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Technical Analysis of a Non-Globally Integrated Stock Index

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Abstract

This study examines the Ecuadorian stock market index, ECUINDEX, a market that is not integrated into international financial markets, unlike others in Latin America. The objective was to determine if graphical technical analysis can describe the price behavior of the ECUINDEX, testing the weak-form efficient market hypothesis. Market stationarity was evaluated to identify suitable volatility indicators. A mixed-methods approach was applied, combining quantitative tests (Boxplot and Dickey-Fuller) with qualitative analyses (graphical observation of prices and TEMA, RVI, and MA indicators). Monthly and daily closing price data of the ECUINDEX from 2013 to 2023 were analyzed, obtained from the Quito Stock Exchange through Investing. The results reveal that the ECUINDEX is non-stationary and that technical analysis consistently describes momentum, price direction changes, and market turns, highlighting the usefulness of technical indicators for understanding price trends and market inefficiencies.

Keywords: financial markets; price action; forecasting; Ecuindex.

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Análisis técnico de un índice bursátil no integrado a escala mundial

Resumen

Este estudio examina el índice bursátil ecuatoriano, ECUINDEX, un mercado no integrado en los mercados financieros internacionales, a diferencia de otros en América Latina. El objetivo fue determinar si el análisis técnico gráfico puede describir el comportamiento de precios del ECUINDEX, poniendo a prueba la hipótesis de eficiencia del mercado en su forma débil. Se evaluó la estacionariedad del mercado para identificar indicadores de volatilidad adecuados. Se aplicó un enfoque mixto, combinando pruebas cuantitativas (Boxplot y Dickey-Fuller) con análisis cualitativos (observación gráfica de precios e indicadores TEMA, RVI y MA). Se analizaron datos de precios de cierre mensuales y diarios del ECUINDEX de 2013 a 2023, obtenidos de la Bolsa de Valores de Quito a través de *Investing*. Los resultados revelan que el ECUINDEX no es estacionario y que el análisis técnico describe consistentemente el impulso, los cambios de dirección y los giros del mercado, destacando la utilidad de los indicadores técnicos para comprender las tendencias de precios y las ineficiencias del mercado.

Palabras clave: Mercados Financieros; Acción del Precio; Pronóstico; ECUINDEX

1. Introduction

The founding of the Quito Stock Exchange in 1969 was a pivotal moment in Ecuador's financial development. Subsequently, in 1993, the ECUINDEX was launched, becoming the country's first stock index. This index provides a comprehensive view of the stock market's performance and evolution, serving as an indispensable indicator of Ecuador's economic activity. It offers valuable information regarding market dynamism, investor expectations, inherent risks, and potential returns (Quito Stock Exchange, 2018)

The evolution of financial markets since the 1990s has been driven by technological advances, escalating cross-border investment, and deepening global interdependence (Acosta-Palomeque & Avilés-León, 2018). Despite these global trends, a disparity in market integration persists. While markets such as Ecuador continue to face challenges in achieving global integration, Latin America has demonstrated significant advancements. The Latin American Integrated Market (MILA), established in 2009, exemplifies this progress, achieving a capitalization of 789.36 billion USD in 2016 (Santiago Stock Exchange, 2024) and contributing to enhanced market efficiency (Delgado-Domonkos & Zeng, 2023), although accompanied by increased volatility and correlation (Kulwizira et al., 2024).

Additionally, the Latibex market's role in facilitating European trading of Latin American securities underscores broader global integration (Latibex, 2024). These contrasting developments highlight the diverse levels of global insertion within financial markets (Mora-Valencia, 2021).

A comprehensive analysis of the ECUINDEX requires an understanding of the Ecuadorian economic and historical landscape (Cadena et al., 2018). Notably, oil price volatility exerts a significant influence on Ecuador's economy and its stock market, impacting both GDP and market transactions, particularly within public sector fixed income. Since its establishment in 1847, the Ecuadorian stock market has experienced profound changes, shaped by government policies and external factors such as debt securitization, dollarization, and fluctuations in the oil market.

These events have been instrumental in defining the market's current dynamics. The ECUINDEX selects the ten leading Ecuadorian stock issuers based on criteria including market capitalization, market presence, and trading volume (Quito Stock Exchange, 2018). Encompassing financial, commercial, and services sectors, the index's daily fluctuations, starting from a base of 1000 points, provide a clear indication of market trends, with positive or negative variations signaling upward or downward trajectories.

In this regard, charts are essential tools for technical analysis (Edwards et al., 2019). These graphical representations of market data illustrate market events and enable the derivation of indices, such as moving averages and the relationship between trading volume and price movement. Despite their complexity during periods of high volatility, charts are crucial for understanding market dynamics. This study focuses on the ECUINDEX chart, using closing prices for analysis.

Financial markets are complex, evolving entities requiring adept interpretation of price movements and market dynamics (Gallegati & Richiardi, 2009; Dumiter et al., 2023a). Scientific research in this field is expanding, aiming to understand market behaviors to improve investment decisions (Domoto et al., 2022). The correlation between price movements and market dynamics is intricate in Latin American markets. Fama (1970) asserts that market efficiency is categorized into weak (historical information), semi-strong (public information), and strong (all information, including private), making consistently above-average returns unlikely in efficient markets.

In financial markets, information asymmetry significantly impacts decision-making (Mehrzad et al., 2021). The dynamics of emotional finance further influence this (Daxhammer et al., 2023; Galariotis et al., 2014), sentiments expressed in financial texts (Krishnamoorthy, 2018), and the interplay of news and market performance (Gao & Martin, 2021; Kräussl & Mirgorodskaya, 2017). Research by Villarraga, Giraldo, and Agudelo (2012) on Latin American emerging markets indicates a lower level of information asymmetry in companies with higher market capitalization. Furthermore, a study by Zhu et al. (2019) postulates that Latin American markets experienced reduced volatility and a shift in investment preferences post-global Financial Crisis. These changes decreased volatility and altered investment patterns, suggesting an enhancement in market efficiency and a change in price behavior, critical factors in technical analysis.

There is a growing interest in technical analysis among academics, stock issuers, and other market participants (Diether et al., 2009). This interest revolves around how industry professionals widely employ patterns and technical indicators to contribute to

buying and selling decisions (Lui & Mole, 1998; Cheung & Chinn, 2001). Murphy (2000) describes technical analysis as a study of market movements, focusing on supply, demand, and investor psychology, using price, volume, and compound interest, including indicators that encapsulate past price movements. There are two primary approaches: the traditional analyst, focusing on charts with a subjective analysis, viewing chart interpretation as an art, and the statistical technician. Emphasizing the significance of qualitative methods in financial research, Ramírez-Elías and Arbesú-García (2019) views them not as substitutes but as essential complements to quantitative methods, crucial for understanding and predicting behaviors in modern capital markets (Lintner, 1956; Kaczynski et al., 2014).

Technical analysis focuses on market dynamics rather than underlying assets, positing that the price of an asset incorporates all relevant variables that impact a market, including investor sentiments and behaviors (Edwards et al., 2019). This technique facilitates the interpretation and prediction of market movements by studying patterns in prices and transaction volumes. Furthermore, technological innovations have allowed greater precision in this analysis, making modern technical analysis techniques as tools for decision-making and optimizing investment performance (Dumiter et al., 2023a; Dumiter & Turcas, 2023b).

Technical analysis integrated with market sentiment analysis improves the accuracy of predicting stock trends in markets such as NYSE and NASDAQ (Yang et al., 2022; Sharaf et al., 2023). Milionis and Papanagiotou (2011) recognize technical analysis as a valuable tool for understanding market dynamics. The integration of social sentiment with technical indicators provides new perspectives to the study of financial markets (Wang et al., 2023). Techniques such as support vector regression and recurrent neural networks have been applied, demonstrating that models combining prices with technical and sentiment indicators are more effective (Ji et al., 2023). These findings emphasize the effectiveness of technical analysis in predicting and interpreting market sentiment.

It is known that most specialists in financial markets resort to technical analysis as part of their investment strategy (Taylor & Allen, 1992; Marshall et al., 2008). This type of analysis has proven effective in forecasting market trends (Menkhoff & Taylor, 2007; Kaniel et al., 2008; Hyo-Jeong & Hyuk Ch., 2014; Richards & Willows, 2019). Technical indicators have been fundamental in creating trading systems since they are based on market patterns generating buy and sell signals (Tharavanij et al., 2015; Ozturk et al., 2016). Although technical indicators do not guarantee perfect market timing and cannot predict future price movements completely (Tharavanij et al., 2015), they have evolved, seeking to improve the understanding and prediction of market behavior (do Prado et al., 2013; Gallegos-Erazo, 2022).

According to Ahmed (2018), in an efficient market, prices change rapidly in response to new information, suggesting a lack of stationarity because the mean and variance of prices can vary with the incorporation of new data. However, market efficiency does not necessarily imply the absence of stationarity. Market efficiency does not preclude the maintenance of stable statistical properties.

Despite price fluctuations driven by new information, the market's

reaction, including volatility, can remain unchanged.

Stationarity in financial markets relates to the temporal stability of price and return time series, distinct from market efficiency, which focuses on the efficient assimilation of information into asset prices. Stationary markets are characterized by consistent statistical properties across time. However, given the ECUINDEX's susceptibility to dynamic economic factors, its limited interaction with global financial markets, ongoing political instability, and inherent volatility linked to oil dependence (Cadena et al., 2018), it is plausible that it does not adhere to these stationarity conditions.

According to Ahmed (2018), time series analysis is essential to understand volatility and trends in stock markets, where historical patterns do not guarantee reliable predictions of the future. Implementing the Dickey-Fuller test (1979) is essential in this context since it allows us to determine whether the fluctuations of the index are random or follow a defined trend. This approach is crucial for technical analysts, considering that, in a non-stationary market, predictions based on historical data can be unreliable. Therefore, greater caution is recommended when interpreting past patterns and including other indicators in technical analysis for a complete evaluation of price behavior.

A non-stationary market has statistical properties, such as mean and variance, that change over time (Ahmed, 2018). This variability implies that historical price and volume patterns do not necessarily indicate future behavior, challenging the premise that "history tends to repeat itself," which is fundamental in technical analysis. The relevance of considering non-stationarity in the analysis of ECUINDEX lies in the need to adapt technical analysis tools and methods to capture and understand these dynamics changing. According to Edwards, Magee, and Bassetti (2019), adaptive moving averages and volatility analysis can be more effective in non-stationary markets, as they allow models to be adjusted to changing market conditions.

Considering the above background, the ECUINDEX, a fundamental stock index in the Ecuadorian Stock Market, is a barometer of Ecuadorian economic activity. However, its integration into the global financial scenario has been limited, which contrasts with other regional emerging markets regarding integration and efficiency. This phenomenon is exacerbated by the historical dependence of the Ecuadorian economy on the price of oil and by transformations in the stock market structure influenced by economic policies and external events. Despite technological advances and the integration of markets such as MILA and Latibex, ECUINDEX still needs a complete integration into the global financial landscape.

The present study aims to describe the specific dynamics of ECUINDEX through the technical analysis of its daily closing price chart, questioning the Efficient Market Hypothesis in its weak form, which suggests the ineffectiveness of this type of analysis. We seek to decipher the patterns of price behavior, considering the possible non-stationarity of the market, to provide a deeper understanding of the Ecuadorian stock market. To this end, the following research questions are posed: Is ECUINDEX a stationary stock market? Does a technical analysis provide valuable information for interpreting the price behavior of ECUINDEX?

This study presents a technical analysis of the ECUINDEX, examining Latin American financial markets that are still undergoing global integration. The research is justified across several dimensions: (a) Despite the Efficient Market Hypothesis (EMH) in its weak form suggesting the ineffectiveness of technical analysis, its widespread use by traders and analysts (Edwards et al., 2019; Dumiter & Turcas, 2023b; Dumiter et al., 2023a) warrants investigation into its applicability within emerging markets like Ecuador; (b) The complex, dynamic, and potentially chaotic patterns observed in stock markets, including the ECUINDEX, pose challenges for conventional statistical interpretation (Acosta-Palomeque & Avilés-León, 2018); (c) This study's empirical and theoretical findings will enhance understanding of ECUINDEX price behavior from a technical and graphical perspective, providing valuable insights for future research, particularly those exploring technical analysis of this under-researched index (Gallegos-Erazo, 2022); (d) The knowledge gained is highly relevant for current and prospective investors, potentially informing investment decisions (do Prado et al., 2013; Richards & Willows, 2019; Dumiter et al., 2023a).

2. Methodological perspective

Due to the characteristics of the study, this research is descriptive with a non-experimental scope which adopts a mixed approach. For quantitative analysis, Eviews statistical software will be used. It will be evaluated whether the ECUINDEX index is stationary. Initially, the boxplot analysis, created by Beyer (1981) will be applied prior to the Dickey-Fuller test to identify the existence of outliers and understand the data dispersion in the index's monthly closing prices. The application of the Dickey-Fuller test will determine if the index's fluctuations are random or follow a defined trend. This method involves identifying whether the statistical properties of the index, such as the mean and variance, remain constant over time. The model will incorporate two key components: the "constant," which will help determine if the time series varies around a constant average level, and the "trend," which will be crucial to analyze whether the series presents an upward or downward trend over time.

The analysis of the ECUINDEX from 2013 to 2023 will be carried out using daily closing price data, represented by Heikin Ashi charts and complemented with technical indicators. This information, provided by the Quito Stock Exchange and the Investing web portal, will be analyzed qualitatively, focusing on market action and using tools such as adaptive moving averages and volatility indicators. Special attention will be paid to interpreting the 50, 100, and 200-period TEMA Adaptive Moving Average, the 10-period relative volatility index, and a 100-period moving average to identify medium-term trends. This approach follows the Edwards, Magee, and Bassetti (2019) methodology which they proposed for graphical analysis.

According to Mitchell (2023), the Triple Exponential Moving Average (TEMA), introduced by Patrick Mulloy in 1994, is an advanced technical indicator for trend tracking and reducing the lag of traditional moving averages. The TEMA smooths out price fluctuations, making it easier to identify unusual behavior by applying multiple (three in total) Exponential Moving Average (EMA) calculations on the original EMA. The

indicator helps to detect rapid changes in price direction, signaling reversals or pullbacks and establishing short-term support or resistance levels. In the present analysis, if the price is above the TEMA of 50, 100, and 200, it suggests a bullish direction in the short term, and below, a bearish one. The Moving Average (MA) indicator calculates the arithmetic average of the price in a specific time frame, which for the present study is set at 100, which is used to smooth the price data and identify a short and medium-term trend (Fernando, 2023).

The Relative Volatility Index (RVI) evaluates market volatility using the standard deviation of prices. For this research, a time frame of 10 periods is used to show aggressive changes in the graph. This characteristic makes it a confirmation indicator of increased volatility and the market's decision in its direction. The indicator operates on a scale from zero to 100, with a reading above 50 indicating that volatility is bullish and bearish below (Dorsey, 1993).

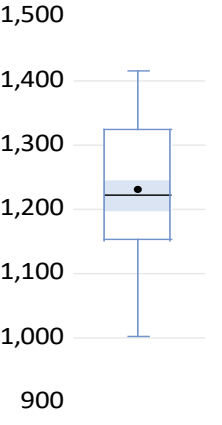
3. Technical analysis results for a non-integrated stock index

This study examines the ECUINDEX's closing price time series (2013-2023) through a combined statistical and graphical analysis, identifying patterns, trends, and volatility. In the statistical analysis, a boxplot is used to assess the data distribution, and the Dickey-Fuller test to determine the index's stationarity. In parallel, graphical analysis uses technical indicators such as the moving average (MA), adaptive moving average (TEMA), and the Relative Volatility Index (RVI) to visualize trend changes and periods of high volatility. Combining these approaches allows a more precise interpretation of ECUINDEX's behavior, considering its statistical properties and the observable patterns in the market.

3.1. Statistical Analysis

This statistical study was carried out using a Boxplot analysis graph, which is shown in Diagram 1.

Diagram 1
Box and whisker plot chart boxplot of ECUINDEX stock index



As depicted in the Diagram 1, the box moved up with a shorter mustache which indicates that the data is concentrated in higher values of the ECUINDEX, with a median (the line inside the box) slightly above the second quartile, around 54%. The presence of a point near 55% suggests an outlier. The smaller, downward-facing box with

more extended mustache signals a more significant data spread at the lower end. This result indicates that there is an asymmetry in the distribution of the data, with a longer tail towards lower values. The ECUINDEX, as revealed by Boxplot analysis, exhibits a general upward trajectory, interspersed with volatility and extreme values that point to specific market occurrences or anomalies. The data's inherent asymmetry, volatility, and outlier presence highlight the critical need for technical indicators that can effectively capture and analyze the ECUINDEX's fluctuating patterns.

For the evaluation of the ECUINDEX's monthly closing price time series stationarity, from 2013 to 2023, the Dickey-Fuller (DF) test was used which results are presented in Table 1.

Table 1
Dickey-Fuller statistical tests of the ECUINDEX stock market index

Null Hypothesis	CLOSING PRICE has a unit root			
Exogenous	Constant, Linear Trend			
Lag Length	0 (Automatic - based on SIC, maxlag=6)			
			t-statistic	Prob.*
Augmented Dickey-Fuller test statistic			-1.246213	0.8961
Test critical values	1% level		-4.029595	
	5% level		-3.444487	
	10% level		-3.147063	
(MacKinnon (1996) one-sided p-values)				
Augmented Dickey-Fuller Test Equation				
Dependent Variable	D(CLOSING PRICE)			
Method	Least Squares			
Date	03/17/24			
Sample (adjusted)	2013M02 - 2023M12			
Included observations	131 after adjustments			
Variable	Coefficient	Std. Error	t-Statistic	Probability
CLOSING PRICE(-1)	-0.030673	0.024613	-1.246213	0.2150
C (constant)	42.43773	27.86069	1.523212	0.1302
@TREND("2013M01")	-0.05265	0.072155	-0.729675	0.4669
R-squared	0.036168	Mean dependent var		1.207634
Adjusted R-squared	0.021108	S.D. dependent var		25.56922
S.E. of regression	25.29792	Akaike info criterion		9.321956
Sum squared resid	81918.08	Schawarz criterion		9.387800
Log-likelihood	-607.5881	Hannan-Quinn criter.		9.348712
F-statistic	2.401607	Durbin-Watson stat		
Probability (F-statistic)	0.094643			

Table 1 illustrates that a t-statistic of -1.246212 was obtained with a p-value of 0.89611. Compared with the critical values for the 1%, 5%, and 10% significance levels, this result does not allow us to reject the null hypothesis that the series has a unit root, thus indicating that it is not stationary. Furthermore, the coefficients of the lagged time series, the constant, and the trend did not show statistical significance. The low adjusted R-squared (0.021108) suggests that

the model does not explain a large part of series variability. The Durbin-Watson statistics of 2.020944 indicates the absence of significant autocorrelation in the residuals. These findings suggest that the analyzed time series does not present stationarity, which implies that its statistical properties, such as the mean and variance, are not constant over time.

The Dickey-Fuller test and Boxplot analysis applied to ECUINDEX show that this market is more active, affecting traditional technical analysis's effectiveness. In non-stationary markets, statistical properties such as mean and variance vary over time (Ahmed, 2018), which means that historical price patterns do not consistently forecast future behavior (Mehrzad et al., 2021). Therefore, it is essential to adapt technical analysis tools, focusing on volatility indicators. The present study has considered the use of the Relative Volatility Index (RVI) or the adaptive moving average (TEMA) to better understand the uncertainty and risk in a price-influenced market due to various factors and without constant patterns (Edwards et al., 2019).

3.2. Graphic Analysis

To develop this graphic analysis for observational purposes, the behavior of the daily closing price of the ECUINDEX stock index was divided into two stages, and represented by 2 and 3. Graphic 1 shows data from 2017 to 2023, and 2, from 2013 to 2016. See both figures below.

Graphic 1
Chart of ECUINDEX stock market index 2017-2023

Graphic 2
Chart of ECUINDEX stock market index 2017-2023

The graphs show the TEMA technical indicators for periods 50, 100, and 200, which are lines that are coupled to the price behavior, while the 100-period moving average seeks to identify the general trend, seeking to show the medium-term average. At the bottom of the graph is the 10-period Relative Volatility Index (RVI). Adaptive indicators such as the triple exponential moving average (TEMA) aim to describe the price in a graphically smooth manner and adjust to its volatility. In contrast, the volatility index seeks to highlight aggressive movements in the short term. For interpretive purposes and to identify atypical movements within temporal ranges, particularly those affecting medium-term trends, a 100-period moving average will be utilized.

As can be seen in Graphic 2, from April 2013 to May 2016, a predominantly bullish behavior is observed until May 2015. In November 2013, according to "literal A," a significant inflection point is detected where the price breaks upwards. A movement that is supported by the Relative Volatility indicator (RVI) and by the alignment of the Triple Exponential Adaptive Moving Averages (TEMA) of 50, 100 and 200 periods. This alignment of the TEMAs suggests a strong confirmation of the bullish trend since each of these averages is successively positioned one above the other, reflecting a sustained increase in the price of the index. Furthermore, the aggressive crossover of the RVI above 50 points during the upward breakout indicates an increase in market volatility, which, in this context, aligns with the observed bullish trend. The 100-period moving average remains below the TEMA, reinforcing the perception of a rising market and serving as support, as seen in "literal B." This uptrend found a turning point around July 2015, when the price began to break down. This change is observable in September 2015, when the TEMAs of 50, 100, and 200 align below the 100-period moving average, and the RVI remains below 50 points, signaling a shift towards a bearish trend in the market.

A technical analysis between January 2017 and December 2018 reveals a phase marked by an upward trend, initiated with an upward break in December 2016 and supported by the Relative Volatility Index (RVI) and the bullish alignment of the TEMA Adaptive Moving Averages of 50, 100 and 200 periods, shown in Graphic 3.

Graphic 3
Analysis and identification of trends in the ECUINDEX stock index 2017-2019

During the period, illustrated in the figure above, the 100-period moving average served as support, keeping the TEMA above it and reaffirming the strength of the uptrend. The formation of descending triangles, according to "literal D," characterized by constant relative lows and descending relative highs, indicated temporary consolidations within the bullish trend, with resistance breaks that confirmed the continuation of the trend, especially when these breaks were accompanied due to an increase in volatility and confirmed by the RVI. Starting in March 2019, a significant change in market dynamics was observed, with the price breaking down and the 50, 100, and 200 period EMAs lining up below the 100-period moving average. The last behavior, with an RVI initially below 50 points and then increasing its volatility, suggests the beginning of a bearish trend, breaking support, as seen in "literal E." This second evaluation shows how technical indicators describe price behavior and how graphic analysis provides valuable information in forecasting future movements (Domoto et al., 2022).

From January 2019 to December 2022, a horizontal consolidation pattern characterized by the absence of a clear long-term trend and multiple short bearish and bullish trends was identified. This identification is Graphic 4.

Graphic 4
Analysis of ECUINDEX stock market index 2019-2022

As demonstrated in the figure, this behavior is evidenced by the 100-period Moving Average, a key indicator in identifying temporary trend changes, where the price crosses this moving average upwards or downwards. Specifically, at the end of April 2021, a significant break to the downside is observed at "literal F," marked by the alignment of the 50, 100, and 200-period TEMA indicators under the 100-period Moving Average, suggesting a bearish market decision.

Finally, an initially bearish pattern from January to December 2021, where the price encounters resistance at the 200-period TEMA indicator, is presented in Graphic 5.

Graphic 5
Analysis and identification of trends and ranges in the ECUINDEX stock index 2021-2023

The situation shown in figure 6, leads to the price increasing its volatility to stop at its resistance, as evidenced in the "literals G and H." However, between January and March 2022, an upward breakout with notable strength is perceived, stabilizing the price in April 2022 and remaining in a range until June 2023. Subsequently, a downward trend resumes and continues until March 2024.

4. Technical Analysis of a Non-Globally Integrated Stock Index: Discussion

The research presented suggests that ECUINDEX is not a stationary market. The results obtained from the Dickey-Fuller test show a lack of stationarity in index fluctuations, which means that its statistical properties, such as mean and variance, vary over time. This finding aligns with Ahmed (2018), who highlights the importance of considering non-stationarity in financial markets. The asymmetry observed in the boxplot reinforces this notion, suggesting a non-uniform data distribution that points to fluctuating and dynamic market behavior.

Despite the non-stationarity of the market and knowing that technical indicators do not guarantee perfect market synchronization and cannot predict future price movements with complete certainty (Tharavanij et al., 2015), in this study, technical analysis has proven to be a valuable tool to interpret the behavior of ECUINDEX (Lui & Mole, 1998; Cheung & Chinn, 2001; Murphy, 2000; Domoto et al., 2022). Indicators such as TEMA, RVI, and MA have allowed the identification of significant patterns and trends within short and medium-term periods. These findings reflect the usefulness of technical analysis for the ECUINDEX non-stationary stock market by providing information on price behavior on the daily closing price chart, explaining its momentum, breakouts, consolidations, and short- and medium-term trends (Edwards et al., 2019).

The main objective of this research was to understand the specific dynamics of ECUINDEX through its technical analysis. The results show that, although the ECUINDEX had identifiable trends in the medium term, the technical indicators have shown to be flexible and adaptable to the behavior of the market. In contrast, the RVI indicator proved to be helpful in clearly indicating price impulses, showing its volatility at times. Breakout, while the TEMA indicator in the concise term was consistent with the direction of the price, providing timely information regarding its atypical behavior. In contrast, the MA indicator served to identify supports and resistances in an average of 100 periods, indicators that, together with the observation of patterns, provide a consistent analysis (Hyo-Jeong & Hyuk Ch., 2014; Kaniel et al., 2008; Menkhoff & Taylor, 2007; Richards & Willows, 2019). This finding answers the question regarding the Efficient Market Hypothesis in its weak form (Fama, 1970), suggesting that, despite the limitations, technical analysis can play a crucial role in interpreting markets as ECUINDEX.

The results show that, for markets like ECUINDEX, it is essential to adapt technical analysis tools to consider the variability and dynamics of the market (Edwards et al., 2019). The use of indicators such as TEMA, RVI, and MA has allowed the identification of trends and patterns, according to the authors (Dorsey, 1993; Mitchell, 2023; Fernando, 2023), in a market characterized by

its dependence on oil and its lack of integration in the global financial market. These results are significant for understanding non-globally integrated stock markets, such as the case of ECUINDEX, which is non-stationary and presents unusual behaviors with atypical values in its historical trajectory.

5. Conclusion

This study demonstrates the value of technical analysis in understanding the dynamics of the ECUINDEX, a non-stationary market lacking global integration. The findings highlight its efficacy in identifying price trends and informing investment decisions, particularly through the adaptation of technical techniques to markets with unique characteristics. The non-stationarity of the ECUINDEX, confirmed by the Dickey-Fuller test, underscores the necessity of employing adaptive volatility indicators and trend-following techniques for accurate market interpretation. The observed price fluctuations and trend reversals further validate the effectiveness of technical analysis tools in capturing momentum shifts and market inefficiencies.

The pivotal role of volatility indicators, specifically the Triple Exponential Moving Average (TEMA), Relative Volatility Index (RVI), and 100-period Moving Average (MA), was evident in analyzing trend behavior, identifying key support and resistance levels, and assessing periods of heightened market uncertainty. This research contributes to the ongoing discourse on market efficiency, providing a foundation for further academic and financial exploration, particularly in refining analytical methodologies for non-stationary markets.

However, this study's scope was limited to the ECUINDEX, focusing exclusively on the Ecuadorian stock market from 2013 to 2023. This specificity restricts the generalizability of the findings to other markets or indices not integrated globally. Furthermore, the methodology exclusively analyzed daily closing prices, omitting potentially relevant data such as opening prices, maximums, minimums, and trading volume. Additionally, while the technical approach prioritized the analysis of indicators like TEMA, MA, and RVI, it did not account for the influence of external economic events, which could have provided a more comprehensive understanding of market behavior.

Therefore, it is recommended that future research replicate this study in other Latin American markets with similar levels of global integration to evaluate the consistency of the observed dynamics and the reliability of the volatility indicators across different contexts. Future studies could also expand upon this research by incorporating an analysis of the economic, fundamental, and financial factors influencing ECUINDEX price behavior. Comparative analyses with other regional or global market indexes would further enhance our understanding of its dynamics. By addressing these limitations, future research can provide a more holistic and generalizable insight into the behavior of non-stationary markets.

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