



Forecasting the future trend of the EUR/USD exchange rate, using advanced technical analysis tools

Previsión de la tendencia futura del tipo de cambio EUR/USD, mediante herramientas avanzadas de análisis técnico

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ABSTRACT

Exchange rate forecasting is a major aspect of exchange rate risk hedging. The objective of this research is to propose a procedure to improve the forecasting of the future trend of the exchange rate. In order to achieve the required results, the use of a set of technical analysis tools is proposed, namely: Elliot waves, harmonic patterns and chartist analysis. The main result obtained in this research is that, by means of the proposed tools and the fractality principle, it is possible to forecast the exchange rate regardless of the time horizon to be analyzed.

RESUMEN

La predicción del tipo de cambio es un aspecto principal dentro de la cobertura del riesgo de tipo de cambio. El objetivo de esta investigación es proponer un procedimiento para mejorar la previsión de la tendencia futura del tipo de cambio. Para lograr los resultados requeridos, se propone la utilización de un conjunto de herramientas del análisis técnico, a saber: las ondas de Elliot, los patrones armónicos y el análisis chartista. El principal resultado obtenido en esta investigación, es que, mediante las herramientas propuestas y el principio de fractalidad, se puede pronosticar el tipo de cambio independientemente del horizonte temporal que se analice.

Keywords/ Palabras clave

Waves, fractality, change

Ondas, fractalidad, cambio

Introduction

The financial market with the highest volume of daily transactions is the international currency market, known by its acronym in English as Forex. It is increasingly influenced by the political and social context facing nations, which leads to a direct correlation in the level of volatility that many currency pairs have presented over the years.

The current context has been dominated in recent times by the scourge of the pandemic caused by the coronavirus, which has had a direct impact on the economy of all countries in the world and, therefore, on the financial markets. Specifically, the damage caused by this virus in the European and US economies had a direct impact on the fluctuations of the EUR/USD pair over the last two years, resulting in increased risk for companies using these currencies.

In addition, the interference of the United States in the Cuban economy limits the possibilities of its development. This is achieved through restrictions such as those applied by former U.S. President Donald Trump, or the blockade unjustly imposed for decades that limits the participation of our country in the financial markets.

This situation obliges Cuba to optimize its risk hedging mechanisms in order to avoid substantial losses in market operations and to continue the sustainable growth process it has been working on despite the obstacles.

An important phase of the procedure for hedging foreign exchange risk is the forecast of the future behavior of the exchange rate trend. Through this, future trend expectations are identified, with the objective of applying hedging instruments to help mitigate losses associated with exchange rate fluctuations.

In Cuba, some organizations have approved exchange risk hedging policies, but they are not satisfactorily complied with, partly due to a lack of knowledge of the tools necessary to effectively forecast the behavior of the exchange rate.

This publication stands out as a research result of the National Finance Project of the Faculty of Accounting and Finance of the University of Havana. In response to the demands of the organizations that present this type of risk in the country, the scientific group led by Professor Dr.C. Fidel de la Oliva de Con, at the Faculty of Accounting and Finance of the University of Havana, has worked for almost a decade to achieve satisfactory results through research carried out on exchange rate risk prediction and hedging procedures.

It can be stated that the central purpose of any market analyst is to know the situation in which the financial markets are, and this can be achieved through the study of price action, patterns and their structure. (Hernandez, 2020).

Technical analysis, according to Murphy (2000a), "is the study of market movements, primarily through the use of charts, for the purpose of forecasting future price trends." (p.27)

This type of analysis presents three fundamental pillars documented in Dow's theory. These fundamentals provide a great starting point for an in-depth understanding of technical analysis (Murphy, 2000b):

- The price movement is expressed through trends: technical analysis is based on the identification of the trends that are forming in order to trade profitably with them, and also to try to predict their change.
- Prices are the essence of technical analysis, everything else will be discounted: the central axis of Dow's theory is that only the

information provided by the price is sufficient to determine the future path of the price action, which is why the study of price charts is used to carry out this analysis.

- History repeats itself: the fluctuations reflect the bullish and bearish psychology that the market possesses, as these patterns have worked in the past, and can be assumed to be useful in the future.

Charts are divided into three main types: line, bar and candlestick. The most important and useful type of chart is the candlestick chart, since it includes four different types of quotes: the opening, closing, highest and lowest of the session, where the rise or fall of prices will make the candle assume a green, blue or white color, in the case of a rise, and in the case of falls it is usually red or black. (Molina Fernández, 2018a).

Charts comply with a property that is fundamental in financial markets: the principle of fractality. The term fractal, according to the Real Academia Española (2019), refers to an "iterative structure that has the property that its appearance and statistical distribution do not change whatever the scale with which it is observed" (p.4266). Applied to technical analysis it implies that any type of pattern that is studied can be appreciated, with the same structure, in any temporality. (Valdecantos, 2016).

Candlestick interpretation: Candlesticks can be of different sizes and shapes depending on the market context. The combination of different types can give signals to the trader of the direction that the price action will take in the short term. For this reason, patterns are studied as: (Candlestick Interpretation Manual, 2009).

- Engulfing candlestick: Enveloping candles usually appear after the end of a trend to start a new one. They can be of two types: bullish and bearish, and are characterized by their large size, which is likely to indicate the beginning of a new trend.
- Doji: The doji candlestick emerges in times of market uncertainty. Its effectiveness increases as more candles of this type appear, and represents a period of temporary pause in the main trend and the beginning of a sideways movement. It is characterized by having the opening and closing price equal, resulting in a cross-shaped candlestick.
- Hammer: The hammer candlestick may appear at the moment when a downtrend is preparing to turn bullish. It is characterized

by having no upper wick, and the lower wick must be long. Its effectiveness increases when it is preceded by a bullish engulfing candlestick that confirms the market's buying psychology.

- **Hanging Man:** The Hanging Man is the opposite version of the hammer. This pattern arises at the moment when an uptrend is preparing to turn bearish. Its confirmation occurs after the formation of a bearish engulfing candlestick.
- **The sunrise and sunset stars:** Both patterns are composed of three candlesticks. The dawn star is formed by a first bearish Japanese candlestick of good size, followed by the central one which must be the smallest and whose color is not important, and the third one corresponds to a bullish engulfing candlestick. This pattern indicates the change of direction to the upside. The evening star is the opposite case in a bearish direction.

Patterns of change and continuity: According to Marta & Brusuelas (2009): The grouping of many Japanese candlesticks can form certain graphic structures, which, once created, can have a possible interpretation with respect to the future of the price, either of change or continuity of the trend. The patterns most commonly used by traders are:

- **Shoulder-head-shoulder:** It can be seen in the chart the arrangement of candles, so that they form two shoulders and a head between them. When it is discovered, the trader senses the beginning of a downtrend.
- **Inverted shoulder-head-shoulder:** This is the opposite pattern to the previous one. The same structure is seen, but the trend that should be about to form is bullish.
- **Double top and double bottom:** It is discovered by observing two highs or two lows respectively. Once detected, the beginning of a downtrend will be expected in the case of a double top, and an uptrend in the case of a double bottom. The distance of the next impulse can be projected with the distance that exists between the support and the resistance that forms the pattern.
- **Triple top and triple bottom:** It is identified by observing in the price action the appearance of three highs or three lows respectively. The distance of the next upward or downward momentum can be projected with the distance between the support and resistance that forms the pattern.
- **Triangles:** Arises from the union of two projected trend lines, between which the price bounces. There are three types of triangles: ascending, descending and symmetrical.

- **Flags:** For its formation, it must be preceded by a rapid upward or downward movement. This constitutes a pause in the rapid trend that is occurring. In addition, it is formed by two parallel trend lines that normally slope opposite to the main trend.

Quantitative analysis is used as a complement to chart analysis. It tries to eliminate the uncertainty caused by chart analysis by using statistical calculations. Technical analysts use tools that provide them with valuable market information, divided into two groups: oscillators and indicators. The difference between indicators and oscillators lies in the fact that the former study everything related to the trend, while the study of the latter is on variables such as the strength and speed with which the price of a security fluctuates. (Molina Fernández, 2018b).

Some indicators and oscillators with great importance are:

- **Relative Strength Index (RSI):** The Relative Strength Index (RSI) measures the strength of supply and demand. The RSI value fluctuates between 0 and 100 depending on the strength of the market. If it takes a value above 70 it means that the market is reaching a ceiling and there may be an oversold point. On the contrary, if it reaches values below 30 it indicates that the price should be approaching a floor and there may be an oversold point. (Núñez, 2009a). The RSI is also used in the detection of divergences, which occur when the oscillator and the price action behave in opposite ways. Divergences can be found bullish and bearish, and are signals of a change in price direction. (Afi Guides, 2017a)
- **Moving Averages:** they are among the most used indicators in technical analysis. This trend indicator moves together with the price, confirming the trend present at each moment. When the price movement cuts the moving average, it is an indication of a trend change. (Núñez, 2009b)
- **Bollinger Bands:** this indicator is made up of two bands drawn around the price action, and its calculation is based on a simple moving average over the closing price, which is located between the bands obtained from the average of two standard deviations.

These principles constitute the fundamental theoretical basis of technical analysis, from which techniques such as Elliott waves arise, through the systematization of key concepts such as trends, market fractality, supports and resistances. (Ruiz, 2020).

The wave theory was proposed by Ralph N. Elliott, and states that the market moves through impulses and reversals, collected as waves, which form graphic patterns that comply with the principle of market fractality. (Burguillo, 2015).

The wave theory is based on the pillars of technical analysis founded by Dow, improving two of them. The first one states that the best way to predict market behavior is through the study of prices; however, Elliott develops this principle by providing a regular scheme for price behavior. The second argues that history repeats itself, but is modified, adding that the repetition will never be exact, because although the price progression is governed by a standard model, it will never be identical due to variables such as volume.

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Elliott included his analytics within the conventional methodology of analysis, using some traditional tools such as confirmation of results. The accompaniment of wave theory with quantitative analysis is key to good analytics, since the identification of divergences in the oscillator division is regularly related to the end of a wave movement.

The essence of this theory consists in the formation of the main 5-3 pattern, structured in five impulses and three retracements, forming a complete market cycle. (Roldan, 2015a)

This above pattern has three main rules (Afi Guides, 2017b) See Appendix A, Figure 1.26A:

- Wave 2 never retraces 100%, so it will never correct to the level of wave 1.
- Wave 3 should not be the smallest of the impulsive wave movements.
- Wave 4 should not be support at the resistance of wave 1, as it means that wave 4 should not enter the price level of wave 1.

To complement the analysis, it is necessary to know the Elliott degrees. These help to improve the graphic visibility of the patterns, since they divide the waves in size and temporality, due to the fractality characteristic. This nomenclature is difficult to represent, since in each degree there are several implicit temporalities, generating a component of ambiguity for the analyst. (Prechter and Frost, 1989, cited in Roldán, 2015b).

- 1- Great Supercycle: Covers more than one hundred years.
- 2- Supercycle: Ten to one hundred years

- 3- Cycle: One year to ten years.
- 4- Primary: Covers from two months to one year.
- 5- Intermediate: From two weeks to two months.
- 6- Minor: Covers one to two weeks
- 7- Minute: One to seven days
- 8- Minuette: Covers from two to twenty-four hours.
- 9- Subminuette: One to sixty minutes.

An important aspect to highlight is the indifference that exists in the Elliott degree that is identified, since the basic 5-3 pattern will remain unalterable and will be appreciated in any seasonality. (Roldán, 2015c).

For Espinosa (1999a), the understanding of the main pattern of the wave theory, its structure is addressed, which is comprised of eight waves, namely:

- 1- Wave 1: This wave is usually the shortest, it is complex to distinguish, as it tends to be confused with the last wave of the basic pattern of the previous cycle. It is divided into five small waves, where market conditions are uncertain and weak to make predictions.
- 2- Wave 2: This is the correction of wave 1. It is divided into the three corrections a, b and c of the five impulsive waves that make up wave 1.
- 3- Wave 3: The third wave is an impulse that should never be the smallest within the pattern. This is divided into five waves. At this point the market begins to look more favorable to predict due to the full confirmation of the main pattern on the chart.
- 4- Wave 4: This represents the correction of the previous wave. Its main characteristic does not allow it to reach the price level of wave 1. It is broken down into three waves.
- 5- Wave 5: The fifth wave is an impulse and is usually smaller than wave 3, although there are exceptions where it can exceed it in size. This wave is also divided into five waves.
- 6- Wave a: This wave corresponds to the beginning of the corrective stage of the basic pattern. At this point a change of trend is being defined, although there are exceptions where the subsequent cycle is created by continuing the main trend. Therefore, this wave is the first impulse of the next trend, so it is divided into five waves.
- 7- Wave b: This is the correction of wave a, but since it is ascending, it tends to be assumed that the previous trend will be resumed,

since there is an increase in demand in the market. This is divided into three waves.

- 8- Wave c: This drives the movement downward, confirming the trend change and causing an increase in supply in the market due to sellers' psychology.

The above waves can be classified into impulsive and corrective. Impulsive waves are those that generate a real advance of the price in favor of the trend, and concentrate most of the emotion of the market participants. These are carriers of five movements and in most cases adopt the same form of the basic pattern. (Torres, 2012).

A fundamental principle in wave theory is the alternation rule. This is based on the fact that when analyzing a chart one should expect alternating movements in all wave formations. For example, if corrective wave two turns out to be simple, such as a zigzag or flat, it can be considered that there is a good probability that the following corrective wave (the fourth wave) will be complex, taking the form of complex triangles, double threes or triple threes, or any movement that denotes graphical complexity. (Molina Barrientos, 2013).

Finally, a key concept for the solid mathematical foundation of various technical analysis tools is studied: the Fibonacci levels. Wave analysis is mathematically based on these levels.

To arrive numerically at these levels we start from the Fibonacci sequence, which is a sequence where each number is the sum of the two numbers before it, being this 1,1,2,3,5,8,13,21,34,55.... (Carpatos, 2014)

To obtain these progressions, Fibonacci ratios are calculated where the first number of the interval chosen is divided by the next one, and in this way progressions are obtained such as: $13/21 \approx 61.9\%$, which is the same as $21/34 \approx 61.8\%$, $13/34 \approx 38.2\%$; and so on until the most important Fibonacci levels are obtained: 38.2%, 50%, 61.8%, 78.6%, 127%, 161.8%, 261.8%. (Afi Guides, 2017c)

Many Fibonacci techniques branch out from these levels, all with a specific objective in consequence of the results they illustrate. The Fibonacci tools most commonly used in this work are retracements and extensions.

The retracements consist in the tracing of zones that constitute supports and resistances, and that allow to divide the trajectory of a

movement in different levels, based on percentages extracted from ratios. This tool is widely used, regardless of the temporality (either in the short term or long term), and the most used percentages are: 38.2%, 50%, 61.8%, 100%.

The Fibonacci extension consists of the projection of an impulse, which is delimited by different Fibonacci levels, sharing the same essence of the retracements. This tool is mainly used in the tracing of resistances, since it allows to know how far the impulse will reach, and, therefore, it will be possible to delimit a price range. The most known and used levels of the extensions: 50%, 61.8%, 100%, 138.2%, 161.8%.

The application of the wave theory leads to trend analysis through the representation of graphic patterns, in combination with Fibonacci retracements. With its application, a probable future time horizon is determined, however, to increase its effectiveness in prediction, it must be combined with more advanced techniques such as harmonic patterns.

Harmonic patterns are a tool based on the search for specific price patterns, accompanied by Fibonacci retracements, to determine points where the probability of a trend change in the financial market is high. This type of analysis has its origin in Dow's theory, as it follows the principle that market cycles repeat themselves on a regular basis. (Carney, 2010a)

One of the fundamentals of this analysis is that price waves are related to each other. Fibonacci levels and price patterns manifest this relationship and provide a solution to determine the point where the trend change will occur, and by correctly identifying where these points are located, a prediction is made with a high degree of effectiveness. Therefore, this analytical technique, like the wave theory described above, has a consolidated mathematical foundation based on the Fibonacci sequence. (Carney, 2008a)

This idea is supported by the principle of harmonicity, put forward by J.M. Hust. In his work, the author states that, in price action, the period of waves that are contiguous tends to have a numerical relationship. Harmonic analysis uses Fibonacci numbers to quantify that relationship, and determine where the moment of trend change will occur. (Carney, 2010b)

These bases are the ones that allow defining the difference between a harmonic pattern and a pattern of change and continuity, such as the

shoulder-head-shoulder or the pennants. This inequality lies in the formation of the pattern, having on the one hand a western pattern, that its formation can be diffuse and sometimes imperceptible due to the subjectivity of the analyst, while harmonic patterns have a mathematical support through Fibonacci retracements.

According to Carney (2008b), a thorough understanding of the graphical structures and numerical specificities is key to proper prediction. The fundamental harmonic patterns that should be studied are:

- **AB=CD pattern:** This pattern can occur in any area of the chart, one of the common areas is in the Elliot corrective waves, more specifically in the Zigzag structure. Its base is two segments of the same size, separated by a minor movement in the opposite direction. In harmonic patterns the appearances of Fibonacci ratios are usually at specific points. In the case of the AB=CD pattern, point C constitutes the correction of the AB impulse, and depending on the percentage term that this impulse reaches, it will result in a projection in the next impulse.
- **Gartley Pattern:** This pattern was first introduced by Gartley. The function of this pattern is to detect signals of a possible future impulse or pullback, which may lead to a new trend. For this five-point pattern to form, among other characteristics, it must have a very precise B point, this retracement being an exact 61.8%.
- **Bat Pattern:** This pattern was discovered by Carney (2001), who describes it in his book *Harmonic Trading* as probably the most accurate pattern of all. This structure represents a strong contact of the price action on a support or resistance that can be very strong and difficult for the price to break through. This 5-point pattern also shares a graphical equivalence with the AB=CD pattern, and therefore with the Gartley, the differences being in the numerical characteristics.
- **Butterfly Pattern:** This pattern was discovered by Bryce Gilmore in his *Wave Trader* software. Its initial output was produced with a large number of different Fibonacci combinations in the points that make up the structure, to which authors such as Carney himself, have assigned more specific values, since specificity is a key element to predict with the harmonic patterns technique.

Within this type of pattern there are several examples, which demonstrate the complexity it can reach and are an indicator of the progress being made in this predictive technique. To exemplify these

patterns it is first necessary to mention their two main aspects, which are the bullish and bearish structure of the base pattern.

From this base arise variations such as the well-known Bullish AB=CD pattern within the CD movement of the 5-0 patterns. This scheme arises because there are many situations and moments where in the CD movement of the reciprocal AB=CD pattern a small AB=CD pattern will form. These are rare and unique moments because AB=CD is usually different, and its structure can be effective as a complement to the other numbers of the 5-0 pattern. The same is true for the bearish what in the opposite nature.

Variations of M and W patterns have also been created, as is the case of the alternative Bat pattern. This alternative version, like many others, arises from the experience where the standard Bat pattern has not generated an adequate forecast, resulting in ineffective operations. This consecutive trading, where analysts correct the preset values to suit their trading, leads, after some trial and error, to the alternative Bat pattern: an M-type pattern that uses a total XA spread of 1.13. The BC projection uses a much higher level than the previous one, located at a minimum of 2.0, and it is more common to find this movement between 2.618 and 3.14.

These patterns are not the only ones that can be used in harmonic analysis. Traders are constantly creating variations and updating levels, seeking the maximum possible effectiveness in each prediction. However, the patterns discussed in this section are the basis for establishing any methodology.

Materials and Methods

In order to explain this procedure, facilitating its understanding and use, the author considers it necessary to organize it in steps that maintain a coherent consecutive order, with the purpose of avoiding failures in the study and possible predictive errors. To this end:

Step 1: Definition of the sample and prediction time horizon.

The prediction time horizon is set by the time horizon over which the operator wants to forecast, so a standard number of observations cannot be selected. From this definition, the sample time horizon is determined. This must be longer than the previous one, because in

order to effectively detect Elliott waves on the chart, there must be enough sessions to identify the cycle to which the time horizon corresponds, and if this is in the middle, then the previous one must also be detected. This generates sample time horizons that can be of one or two years to analyze short terms, or seven or eight years for forecasts with a longer predictive horizon.

This will allow us to have enough information about the historical movement of the price, which translates into a more effective forecast. The choice of these timeframes, as well as the operation in the following steps, is made using the Japanese candlesticks as a tool to analyze the chart, due to the amount of information they provide, and the visual facility they provide, allowing a better appreciation of the structures.

Step 2: Definition of the temporality of the sections.

In this step the temporality to be defined for each candle is selected, since the level of detail of each type of candle varies, and therefore its choice must be given according to the time horizons of the sample and the prediction that were previously selected. In the specific case of this research, three temporalities will be used: daily, weekly and monthly, to demonstrate the effectiveness of the procedure in these different time periods, due to the use of the fractality principle that is present in the proposed tools.

Step 3: Identification of the main Elliott pattern.

The trend analysis of this procedure will be reflected in the discovery of the main Elliott 5-3 pattern. With this, it will be possible to record a historical price path and the current trend experienced by the price. The analyst will be able, through the properties of the waves and the principles of Elliott's theory, to have a notion of the future direction that the pair will take, which allows the trader to also measure the length of the trend. This pattern is identified by observing the impulses and retracements of the price action, and the chart pattern in which they appear. Waves 2, 4 and C, which constitute retracements, need the Fibonacci retracement for validation, as movements that do not reach an important area of this tool cannot be identified in this way.

Step 4: Identification of the possible harmonic pattern.

Once the trend has been studied according to Elliott's theory, we proceed to the graphic search for the existence of a harmonic pattern

that may serve as a justification for the price movements interpreted in the chart during that period. In addition, the possible presence of a harmonic pattern in the final part of the price path is investigated, since these patterns tend to appear at the moment when a change in the direction of the price is imminent, so their detection is key to define the beginning of a momentum or a retracement. If the price is in full momentum, these patterns will not be a relevant resource, however, when the price starts to oscillate, they can be identified, so we must look for M or W shapes in the price action, depending on whether the main trend is bullish or bearish, respectively.

Step 5: Chartist and quantitative analysis of the sample time horizon.

In order to accomplish this step, chartist tools of western analysis and the interpretation of Japanese candlesticks are used, which in many cases will be a confirmatory signal of the future price movement predicted in previous steps. Also highlighted are the supports and resistances that will be used in their traditional form to measure the price graphically. These can be identified in two ways: the first is by graphically observing their primary function, being the ceiling or floor of the price on a repeated number of occasions, which validates the support or resistance in question; and the second is by means of Fibonacci tools, either retracement or extension, which gives levels where the price is likely to change course.

As for quantitative analysis, two traditional tools will be used: the RSI and moving averages. The RSI, as an oscillator, is used both in its function to detect possible overbought and oversold points, which are possible changes in the direction of the price, and in the identification of divergences in case they exist, being both uses confirmatory of the results of previous steps. The moving averages, two of periods 20 and 9 are used, also help to confirm possible trend changes through their crossing.

Step 6: Predictive Range Calculation .

Once all the chart details have been analyzed, the supports and resistances have been plotted, and a logical conclusion has been reached about the future price movement, it is time to delimit the range in which the price action will move over the time horizon. For this purpose, the most probable supports and resistances are used, according to what is established by the Wave Theory and the Fibonacci tool, thus leaving a probable prediction range.

After the theoretical exposition of the proposal, we proceed to the explanation of the same in three illustrative examples, which will revolve around the current prediction of the price of the EUR/USD pair. During this subheading, predictions in different timeframes will be addressed. Therefore, predictions will be made in daily, weekly and monthly timeframes, emphasizing mainly in the first one, since due to the fractality principle the analyses in these timeframes will share elements and conclusions in common.

Results

This time frame is the one most commonly used by traders to predict the price of a currency pair, and most of the procedures are geared towards it.

First, the time horizon is delimited, which will be the one corresponding to the forecast. This comprises the 30 days of July, so it is between July 1 and August 1, 2021. On the other hand, the analytical period to identify the main pattern of the Elliott waves will comprise between March 12, 2020 and June 26, 2021, deepening more in the analysis in the last six months approximately to the temporary horizon in search of harmonic patterns, reason why a second moment of study more in depth will be from January 6 to June 26, 2021.

The time frame to be used in this case will be daily Japanese candlesticks, in order to demonstrate the effectiveness of this procedure in this type of time horizon.

Next, we proceed to identify the basic 5-3 pattern of the last cycle. This main Elliott pattern starts on May 18, 2020. Its beginning can be traced back to that day, because before it is the corrective movement of the previous cycle, which presents a triangular contraction structure.

This pattern started when the price was at 1.0820 and progressed until its first five waves reached January 6, 2021. Throughout this pattern the price progressed as follows: impulse wave 1 is displayed when the price reached 1.1382 on June 10, 2020.

The second wave was confirmed on June 22, when the price was close to 1.1176. To validate this wave it is necessary to apply Fibonacci

retracements. By applying it, it can be seen that this wave crosses the 38.6% zone, confirming it and initiating impulsive wave 3.

Figure 1. Checking the validation of the corrective wave 2.



Impulsive wave 3 ends on September 1, 2020 when the price reaches the 1.1994 level. This is validated by the fact that theoretically it should never be the smallest wave of the pattern, and being smaller than the first wave it consolidates.

The previous wave gives way to wave 4, which is a retracement. Wave 4 reached 1.1615 on November 2, 2020. When applying the retracements to validate it, it can be seen that it crossed the 38.6% level, and was about to reach the 50% zone, which confirms the creation of the fourth wave.

Figure 2. Checking the validation of the corrective wave 4.



Finally, the fifth wave comes to form on January 6, 2021, reaching a high of 1.2350, thus concluding the five impulsive movements of the pattern that follow the fundamental principles established by Elliott in terms of length and path.

We then proceed to identify the ABC corrective structure of this pattern, which in this case has not yet been fully defined. Wave A is completed on March 31, 2021 when the price declined to 1.1715.

To validate wave B it is necessary to apply the retracements to check the level it reached. After this operation, it can be seen that on May 25, 2021, the price action crossed the 78.6% level when the price was at 1.2253.

Figure 3. Checking the validation of corrective wave B.



At this moment the price action is in a transition period, between this cycle and the next one. It is at the creation of the end of the corrective structure. Everything seems to indicate that the formation will take a simple zig zag structure, being the most common, so we can expect in the coming months a fall in the price as a result of the complete conformation of the trend change.

Looking at the chart, it can be seen that on November 3, 2020, the price action begins to form a Bat pattern when the price was at 1.1641. The structuring of this type M pattern, is observed when the price reached 1.1641 forming the initial point X on November 3, then the price rose to 1.2337 on January 6, 2021, creating point A, then fell to 1,1956 on February 4, forming point B, then rose to 1.2174 on February 26 to form point C, and finally on March 30, 2021, the price fell again to 1.1714, thus creating point D of the pattern and completing the XABCD structure.

Figure 4. Bat pattern. Daily temporality



The formation of this pattern is relevant to justify the creation of the B retracement wave. In addition, its appearance during the formation of wave 5, being associated with trend changes and important price deviations, is a considerable signal of the installation of a possible downtrend during the next months, which confirms the conclusion reached with the Elliott wave analysis.

In addition to this pattern, no other pattern was found in the last six months of the analysis period that could more significantly validate the conclusion from these steps.

Looking at the chart, we can see that since the formation of wave B, the candlesticks have strongly reflected the bearish aspirations of the market. On May 26, 2021, when the price was at approximately 1.2253, a bearish engulfing candlestick was created, which impacts the sharp decline in the price. In addition, on June 11, 16 and 17, engulfing candles were formed, confirming the market's attitude towards the sell-off.

Figure 5. Bearish engulfing candles. Daily seasonality



The next thing that can be seen is a small move against the downtrend, which may be a product of the same retracement of the impulsive wave C, a phenomenon that occurs due to the principle of fractality. The lack of size in the body of the final green Japanese candlesticks indicates the eventual fall of the price.

The next thing to be done is the plotting of supports and resistances to generate those floors and ceilings that will be fundamental in the conformation of the range. The Fibonacci extension will be used to plot the supports, which will project the possible length to which the impulse of wave C can reach. When using it, it can be seen that the most expected levels to which the price action can reach in its descent are 78.6% and 100%, which places the price at 1.1783 and 1.1653 respectively, so supports will be plotted at these levels.

For the plotting of resistances, the last downward movement is adopted as part of the structure of five small impulses that have the impulsive waves, because when measuring the retracement of the last movement, it is observed that it has not yet reached the level of 38.6%, so there should still be a few sessions for the price to rise until it begins its descent following the downtrend. Both the 38.6% level and the 50% level, which are located at 1.1988 and 1.2032 respectively.

On April 28, a bearish divergence is seen, which is another confirmation signal of the downward price movement on May 26 to start wave C. These divergence signals are usually quite reliable for traders.

Regarding the overbought and oversold points, an overbought point is observed on June 18, pointing to a rise in the direction of the price. This oscillator confirms the analysis of all the previous steps, because in addition to providing clear indications of the creation of wave C, it also generates an overbought point to warn of the small rise that the market has experienced.

By properly configuring the periods of the moving averages, we can see how on June 9 the price was at approximately 1.2180, a crossover of the moving averages occurred, representing another signal confirming the price decline in the wave C formation.

The nine-session average is crossing the price downwards, while the 20-period average remains above the price action, constituting a kind of resistance, which coincides with the previously marked resistance at 1.2032.

Figure 6. Moving average crossover. Daily seasonality

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Finally, it is time to establish and state a predictive interval based on all the previous steps. First, it is known through Elliott wave analysis that the price action will decrease, establishing the end of the current cycle and the beginning of the next one.

The observation of wave C, is in the process of creating its retracements, so it is necessary to be cautious in terms of prediction, as it is not 100% clear how far this upward momentum will go.

All this leads to the conformation of two possible continuations of the price action, as it yields two perfectly possible scenarios. The first scenario is the most expected by the author, in which the price should rise in the coming sessions, and then start its total decline to complete wave C and define the simple zig zag corrective structure.

A second scenario is composed by the rapid decline of the price without generating bullish candles in the next sessions. This completes the formation of wave C, initiating the downtrend and starting the next cycle.

For the conformation of the July quantitative forecast, both scenarios share 1.2032 as the range high, drawing from resistance found at the 50% level of the Fibonacci retracement of the last impulse, due to the need to leave room for upward movement for price action.

In the case of the low for the first and most conservative scenario, this is selected at the author's criteria at a level of 1.1783, which constitutes the support corresponding to the 78.6% level of the Fibonacci extension, applied to project the impulsive wave C. This leaves the continuation in a predictive range between 1.1783-1.2032.

In the second scenario, the price falls faster, so the low varies from the first. In this case, the support created by the Fibonacci extension at the 100% level, which is located at 1.1653, is chosen. Therefore, the second predictive range is between 1.1653-1.2032.

Figure 7. Exchange rate prediction.



Conclusions

The proposed procedure was developed in six logical steps, namely: definition of the time horizon of the sample and of the prediction, definition of the temporality of the sections, identification of the main Elliott pattern, identification of the possible harmonic pattern, chartist and quantitative analysis of the time horizon of the sample and calculation of the predictive range. The proposed procedure is established on the basis of technical analysis tools, which allow its application in different time horizons, due to the use of the fractality principle. It yields significant values for forecasting the future trend of the EUR/USD exchange rate.

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