Fibonacci Retracement and Elliot Waves to Predict Stock Market Prices: Evidence from Amman Stock Exchange Market

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Abstract

In this paper we have tried to give an explanation of Fibonacci retracement and Elliot wave theory, and then we have included the applied of the theory and its application to ASE prices, as evidence of Fibonacci numbers, and application of Elliot waves in order to have the good time to buy or sell for the shares and stocks in market. Fibonacci sequences have been a topic for mathematical researchers and studies for a long time. The functionality of this analysis is to determine whether this proposed method between Fibonacci retracement and Elliot waves theory which validated in simulation methods, which can help to have the more efficient prediction of trends of ASE.Results of this paper shows, when the investor in ASE can buy-or – hold, also it shows on conclusive evidence of significant analysis through this method levels trading strategy, as a result of the study the investors can be performed the path of ASE for future shareholders expectations which reflects after accounting to transaction cost and risk. This study focused on the pattern recognition in time series of ASE with experimental simulations, to consecrate the purpose of the study that will be presenting the trends. Therefore results of this study do not reject the effect prices but support it in dealing with buying or hold.

Keywords: Fibonacci numbers, Elliot wave, ASE (Amman Stock Exchange), predict trends, Japanese candlestick.

Jell classification: G15, G020.

Section One: Introduction:

1-1: Objective of study:

The main objective of this study is to determine when the investor can buy or hold his share and to analyze the price and returns through Elliot waves retracement and Fibonacci retracements in ASE.

1 – 2: Research hypothesis:

This paper depends on the following hypothesis:

H:$_1$: during the impulsive wave cycle between the predicted prices and real prices, when we use the Elliot waves and applied for Fibonacci numbers some errors happened by 5% ratio, and 10% for stock prices of the returns in each cycle.

H:$_2$: In corrective wave cycle between the predicted prices and real prices when applying Elliot waves and Fibonacci numbers there is an error of the correction less than 10% on average of the stock prices of the shares in Amman stock exchange in each cycle.

H:$_3$: The Procedure of predicted of these returns has successful in predicting the future prices, but it has an error not more than 10% and not less 5%.

1-3 : Previous Studies:

This paper focuses on data analysis with Fibonacci numbers through sequences, and Elliot waves, the set of data are time series, which are using in this paper from Amman stock exchange during the period 2010 to 2015.Technical analysis was ignored the political disorder and social crashed event in the community, fundamentals of the stock market, and what was the situation of economic factors should be affected it. It believed on charts to predict the movement of future price movements, which focused on recognizing the chart movement patterns.

These predictions depend on individual experience and their view sight in the analysis of the charts, the scientists used several subjective methods to interpret the chart results, but many professionals and researchers have used the technical analysis during their working analysis approach in order to improve the investment returns. The chart types which are used:

1: Japanese candlestick charts.
2: Bar charts, and
3: Point – and – finger charts.

Ralph Elliot as other scientists depends on charts of returns of the stock market, and interprets them, but generally depends on Fibonacci numbers, the Elliot wave theory as it is more popular in use by the researcher in their analysis of the stock market, and widely implemented as an approach of analysis. Where it is difficult task to identify Elliot waves, due to the nature of interpretation of Elliot wave charts, which depends on analysts experience on the stock market, and his future expectations, then the stock market time series, which demonstrated it is moving in a fluctuations way according to some economic changes of economic factors and political events.As general there is no major consensus on the use of technical analysis, but in some inconclusive results,we can use many indicators or made some contribution of combination between more than comparison indicator, In this survey it seems as technical analysis, which has obtained and conducted on a professional traders strategies, and background of scientists researches related to the subject of study such as **[1]**, **[2], [3], [4], [5]. [6]**,and **[7]. [8],** have studied and investigated the currency pairs at the weekly, daily, an hour time for the sample period 2005-2013, the currency pairs as Australian dollar Vs U.S dollar, euro vs. U.S dollar, Canadian dollar Vs U.S dollar and Japanese Yen with U.S dollar. **[9],**stated each Elliot waves has its own characteristic, also the wave itself reflects the psychology of this wave moment. Where **[10]**,. Have to test in their research a trading role on New York stock exchange, which based on discriminate function, they have analyzed the daily technical indicators in order to predict the future change in standard and poor's 500 **[11]** , they have a model depends on a question, that can money flow predict? Which can be defined as the difference between up stick and down the stick dollar trading volume, the most important finding in their paper is that money flow appears to predict a cross-sectional variation in future returns.

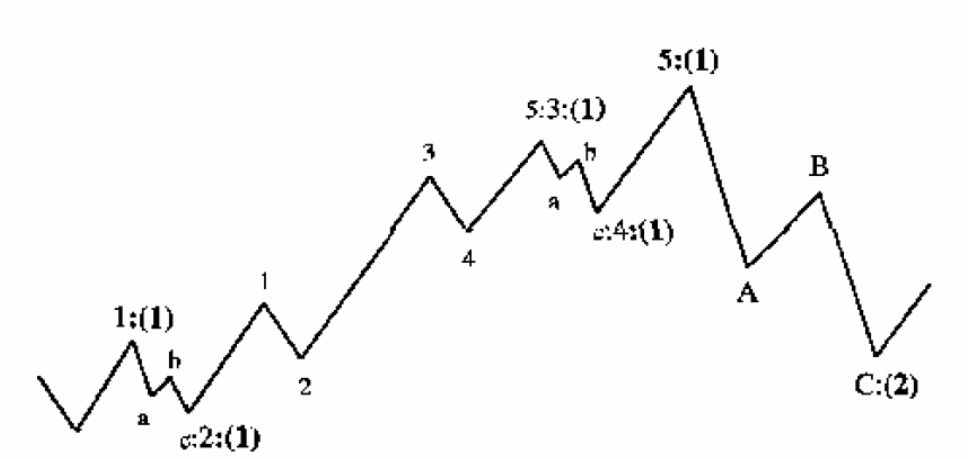
[12] , they have predicted the intra-day price movements, in their study they have used technical indicators for this purpose **[13]** , they have suggested that the best forecasting tool in existence, that principle wave it's a detailed description of how the market has. But **[14]** investigated the frequency of price and time ratios attending adjacent movements in the DJIA retracements. **[15],**attempt to form conclusions about Elliot waves by using such as filters; he was unsuccessful because the waves are a function of forms. Anywho the Elliot waves have a great relationship with Fibonacci sequences, in another hand the market behavioral analysis should be considered when we analyzed the movement of prices due to the psychological situation of the investors and how their psychological moods governed the movement of market price, these behavioral moods at a certain time also can control the future attitudes of investors this can shift the expectations from pessimistic into optimistic, this happens regardless of bullish and bearish. In figure (1) below, it explained the waves as below:

Wave A: is a correction which are typically is hardened to identify the impulse wave, in this wave the fundamental news is usually still positive.

Wave B: Prices reverse higher which may be shown as a resumption .With classical technique we may see the peak as right shoulder of head and shoulder reversal pattern, fundamental are probably no longer improving, but mostly not turned negative.

Wave C: prices move impulsively lower in five waves, volume picks up, it often extended to 1.618 times wave A or beyond as **[16]**

Figure (1): Nested Waves. Elliott-Wave "map" of the market



Gorman, W. and Kennedy, J. (2013).Visual Guide to Elliott Wave Trading. Bloomberg financial.

In this paper Elliot waves which gives an idea about the trend direction and the reversal of trend prices if combined with Fibonacci waves in order to have good knowledge about the market behavioral, also to predict the future prices of market, **[12]**, studying the intra-day price movement, through the adaptive use of technical indicators, and they have designed a system, through this system we can select the best technical indicators which can by choose best combination of the parameters values, the results of their system let us have the best prediction on the direction of market movement with hitting rate of 10 ticks ahead **[10],**

they have studied the trading rules for the New York stock exchange based on discrimination function, they used daily index data to predict future changes through "Standard and Poor's 500 index", the results of the study determined the extent, also they decided that the indicator reflects the market participants ,and they have applied the difference of means between the groups in their data, and computed Vs F -test results **[17]**, they have proposed SB- tree represents the performance of financial time series dimensionality reduction. Were introduce a novel as **[18]** transforming technique called pier-wise aggregate approximation (PAA), by segmenting the sequence into equal – length sections, this technique which they have used for time series dimensionality reduction. AS **[19]**, the Elliot waves, each one wave holds the individual reaction of participants in the stock market, and it has been present the time and reflects the psychology of the moment. Where **[20]**, classified Elliot waves gradually runs from smallest to the largest part of Eliot waves, in this process, they fund a scale and separate mono waves Marking, they are a completed pattern according to particular ratios.

[21], he used in his study for data analysis a different technique tool, he found that using this procedure can make predictions of the following of the stock market index. And he depends on the proficiency of the tool which used in his analysis. studied data from Elliot **[22]** ,wave theory and Neuro-Fuzzy system, to predict the stock market direction. The results of analyses which based on stock historical data historical data to compute new predictors, which aimed to deal with the treat with sell or buy at the market moment. This paper is organized and prepared for the subject into six sections, where section one included the introduction. Were section two included hypothesis of study and the brief notes of Amman Stock Exchange, And section three contains the theoretical approach, which describes the theory of Fibonacci numbers and sequences, and then Eliot wave theory, Section for included data and methodology of analysis, section fife represents the empirical results of the analysis, was section six present the concluded remarks of the paper.

Section Two: literature review:

2 -1: Brief notes on Amman Stock Exchange:

This part of the paper depends on the annual report of the ASE.the value of trading in the secondary market mounted to J.D 505 million in 2015 where J.D 2347 million in 2014 **[23],**when compared the increases ratio is 49.3%. In the secondary market, the traded of stock made up 97.5% of total trading value.

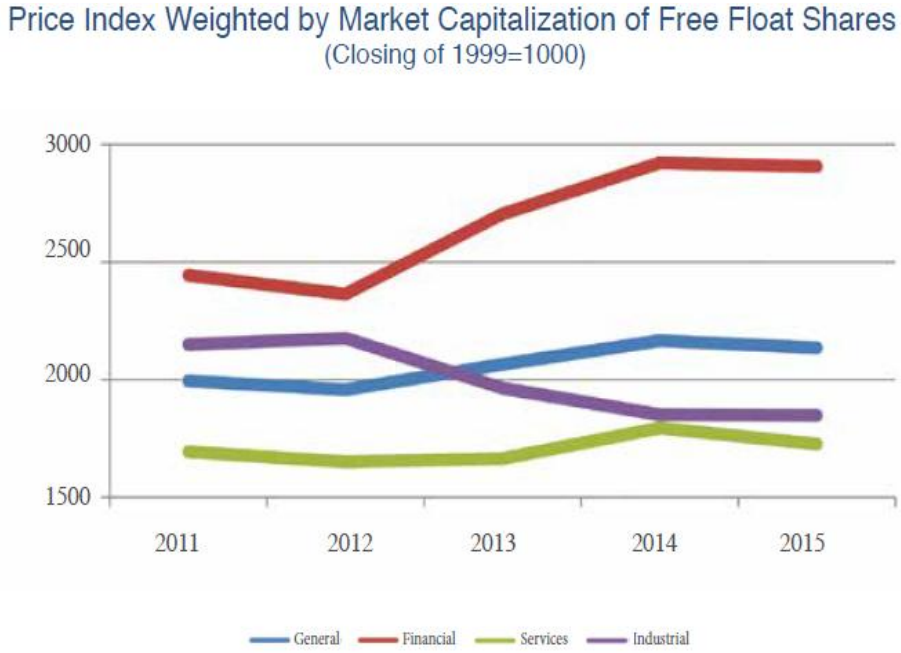
The financial sector ranked first according to the scrotal distribution of trading value , and the services sector becomes the second, followed by the industrial sector, the figure (2) shows that the trading value ratio of real estate, the ratio of banks, financial services, finally the commercial services, and transportation, made up 36.3%, 21.1%, 10.2% and 9.1%.

Figure (2): The ASE Trading Value by Sectors, 2015.

Central Bank of Jordan; annual report 2016.

The daily trading value during 2015 increased, reaching J.D 13.9 million against 2014 with J.D 9.1 million, the increasing ratio of 52.6%. Where market capitalization is weighted the index of prices off free float shares, also the analysis shows an improvement in the early 2015 period by 0.2%, and finally closed with decreased of 1.3% in the end period of the year 2015.

Figure (3):



Amman Stock Exchange; annual report 2016&Society of Jordanian banks annual report 2016.

The indices according to market indicate that the first market scored 1107 points, marking a decrease of 0.1% against 2014, where the second market index reached 1o65 points with a decrease of 7.1%, while the third market closed at 1458 points.

Figure (4): Average of daily trading value, of ASE, 2015

Amman Stock Exchange; annual report 2016.

According to results of these motions in share prices, the market capitalization decreased of listed companies in ASE by 0.5% in 2015 representing 70.7% of the GDP.

Table (1): Market capitalization of ASE, by J.D million

Year	Financial sector	Services	Industry	Total
2011	9847	3481	5944	19273
2012	9584	3398	6159	19142
2013	10562	3276	4395	18233
2014	11001	3389	3693	18083
2015	110032	3199	3654	17985

Source: Amman Stock Exchange annual report, 2016.

The total trade value of bond increased by J.D 0.85 million in 2015, the right issues market traded value reached the amount to J.D 114.3 thousand, and the (SDC) showed that the value of money transfer, and the government treasury bonds, may list issues amounted by J.D 3597 million during 2015.

Figure (5): price indices of ASE (2012 – 2015).

The central bank of Jordan; annual report 2013, and 2016.

Section Three: theoretical approach:

3 - 1: Fibonacci numbers and Elliot wave theory:

Fibonacci (1175 – 1240) has been constructed to new financial science after his return from a trip to Egypt 1202, where his back to Italy he published a treatise on arithmetic and algebra. In this treaty, he introduces for the first time to Europe the numerical Arabic numbers which used up to now, due to his contact with Greek and Arabic civilization and culture. He believes that Grecians built Parthenon, and Egyptian built the Pyramids, also this ratio adapted in fields of science such as music theories, Arts, and biology If you assigned Fibonacci numbers as (^{f}n):

$$f\ 0 = 0, f\ 1 = 1, then fn + 1 = fn\{n - 1\} + fn\ \ n \geq 1 \ldots\ldots\ldots(1)$$

The induction often (n) will prove as for if we suppose that:

$$X\,n - fn - 1 + fn - 2 \ \ldots\ldots\ldots\ldots\ldots\ldots(2)$$

The Binet formula of n-th term of Fibonacci as:

$$Fn = \frac{1}{\sqrt{5}}\left(1 + \frac{\sqrt{5}}{2}\right)n - \left(1 - \frac{\sqrt{5}}{2}\right)n \ \ldots\ldots\ldots\ldots(3)$$

As a result of Binet formula:

$$\theta = \left(1 + \sqrt{5}\right) and\ 1 - \theta = \left(1 + \frac{\sqrt{5}}{2}\right) \ldots\ldots\ldots\ldots(4)$$

Forward as a result of Binet formula:

$$\theta n - (1 - \theta)\,n = \sqrt{5}^{\ fn} \ldots\ldots\ldots\ldots\ldots\ldots..(5)$$

Fibonacci ratio is mathematical formulas expressed as ratio, the ratio is stated as: 0%, 23.6%, 38, 2%, 50%, 61.8% and 100%. The stock market, so they used them to determine the critical values which cause on an asset Fibonacci golden ratio is 61.8%, but we can calculate other ratios such as ^{f}78. 6% = {(1++√5) / 2}0.5 ~ 0.786151.

The result, due subtracting confirmed 0.214, the ratios play an important role in the prices to reverse, as the behavior prior trend is likely to reduce and retracted to one of the ratios. The Fibonacci ratios can be used often with other technical analysis as RSI, moving average and others, the Fibonacci ratios predict in the stock market, future and commodities, these are can be traded using the Fibonacci retracement of a trend. The idea of traded off a trend depends on retracement of the Fibonacci support level and Fibonacci resistance level in trend.

Figure (6): Fibonacci price retracement and price extensions with a candlestick.

www.markets.com/education/technical-analysis/fibonacci-Elliot-wave.html.

3 - 2: Fibonacci fan:

Due to peak, which drowns between the extreme points, the vertical line draws among the interval of the 2nd point, intersecting with the trend line at Fibonacci ratios as, 38.2%, 50%, and 61.8%. On the other hand, the two extreme points should be determined in order to specify the length interval according to Fibonacci numbers, also, it is important to determine the zone of the expansion of the Fibonacci which is similar to Fibonacci retracement, and determined in the third wave, The rules to perfect Fibonacci chart plotting:

A- Identifying the high and low relative prices on the historical chart.
B- Plot the Fibonacci retracements levels: the low level is zero %, and the highest level point represents 100%. Between the two extreme points, we can plot below and above the high and low level the significant Fibonacci percentage of 38.2%,50%, and 61.8% ratio.
C- In this plot, we should observe the historical behavior of stocks, which is necessary to demonstrate the support and resistance levels.
D- It is important to forecast the future movement, Fibonacci retracements will vary from the stock market to other ones, also may be a function of trading character; this depends on the accurate interpretation of previous price movement.
E- We should have the confirmation when we used in conjunction with other techniques tools which has been identified where the support and resistance levels are available the levels.

3 – 3: Fibonacci Q-matrix:

The scientists and mathematicians saw that the popular method for studying the Fibonacci sequence is called Fibonacci Q-matrix which can be expressed as:

$$Q = \begin{pmatrix} 1 & 1 \\ 1 & 0 \end{pmatrix}, \text{then } Qn = \begin{pmatrix} fn+1 & fn \\ fn & fn-1 \end{pmatrix} \quad \ldots\ldots\ldots\ldots\ldots\ldots(6)$$

Where: $f_1=1$, $f_0=0$, thus .f_{n+1} = fn +f_{n-1}. The famous formula of Fibonacci can be as follows:

$$fn+1-fn-1-fn-2=(-1)n \quad \ldots\ldots\ldots\ldots\ldots\ldots(7)$$

Robert Simon expressed this formula according to the Fibonacci sequence considered as the basis for the well – known geometrical paradox. Charles King has originated in his thesis the phrase Q- matrix, and the **[24],**said that the idea caught from the Q- matrix phase of Fibonacci on like wildfire among Fibonacci enthusiasts. The Fibonacci matrix seems to appear as a form of which designed by Joel Brenner, the n-th power matrix is:

$$\begin{pmatrix} Un+1 & Un \\ Un & Un-1 \end{pmatrix} \ldots\ldots\ldots\ldots(8)$$

Where: Un: represents Fibonacci numbers, the n-th power of:

$$\begin{pmatrix} Un+1 & -abUn \\ Un & -abUn-1 \end{pmatrix} \ldots\ldots\ldots\ldots\ldots\ldots(9)$$

Where: $U_n = (a_n - b_n)/(a-b)$, this so-called Lucas number, according to these facts we can deduce the general theory of the Fibonacci sequence, the sequence:

$$Un = abUn-1+....+abUn-b \quad \ldots\ldots\ldots(10)$$

We can have the properties of a matrix which has a dimension b, which can generalize the matrices, many authors pointed out that several relationships between the Fibonacci sequence compared to the sequences of polynomial numbers by manipulates of two –by two matrices.

$$B = \begin{pmatrix} 1 & b \\ 1 & 0 \end{pmatrix}, then Bn = \begin{pmatrix} fnb & bfn-1b \\ fn-1b & bfn-2 \end{pmatrix} b \quad \ldots\ldots\ldots\ldots\ldots\ldots(11)$$

Therefore the explicitly of Fibonacci polynomials is :

$$fn(X) = \sum \begin{pmatrix} n-k \\ k \end{pmatrix} X^{k}, \text{where } 0 \le k \le n/2 \ldots\ldots\ldots(12)$$

We can conclude as:

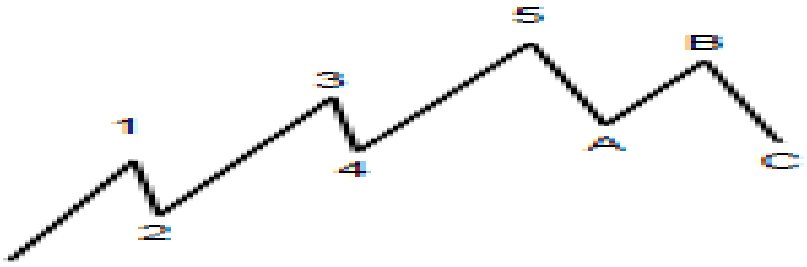
$$Hn = qnT - 1\,BnT \quad \text{.....(13)}$$

3 – 4: Elliot waves:

Elliot wave theory is introduced by Ralph Wilson, Elliot, which inspired by the Dow theory, Elliot observed that the movement of the stock market prices could be predicted by a repetitive pattern of waves of stock market prices, which influenced by identifiable series of waves. Through these series of waves, we can observe the fractal nature of the stock market action and analyze the stock market depth, therefore we able to describe the characteristic of wave pattern, and then detailed market prediction based on these wave patterns. The graphical view of Elliot wave is depicted in figure (7).

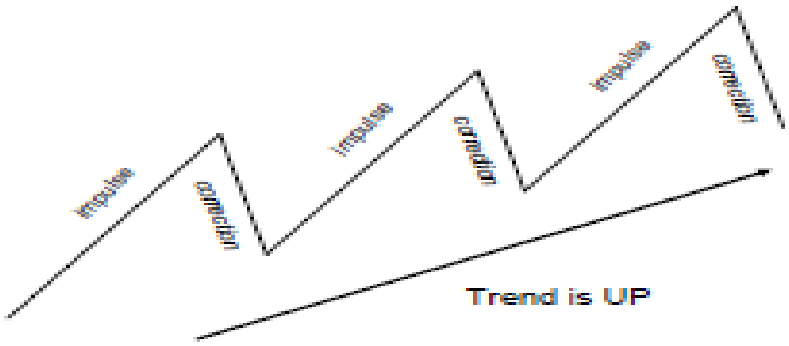
Figure (7): Elliot wave cycle

A major Elliott wave pattern.



Where the principle of market trend can be depicted as the following figure (8):

Figure (8): The Elliot wave market trend



This figure was retrieved from http://www.bigtrends.com/trading-education/basics-of-elliott-wave/

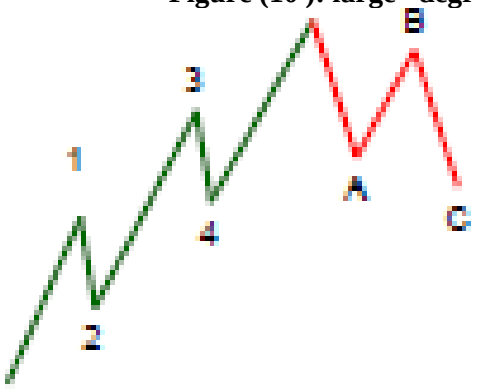
The market trends in Elliot wave theory depends on the markets move in the trend, the movement with a trend is called impulse and the movements against the trend are called correction, finally these trends are eventually changed, also depends on their time frame, and they are advanced in 5 waves, and retracted in 3 waves, these of movement can be as large –degree uptrend shown in figure (9).

Figure (9): large – degree uptrend

A major Elliott wave pattern.

And the larger – degree downtrend as below in the figure (10).

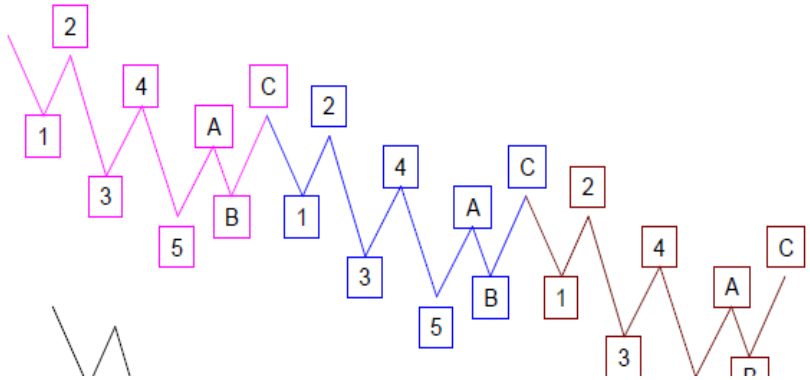
Figure (10): large –degree downtrend



A major Elliott wave pattern.

These trend structures are repeated and connected to another, they appear as a figure (11):

Figure (11): trend structures



The fractal nature of the Elliott wave pattern. I.e. each Elliott wave pattern consists of smaller Elliott wave patterns. This figure was retrieved from http://www.bigtrends.com/trading-education/basics-of-elliott-wave/

Therefore the five wave pattern –dominate trend as the trend structure above and move upward and downward as above figure.

Wave 1: it is an impulse and inception; the fundamental news when this wave begins in the stock market is almost negative, where the implied volatility is high, and stock prices rise. Is subdivided into smaller waves slow and steady, the trend appears can be sharp and decisive.

Wave 2: the movement of wave 1 is corrected by wave 2 the fundamental news of stock market still bad, and the prices are low, bearish sentiment quickly builds, and during wave 2 volume is lower than wave one, and the prices do not retrace more than Fibonacci ratio 61.8%, and some positive signs appear. Wave 2 is subdivided into 3 smaller waves they appear in sharp shape and deep. In this wave, the trends are still convinced, and it never reacts more than 100% of wave 1.

Wave 3: in wave 2 the prices should fall than it in wave 3, enhance wave three is a powerful wave in a trend. The news of market is good and positive signs are giving a chance for the market to rise, earnings estimates, the corrections are shallow due to quickly rises in prices, wave 3 extends wave by ratio 1.618:1, is subdivided into 5 smaller waves, these waves occur in high volume, and never become the shortest impulse wave.

Wave 4: It retraces nearby but less than 38.2% of wave three (Fibonacci relationships) the traded value of wave 4 is less than value 3, due to lack progress in the trend wave 4 still frustrating, this a good place to buy, it has a complex moves and is subdivided into 3 smaller waves.

Wave 5: the news still positive, and everyone is bullish, the volume is less than wave 3, the momentum indicators show divergences, where the indicator is reaching new peaks, also is subdivided into 5 smaller waves, and in distributed phase, wave 5 usually displays a weakness of the trendy prices.

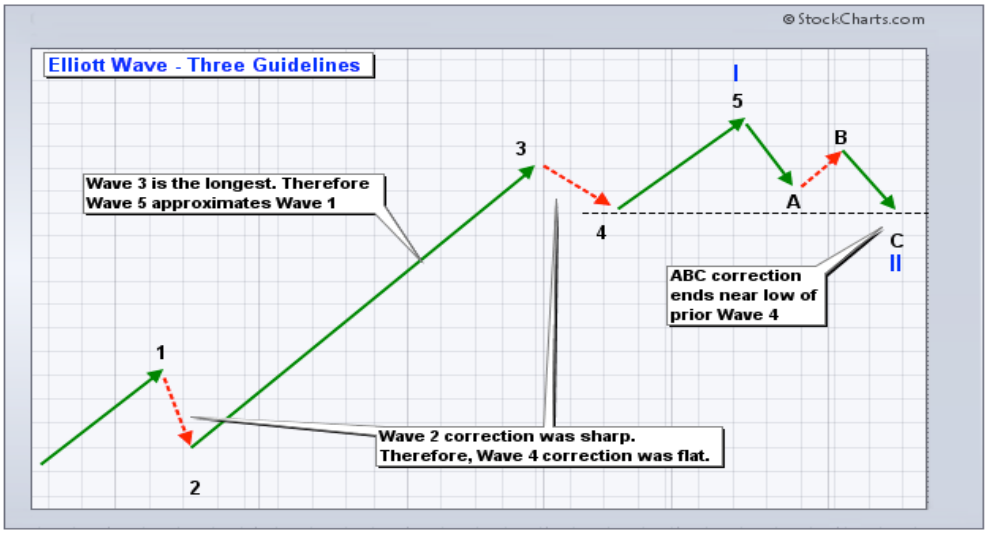
The three wave patterns: corrective trends:

Wave A: The fundamental news still positive and it has increased volume, where the implied volatility is raised in options markets and possibly higher in future markets.

Wave B: we can note that a resumption of large-gone, due to the prices reverse. The volume should be lower than the volume of wave A ,but mostly have not yet a negative trend.

Wave c: it's typically large as wave A, or beyond, the price moves lower in five ways.

The common ratio is used to determine price retrace, and price extensions during the trend which can see in figure (12)



The fractal nature of the Elliott wave pattern. I.e. each Elliott wave pattern consists of smaller Elliott wave patterns. This figure was retrieved from http://www.bigtrends.com/trading-education/basics-of-elliott-wave/

The corrections of movements as a common retrace ratio:

Wave 2: - 0.616, 0.786. And wave 4 is – 0.382, 0.50, in wave 4 trend is pass toward a shallower retrace and will often support at 0.382 levels of wave 3.

Wave B: they usually constant, and changes in its movement in length more than - 0.50, 0.618, 1.09,1.2. Where the correction generally has a zigzag behavior consists of three smaller waves.

3- 5: The relation between time series and Elliott waves:

The time series of a stock market present with several fluctuate price movements, in both directions upward and downward; these appear as a structure wave like an algorithm. Enhance as analysis results of fluctuated price movements of stock market time series, there is a disturbance (noise), sometimes it is quite, others are high level. But it is too important to the trader to have an early identified it is forming of waves and its expected movements to decide their position in buying or selling in their trading position in the stock market. This early identification can be used an algorithm identification process. Many authors in recent papers studied and used algorithm method in their papers, such as **[25]** , **[26]**, and **[27]**in this context we explain the Fu, 2007 method without application, because our mission is Fibonacci and Elliott waves.

3 – 6: The algorithm identification process reduction process:

1: The first iteration can be included first and last end point of S, which indicates to time series as (s1,s2,….sn). The first leap of S1; has two segments s1p1, s2pn.then it will be recorded.

2: The second step: is as a result of step 1 of each segment, the retrieval is considered, then we can connect from the peak-to-peak and from bottom-to-bottom.

3: All perceptually important points retrieval, which considered can be recorded.

4: In this point, the threshold is used to determine the trading period point.

When we matched the time series and the pattern templates, we can through this method identifying the existing of Elliot waves. This method proposed by **[28]**. In their method the amplitude-distance between two points can be performed as follows:

$$DA(SpA, Cp) = \sqrt{1/n} \sum (\mathrm{SpA} - \mathrm{CA})^{2} \ldots\ldots\ldots\ldots (14)$$

Where: (A, C) indicates to points in time series and templates SpA, CPA; are considered as (PIPS) in P. This preferred to be considered as a horizontal distortion of pattern against templates. The temporal distance can be performed as (TD) in**[28]**method:

$$TD(SptA, Cp) = \sqrt{1/n} \sum (\mathrm{SptA} - \mathrm{CtA})^{2} \ldots\ldots\ldots\ldots ...(15)$$

The SptA and CtA represent the time coordinate of the sequence points. Other models and mathematical calculations studied the stock market prices movements such as Black – Litter man who studied the active portfolios with E-views. This method of Black – Litter man is the optimized approach used to obtain diversification portfolios, resembling portfolios, and real market participants. The vector implied excess equilibrium returns are derived from already available information applying
the following equation:

$$\pi = \Omega \sum W mkt \ldots\ldots\ldots\ldots\ldots\ldots (16)$$

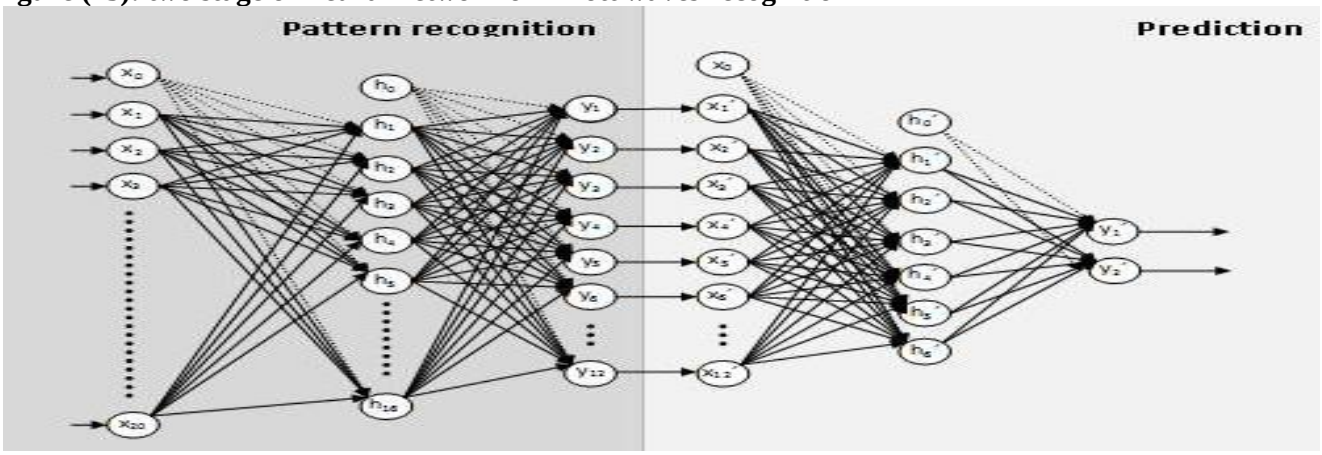
Where: Π – the Implied Excess Equilibrium Return Vector (N x 1 column vector);
Ω– the risk aversion coefficient; ∑– the covariance matrix of excess returns (N x N matrix);
and wmkt – the market capitalization weight (N x 1 column vector) of the assets;

Black-Litter man model assumes K represents the number of views and N demonstrates the number of assets. Some rearrangement of the previous formula by substitution μ which characterizes any vector of excess. The important condition is if μ does not equal Π, w will not equal wmkt. The risk aversion coefficient in the reverse optimization process acts as scaling factor for the reverse optimization estimate of excess return and is calculated as follows :

$$\lambda = \frac{E(\mathrm{r} - \mathrm{rf})}{\sigma^{2}} = \frac{riskprimuim}{\mathrm{var}iance} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (17)$$

This scaling factor characterizes the expected risk-return trade-off and is the rate at which more return is required for more risk. The Goetzmann, Brown approach is based on simulation of trading strategy, which generally shifts from long stocks to short stocks. When we compare with Cowles who used 50 to 50 portfolio mixtures of Dow Industrials and Dow Railroads, the S & P index was used as the basis. Short-term commercial paper rates represent the alternative investment. The results showed that Hamilton's portfolio as overall indistinguishable from average return holding S&P all-stock portfolio. **[29]** have adapted by back propagation a neural network of two stages which designed in order to recognize the selected Elliott waves pattern. The purpose of the adaptation is to the accurate information about the quality and behavior of wave pattern, then to evaluate this pattern with consensus method. The second stage of their adaptation is to made evaluation of prediction of trend component, which in essence give us assigned that the neural network can explain and described the time series of prices or returns in stock market data set with respect of corrective or impulse direction, depends on a rule-based of knowledge system, diagram (13) shows this two stages.

Figure (13): two stage of Neural network of Elliott waves recognition



Source adapted from Volna, Kotyrba and Jarusek 2013.

Section Four: Data and Methodology:

The data that will be used in this paper analysis is daily price data on Amman stock exchange from January 2011 – to 31st of December 2015, by the index of daily trades in the stock market. Where the methodology of the paper as follows:

1: The impulse waves: we should begin with the first step to draw the graph of data stock prices of the daily trade index, then we can identify the impulse waves that occurred in each year, also the corrective waves, then we can be decided the highest of the first wave, finally we should calculate the final price which is equal the higher of the impulse wave from +(1.618 x).

2: as point 1 we indicate the lowest points of a corrective wave, the final calculation should be demonstrated as the difference between the lowest and the highest point of the first wave of the corrective, the final price should be as – (1.618x).

The human behavior is embedded and reflected in the movements of stock market prices, therefore the best achieved by considering as currents, and must always endeavor to take step back and try to not interfere or separate ourselves from the crowd, the advice for the analyst who uses Elliot waves can be expressed as: You should accept when your analysis is wrong, also you should use Fibonacci in conjunction with your Elliot wave analysis, after that you can have your decision and your plan. The support level used when the market is trading up, where the resistance level used when the market is trading down. These are according to the recent significant swing highs and swing lows.

Section five: Empirical results analysis by impulse and corrective waves and charts.

5 – 1 : Empirical Results of analysis:

Table (2): The impulse waves of ASE daily stock price prediction

No.	Lowest of 1st wave	Highest of 1st wave	Multiplied by 1.618	Predicted price	Actual prices	Percent errors
1	316.81	136.53	220.9055	648.533	597.564	0.0785
2	543.26	78.41	126.8673	583.126	564.613	0.0317
3	618.39	95.63	154.7293	743.262	716.387	0.0362
4	826.14	127.43	206.1817	998.154	907.544	0.09078
5	953.21	81.79	132.3362	1182.785	1087.65	0.08043

Average geometric mean: 6.72%, Mean = 0.063522.

Calculated: by author according to statistics of ASE daily prices – central bank monthly report for the years(2011-2015).

Calculated by formula as. $G = \sqrt[N]{\frac{100\pi(P1 - P)}{P}}$,the values are calculated by the author.

Where: N, is a number of waves will be count one is impulse and one for corrective waves, P: is the highest price for each impulse and the lowest price for the corrective wave. Is predicted prices. These results of table (2) show the impulse waves of Elliot waves for a daily price index of Amman stock exchange (ASE) during the period 2011 – 2015, we have in this table start by impulse wave, we see that wave 1 increased per time, and vary at time in the lowest of 1st wave and the highest of 1st wave per time where the geometric mean is 6.27%. Table (3) contains the results of the corrective wave.

Table (3): the corrective wave of ASE daily stock price prediction

No	Lowest of 1st wave	Highest of 1st wave	Multiplied by 1.618	Predicted price	Actual prices	Percent errors
1	479.62	362.15	585.9587	389.16	354.654	0.0887
2	618.29	522.41	845.2593	438.72	389.721	0.1169
3	734.65	679.18	1098.913	409.19	382.982	0.0641
4	915.40	784.26	1268.933	672.33	587.993	0.1254
5	1209.17	917.13	1483.916	814.05	783.323	0.03777

Geometric mean 7.01%. Mean = 0.08657.

Calculated: by author according to statistics of ASE daily prices – central bank monthly report for the years(2011-2015).

The efficiency test shows that the average geometric mean is less than the rate of accepted errors at 10%, and rejected at the 5% level. The lowest of wave A has increased during the period of study(per time), also between wave 5 and wave A is increased, often the predicted price is shifted upward, the geometric mean is 7.01%, which measured the accuracy in stock price prediction.

Table (4): The impulse waves of Financial sector & commercial banks, which are listed in ASE.

No	Lowest of 1st wave	Highest of 1st wave	Multiplied by 1.618	Predicted price	Actual prices	Percent errors
1	140.16	212.39	343.647	310.17	291.05	0.0616
2	233.27	249.18	403.173	298.53	273.21	0.0848
3	298.12	287.03	464.4145	361.27	345.87	0.0426
4	360.22	346.09	559.9736	426.39	413.67	0.0619
5	374.38	421.45	681.9061	517.33	502.43	0.0288

Geometric mean 8.17%. Mean = 0.05594.

Calculated: by author according to statistics of ASE daily prices – central bank monthly report for the years(2011-2015).

The impulse wave in a table (4) represents the result of Elliot wave which is varied along the period of the study for the financial institutions and commercial banks, which are listed in ASE, the low of wave 1is increased and vary per time, according to the lowest and height of wave 1 we can note that the prediction prices also changed per time, where the ratio of geometric mean is less than 10%, but more than 5%.

Table (5): The corrective waves of Financial sector & commercial banks, which are listed in ASE.

No	Highest of wave 5	Lowest of wave A	Multiplied by 1.618	Predicted price	Actual prices	Percent errors
1	243.16	213.10	344.7958	181.27	172.34	0.04926
2	317.02	265.42	429.4496	213.56	205.48	0.12212
3	361.54	290.73	548.9717	283.66	276.27	0.02605
4	428.22	365.82	591.8967	231.73	218.93	0.05523
5	439.74	389.65	630.4537	299.86	278.41	0.07153

Geometric mean 9.26%. Mean = 0.064878. Calculated: by author according to statistics of ASE daily prices – central bank monthly report for the years(2011-2015).

The corrective waves of Financial sector &commercial banks, which are listed in ASE as the nature of the stock market and the growth of the stock market is varied per time, the low of the wave, the geometric mean is less than the ratio to accept the errors 9.26%, and more than 5%.

Table (6): The impulse waves with Elliot wave of service sector

No	Lowest of 1st wave	Highest of 1st wave	Multiplied by 1.618	Predicted price	Actual prices	Percent errors
1	75.81	89.66	145.0699	89.73	82.15	0.08448
2	105.92	123.87	200.4217	148.65	137.34	0.07608
3	117.84	156.43	253.1037	154.76	145.63	0.05899
4	154.53	187.11	302.7439	172.31	171.09	0.00709
5	167.89	207.63	335.9453	189.93	183.25	0.03517

Calculated: by author according to statistics of ASE daily prices – central bank monthly report for the years(2011-2015).

In table (6), the impulse waves have been tested for service sector, the geometric mean is too little compared to daily prices index test in table (3) it is 5.62%less than the accepted of errors at 10%, and the predicted price is less than the financial institutions, and commercial banks in Jordan .

Table (7): The corrective waves of service sector efficiency of the stock price prediction.

No	Highest of wave 5	Lowest of wave A	Multiplied by 1.618	Predicted price	Actual prices	Percent errors
1	101.12	87.32	141.2837	104.67	102.78	0.01805
2	138.94	117.65	190.3577	113,43	109.89	0.03121
3	135.32	124.67	201.7161	127.84	123.74	0.03207
4	175.40	148.09	239.6097	135.17	128.32	0.05016
5	178.25	159.52	258.10336	146.77	137.54	0.06289

Geometric mean 5.98%. Mean = 0.038876. Calculated: by author according to statistics of ASE daily prices – central bank monthly report for the years(2011-2015).

The corrective waves of Financial sector &commercial banks, which are listed in ASE as the nature of the stock market and the growth of the stock market is varied per time, the low of the wave, the geometric mean is less than the ratio to accept the errors 6.29%, and more than 5%.the geometric mean is 5.98%is too few, were the mean is 0.038876 is too little either, this means that the sector can be developed the service, and can improve their type and quality, more than available sector.

Table (8): The impulse waves with Elliot wave of industrial sector

No	Lowest of 1st wave	Highest of 1st wave	Multiplied by 1.618	Predicted price	Actual prices	Percent errors
1	103.46	36.51	59.0732	106.83	98.23	0.07273
2	121.38	43.19	69.8814	114.23	102.43	0.1033
3	134.76	64.32	104.0698	135.87	131.76	0.03024
4	128.89	76.53	123.8256	128.19	120.78	0.0578
5	168.74	87.09	140.9116	153.76	143.89	0.0642

Geometric mean 7.32 %. Mean = 0.065654. Calculated: by author according to statistics of ASE daily prices – central bank monthly report for the years(2011-2015).

According to an Elliott Wave Principle forms the Fibonacci sequence and this is the relationship between the Fibonacci sequence and the Elliott Wave Principle. Summarizing the relationship between Fibonacci and Elliot wave with illustrations**; and the actual price from 102.78 to 137.59 with the percent of errors 6.29%, but the impulse wave of industrial sector with Elliot waves of actual price is 98.23 to 143.89, with percent errors 7.28%to 6.42%.And the highest of 1st wave 36.57 to 87.09.**

Table (9): The corrective waves of industrial sector efficiency of the stock price prediction.

No	Highest of wave 5	Lowest of wave A	Multiplied by 1.618	Predicted price	Actual prices	Percent errors
1	109.53	72.11	116.67393	93.17	86.32	0.07438
2	117.84	84.52	136.75336	107.25	91.43	0.1398
3	126.06	103.63	167.67334	122.49	105.47	0.04327
4	135.93	118.32	191.44176	136.53	112.65	0.05981
5	147.38	134.08	216.94144	138.34	119.82	0.06014

Geometric mean 5.98. Calculated: by author according to statistics of ASE daily prices – central bank monthly report for the years(2011-2015).

The geometric mean 5.98.the corrective waves of industrial sector efficiency in table 9 .the highest corrective waves 109.53 to 147.38, and the lowest of a wave as 72.11 to 134.05. The corrective waves of industrial sector companies, which are listed in ASE as the nature of the stock market and the growth of the stock market is varied per time, the low of the wave, the geometric mean is less than the ratio to accept the errors 6.01%.

5 -2 : empirical results of charts of ASE:

The following charts of Elliot waves of ASE represent the waves and retracements, calculated and drawn by using Meta stock software to market charts and drawing tools.

Figure (14): The financial sector waves analysis

Source : by author according to statistics of ASE daily prices – central bank monthly report for the years(2011-2015).Using Meta stock software.

Wave cycle of financial sector of ASE.

- Wave1: 1231.40 to 2120.56
- Wave 2: 2120.56 to 1523.10, 61.8% retracement of wave 1
- Wave 3: 1523.1 to 3428.12, 217,4% extension of wave 1
- Wave 4: 3428.12 to 2389.72, 50% retracement of wave 3
- Wave 5: 2389.72 to 5983.54, 186,9% of wave 3
- Wave A: 5983.54 to 3765.74, 50% retracement of wave 5
- Wave B: 3765.74 to 4923.57, 50% retracement of wave A
- Wave C: 4923.57 to 2167.81, 158.7% of wave A.

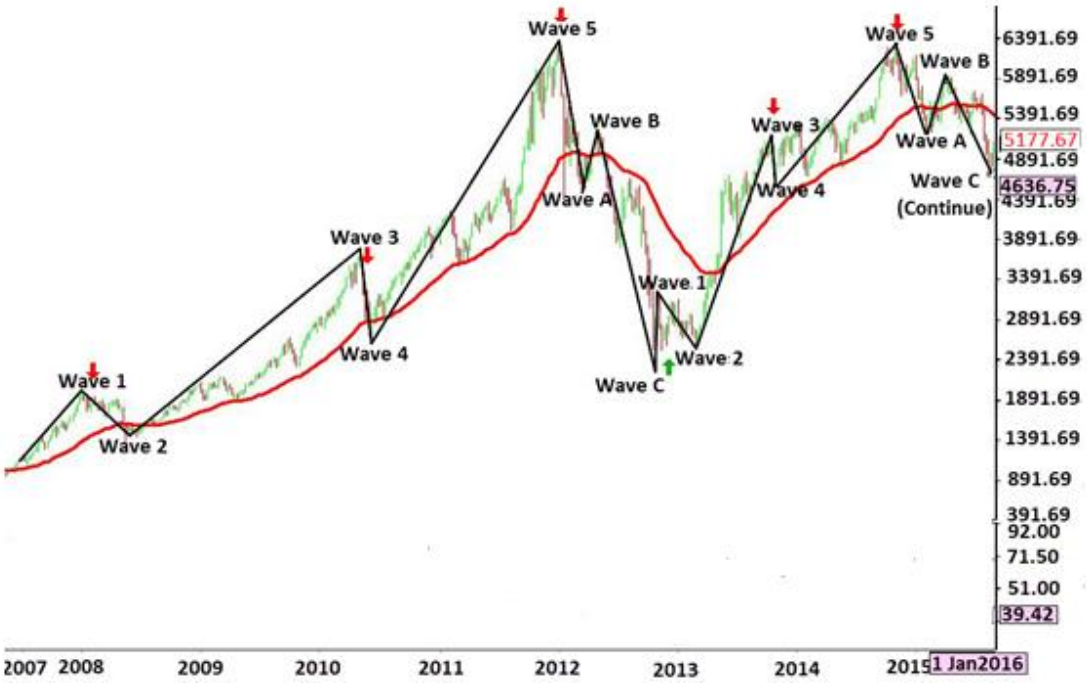
Figure (15): The waves of service sector analysis of ASE(2010-2015).

Source : by author according to statistics of ASE daily prices – central bank monthly report for the years(2011-2015).Using Meta stock software.

Wave cycle of service sector of ASE.

•Wave 1: 84 to 298.43
• Wave 2: 298.43 to 231.29, 50% retracement of wave 1
• Wave 3: 231.29 to 584, 158.43% of wave 1
• Wave 4: 584 to 402, 50% retracement of wave 3
• Wave 5: 402 to 987.52, 387.6% of wave 1
• Wave A: 987.52 to 716,5, 61.8% retracement of wave 5
• Wave B: 716,5 to 1012, 45.7% retracement of wave A
• Wave C: 1012 to 354.8, 126.4% of wave A.

Figure (16): The industrial sector companies in ASE analysis waves.



by author according to statistics of ASE daily prices – central bank monthly report for the years(2011-2015).using Meta stock software.

wave cycle with Fibonacci for industrial sector of ASE(2010- 2015):

• Wave1: 983.64 to 1786. 38
• Wave 2: 1786.38 to 1328.9, 59.8% retracement of wave 1
• Wave 3: 1328.9 to 3421.65, 254.7% extension of wave 1
• Wave 4: 3421.65 to 2274.28, 50% retracement of wave 3
• Wave 5: 2274.28 to 5432.17, 139.4% of wave 3
• Wave A: 5432.17 to 4329.89, 50% retracement of wave 5
• Wave B: 4329.89 to 5192.36, 50% retracement of wave A
• Wave C: 5192.36 to 2176.495, 134.78% of wave A.

As a main result of analysis the first adjacent can be determined through the Fibonacci ratio 0.618 and 0.382 then 0.618 and 0.782, as a first level constant ratio. While second ratio and third adjacent levels between 0.618 and 0.382 of Fibonacci numbers, the middle point can be decided as 50 %; which means an important level, the changes of this level gives the following consideration points: 61.8%&78.6 %, 50%, 38.2%, these results are related the relationship between the Fibonacci sequences and Elliot waves principle; finally this what we have reached in our applications in this paper.

Section six: Concluded remarks

The paper discussed the Fibonacci retracements trading, which used in all markets, then Elliot wave, both of them applied to Forex trading and in the future stock market. The two methods are pervasively creating a significant self-fulfilling.

Some authors said about Fibonacci retracements cannot make a professional trader, when the investor used alone, but it should have beyond other analysis methods such as MACD, Stochastic, RSI, and Candlestick. this paper is not interested in the psychological behavior effect of consumer prices, but considered attention to theory and evidence application. It mainly interested in detecting the Fibonacci retracement, and Elliot wave.

It's too important to be aware of all risk of levels with views portfolios; this has a great advantage over equilibrium ones in returns of drawdown, therefore more risky with view portfolios are dominating by all possible measures. According to the reliable wave relationships which suggest that the Elliott waves have been able to make distinctions between the situation in a relative Fibonacci relationship, and testing relationships with a narrow claim and this process sometimes can yield a random result.

Also, there is a certain combination of waves can display Fibonacci relationships, the other notes come from the investigating any tends to have Fibonacci relationships, these require to using Elliott waves, and overall that there are no Fibonacci –based retracements or projection roles to all waves or price trends. In Jordan most of the financial sector as commercial banks are involved in no such risks and returns will fair, or at the minimum they have avoided the risk state by increasing the payment of dollars. in the other hand, service sector, the risk involved in returns before taking a decision on market buy or sell. While most companies in the industrial sector should keenly observe and watch the price behavior in the stock market and investor's expectation of price direction, also these companies required a huge amount of capital investment.

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