BIG DATA AND EXCHANGE RATE EFFICIENCY IN NIGERIA: ANY ROLE FOR INVESTMENT SENTIMENTS?

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ABSTRACT. The efficiency of the exchange rate is a strong indicator to determine appropriate exchange rate returns. This study engages the use of big data to investigate exchange rate efficiency in Nigeria and further examine the role of investment sentiments. The study employs both the unit-root and variance ratio tests. Also, the granger causality test was employed to investigate the direction of causality. The data spanned 4,992 daily observations each for exchange rate and investment sentiments and cover the daily period 12/10/2001 – 5/13/2022. For further interrogation, quarterly and yearly data frequencies of these two variables were employed in order to explain the varieties of big data. With recourse to the effect of big data, results show that the exchange rate exhibits a random walk behaviour in Nigeria only for daily and quarterly data frequencies and not for the yearly data frequency. However, the causality test indicates that investors' speculations do not affect exchange rate dynamics in the country. As the exchange rate is found efficient in Nigeria, the monetary authority is enjoined to promote real-time information about the exchange rate to deflect undue speculations by investors. This study implies that the monetary authority in Nigeria should model exchange rate efficiency around its intrinsic data-generating process.

Keywords: Big data, Exchange rate, Efficiency, Investment sentiments, Random walk, Unit root test, Granger causality, Real-time.

JEL Classification: **C38, C55, F31, G14, G11**

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Introduction

The efficiency of financial services remains a topical economic discourse and dates back to earlier writers like Fama (1970) and Fama and French (1992). For financial series to be efficient, it is expected to reflect adequate market information, and to this end, weak form and strong form categorizations of efficiency have been identified in the literature. These two forms suggest the extent that both public and private information are accommodated in reflecting the true price of such financial series. An inefficient financial asset breeds arbitrage activities by speculators and gives room to abnormal as well as excessive profiteering when traded. In Nigeria, the foreign exchange market has been seriously balkanized, and allegations of wanton speculations have been levelled against players in the market. Specifically, the Bureau De Change operators have been accused of undue speculations that have resulted in wider disparities in the prices that the domestic currency exchanged for the internationally referenced currencies, especially the United States dollar. The arbitrage opportunities led foreign currency traders to prefer selling at the parallel market (otherwise known as the black market) window but buying at the interbank window. This brought about disequilibrium between the demand for and the supply of foreign currency in the Nigerian economy.

The disequilibrium of the demand for and supply of foreign currency has deteriorating implications for international trade and the balance of payment positions in the country. The height of this worrisome situation led the Central Bank of Nigeria (CBN) to suspend the activities of Aboki FX indefinitely for alleged illegal activity that undermines the economy in September 2021[1]. Aboki FX is a website that provides real-time data on the movements of exchange rates in Nigeria. Aboki FX is a window for tick-by-tick data related to the value of the domestic currency in terms of foreign currencies and internationally referenced currencies of United States dollar, pound sterling, yuan, franc, etc. Put differently, Aboki FX created a real-time data window for parallel market exchange rates of naira. The CBN alleged that owing to the news sentiments, the activities of this foreign exchange window have put pressure on the values of the domestic currency and have altogether made nonsense of the policy directives of the monetary authority. The issue really is not that Aboki FX traded foreign currencies and made speculations therefrom. However, the monetary authority alleged that the continual wide-range differentials between the parallel and interbank exchange rates created by such activities promote undue speculations and remain a matter of concern.

The CBN (2021) posited that the overall health of the Nigerian economy was relapsed on the exchange rate speculations due to the 'untrusted' real-time data provided by Aboki FX. The monetary authority posited that this was consequent upon investors' sentiments toward the news from this real-time source and making this reflects on the expected rate of exchange of the domestic currency. In the same token, it is expected that every financial series should fully reflect all available market information. The idea that Nigeria currently operates a managed-float exchange rate regime made the interbank rate fall short of full market information. However, the monetary authority has copiously argued that the exchange rate in Nigeria has been over-valued; hence, the need for intervention to obtain its right price. Although the activities of Aboki FX create big data for exchange rate determination in Nigeria, it has been alleged by the monetary authority that the speculative tendencies attributed to this data-generating process, owing to news sentiments, have

[1] See CBN (2021)

undermined this benefit. This study seeks to make inference about the role of big data in determining the efficiency of the exchange rate in Nigeria through a comparison between low-frequency and high-frequency data. The empirical literature has alluded to the potency of big data in economic analyses (see De Mol et al., 2017; Shen, 2021; United Nations ESCAP, 2021; Wibisono et al., 2019). The low-frequency data here would be the exchange rate in monthly and quarterly frequencies, while the daily data on the exchange rate serves as the high-frequency data. The efficiency parameter of these data frequencies will validate the role of big data, such as the real-time data provided by Aboki FX, in determining the efficient price of the exchange rate in Nigeria. More so, this study seeks to investigate the direction of causality between news sentiment and exchange rate in Nigeria, both for the low and high-frequency data.

Theoretical background and Empirical Review

The conceptual expositions for this study harp on efficiency, big data and news sentiment. Big data is a novel concept that describes varying, rich, updated and sufficient data-generating economic and financial series processes. On the other hand, financial asset efficiency usually hinges on information-full prices where prices of financial assets fully reflect all known information of the past, present and future, including private and public information. As news is uncertain, making information highly unpredictable, prices of financial assets are expected to follow a random walk process. Random walk is a term that describes a radical departure away from the previous trend of prices in the past. This suggests that the prices of financial assets cannot be obtained in any deterministic or characteristic pattern but follows through unpredictable as well as random walk process. Theoretically, there are three theoretical expositions on the efficiency market hypothesis. These are the fair game model, the martingale difference hypothesis and the random walk hypothesis. The fair game model hinged on the risk-return maxim that a financial series with a higher return should have a correspondingly high risk. This theory relies on the presumption of full utilisation of all available information. In addition to the full utilisation of available information, the equal distribution of successive changes in returns to financial series combined to form the third theory known as the random walk hypothesis. The second theory presumes that the predicted value of financial series can be, at least, equal to the current value subject to the projected information that exists.

The empirical literature on big data analytics exists in two major strands. The first strand relates to those studies that seek to examine the benefits and attendant opportunities that come with the use of big data for obtaining efficient and robust economic analyses. Big data promotes a systematised framework to study economic shocks and allow for the development of machine learning procedure to have in-depth analyses of the heterogeneous components of statistical models (Almeida, 2017; Balar and Chaabita, 2019). With big data, the forecasting abilities of economic models improve and policy choices become robust for far-reaching effects on economic agents, institutions and stakeholders (Balachandran and Prasad, 2017; Byers, 2015; Hersh and Harding, 2018). It is cost-effective and has high extrapolation power, lending credence to its high forecasting credibility. Despite these standard merits, economic analyses have not been at top speed with the pace of big data. There are many inherent factors, including the complexity of building a sophisticated model to accommodate the volume and versatility of big data. The quality and novelty requirements of big data are also important. Based on these, the general application of big data has suffered serious setbacks, and its applications to economic and financial analyses have

been limited (Chavan and Akarte, 2014; Hammer, Kostroch, Quiros., and STA Group; 2017 AbdulKadri, Evans and Ash, 2016; Doerr, Gambacorta, and Serena, 2021).

The second strand of the literature are those studies that seek to employ the use of the behavioural model to investigate the robustness of empirical assessment on the attendant availability of big data. However, this strand of the literature has not enjoyed rich patronage as all the authors have employed the use of survey techniques, questionnaire administration, or just undertaken a literature review. Hassani and Silva (2015) reviewed the literature and found that the attributable techniques befitting of big data analytics in economics and financial studies include the network as well as neural models, factor models, forecasting models and Bayesian models. The study of Taylor, Schroeder and Meyer (2014) alluded to the innovative dimensions that big data brings to economic analysis. Creative thinking, novel techniques and robust analytics are some of the perspectives of big data. With big data, the conservative approach to theoretical modellings is revisited as more sophistication is brought to unveil realistic theoretical propositions.

Methodology

As earlier posited, there are five attributes of big data: volume, velocity, variety, veracity and value. This study seeks to employ daily, quarterly and yearly data frequency to meet the volume and velocity contents of Nigeria's exchange rate data. In terms of variety, the interbank foreign exchange market (IFEM) data would be employed for analyses, and inference would be made about the need for real-time data as available through the parallel market window. For veracity, only data on the exchange rate from credible sources would be used. The annual statistics of the Central Bank of Nigeria (CBN) would be consulted for these exchange rates data, and the value content of the price value of exchange rate data is predicated on the fact that it is useful for policymakers to identify arbitrage activities of speculators in the foreign exchange market. To strengthen the variety content, the price efficiency of the exchange rate in Nigeria will be spliced into different frequencies.

Since investment sentiments are also considered for this examination, the index computed by Bukman, Shapiro, Sudhof and Wilson (2020 as updated) is opted for, which is collected via the Federal Reserve Bank of San Francisco's database. The datapoints for the analysis span the period 2001 – 2022. This period is considered desirable, as it is long enough to address the dynamics of exchange rate using daily, quarterly and yearly data frequencies to elicit vital information about the price efficiency of the exchange rate in Nigeria. Traditionally, the efficiency of financial series can be ascertained using graphical trends. However, this study employs three approaches of analyses: graphical analysis, descriptive analysis, and the use of a data stability test together with a variance ratio test. A comparison of the price efficiency of the exchange rate would be made across these different data frequencies.

The test for unit root for a variable S is carried out using the following specification:

$$\Delta S_t = \beta_0 + \beta_{it} + \beta_2 S_{t-1} + \sum_{i=0}^{p} \varphi_i \Delta S_{t-i} + \varepsilon_t \quad (1)$$

Where β_0, β_1, β_2 and ψ_i----------ψ_p are parameters to be estimated, and ε_t is normally and identically distributed.

The framework for the pair-wise granger causality is given below as

$$EXCHR_t = \alpha_0 + \sum_{i=1}^{k} \alpha_{1i} EXRVOL_{t-i} + \sum_{i=1}^{k} \delta_{1i} INVS_{t-i} + \upsilon_{1t}$$

$$INVS_t = \beta_0 + \sum_{i=1}^{k} \beta_{1i} INVS_{t-i} + \sum_{i=1}^{k} \phi_{1i} EXCHR_{t-i} + \upsilon_{2t} \quad (2)$$

Results

The trend depicted in Figure 1 is highly instructive as it demonstrates how changes in exchange rates also translate to corresponding changes in returns. There are periods of a substantial rise in the exchange rate of the domestic currency to the internationally referenced currency of the United States dollar. The exchange rate increased tremendously in the periods 2008, 2014, 2016, 2018 and 2020. Two important occurrences within these periods are the global economic cum financial crisis of 2007 – 2009 and the global health emergency of the COVID-19 pandemic that occurred in December 2019. Evidently, too, the stock market crash of 2016 is another economic scenario that crashed the domestic currency. Precisely, the domestic currency exchange for above N150 to US$1 in 2008, about N200 in 2014, around N300 in 2016 and gravitated to N350 in 2018, prior to the global pandemic, and has climbed to above N400, since the global pandemic in 2019 (see Figure 1).

As evident, the effects of global crises on the value of exchange rates in Nigeria cannot be disregarded. However, the fact that the highest depreciation of the domestic currency occurred in 2016 is an indication that the factors endangering the domestic currency is an inherent and endogenous factor(s). This lends credence to the assertion that perhaps wanton speculations by traders in the exchange rate markets could be instrumental to its abysmal performance with other internationally referenced currency, the chief of which is the United States dollar. Interestingly, the returns corresponding to the depreciation of the domestic currency also increase, even more than the increase in the exchange rate of the domestic currency itself. This provides insight into the efficiency issues that this study seeks to investigate. In an efficient market, there is no room for any arbitrage activity that would permit any of the players to gain supernormal profits and/or returns, as is the case with the exchange rate of the naira to the United States dollar.

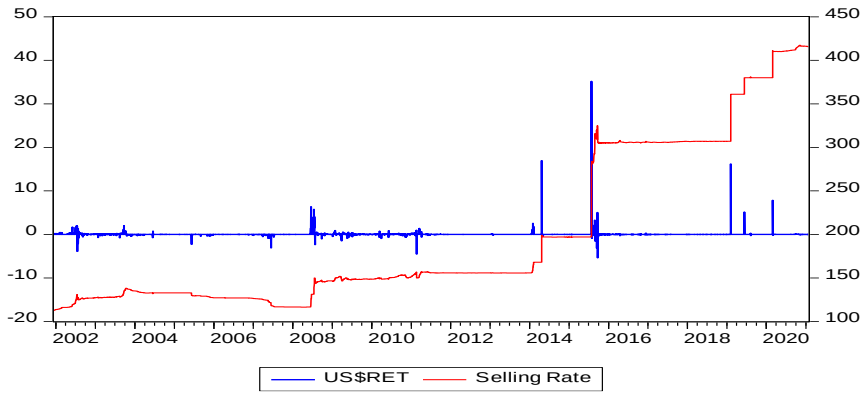

Figure 1: Value and Returns of Exchange Rate in Nigeria (12/10/2001 – 5/13/2022)
Source: Authors

Interestingly, the study seeks to investigate the role of investors' sentiments in the efficiency behaviour of the exchange rate. News sentiments are the sentiments professed by investors during their portfolio balancing decisions, hence, otherwise known as investment sentiments. As depicted in Figure 2, the investment sentiments are well suited as the investors became most pessimistic during the periods of the global financial crisis of 2007 – 2009 and the COVID-19 global pandemic. Investors cast a more pessimistic view during the period of the global pandemic. As there was to be a ray of investment optimism by October 2021, but this was short-lived as the investment sentiments reclined again in November 2021 and since March 2022 (see Figure 2).

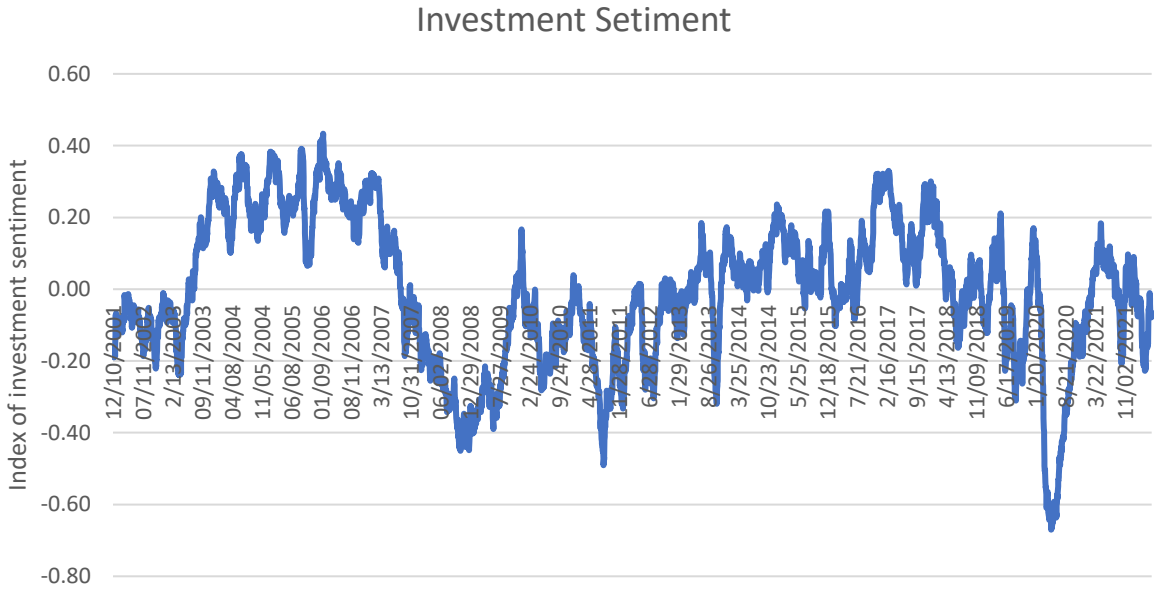

Figure 2: Investment Sentiments. Source: Authors with data sourced from Bukman, Shapiro, Sudhof and Wilson (2020 as updated). Federal Reserve Bank of San Francisco

The period 2003 – 2007 has been that where the investors have been optimistic about their portfolio balancing decisions. Coincidentally, the value of the exchange rate and the corresponding returns were relatively stable during this period. The returns on exchange rate trading during this period were near zero. Zero exchange rate returns indicate that there were no excessive arbitrage activities of the exchange rate during the period 2003 – 2007 that would allow investors to make abnormal returns as compared to other periods. Stemming from these trend analyses, this study seeks to investigate how investment sentiment granger causes the depreciation of the exchange rate in Nigeria. More so, the study would ascertain if the exchange rate has been efficient in Nigeria for the period under consideration. To pursue the objective of ascertaining the exchange rate efficiency in Nigeria, conventional and modified unit-root, as well as stationary tests, have been estimated (see Tables 1 – 3). The decision rule is that a financial series that is of, at least weak-form efficiency; would be unit-root. This denotes a random walk behaviour of the exchange rate as it is expected to be independent of past events. As detailed in Table 1 -3, the exchange rate in Nigeria is of weak-form efficient. This suggests that the exchange rate follows a random walk pattern and cannot be predictable for abnormal profits by investors engaging in wanton arbitrage activities.

Table 1: Unit-Root Test for Investment Sentiments and Exchange Rate Efficiency in Nigeria – Daily Data

Conventional Unit Root Test						
	ADF			**PP**		
Variables	T- Statistics	P Value	Decision	T- Statistics	P Value	Decision
Exchange Rate	-70.35* (I(1))	0.0001	Weak-form Efficient	-70.35* (I(1))	0.0001	Weak-form Efficient
Investment Sentiment	-3.84* (I(0))	0.0025	Not weak form efficient	-3.71* (I(0))	0.0040	Not weak form efficient
	KPSS					
Variables	LM Stat		Decision			
Exchange Rate	0.45* (I(1))		Weak-form Efficient			Weak-form Efficient
Investment Sentiment	0.66* (I(0))		Not weak form efficient			Not weak form efficient
Modified Unit Root Test						
	Dickey-Fuller GLS			**Elliot Rothenberg Stock Point Test**		
Variables	Elliott-Rothenberg-Stock DF-GLS test statistic		Decision	Elliot Rothenberg Stock Test Statistic		Decision
Exchange Rate	-70.26* (I(1))		I(1)	0.01		Weak-form Efficient
Investment Sentiment	-2.96* (I(0))		I(0)	1.39		Not weak form efficient
	NG Perron					
	NG Perron Test Stat					
Variables	MZa	MZt	MSB	MPT	Decision	
Exchange Rate	-2494.43*	-35.32*	0.01*	0.01*	Weak-form Efficient	
Investment Sentiment	-17.78*	-2.98*	0.17*	1.40	Not weak form efficient	

Source: Authors' Computations

Note: *, **, * imply the series' stationarity at 1%, 5% and 10%, respectively. Likewise, ADF, PP and KPSS stand for Augmented Dickey-Fuller, Phillips-Perron and Kwiatkowski-Phillips-Schmidt-Shin tests, respectively.**

Table 2: Unit-Root Test for Investment Sentiments and Exchange Rate Efficiency in Nigeria – Quarterly Data

Conventional Unit Root Test						
	ADF			**PP**		
Variables	T- Statistics	P Value	Decision	T- Statistics	P Value	Decision
Exchange Rate	-5.97* (I(1))	0.00	Weak-form Efficient	-5.84* (I(1))	0.00	Weak-form Efficient
Investment Sentiment	-2.97** (I(0))	0.04	Not weak form efficient	-2.93** (I(0))	0.046	Not weak form efficient
	KPSS					
Variables	LM Stat		Decision			
Exchange Rate	0.048* (I(1))		Weak-form Efficient			
Investment Sentiment	0.12* (I(0))		Not weak form efficient			
Modified Unit Root Test						
	Dickey-Fuller GLS			**Elliot Rothenberg Stock Point Test**		
Variables	Elliott-Rothenberg-Stock DF-GLS test statistic		Decision	Elliot Rothenberg Stock Test Statistic		Decision
Exchange Rate	-5.94* (I(1))		Weak-form Efficient	0.74* (I(1))		Weak-form Efficient
Investment Sentiment	-2.68* (I(0))		Not weak form efficient	2.27** (I(0))		Not weak form efficient
	NG Perron					
	NG Perron Test Stat					
Variables	MZa	MZt	MSB	MPT	Decision	
Exchange Rate	-33.09*	-4.07*	0.12*	0.75*	Weak-form Efficient	
Investment Sentiment	-12.05*	-2.45**	0.20**	2.04**	Not weak form efficient	

Source: Authors' Computations

Note: *, **, * imply the series' stationarity at 1%, 5% and 10%, respectively. Likewise, ADF, PP and KPSS stand for Augmented Dickey-Fuller, Phillips-Perron and Kwiatkowski-Phillips-Schmidt-Shin test, respectively.**

Table 3: Unit-Root Test for Investment Sentiments and Exchange Rate Efficiency in Nigeria – Yearly Data

Conventional Unit Root Test						
	ADF			**PP**		
Variables	T- Statistics	P Value	Decision	T- Statistics	P Value	Decision
Exchange Rate	-5.092978* (I(1))	0.0038	Weak-form Efficient	-2.158** (I(1))	0.0330	Weak-form Efficient
Investment Sentiment	-4.284625* (I(0))	0.0039	Not weak form efficient	-4.284 (I(0))	0.0039	Not weak form efficient
	KPSS					
Variables	LM Stat		Decision			
LOG(Exchange Rate)	0.346215* (I(1))		I(I)			
Investment Sentiment	0.077890* (I(0))		I(0)			
Modified Unit Root Test						
	Dickey-Fuller GLS			**Elliot Rothenberg Stock Point Test**		
Variables	Elliott-Rothenberg-Stock DF-GLS test statistic		Decision	Elliot Rothenberg Stock Test Statistic		Decision
Exchange Rate	-5.158861 (I(1))		Weak-form Efficient	1.668989* (I(1))		Weak-form Efficient
Investment Sentiment	-4.399597 (I(0))		Not weak form efficient	2.436411** (I(0))		Not weak form efficient
	NG Perron					
	NG Perron Test Stat					
Variables	MZa	MZt	MSB	MPT	Decision	
Exchange Rate	-50.9159*	-5.01*	0.09845*	1.94669*	Weak-form Efficient	
Investment Sentiment					Not weak form efficient	

Source: Authors' Computations

Note: *, **, * imply the series' stationarity at 1%, 5% and 10%, respectively. Likewise, ADF, PP and KPSS stand for Augmented Dickey-Fuller, Phillips-Perron and Kwiatkowski-Phillips-Schmidt-Shin test, respectively.**

On the other hand, investment sentiments are not weak form efficient as the series shows a level of stationarity across all the various data dimensions – daily, quarterly and yearly. This implies that investment sentiments are highly predictable. As depicted in Figure 2, the investment sentiments follow the expectation of ongoing economic issues such as the global financial crisis of 2007 – 2009 and the COVID-19 global pandemic. The variance ratio test also confirms that the exchange rate is of weak form efficient both for both daily and quarterly data. The probability value could not reject random walk behaviour at the 5 percent level of significance as both has probability values of 0.999 and 0.098, respectively. However, the estimates of the yearly data frequency show that the yearly exchange rate is not weak-form efficiency as the probability value of 0.01 is lesser than the 0.05 level of significance (see Figure 4a). Therefore, it indicates the null hypothesis of random walk is rejected at the 5 percent level. These findings lend credence to the fact that big data, as produced by the Aboki FX real-time data, would only show the efficiency of the exchange rate in Nigeria and could not adduce abnormal returns to investors even during wanton arbitrage activities.

Table 4a: Variance Ratio Test for Exchange Rate Efficiency in Nigeria

Daily			**Quarterly**			**Yearly**		
Joint Tests	**Value**	**Prob.**	**Joint Tests**	**Value**	**Prob.**	**Joint Tests**	**Value**	**Prob.**
Max [z] at period 16	0.136	0.999	Max [z] at period 8	2.237	0.098	Max [z] at period 8	3.022	0.01

Source: Authors' Computations

On the other hand, investment sentiments are only of weak-form efficient for the quarterly and yearly data frequencies. The daily data frequency suggests that it is not weak form efficient when done on a daily basis.

Table 4b: Variance Ratio Test for the Efficiency of Investment Sentiments in Nigeria

Daily			**Quarterly**			**Yearly**		
Joint Tests	**Value**	**Prob.**	**Joint Tests**	**Value**	**Prob.**	**Joint Tests**	**Value**	**Prob.**
Max [z] at period 16	11.358	0.000	Max [z] at period 4	0.904	0.838	Max [z] at period 8	1.077	0.734

Source: Authors' Computations

From the foregoing, it is imperative to emphasise that this study conforms to the results in previous studies that big data increases the forecasting ability and the efficiency parameter of financial and economic dynamics. Empirical studies that stressed this submission include Hassani and Silva (2015); Taylor, Schroeder, and Meyer (2014); Almeida (2017); Balar and Chaabita (2019); Balachandran and Prasad (2017); Byers (2015); Hersh and Harding (2018). The implication is that the modelling framework for exchange rate efficiency should pattern its intrinsic data-generating frequency as well supported with the use of big data.

Consequent upon this, this study seeks to investigate the direction of causality between investment sentiments and exchange rate dynamics in Nigeria. To achieve this, pair-wise granger causality tests conducted have been tabulated below for the various data dimension. The estimates of the granger causality test for daily data are detailed in Table 5, for the quarterly data frequency is detailed in Table 6 and the yearly data frequency is in Table 7.

Table 5: Granger Causality for Daily Exchange Rate Data in Nigeria

Null Hypothesis:	Obs	F-Statistic	Prob.
INVESTMENT_SETIMENT does not Granger Cause D(EXCHANGE_RATE)	4988	2.55391	0.0779
D(EXCHANGE_RATE) does not Granger Cause INVESTMENT_SETIMENT		0.14397	0.8659

Source: Authors' Computations

The granger causality test suggests that there is no causal link between investment sentiments and exchange rate depreciation in Nigeria. The null hypothesis that there are no granger causalities between these two variables cannot be rejected at the 5 percent level of significance. (Tables 5 – 7). As a result, this study could not find evidence to ascribe the depreciation of the domestic currency to investment sentiments, part of which include speculations on the basis of domestic and global economic cum financial dynamics. This result is striking and instructive enough about investors making their decisions and the policy directions from the regulatory authorities, including the monetary authority – the Central Bank of Nigeria.

Table 6: Granger Causality Test for Quarterly Exchange Rate Data in Nigeria

Null Hypothesis:	Obs	F-Statistic	Prob.
INVESTMENT_SETIMENT does not Granger Cause D(EXCHANGE_RATE)	75	0.471	0.626
D(EXCHANGE_RATE) does not Granger Cause INVESTMENT_SETIMENT		2.3991	0.098

Source: Authors' Computations

Table 7: Granger Causality Test for Yearly Exchange Rate Data in Nigeria

Null Hypothesis:	Obs	F-Statistic	Prob.
INVESTMENT_SETIMENT does not Granger Cause D(EXCHANGE_RATE)	18	0.527	0.6023
D(EXCHANGE_RATE) does not Granger Cause INVESTMENT_SETIMENT		1.053	0.3769

Conclusion

The study engaged big data to investigate foreign exchange efficiency in Nigeria, accounting for the role of news as well as investment sentiments. The study found evidence for the efficiency of the exchange rate both for daily and quarterly data frequencies but not for the yearly data. That this evidence holds at a higher frequency of exchange rate data but not at a lower frequency confirms that the variability and voluminous nature of the data used for investigation would determine to what extent exchange rate prices would reflect market information and represent its true price. However, there was no evidence that investment sentiments (that is, the extent of pessimism or optimism of the investors) drive the dynamics of the exchange rate in Nigeria, as the null hypothesis of no granger causality could not be rejected. Consequent to these insights, this study, therefore, recommends that;

(a) Larger datasets for exchange rates through real-time arrangement would rather stimulate exchange rate efficiency as against making it overvalued. As such, the monetary authority is enjoined to create a very rich real-time data platform as Aboki FX which was suspended in September 2019. Investors would obtain current and instantaneous information on the value of the exchange rate.

(b) Investment sentiments are found not to be subjective as they reflect essential domestic cum global dynamics. As such, it should not be discountenanced as wanton speculations by the monetary authority to clamp down on Bureau De Change (BDC) market in the country.
(c) That the study could not obtain evidence that investment sentiment granger causes exchange rate dynamics in the country further corroborate the possibility that exchange rate dynamics react to other market fundamentals.

The implication of these results is that following its data-generating process, the exchange rate is efficient in Nigeria. Hence, the monetary authority should promote real-time information about exchange rate value in Nigeria to reduce speculations that would promote excessive returns on arbitrage activities by investors. In addition, this study implies that the monetary authority in Nigeria should model exchange rate efficiency around its intrinsic data-generating frequency, as supported by big data analyses in this study. Within the global context, the efficiency of the exchange rate in Nigeria would indicate there would not be much difference between the spot rate and the future rate of the exchange rate. Therefore, importations by manufacturers would not experience huge spikes within the shortest possible time, and there would not be price distortions within the domestic economy. Nonetheless, the implications of these policy suggestions have to be taken with caution owing to issues that would have limited the extent of reliability and validity of the estimates obtained. The following areas are suggested for further studies.

(i) Real-Time Parallel Market Exchange Rate Data: In order to properly situate the role of big data, this study suggests that a comparison should be made between exchange rate data obtained from the parallel market and interbank windows. This is to further enrich the conclusion reached in this study and will further assist in justifying the role of speculations in determining the efficiency of the domestic currency with reference to the internationally referenced currencies of the United States dollar, China Yuan, United Kingdom pound sterling and others.

(ii) Accounting for Structural Breaks: This study suggests a way to embellish the decision on exchange rate efficiency is to account for the role of structural breaks. Within the period under review, the global economic crisis of 2007 – 2009 and the recent global health emergency have been observed to compound news sentiments across the globe.

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