetry, Rhinology, 51, 2013.
15. Rivier, N., Sadoca, J.F. and Charvolin, J. "Phyllotaxis: a framework for foam topological evolution", The European Physical Journal E, 39(1), 1-11, 2016.
16. Shank, G. D., Qualitative research: A personal skills approach, Merril Prentice Hall, 2002.
17. Sigalotti, L.G. and Mejias, A., "The golden ratio in special relativity", Chaos, Soliton and Fractals; Vol. 30, 2006.
18. Thapa, G. B. & Thapa, R., The relation of Golden Ratio, mathematics and aesthetics, Journal of the Institute of Engineering, 14(1), 2018.