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## **Stock Exchange Fungibility and Exchange Rate Volatility in Zimbabwe**

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### **ABSTRACT**

*Investors, policymakers, and Economists have debated whether high volatility in the parallel exchange rate in Zimbabwe was driven by stock exchange fungibility or not. This study investigated the interaction between the stock exchange fungibility market and the parallel exchange rate market. The study utilised the Granger Causality, Cointegration Test, and the Engle-Granger Error Correction Model to determine the short-run, long-run relationships and speed of adjustment between the variables. Stock exchange fungibility was found to granger cause exchange rate volatility implying a Portfolio Balance Approach Model. The bearish market activities would chase away investors, so they would sell their shares, convert their monies into foreign currency to turn to the alternative bullish market where shares are fungible. This would lead to the depreciation of the local currency. The results also showed evidence of cointegration with a perfect long-run speed of adjustment towards the equilibrium.*

**Keywords:** *stock market, fungibility, exchange rate volatility*

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## **1.0. Introduction**

Volatility spillover effects between exchange rates and stock prices in emerging markets are a critical focus in the financial economics policy fraternity. Zimbabwe has been experiencing a fast-growing fluctuating parallel market for the exchange of the United States Dollar (USD) against Real Time Gross Settlement (RTGS) balances, bond notes, and mobile money during both the formal fixed exchange rate period and the free market exchange rate period. Ideally, the surfacing of a significant parallel market is enough evidence of market failure on the formal side. The formal market was fixed until February 22, 2019, when the Reserve Bank of Zimbabwe (RBZ) removed the 1:1 peg between the RTGS balances and the USD. The RBZ then created an interbank market on which the RTGS balances and the USD were to trade on a willing buyer willing seller basis. From then on, the formal exchange rate developed a steep gradient of depreciation trend which was fast-tracking the informal rate with a tendency of convergence.

The need to explain this exchange rate volatility was shadowed by many hypotheses which were thought to be driving the exchange rate. Some of the explanations included an increase in the monetary base which is chasing a crunching USD supply. Besides, the general speculative tendency by market chancers found its position in literature. However, there was a greater opportunity that the stock market fungibility could be used to explain the volatility given that the Old Mutual Implied Rate (OMIR) has been an asymmetric proxy for exchange rate direction. OMIR is an unofficial rate that is used by investors to compare share price movement of Old Mutual shares on the Zimbabwe Stock Exchange (ZSE), Johannesburg Stock Exchange (JSE) and London Stock Exchange (LSE), hence worked as an index for fungibility. The depreciation of the exchange rates which directly mimicked the OMIR has been interpreted as the OMIR being the driver of the exchange rate in Zimbabwe. Theoretically, the portfolio balance approach and the flow approach models can be used to explain the relationship between exchange rates and stock prices (Zhao, 2010).

The fungibility of Old Mutual shares could have implications on the exchange rate volatility in Zimbabwe. A financial instrument is fully fungible when it can be sold or bought from one market or exchange into the other and vice versa. Three counters were fully fungible on the ZSE which are Old Mutual Limited (OMU.zw), PPC Limited (PPC.zw), and Seedco International Limited (SCIL.zw). Of these three, it is the OMU.zw that is listed on more than one market which are the JSE, LSE, Malawi Stock Exchange (MSE) and Namibia Stock Exchange (NSX) whereas PPC.zw is on the JSE only and SCIL.zw on the Botswana Stock Exchange (BSE). This would make the Old Mutual shares more attractive to investors who would want to maximise gains from these markets simultaneously. Resultantly, the movement of trades across markets using this counter is indexed to each market's performance and could have significant implications on the exchange rate. Policymakers argued that this was the major source of exchange rate volatility while economists would point to the excessive money supply by policymakers.

The volatility and presence of a significant parallel foreign exchange market could be traced backed to 2016 when the RBZ introduced Bond notes as a pseudo currency to cover for cash

crisis. This informal market grew significantly over the years. According to the June 2017 Monetary Policy Statement (MPS), one could obtain USD in the parallel market at a premium of close to 50% for both the RTGS or bond notes. As a result, economic agents would prefer trading on the informal market despite its risks.

Since the Asian crisis of 1997-98, a lot of research attention in developed nations has been made towards the dynamic linkage between stock prices and exchange rate. The crisis period drew more attention when emerging markets collapsed following significant depreciation of exchange rates (USD), alongside a fall in stock prices. Researchers assessed the large movement of funds across borders under portfolio investments which were not subject to trade flows.

The concept of fungibility allows an investor to compare stock prices of the same counter across bourses then make decisions on investment changes. Differentials in prices of the same counter on different bourses can then be explained by the exchange rate while the implied investment changes from one bourse to another would also result in exchange rate movements. This will mean an underlying bilateral causality may exist. For instance, as at 23 February 2018, the Old Mutual shares were trading at USD5.20 on the ZSE versus an average of USD3.58 on both the JSE and the LSE (PAAB<sup>1</sup>, 2018). The shares are fungible and ideally should be comparable across all these markets including the MSE and NSX as well. This Old Mutual share price scenario implies a 1:1.45 exchange rate with currencies that have a readily determinable exchange rate against the USD. In this case, a decision by an investor to switch a portfolio from the JSE to the ZSE would have implications on the exchange rate movement. Therefore, this paper seeks to assess the direction of causality between the OMIR and the exchange rates.

## **2.0. Literature Review**

Theoretically, different approaches can explain the relationship between stock exchange dynamics and the exchange rate. These include the Portfolio Balance Approach (Stock-oriented model) and the Goods Market Approach (Flow-oriented Model).

The Portfolio Balance approach by Branson (1983) and Frankel (1983) stresses the role of capital account transactions in explaining the relationship between exchange rate and stock prices. The exchange rate is determined by market mechanisms of demand and supply conditions. A market that is performing well would attract capital flows from foreign investors which may increase the demand for the country's currency. However, a bearish market tends to chase away investors as they would want to avoid losses, so they would sell their shares, convert their monies into foreign currency, and leave the country. In this case, an increase in demand for foreign currency would happen implying depreciation of the local currency. Consequently, it is the rising or falling of stock prices that would lead to an appreciation or depreciation of an exchange rate. Hence, the movements in stock prices may influence

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<sup>1</sup> Public Accountants and Auditors Board

exchange rates and money demand because investors' wealth and liquidity demand could depend on the performance of the stock market.

Thus, in terms of fungibility, the movement of trades becomes easy as one stock can be bought on one market and be sold on another. Given that the two markets can significantly perform differently, it is highly possible that investors would move their portfolios from the bearish market to the bullish market. Such movements have implications on exchange rate movements.

On the other hand, the flow approach model by Dornbusch and Fischer (1980), suggests a causal relationship that flows from the exchange rate to stock prices. In this model, exchange rate fluctuations affect international competitiveness in which case the less favourable terms of trade may affect the real incomes which have an impact on stock prices. A depreciation of the local currency makes exports attractive which leads to an increase in foreign goods demand thus, revenue for the firm increases as well as its value hence the stock prices (Golaka & Samantha, 2003). If the exchange rate appreciates, the opposite will happen. Also, the value of stocks equals the present value of expected future cash flows which react to macroeconomic dynamics including the exchange rate.

These two antagonistic theoretical approaches have been the basis for empirical tests in the literature. On the empirical front, several studies have examined the relationship between exchange rates and stock prices with limited evidence on the significant exchange rate exposure. Although there are no studies on the relationship between stock exchange fungibility and exchange rate, this study made use of closely related studies that focused on the stock market performance and exchange rate.

Empirically, the literature is largely concentrated on Eastern and Western countries with minimum studies on African countries. Many studies have attempted to establish the relationship between stock prices and exchange rates for instance Rahman (2009) found no causal relationship between the two in Bangladesh, India, and China. Zhao (2010) found similar results where there was limited evidence of a dynamic relationship between the Renminbi (RMB) real effective exchange and stock price in China using multivariate GARCH and VAR models from 1991, January to 2009, June.

In Latin America, Diamandis and Drakos (2011) analysed the long-run relationship and short-run dynamics between exchange rates and stock prices. The study also examined the impact of exogenous shocks. This was done in four countries: Argentina, Brazil, Chile, and Mexico using cointegration techniques and Granger causality tests. They found no significant long-run relationship between stock prices and exchange rates for each country.

Caporale, Hunter, and Ali (2013) examined the nature of the linkages between stock market prices and exchange rates in six advanced economies which are the United States, the United Kingdom, Canada, Japan, the euro area, and Switzerland. Data on the banking crisis between 2007 and 2010 were used. Bivariate GARCH-BEKK models were estimated, which produced evidence of unidirectional spillovers from stock returns to exchange rate changes in the United States and the United Kingdom. However, the opposite was true in Canada while there were bidirectional spillovers in the euro area and Switzerland. Similarly, Athanasios and Costas

(2013) examined the nexus of stock price and exchange rate in the European Union and the United States of America during the era of the financial crisis: 2008–2012. The results exhibit a causal relationship from stock price to exchange rates.

Inci and Lee (2014) examined the relation between stock returns and changes in exchange rates in five European countries—France, Germany, Italy, Switzerland, and the UK. The study found a significant positive impact of lagged exchange rate on stock returns.

Mouna and Anis (2016) examined the causality links of exchange rates, the interest rates, and the stock returns of three financial sectors (financial services, banking, and insurance) from the United States and European countries throughout 2006-2009. They found mixed evidence (significant positive and negative effects). However, Safitri and Kumar (2015) found that the exchange rate and other macroeconomic factors (that is, interest rates and inflation) have no significant influence in explaining the Indonesia Plantation sector’s stock price during 2008-2012.

**3.0. Methodology**

The Granger’s (1981) causality concept can be used to examine the dynamic linkage between stock exchange fungibility and exchange rate volatility. A formal econometric representation of a time series  $X_t$  Granger causes another time series  $Y_t$  if  $Y_t$  can be predicted better by using past values of  $(X_t, Y_t)$  then only relying on historical values of  $Y_t$  (Gujarati, 2004). Presenting it differently,  $X_t$  fails to Granger cause  $Y_t$  if for all  $n > 0$  the conditional probability distribution of  $Y_{t+n}$  given  $(Y_{t,t-1}, \dots)$  is the same as the conditional probability distribution of  $Y_{t+n}$  given both  $(Y_{t,t-1}, \dots)$  and  $(X_t, X_{t-1}, \dots)$ . That is to say  $X_t$  does not Granger cause  $Y_t$  if  $\Pr(Y_{t+n} | \psi_t) = \Pr(Y_{t+n} | \Omega_t) \dots \dots \dots (1)$

Where  $\Pr (*)$  denotes a conditional probability,  $\psi_t$  is the information set at time  $t$  on past values of  $Y_t$ , and  $\Omega_t$  is the information set containing values of both  $X_t$  and  $Y_t$  up to time  $t$ .

Presenting the series formally, causal relations between two stationary series  $X_t$  and  $Y_t$  can be done using the following bivariate autoregression (Greene, 2007):

$$Y_t = \alpha_0 + \sum_{k=1}^q \alpha_k Y_{t-k} + \sum_{k=1}^q \beta_k X_{t-k} + \varepsilon_t \dots \dots \dots (2)$$

$$X_t = \rho_0 + \sum_{k=1}^q \rho_k Y_{t-k} + \sum_{k=1}^q \varphi_k X_{t-k} + \mu_t \dots \dots \dots (3)$$

Where  $q$  is a suitably chosen positive integer;  $\alpha_k$ 's,  $\beta_k$ 's = 0,1, .....,  $q$  are constants; then  $\varepsilon_t$  and  $\mu_t$  are usual disturbance terms with zero means and finite variances. The null hypothesis that  $X_t$  does not Granger cause  $Y_t$  is rejected if the  $\beta_k$ 's,  $k > 0$  in equation (2) are jointly significantly different from zero using an *F-test*. In the same manner,  $Y_t$  Granger causes  $X_t$ , if the  $\rho_k$ 's,  $k > 0$  coefficients in equation (3) are jointly different from zero. A bi-directional causality relation exists if both  $\beta_k$ 's and  $\rho_k$ 's,  $k > 0$  are jointly different from zero.

This test is only valid when applied to a stationary series. Given that the series is not stationary, they have to be transformed into a stationary series where causality tests would be applied to

transformed stationary series. A non-stationary series can become stationary after first differencing meaning that it would be integrated of order one that is I(1). A stationary series is integrated of order zero ~ I(0) if it is stationary without differencing. Therefore, when dealing with two ~ I(1) processes for causality, equations (2) and (3) must be expressed in terms of differenced series. However, a special case may then arise, such a case where the underlying series are cointegrated, the specifications obtained must be modified by inserting lagged values of the cointegration relation which is the error term as an additional explanatory variable. This will result in the following equations:

$$\Delta Y_t = \alpha_0 + \sum_{k=1}^q \alpha_k \Delta Y_{t-k} + \sum_{k=1}^q \beta_k \Delta X_{t-k} + \delta ECT_{t-1} + \varepsilon_t \dots \dots \dots (4)$$

$$\Delta X_t = \rho_0 + \sum_{k=1}^q \rho_k \Delta Y_{t-k} + \sum_{k=1}^q \varphi_k \Delta X_{t-k} + \vartheta ECT_{t-1} + \mu_t \dots \dots \dots (5)$$

Where  $\Delta$  represents change by differencing and  $ECT_{t-1}$  represents an error correction term derived from the long-run cointegrating relationship between  $X_t$  and  $Y_t$  series ~I(1). This ECT can be estimated using the residuals from a cointegrating regression.

**4.0. Data Sources and Findings**

The study examined the interrelationship between the stock exchange fungibility and the exchange rate volatility in Zimbabwe using daily data from February 2019 to January 2020. Data on the stock exchange fungibility (OMIR) were collected online from the *omir.today* website. The OMIR was adopted as an index for fungibility because it is used by investors to compare share price movement of Old Mutual shares on ZSE, JSE, and LSE. For the exchange rate (EXPARALLEL) relative to the USD from the RBZ, the market-oriented rate was adopted – which was the daily prevailing informal exchange rate. The parallel market rate was used as a good proxy for a competitively floating exchange rate since the official was partially fixed. The data begin in February 2019 when the hard peg of the formal exchange rate was removed. In this way, the data used tried to minimize any effects of the distortions created by using the formal exchange rate data which was slowly adjusting from the hard peg of 1:1 between the Bond Note and the USD dollars. On the other hand, the sample size had to end in January 2020, two months before the fungibility of shares was outlawed in Zimbabwe.

**4.1. Descriptive Statistics**

The descriptive statistics of the selected sample covering a period from 2019 to 2020 for both stock exchange fungibility and exchange rate in Zimbabwe are presented in Table 1 below. Average values for stock exchange fungibility and exchange rate are 15.4 and 13.0 respectively, reflecting a positive performance from 2019 to 2020. However, the standard deviations for stock exchange fungibility and exchange rate are 8.70 and 7.13 respectively, suggesting a high level of volatility spill-over. The values of kurtosis for stock exchange and

exchange rates are 1.4 and 1.5 respectively, which means that kurtosis return distribution is inconsistent. The Jarque Bera statistics show the absence of normal distribution.

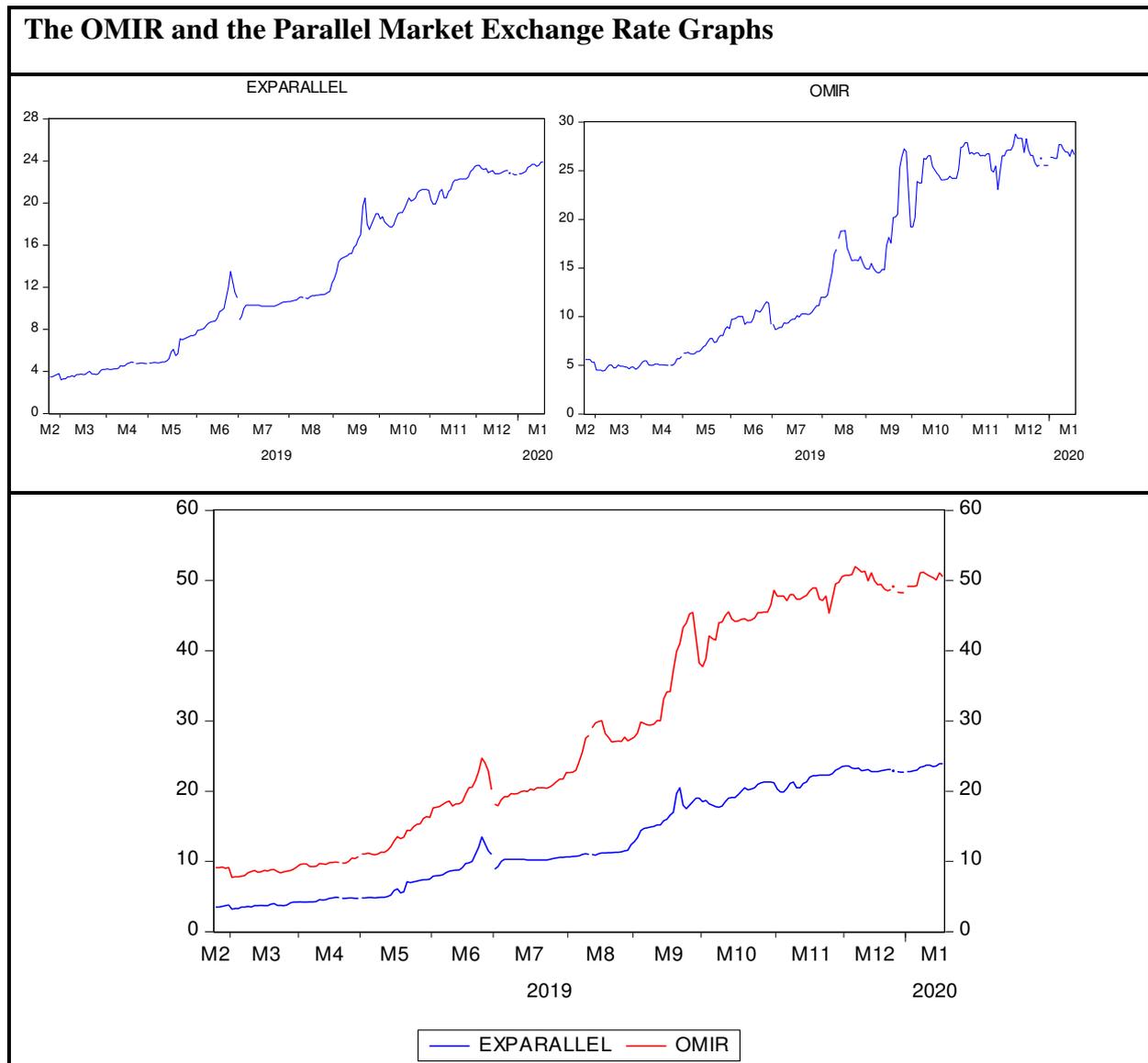
**Table 1: Descriptive Statistics**

	<b>OMIR</b>	<b>EXPARALLEL</b>
Mean	15.40640	13.00213
Median	13.45000	11.00000
Maximum	28.77000	23.90000
Minimum	4.400000	3.200000
Std. Dev.	8.689631	7.139536
Skewness	0.213934	0.164893
Kurtosis	1.413040	1.530558
Jarque-Bera	25.32669	21.26266
Probability	0.000003	0.000024
Sum	3466.440	2925.480
Sum Sq. Dev.	16914.17	11417.95
Observations	225	225

*Source: Authors' Calculations*

Figure 1 below is a graphical representation of the stock exchange fungibility and exchange rate daily data for the selected period from 2019 to 2020. The figure evidence that stock exchange fungibility was always greater than the exchange rate with the possibility of driving the volatility in the exchange rate. Antonakakis (2012), noted that stock volatility is higher compared to that of the exchange rate.

**Figure 1: Graphical Presentation**



*Source: Authors Calculations*

**4.2. Unit Root Test**

To determine the order of integration of the variables, the ADF (Augmented Dickey-Fuller) test complemented with the PP (Phillips-Perron) test in which the null hypothesis,  $H0:\beta=0$  (that is,  $\beta$  has a unit root) and the alternative hypothesis,  $H1:\beta<0$  were implemented.

The stationarity tests were performed first in levels and then in first difference to establish the presence of unit roots and the order of integration of all the variables. The results of the ADF and PP stationarity tests for each variable show that both tests fail to reject the presence of unit root for all the variables in level, indicating that these variables are non-stationary at levels. The first difference results show that these variables are stationary at a 1 percent level of significance thus integrated of order one I (1). The results are presented in Table 2 below.

**Table 2: Unit Root Test Stationarity Results\***

	ADF	PP	Decision	ADF	PP	Decision
Variable	In Levels ~ I(0)			First Differenced ~ I(1)		
OMIR	-0.5192 (0.8837)	-0.5559 (0.8762)	Non-Stationary	-11.0441*** (0.0000)	-11.0910*** (0.0000)	Stationary
EXPARALLEL	-0.1538 (0.9408)	-0.1015 (0.9467)	Non-Stationary	-9.3928*** (0.0000)	-11.9083*** (0.0000)	Stationary

\*\*\*Level of significance at 1%; figures in parentheses indicate p-values.

Source: Authors' Computations in Eviews 9

\*test equation with no intercept

### 4.3. Granger Causality

The test results of Granger-causality between exchange rate and stock exchange fungibility are given in Table 3. There is evidence of causality which is unidirectional from the stock exchange market to the exchange rate market, valid at a 5 percent level. This result is in line with the Portfolio Balance Approach. The fungibility of shares Granger causes exchange rate volatility. As investors would be switching to the foreign market, they demand more foreign currency which will result in the depreciation of the local currency.

**Table 3: Granger Causality Test Results**

Null Hypothesis:	F-Statistic	Prob.
D(EXPARALLEL) does not Granger Cause D(OMIR)	1.48269	0.2293
D(OMIR) does not Granger Cause D(EXPARALLEL)	3.44550**	0.0336

\*\*level of significance at 5%

Source: Authors' Computations in Eviews 9

### 4.4. Cointegration Test

The two variables were found to be integrated of the same order, that is, order one. The study proceeded to test for cointegration. Cointegration of two (or more) time series suggests that there is a long-run, or equilibrium, relationship between them. The Johansen cointegration test was employed. The results presented in Table 4 show evidence of cointegration which prompted the estimation of the Engle-Granger Error Correction Model.

**Table 4: Unrestricted Cointegration Rank Test (Trace)**

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.
None	0.0470*	16.8827	12.3209	0.0081
At most 1	0.0282 *	6.2979	4.12991	0.0144
Trace test indicates 2 cointegrating eqn(s) at the 0.05 level				

\* denotes rejection of the hypothesis at the 0.05 level

Source: Authors' Computations in Eviews 9

**4.5. Engle-Granger: Error Correction Model (ECM)**

All short-run coefficients were statistically significant at the 0.01 level, but those for DEXPARALLEL (-1) and DOMIR (-1) were economically significant. Short-run changes on the stock exchange fungibility (OMIR) have positive short-run changes on the parallel exchange rate (EXPARALLEL) of 0.79. The long-run coefficient is positive, while the OMIR coefficient is positive, leading the parallel exchange rate to rise in period  $t$ , while the speed of adjustment to the equilibrium is 100 percent. The results are presented in Table 5 below.

**Table 5: The Error Correction Model**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DEXPARALLEL(-1)	2.08E-13***	1.62E-14	12.85046	0.0000
DOMIR	0.7989***	1.63E-14	4.90E+13	0.0000
DOMIR(-1)	7.48E-14***	8.31E-15	8.995428	0.0000
RES(-1)	-1.0000***	1.60E-14	6.23E+13	0.0000

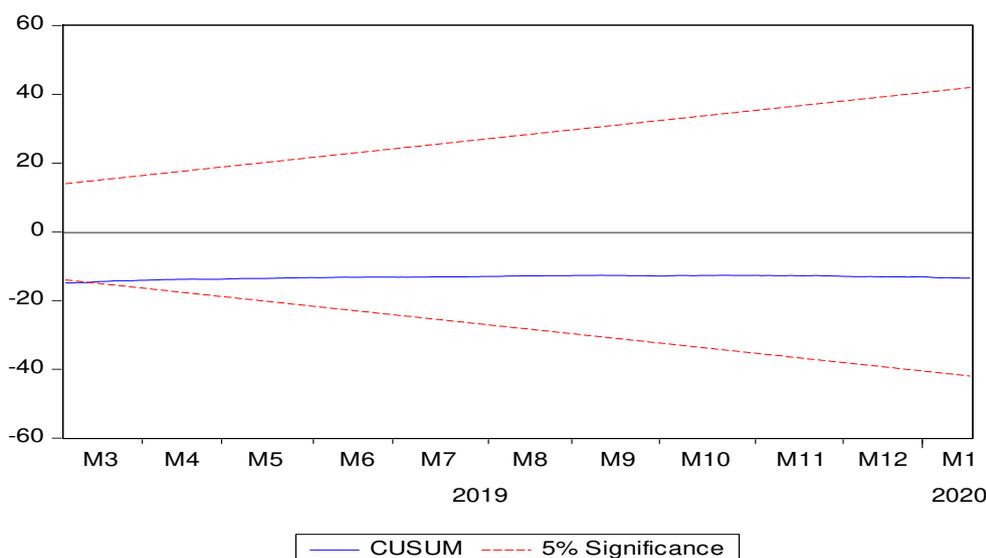
\* denotes rejection of the hypothesis at the 0.01 level

Source: Authors' Computations in Eviews 9

**4.6. Stability Diagnostics and Robustness Test**

To check the stability of recursive residuals of the estimated error correction model (ECM), the CUSUM test developed by Brown, Durbin and Evans (1975) was run. The CUSUM test of stability plots the cumulative sum of recursive residuals with 5% critical lines. The parameters are considered unstable if the plot of cumulative sum crosses the 5% critical bound (the red lines). The graph of the cumulative sum of the recursive residual line for the ECM model does not show any sign of structural breaks as the recursive residual lines do not cross the 5% critical red lines. Therefore the model is stable.

**Figure 2: CUSUM Test Results**



Source: Authors' Computations in Eviews 9

## 5.0. Conclusion

This study investigated the interaction between the stock market and the exchange rate market. The study was motivated by the purported influential impact of the stock exchange fungibility on the exchange rate dynamics. To capture the competitive exchange rate market volatility, the parallel market figures were used. The Granger causality results showed a unidirectional impact running from the stock market to the exchange rate market. The result was consistent with the Portfolio balanced approach where a rise in the domestic stocks market will attract foreign investors to invest in the stock market and diversify their portfolios. A rise in stock prices concerning the price of the same stock on the alternative market where that counter is fungible encourages investors to buy more domestic assets simultaneously selling foreign assets to obtain domestic currency will cause domestic currency appreciation. The opposite is true. Using Cointegration and the Engle-Granger Error Correction Model, the results also revealed a significant positive short run and long run associations between the stock market and the exchange with a perfect rate of adjustment to the equilibrium. In light of this, authorities should strengthen the local exchange market to maintain competitive bullish activities in line with alternative markets where shares are fungible to maintain a balanced flow of portfolios which will not adversely affect the exchange rate.

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