



THE REGIONAL ECONOMIC DETERMINANTS EFFECTS ON STOCK MARKET VOLATILITY: CASE OF LA BOURSE RÉGIONALE DES VALEURS MOBILIÈRES (BRVM) STOCK EXCHANGE

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Abstract:

This paper analyzes the effects of regional economic determinants on stock market volatility especially for the BRVM Stock Exchange by using Generalized Autoregressive Conditional Heteroscedasticity (GARCH) models with the data from March 2005 to September 2023. The effects of economic determinants as the USD exchange rate, CNY exchange rate, inflation rate, and average interest rate on credits on stock market volatility is tested with GARCH (1,1) models. The results show complex relationships, including an inverse relationship between stock market volatility, the USD rate, the CNY rate and AIR rate. However, inflation rate has a significant impact on stock market volatility. In the dynamic landscape of the BRVM Stock Exchange, the study offers useful insights for risk management, policy considerations, and investment decisions enabling market participants to make appropriate decisions. Moreover, the study's outcomes bear relevance to policymakers, offering guidance for shaping economic policies that may influence stock market dynamics. Additionally, investors may benefit from the research by getting a broad view of the determinants that may affect stock prices, thereby enhancing their ability to formulate sound investment strategies.

Keywords:

BRVM Stock Exchange, Regional Economic determinants, Stock market volatility, Investment Decisions

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1. Introduction

The volatility of financial markets reflects and reacts to a wide range of factors that affect investor behaviour. A particular aspect that requires scholarly investigation is the link between stock price volatility and regional economic variables. In this context, the objective of our research is to analyze that relationship which exists between the West African Economic and Monetary Union (WAEMU) region's economic determinants and the volatility that are observed at Bourse Régionale des Valeurs Mobilières (BRVM) Stock Exchange. This stock exchange belongs to the The West African Economic and Monetary Union (WAEMU), which comprises eight countries that utilize the West African CFA franc as their common currency, positioning itself at the crossroads of financial market dynamics and economic integration. The BRVM Stock Exchange, a pivotal center for securities trading, offers a unique perspective on the intricate interplay between stock price volatility and regional economic variables, serving as the focal point for this economic synergy.

As the primary securities market for member countries, the BRVM provides a comprehensive understanding of regional economic performance and serves as an indicator of the overall health of the regional economy. Despite these advantages, challenges persist. The BRVM stock exchange is exposed to downturns or instability in any member nation, owing to its dependence on their economic success, which could influence the stock exchange. In

fact, the political and economic external shocks could significantly affect the BRVM, underscoring the importance of prudent risk management and contingency plans. Despite the WAEMU countries using the same currency, currency risks remain a concern due to the interconnectedness of global currency markets. Additionally, the market has relatively limited diversification options, compared to broader international exchanges. The feature is seen as a vulnerability, necessitating the development of strategies to broaden investment opportunities.

Nevertheless, the BRVM stock exchange has garnered attention from both domestic and global investors. This high popularity reflects optimism about the economic prospects of the WAEMU region. Infrastructure projects hold the potential to stimulate economic growth and create new opportunities for companies listed at the BRVM, paving the way for further expansion. Moreover, foreign direct investment (FDI) could enhance liquidity and contribute to the overall growth of the region's financial markets.

Thus, this study aims to contribute to the existing researches related to this topic by providing a comprehensive analysis of how some economic indicators correlate with and impact BRVM stock market. To achieve the outlined objectives, this article is organized into distinct sections. The subsequent sections include a comprehensive literature review, detailing the existing research on the topic. The research design, data gathering methods, and analytical strategies used are explained in the methodology section. Following this, the empirical findings will be presented and discussed in order to provide a thorough comprehension of regional economic determinants effects on stock market volatility. The conclusion synthesizes the key findings, discusses their implications, and suggests avenues for future research.

As we embark on this exploration, it is crucial to recognize the multifaceted nature of the BRVM stock exchange and the diverse economic landscapes within the WAEMU region. This research is important not only for academics but also for investors, market players, and policymakers who can gain further insight into the fundamental dynamics driving the BRVM stock exchange. Through the process of identifying the complex relationship between stock market volatility and regional economic determinants, interested parties can reduce risk, take advantage of opportunities, and make well-informed decisions within this emerging financial ecosystem.

2. Brief Literature Overview

Examining the economic determinants that influence stock market volatility is essential for understanding the complicated structures of financial markets. Economic theories that have long examined the variables influencing stock market globally include the Behavioural Finance theory (Shiller, 1981) and the Efficient Market Hypothesis (Fama, 1970). Interest rates, inflation, exchange rates, and GDP growth are important factors (Smith & Brown, 2020). These variables are crucial in explaining variations in stock prices and are commonly examined in empirical studies to identify their impact on financial markets.

Regional factors have an important role in determining how stock markets behave. The success of regional stock markets can be strongly influenced by the state of the local economy. Many researches have shown that regional economic issues, such as changes in inflation and exchange rates, have unique effects on stock markets like the one made by Chen, N. F., Roll, R., & Ross, S. A., (1986). The study of Mahmoud Abdelaziz Touny, Mostafa Ahmed Radwan, and Mahmoud M. Hussein Alayis(2021) on the Middle East region, suggests inflation, corruption, and stock market factors positively impact stock market volatility. The analysis of Caner Demir(2019) about the BIST-100 suggests that economic growth, currency values, portfolio investments, and foreign direct investments positively influence the stock market index, while interest rates and crude oil prices have negative impacts. In Malaysia and Indonesia, Lida Nikmanesh and Abu Hassan Shaari Mohd Nor(2016) find that macroeconomic volatility and trade openness explain a significant portion of stock market volatility. Moreover, FengSheng Chien, Ka Yin Chau, Muhammad Sadiq, and Ching-Chi Hsu(2022) discover positive links between inflation, GDP growth, social contribution, human capital, and natural resource commodity prices in China. For Suvdaa Damiran, Odbileg Dorjdagva, Batbileg Sukhee, and Tsevelmaa Myagmarsuren(2022) there are mixed effects of economic freedom, turnover ratio, inflation, corruption, economic growth, and stock market value on volatility in post-socialist countries.

In contrast, Hewamana, Siriwardhane, and Rathnayake(2022)'s literature review identifies inconsistencies in macro and micro-level determinants of stock volatility but emphasizes the significance of behavioral determinants. The research of Aziz, Marwat, Mustafa, and Kumar(2020) reveals that Islamic stock markets are less influenced by global economic policies and macroeconomic factors. In the same vein, exchange rates and stock market volatility have a

complex relationship that can have both positive and negative consequences, Studies like Bordo et al. (2003) and Agosin & Mody (2005) have shown that a declining domestic currency has been linked to favourable results. These results imply that a depreciating currency might improve export competitiveness, which can raise corporate earnings and stock prices.

On the other hand, as Ahearne et al. (2004) pointed out the strengthening of the home currency could have negative consequences, reducing the competitiveness of exports and possibly driving down stock values. Furthermore, as Bekaert & Wu (2000) point out currency rate volatility plays a significant role. It can create uncertainty, reduce investment and depress stock prices. Besides, Valentina Corradi, Walter Distaso, and Antonio Mele(2013) highlight the importance of macroeconomic factors in explaining volatility and volatility premiums.

Lastly, rising interest rates, as noted by Croushore (2011), may make borrowing more expensive for businesses, lower earnings, and indicate economic concerns, all of which could lead to a decline in stock values.

3. Data And Methodology

3.1. Data Source

The study utilizes quarterly data spanning from March 2005 to September 2023, sourced from SIKA finance and The Central Bank of West African States (BCEAO) data bank.

3.2. Variables

The dependent variable in this analysis is the stock index price, which will be BRVM-COMPOSITE (BRVM-CI) in our case. This index takes into account all the 46 listed companies at the BRVM Stock Exchange.

The independent variables include:

- Exchange Rate US Dollar (USD): The exchange rate of the US Dollar against the FCFA (West African local currency). This variable captures the exchange rate of the US Dollar, providing insights into the region's international trade relationships and its vulnerability or resilience to currency fluctuations.
- Exchange Rate Chinese Yuan (CNY): The exchange rate of the Chinese Yuan against the FCFA (West African local currency). This variable further explores the international economic ties of the participating West African countries, considering China's increasing influence in global trade.
- Inflation Rate (IF): The percentage change in the general price level of goods and services for the WAEMU region. The inflation rate is a fundamental economic indicator that influences investor behavior and decision-making.
- Average Interest Rate on Credits Granted by Banks (AIR): The average interest rate charged by banks on loans services for the WAEMU region. The interest rates set by banks play a crucial role in shaping the cost of capital. This variable is included to understand how changes in borrowing costs may affect investor preferences and stock prices.

3.3. Hypothesis

USD

- Null Hypothesis (H0): USD exchange rate do not have a significant impact on stock market volatility.
- Alternative Hypothesis (H1): USD exchange rate has a significant impact on stock market volatility.

CNY

- Null Hypothesis (H0): CNY exchange rate do not have a significant impact on stock market volatility.
- Alternative Hypothesis (H1): CNY exchange rate has a significant impact on stock market volatility.

IF

- Null Hypothesis (H0): Inflation rate do not have a significant impact on stock market volatility.
- Alternative Hypothesis (H1): Inflation rate has a significant impact on stock market volatility.

AIR

- Null Hypothesis (H0): Average interest rate do not have a significant impact on stock market volatility.
- Alternative Hypothesis (H1): Average interest rate has a significant impact on stock market volatility.

3.4. Econometric Model

A-Descriptive Analysis

Before delving into the econometric model, a descriptive analysis of the data will be conducted. This includes calculating summary statistics such as mean, median, standard deviation, and skewness for each variable.

Performing a descriptive analysis prior to utilizing an econometric model is an essential preprocessing step that greatly enhances the research's overall usefulness. In fact, Descriptive statistics provide a thorough overview of the dataset, clarifying features such as central tendency, dispersion, and distribution.

B-Unit Root test

To determine whether a time series has a unit root, we shall apply the ADF test. According to the null hypothesis, the time series has a unit root, which suggests that it is non-stationary. The time series may be stationary, which is the alternate hypothesis. Because stationarity affects the long-term stability of statistical traits, its evaluation is essential. The differentiation of a time series in order to get stationarity is necessary because it displays a unit root, which is indicative of non-stationarity.

The ADF test is shown as following:

$$\Delta y_t = \rho y_{t-1} + \alpha(\Delta y_{t-1}) + \beta_1 \Delta y_{t-2} + \dots + \beta_k \Delta y_{t-k} + \varepsilon_t$$

Where:

Δy_t represents the first difference of the time series at time t .

ρ is the coefficient to be tested for unit root presence.

α and β_i are coefficients.

ε_t is the error term.

C- GARCH (Generalized Autoregressive Conditional Heteroscedasticity) Model

Given the volatility often observed in financial markets, a GARCH model will be employed for capturing time-varying volatility patterns and ensuring robustness in the estimation of coefficients.

Formula:

$$\sigma_t^2 = \omega + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2$$

Where:

σ_t^2 represents the conditional variance of BRVM-C stock price at time t .

ω is the constant of the GARCH model.

α and β are parameters that account for the persistence and lagged volatility effects, respectively.

ε_{t-1}^2 is the squared error term at time $t-1$.

After the Garch test, we will performed diagnostic tests to ensure the robustness of the results.

4. Findings And Discussion

4.1. Descriptive Test

Table 1: Descriptive summary BRVM Composite index

	USD	CNY	IF	AIR
Mean	535491.3	78955.73	2428.426	7383.773
Median	537270.0	81650.00	1940.000	7190.667
Maximum	662320.0	97000.00	8700.000	8753.333
Minimum	421760.0	59720.00	-1175.000	6200.000
Std.Dev.	55216.23	9991.469	2315.854	739.1543
Skewness	-0.005606	-0.344102	0.901968	0.206483

Kurtosis	2.090869	2.023421	3.339839	1.751952
Jarque-Bera	2.583264	4.460409	10.53023	5.400516
Probability	0.274822	0.107506	0.005169	0.067188
Sum	40161850	5921680.	182131.9	553783.0
Sum Sq.Dev.	2.26E+11	7.39E+09	3.97E+08	40429828
Observations	75	75	75	75

Source: Author's calculation in Eviews 9.0

This table 01 provides a comprehensive view about the descriptive analysis. The moderate deviation around the mean of the USD rate indicates a relatively stable currency. Furthermore, the kurtosis value shows that the USD rate distribution is more peaked and has larger tails than a normal distribution. Compared to the USD, the CNY rate exhibits less movement around the mean, suggesting a more stable Chinese Yuan. This distribution appears to have a minor leftward tilt, based on the negative skewness. The Inflation Rate (IF) has a moderate degree of variability with respect to the mean. Moreover, the positive skewness of the IF distribution suggests a longer right tail. Furthermore, the higher kurtosis suggests a distribution with heavier tails and a more peaked shape. The average interest rate on bank-granted credit, or AIR, is a variable with comparatively little variation around the mean. The distribution is more peaked in shape and has a longer right tail due to the increased kurtosis and positive skewness. None of the variables (USD, CNY, IF, and AIR) follow a normal distribution, according to the Jarque-Bera Test results, suggesting possible nonlinearity or skewness in the corresponding datasets. Moreover, the study gains confidence from the dataset's strong sample size of 75 observations for every variable.

4.2. Unit Root test

Table 2: Unit Root Test for variables

VARIABLES		ADF test statistic	Test critical values:		
			1% level	5% level	10% level
BRVM-C	t-Statistic	-2.077974	-3.522887	-2.901779	-2.58828
	Prob.*	0.2541			
LBRVM-C	t-Statistic	-6.14103	-3.522887	-2.901779	-2.58828
	Prob.*	0.0000			
USD	t-Statistic	-3.579641	-4.088713	-3.472558	-3.163450
	Prob.*	0.0000			
CNY	t-Statistic	-7.517588	-3.522887	-2.901779	-2.588280
	Prob.*	0.0000			
IF	t-Statistic	-3.938838	-3.524233	-2.902358	-2.588587
	Prob.*	0.0000			
AIR	t-Statistic	-11.44464	-3.522887	-2.901779	-2.588280
	Prob.*	0.0000			

***BRVM-C**

Null hypothesis: BRVM-C have unit root

Alternative hypothesis: BRVM-C do not have unit root

Based on the test results in table 2, the Augmented Dickey-Fuller statistics indicate a probability of more than 5%. In that case, BRVM-C is non-stationary, it required taking difference. After applying logarithmic, the results show that LBRVM-C is stationary at first difference and intercept. Now, we have evidence to reject the null hypothesis of a unit root.

***USD**

Null hypothesis: USD have unit root

Alternative hypothesis: USD do not have unit root

Based on the test results in table 2, the Augmented Dickey-Fuller statistics indicate a probability of less than 5%. We have evidence to reject the null hypothesis of a unit root. This implies that USD is stationary at level, trend and intercept, which is often desirable.

***CNY**

Null hypothesis: CNY have unit root

Alternative hypothesis: CNY do not have unit root

Based on the test results in table 2, the Augmented Dickey-Fuller statistics indicate a probability of less than 5%. We have evidence to reject the null hypothesis of a unit root. This implies that USD is stationary at first difference and intercept, which is often desirable.

***IF**

Null hypothesis: IF have unit root

Alternative hypothesis: IF do not have unit root

Based on the test results in table 2, the Augmented Dickey-Fuller statistics indicate a probability of less than 5%. We have evidence to reject the null hypothesis of a unit root. This implies that IF is stationary at level and intercept, which is often desirable.

***AIR**

Null hypothesis: AIR have unit root

Alternative hypothesis: AIR do not have unit root

Based on the test results in table 2, the Augmented Dickey-Fuller statistics indicate a probability of less than 5%. We have evidence to reject the null hypothesis of a unit root. This implies that AIR is stationary at first difference and intercept, which is often desirable.

4.3. ARIMA

Table 3: Automatic ARIMA forecasting

Selected dependent variable: LBRVM-C

Number of estimated ARMA models	25
Number of non-converged estimations	0
Selected ARMA model	(2,2) (0,0)

Source: Author's calculation on Eviews

Table 3 shows the ARMA outcomes, specifically indicating an autoregressive (AR) component of 2.2. The ARIMA model reveals 2 autoregressive components and 2 moving average components.

4.4. GARCH (1,1)

Table 4: GARCH (1,1) analysis

Variables	Coefficient	Std Error	T-Statistic	Prob.
USD	-0.0000000132	0.0000000191	-0.688826	0.4909

CNY	-0.000000149	0.000000126	-1.182806	0.2369
IF	-0.000000250	0.000000111	-2.253957	0.0242
AIR	-0.000000346	0.000000896	0.385498	0.6999

Source: Author's calculation on Eviews

According to the table 4, the negative coefficient indicates that a decrease in the Dollar US rate, CNY rate, AIR rate is associated with an increase in conditional volatility on LBRVM-CI stock prices and even though it remains non-significant with a p-value less than 0.0005. On the other hand, the Inflation Rate (IF) with a significant coefficient (p-value = 0.0242) implies that variations in inflation would have a substantial impact on volatility of LBRVMC- stock prices.

Table 5: ARCH test results GARCH (1.1)
Heteroscedasticity Test ARCH

USD	F-statistic	1.178784	Prob. F(2,68)	0.3139
	Obs*R-squared	2.379094	Prob. Chi-Square (2)	0.3044
CNY	F-statistic	1.685426	Prob. F(2,68)	0.1930
	Obs*R-squared	3.353336	Prob. Chi-Square (2)	0.1870
IF	F-statistic	1.620650	Prob. F(2,68)	0.2053
	Obs*R-squared	3.230322	Prob. Chi-Square (2)	0.1989
AIR	F-statistic	1.507417	Prob. F(2,68)	0.2288
	Obs*R-squared	3.014204	Prob. Chi-Square (2)	0.2216

Source: Author's calculation on Eviews

Based on the ARCH test results from table 5, the relatively high p-values from the ARCH test (F-statistic and Obs*R-squared) shows the absence of heteroscedasticity in the model. Thus, the absence of substantial ARCH effects indicates that the GARCH model properly captures volatility dynamics.

5. Conclusion

This study examines the impact of regional economic determinants like USD rate, CNY rate, inflation rate (IF), and average interest rate on credits (AIR) on the stock market volatility for the BRVM stock exchange using quarterly data from March 2005 to September 2023. Each variable has its null and alternative hypotheses evaluated, and the findings offer important new information about the dynamics of these interactions. Descriptive statistics highlight non-normal distributions and draw attention to the distinctive characteristics of the variables while offering a comprehensive understanding of the fluctuation of the variables. Moreover, unit root tests highlight the time-series characteristics of the variables and validate their importance for each one.

Besides, we conducted ARIMA forecasting to determine the autoregressive and mean component before the GARCH (1,1). Finally, the GARCH tests reveals the USD rate, CNY rate and AIR rate do not have significant impact on stock market volatility. In contrast, the inflation rate (IF) has significant effect on stock market volatility. The findings of Arch LM tests, which provide no evidence of heteroscedasticity, support the results and suggest that the GARCH model is a good fit for explaining volatility dynamics.

MODELS	USD	CNY	IF	AIR
UNIT ROOT TEST				
<i>Null Hypothesis (H0)</i>	Rejected	Rejected	Rejected	Rejected
<i>Alternative Hypothesis (H1)</i>	Accepted	Accepted	Accepted	Accepted
ORDINARY LINEAR SQUARES				
<i>Null Hypothesis (H0)</i>	Rejected	Rejected	Accepted	Accepted
<i>Alternative Hypothesis (H1)</i>	Accepted	Accepted	Rejected	Rejected
GARCH(1,1)				
<i>Null Hypothesis (H0)</i>	Accepted	Accepted	Rejected	Accepted
<i>Alternative Hypothesis (H1)</i>	Rejected	Rejected	Accepted	Rejected

Table 7: Summary of findings

5.1. Recommendations and Implications

Inflation Hedging: Given that the inflation rate (IF) has a major influence on stock market volatility, fund managers and investors may want to look into inflation-hedging techniques. This can require investing a part of the portfolio in commodities or inflation-protected securities, which have a track record of outperforming other assets during periods of inflation.

Risk Management methods: Investors and financial institutions should put strong risk management methods in place to handle variations in the USD and CNY rates, given the influence of exchange rates on stock market volatility.

Policy Considerations: Given that, the study indicates that changes in the inflation rate may have a significant impact on stock market volatility; policymakers should keep a careful eye on inflationary developments. Monetary and economic policies can be informed by this knowledge in order to promote stability.

Investment Decisions: Given that, the study indicates non-significant coefficients for the average interest rate on credits, investors should exercise caution when evaluating the impact of interest rates on stock market. This means that considering interest rate dynamics when making financial decisions requires a complex strategy.

Diversification Strategies: Investors may want to think about spreading their holdings over a range of industries and assets, as evidenced by the findings that certain economic indicators, such as the USD rate, CNY rate, and average interest rate (AIR), do not substantially affect volatility of stock market. This strategy can improve overall portfolio stability and reduce risks related to particular economic variables.

Global Economic Factors: The study emphasizes how the USD and CNY exchange rates, in particular, are closely related to the BRVM Stock Exchange. Market players should take into account prevailing worldwide economic trends when making decisions.

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