“Investigating adaptive behavior in the foreign exchange market: ZAR versus USD and CNY”

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ARTICLE INFO	Adefemi A. Obalade (2021). Investigating adaptive behavior in the foreign exchange market: ZAR versus USD and CNY. *Investment Management and Financial Innovations*, *18*(2), 391-401. doi:10.21511/imfi.18(2).2021.31
DOI	http://dx.doi.org/10.21511/imfi.18(2).2021.31
RELEASED ON	Wednesday, 30 June 2021
RECEIVED ON	Tuesday, 04 May 2021
ACCEPTED ON	Monday, 28 June 2021

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JOURNAL	"Investment Management and Financial Innovations"
ISSN PRINT	1810-4967
ISSN ONLINE	1812-9358
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
56	2	1

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BUSINESS PERSPECTIVES

LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10,
Sumy, 40022, Ukraine

www.businessperspectives.org

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INVESTIGATING ADAPTIVE BEHAVIOR IN THE FOREIGN EXCHANGE MARKET: ZAR VERSUS USD AND CNY

Abstract

This study examines the adaptive behavior of South African Rand (ZAR) exchange rate against its major trading partners, the US Dollar (USD) and the Chinese Yuan (CNY) over the period 1999–2020 . The study uses a rolling parametric linear variance ratio (VR) test, nonparametric linear runs test, and non-linear Brock, Dechert and Scheinkman (BDS) test to determine time-varying predictability and regression analyses to assess the effect of market conditions. The results show that the foreign exchange market was found to be inefficient based on the VR tests, but efficient with very few windows of inefficiency based on the runs test and BDS test. In addition, apart from the GDP, none of the market conditions studied is associated with non-parametric linear and nonlinear predictabilities. The study draws two main conclusions. Firstly, the South African foreign exchange market is adaptively efficient. Secondly, foreign exchange market efficiency is primarily driven by the level of economic growth. Practically, it will be difficult for investors to exploit the few windows of predictability in the South African foreign exchange market by focusing mainly on the market conditions studied.

Keywords South Africa, efficiency, financial crisis, GDP, inflation

JEL Classification G14, G15, N2

Received on: 4th of May, 2021
Accepted on: 28th of June, 2021
Published on: 30th of June, 2021

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Conflict of interest statement:
Author(s) reported no conflict of interest

INTRODUCTION

Efficient Market Hypothesis (EMH) is a popular but highly doubtful idea of neoclassical school of finance that has piqued the interest of researchers than any other financial theory (Hiremath & Kumari, 2014). The basic or weak form of EMH is inextricably intertwined with the notion of random walk hypothesis and states that price history has no memory as price movements follow no discernible trends or patterns. EMH asserts that prices fully reflect previous information (Sewell, 2011), implying that it is impossible to make significant price forecasts based on technical analysis (Ching et al., 2014; Obalade, 2019). Under the weak-form efficiency, historical returns cannot be used to forecast future returns (Fama, 1965, 1970). Despite the position of EMH, market participants are relying on technical analysis by studying previous prices such as past exchange rates, in an effort to project future exchange rates (Neely et al., 2009). Thus, while the EMH suggests that the financial market is efficient and prices are unpredictable, the technical analysts believe that the prices are predictable and hence the market is inefficient. This debate spans several decades. Beyond this, empirical studies on EMH generally produce inconsistent findings. The conflicting findings are not totally surprising as the ideology of seeing financial market as either efficient or inefficient over a prolonged period of examination period inevitably produces conflicting findings among scholars.

The prolonged debates lead to the formulation of a contemporary theoretical framework for the explanation of price behavior, known as the adaptive market hypothesis (AMH). The proponent (Lo, 2004, 2005) of AMH suggests that market is evolutionary and dynamic. The perception is that financial markets do not operate in isolation as they are influenced by changing environmental conditions and factors, which could be political, social, economic, or cultural (Lo, 2017); bearish or bullish (Fabozzi & Francis, 1977); normal, down, or up (Klein & Rosenfeld, 1987). These conditions lead to fluctuations in market efficiency. There has been an upsurge in the volume of research focusing on AMH since its inception in 2004 with more and more studies in the last decade. Despite the studies, the adaptability of forex market is thinly researched, particularly in emerging African countries such as the South Africa. Forex market occupies a central position in the macroeconomy (Mi, 2016) and financial market (Khuntia et al., 2018), serving as a conduit through which international financial transactions, exchanges and investments are facilitated. Furthermore, forex market is one of the oldest, largest, fast growing and most liquid financial markets (Mi, 2016).

In terms of forex demand and trading, South Africa has the biggest forex market in Africa (Businesstech, 2019). This can be attributed to the presence of a well-regulated and strong financial system, the role of the financial sector conduct authority (FSCA) and the attraction of South African economy and currency to the foreign investors. Lo (2004) suggests that each market ecology has its own unique features, signifying that every market should be assessed individually. Untangling the dynamic behavior of South African forex rate is key for policymaking and design of risk and investment management plans, hence the study. In this context, this study provides the first attempt linking the forex efficiency with AMH in the emerging African market.

1. LITERATURE REVIEW

Efficiency of financial markets has generated substantial research interest in the last five decades. In this section, empirical reviews on forex market efficiency in absolute form and under AMH are presented. In the context of developing Asian countries, while Noman and Amhed (2008) posit that seven south Asian forex markets are efficient using unit root and VR tests, Ahmad et al. (2007) indicated that eight south Asian forex return are efficient using unit root tests but the Ljung Box (Q) test, the non-parametric runs test and nonlinear BDS test disclosed that they are not efficient. The conflicting finding implies that linear tests are not sufficient. Applying detrended fluctuation analysis, Abounoori et al. (2012) submitted that Iranian forex markets are generally inefficient despite changing degree of efficiency. Studying the monthly frequency of exchange rate, literature such as Matebejana et al. (2017) use unit root tests and find that Botswana's forex rate against South African Rand, American Dollar and Japanese yen are unpredictable, while Pula against Great British Pound is predictable.

In the league of the Organisation for Economic Cooperation and Development (OECD) countries, Ibrahim et al. (2011) posit based on unit root tests that OECD forex rate align with random walk. Applying similar tests, Mabakeng and Sheefeni (2014) and Kisto and Ummersingh (2015) respectively submit that Namibia and Mauritius forex markets are unpredictable and efficient. However, these unit root tests are not sufficient to establish market efficiency (Obalade, 2019). Studying the efficiency in the developed forex markets, Alexander and Johnson (1992) find that developed forex rates against US dollar, namely the German, Japanese, Swiss and French currencies are cointegrated, suggesting they are inefficient. In addition, Kallianiotis (2017) finds relative efficiency with (USD/EUR) being more efficient relative to the USD/GBP and JPY/USD, which are not random.

Lim and Brooks (2006) and Obalade and Muzindutsi (2020b) critically review the empirical literature and find mounting support for AMH. Applying three tests of RW in rolling windows. Charles et al. (2012) find that UK, Australian, Swiss, Canadian and Japanese currencies against the US dollar are efficient for most periods, albeit some episodes of inefficiency, especially during recession and coordinated central bank interventions. Subsequently, Neely and Weller (2013) find the performance of a forex trading

http://dx.doi.org/10.21511/imfi.18(2).2021.31

technique to be adaptive rather than being static. On the other hand, Katusiime et al. (2015) reveal that the Ugandan forex market is adaptively inefficient as the profitability of trading rule changes with time. In the context of developing African countries, Adeyeye et al. (2017) find that 10 Sub-Saharan African countries are mostly linearly and nonlinearly inefficient in a full sample, but the efficiency of most of the forex markets was sensitive to structural breaks, suggesting they are adaptive.

Kumar (2018) shows that Indian FOREX rates against UK, Euro and Japanese currencies fluctuate in degrees of efficiency over time, depending on crucial macroeconomic conditions. However, Indian currency remains generally inefficient against the US dollar. Similarly, Khuntia et al. (2018) reveal that Indian forex efficiency is path dependent. Evaluating the cryptocurrency market, Khuntia and Pattanayak (2018) find that bitcoin market changes in response to market events, which is in consonance with the findings of Chu et al. (2019) who posit that Ethereum and Bitcoin markets are adaptive. Further, the efficiency of Indonesia's forex rate against the US dollar switches between periods of predictability and unpredictability (Kumar & Anandarao, 2020).

Overall, a cursory look at the recent empirical evidence suggests that AMH explains the behavior of financial markets than the traditional EMH. It is noteworthy that limited studies exist on the adaptability of the forex market. In the leading emerging markets such as BRICS, the Indian forex market has been studied by Kumar (2018) and Khuntia, et al. (2018), while others have not been adequately explored. The broad objective of this study is to examine the implications of AMH for the emerging African market, namely South Africa market. To achieve this objective, the study investigates whether the South African foreign exchange market exhibits cyclical efficiency. Secondly, it explores the possibility of cyclical efficiency being dependent on market conditions.

2. RESEARCH METHODS

2.1. Estimation techniques

There are four segments of the estimation techniques. The first three segments entail testing for the independence and identical distribution (*i.i.d.*) of the changes in exchange rate series using rolling parametric linear (VR) and nonparametric linear (runs test) and nonlinear (Brock-Dechert-Scheinkman (BDS), (1987)) approaches respectively, while the fourth segment captures the models employed in examining the effect of market conditions on the dependence of stock returns. Linear tests constitute the earliest tests of weak-form efficiency. As nonlinear dependence cannot be picked by linear testing tools (Lim & Hooy, 2012), combining both the linear and non-linear testing tools will ensure the avoidance of possible wrong inferences (Obalade, 2019). Additionally, the accuracy of the results can be confirmed if different tests point to the same conclusion.

2.1.1. *Parametric linear variance ratio test*

The VR test is the primary and the most influential test of *i.i.d.* (Verheyden et al., 2013), and was first developed by Lo and Mackinlay (1988); after the introduction of this test, several significant enhancements have been proposed, including the Signs and Ranks test by Wright (2000) and the Wild Bootstrap test by Kim (2006). The VR test rests on the postulation that if an asset price is *i.i.d*, the variance of *p*-period change is *p* times the variance of the *1*-period change. The variance of exchange rate changes, with holding period p can be expressed as:

$$VR(P)=1+2\sum_{j=1}^{p-1}\left(1-\frac{j}{p}\right)\cdot\varphi(j). \qquad (1)$$

VR sets the null hypothesis (*Ho*) as $VR(P)$ equals unity 1 for all p if exchange rate changes are *i.i.d*. To test if foreign exchange return is *i.i.d.,* this study follows the Lo and MacKinlay (1988) heteroscedasticity consistent *VR* test, with test statistic $M_2(P)$:

$$M_2(P)=\frac{VAR(X;P)-1}{\psi(P)^{-\frac{1}{2}}}, \qquad (2)$$

where

$$\psi(P)=\sum_{j=1}^{p-1}\left[\frac{2(p-j)^2}{P}\right]\cdot\beta(j),$$

$$\beta(j)=\frac{\left\{\sum_{t=j+1}^{M}(X_t-\mu)^2(X_t-\mu)^2\right\}}{\left\{\left[\sum_{t-1}^{M}(X_t-\mu)^2\right]^2\right\}}.$$

Positive or negative serial correlation is suggestive if $VR(P)$ value is greater than or less than 1, respectively. This hypothesis is rejected when the probability of *VR* statistic is significant (< 0.05). In this study, the wild bootstrap *VR* statistics of Kim (2006) is implemented.

2.1.2. Nonparametric linear runs test

Runs test is a popular non-parametric technique used to test H_0 that elements of a series is *i.i.d.* Runs test does not require data to be normally distributed (Poshakwale, 1996). A run describes a series of identical signs, which are followed or preceded by different signs or by no signs at all (Siegel, 1956). Suppose exchange rate changes rise in sequence four times (+ + + +), it denotes a run. A new run starts counting when positive sequence is altered with a decrease or no change. Hence, this test discloses the turning point (mean or median), the number of runs that is lower than, greater than or equal to the mean/median (Urquhart, 2013). Denoting the number of positive and negative runs as *P* and *N*, respectively, the expected number of runs, denoted as ER is expressed as:

$$ER=\frac{2PN(P+N)}{P+N}+1. \quad (3)$$

The variance of runs can be expressed as follows:

$$\delta^2=\frac{2PN(2PN-P-N)}{(P+N)^2(P+N-1)}. \quad (4)$$

Using the standard *Z* statistics, *Ho* that exchange rate changes is independent can be rejected when the critical values are less than z-value. In this study, *Ho* of *i.i.d.* is rejected when probability of *Z* statistics is significant (< 0.05).

2.1.3. Nonlinear BDS test

BDS by Brock, Dechert and Scheinkman (1987; 1996) is a popular nonlinear predictability test. Patterson and Ashley (2000) identified BDS as the best performing tests in the league of nonlinear dependence tests. BDS uses the correlation dimension[1] of Grassberger and Procaccia (1983). Consider exchange rate return series x_t, $(t=1,2,\ldots,T)$, with *m*-history $x_t m=(x_t,x_{t-1},\ldots,x_{t-1+m})$, the correlation integral at consecutive point *m* can be expressed as:

$$C_{m,\varepsilon}=\frac{2}{T_m(T_m-1)}\sum_{m\le s}\sum_{\angle t\angle\le T}I\left(x_t^m,x_s^m;\varepsilon\right). \quad (5)$$

With $T_m=T-m+1$ and $I\left(x_t^m,x_s^m;\varepsilon\right)$ being an indicator function takes 1 if $|x_t-x_{t-1}|\le\varepsilon$ or 0 otherwise. The estimation of joint probability of independence of x_t is:

$$PR\left(|x_t-x_s|\angle\varepsilon,|x_t-x_{t-1}|\angle\varepsilon,\ldots,|x_{t-1+m}\angle x_{s-1+m}|\angle\varepsilon\right).$$

Brock et al. (1996) showed that:

$$W_{m.\varepsilon}=\sqrt{T}\frac{C_{m,\varepsilon}-C_{1,\varepsilon^m}}{S_{m,\varepsilon}}, \quad (6)$$

where C_{1,ε^m} is probability equaling $PR\left(|x_t-x_s|\angle\varepsilon\right)^m$, while $S_{m,\varepsilon}$ stands for standard deviation of $\sqrt{T}\left(C_{m,\varepsilon}-C_{1,\varepsilon^m}\right)$. $W_{m.\varepsilon}$ is BDS, which tests the H_0 that return series are *i.i.d.* for all windows. This hypothesis is rejected when p-value of BDS is significant at 5 percent, implying non-linear dependence or predictability. The BDS nonlinear test performs well when exchange rate changes are free of linear autocorrelation and heteroscedasticity (Urquhart, 2013). Consequently, BDS tests is performed on the standardized residuals of AR-GARCH (p, q).

The study executes rolling VR, runs and BDS tests and the hypothesis of *i.i.d.* is tested for each of the windows to determine how forex market efficiency varies over time. This study uses two-year window size by one-month step size in consistence with the existing AMH studies (Obalade, 2019). The first window is 1/January/1999-31/December/2000, while the last window is 1/August/2018-31-July/2020. Doing so, monthly measures of return predictabilities represented by *p*-values of linear (VR and runs) and nonlinear (BDS) predictability tests are generated and plotted on graphs to show behavior of forex market efficiency over time.

1 Correlation integral is the probability that any pair of points are within a given distance 'ε' apart in phase space.

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2.1.4. Regression model

AMH indicates that time-varying predictability is caused by changing market conditions. To test this hypothesis, this research modifies the model of Zhou and Lee (2013) and Obalade and Muzindutsi (2020a) in the selection of markets' condition indicators. The selected indicators include bull and bear conditions and financial crisis, while controlling for economic conditions using economic growth rate and inflation. Fabozzi and Francis (1977) define bull and bear markets by separating stock returns into Up and Down months when returns are positive and negative, respectively. In this context, a dummy is created for a bull market when the mean exchange rate return for a given window is positive. Similarly, a dummy is created for a bear market when the mean exchange rate return for a given window is negative. Furthermore, Kim et al. (2011) have identified 2007 global financial crises as one of the fundamental conditions influencing return predictability, hence the study creates a dummy for financial crisis that takes the value of 1 when t is any month between December 2007:12 and June 2009. The following regression model is specified to determine if the return predictability is caused by market conditions:

$$\begin{aligned} RP_t &= \alpha + \beta_1 UP + \beta_2 DW_t + \\ &+ \beta_3 \Delta GDP_t + \beta_4 \Delta CPI_t + \\ &+ \beta_5 GFC_t + \varepsilon_t, \end{aligned} \tag{7}$$

where RP – return predictability (*p*-values of *VR*, runs, and BDS); GDP – economic output growth rate, which is computed as percentage changes; CPI – inflation rate, computed as Consumer Price Index percentage changes; UP – dummy variable, which is 1 for a bull window, and 0 otherwise; DW – dummy variable, which is 1 for a bear window, and 0 otherwise; GFC – global financial crisis dummy variable.

2.2. Data and sample

This study examines the adaptive behavior in the South African foreign exchange (forex) market. It investigates the South African daily forex rate against the Chinese Yuan (CNY) and the US Dollar (USD) for a sample period of 21 years (January 1999– July 2020). Based on international trade statistics, China and the USA occupy the first and third positions, respectively, in the list of South African major trading partners (Santander, 2020), while daily frequency produces sufficient dataset for critical evaluation of changing efficiency. In addition, the sample period accounts for a major event such as the 2007/2008 global financial crisis. The daily ZAR /USD and ZAR/CNY are obtained from McGregor BFA.

The data used for the regression model (section 2.1.4) include GDP growth rate and the consumer price index, which are available on a monthly basis. As a result, this study generates return predictability (dependent variable) using a two-year window by one-month step size, which results in 236 windows of VR, Runs and BDS tests *P*-values over January 1999–July 2020 periods. This study conducts the regressions for monthly data following Zhou and Lee (2013).

3. RESULTS AND ANALYSES

A graphical plot of the windows' VR, BDS and runs tests *p*-values shows how linear and nonlinear dependences behave over time. Figure 1 presents the VR, runs, and BDS tests *p*-values for ZARUSD forex market over time, based on a 2-year window by 1-month step size. For VR test, all p-values are significant throughout the windows. This suggests strong linear predictability of returns and inefficiency of South African forex market. Runs test displays cyclical efficiency considering significant predictability/inefficiency during August 2002 – January2003, December 2005 – June 2006, October 2011 – December 2013 (as indicated by *p*-value < 5% below dotted line) and unpredictability/efficiency during other periods (as indicated by *p*-value > 5%). 5% *P*-value is demarcated by the dotted horizontal line.

The BDS p-values are significant during January 1999 – February 1999, April 2004 – January 2005, May 2011 – December 2012, suggesting nonlinear predictability of the exchange rate only during these periods. Since *p*-values are not significant in periods other than January 1999 – February 1999, April 2004 – January 2005, and May 2011 – December 2012, the nonlinear predictability is adaptive or cyclical. Generally, the ZAR/USD market is adaptive going by BDS and runs test results. It is noteworthy that the ZAR/USD market is unpredictable/efficient dur-

Source: Author's estimation (2020).

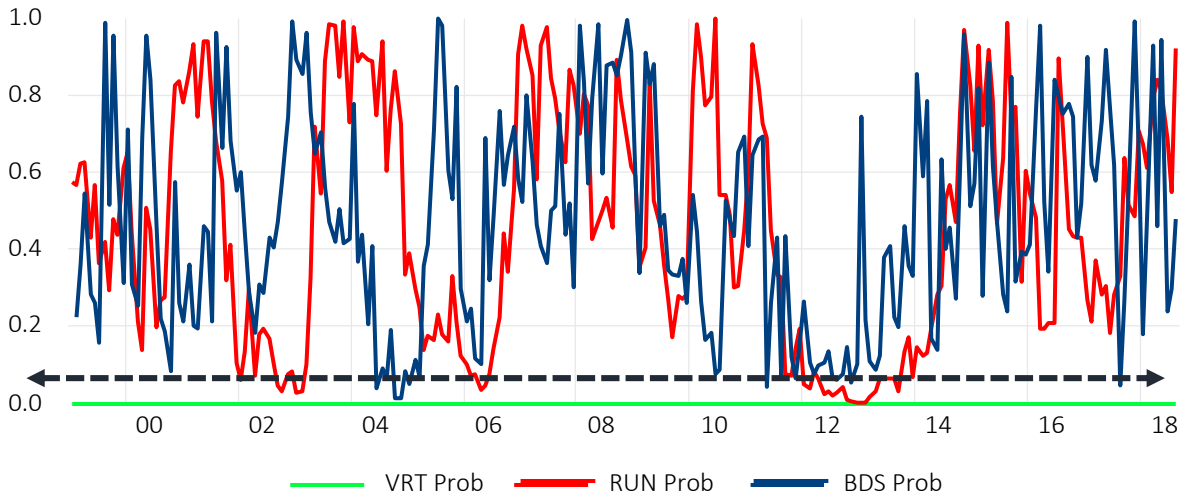

Figure 1. ZARUSD VR, runs and BDS *p*-values (2-year window, rolled by 1-month)

ing the 2007/2009 global financial crisis, since *p*-values are greater than 5%.

Figure 2 shows that ZAR/CNY VR test produces significant *p*-values throughout the windows, while BDS and runs tests produce bouts of significant and non-significant *p*-values for the ZAR/CNY. The VRT *p*-values for the entire period show evidence of strong inefficiency as they all lie below the dotted black line (0.05). As stated above, this means that over the entire period, the ZAR/CNY were predictable and dependent, thus the market was inefficient. The runs test p-values show that the ZAR/CNY are statistically significant and inefficient during August 2002 – March 2003, May–June 2006, September–October 2009 and January–March 2013, while other periods depict efficiency. The BDS p-values show that the ZAR/CNY series are statistically significant and inefficient during October 2000, June 2002, November 2004 – May 2005, November 2011 – February 2012 and March–April 2013, while other period depicts efficiency. As observed with ZAR/USD, all the tests except VR revealed that the ZAR/CNY market is adaptive, while the 2007/2009 financial crisis period is efficient and unpredictable. Despite its adaptive nature, it must be noted that the South African forex market measured by ZAR/USD and ZAR/CNY is efficient, albeit very few windows of predictability.

Subsequently, the study attempts to trace the episodic predictability to certain market conditions such as bull, bear, and the global financial crisis while controlling for the macroeconomic condition. The results of the regression analyses performed to achieve this objective are presented in Table 1 using *P*-values of the various linear[2] and nonlinear tests as dependent variables. The residual diagnostic tests were performed, and their *p*-values are reported[3].

Table 1. Regression results

Source: Author's estimation (2020).

Variables	VRT	RUNS	BDS
ZAR/USD			
BULL	180.3500***	–1.581009	–6.458511*
BEAR	182.0703***	–1.584048	–6.613536*
CPI	0.382399	–0.040896	–0.018538
GDP	–1.741522***	0.016756	0.070413**
GFC	1.363880	–0.001856	0.129659
Prob. Q-stat	0.659	0.352	0.231
B-Godfrey LM	0.7676	0.3316	0.5881
ARCH	0.9751	0.8980	0.8146
ZARCNY			
BULL	19.94655**	–6.962522	–3.630848
BEAR	19.90154**	–6.920620	–3.525563
CPI	–0.041481	–0.022312	0.004958
GDP	–0.177681**	0.074856	0.040792
GFC	0.071947	0.007107	0.112039
Prob. Q-stat	0.085	0.057	0.544
B-Godfrey LM	0.0002	0.5082	0.4660
ARCH	0000	0.5600	0.4583

Note: ***, **, and * indicate significance at 1, 5 and 10 percent, respectively.

2 Given that VR generated very small P-values (0.0000), absolute value of VRT t-statistics was used as a dependent variable for VRT-based regression. The use of t-statistics is consistent with Zhou and Lee (2013).

3 Heteroscedasticity and autocorrelation consistent (HAC) standard error was used for ZARCNY VRT and AUT regression.

http://dx.doi.org/10.21511/imfi.18(2).2021.31

Source: Author's estimation (2020).

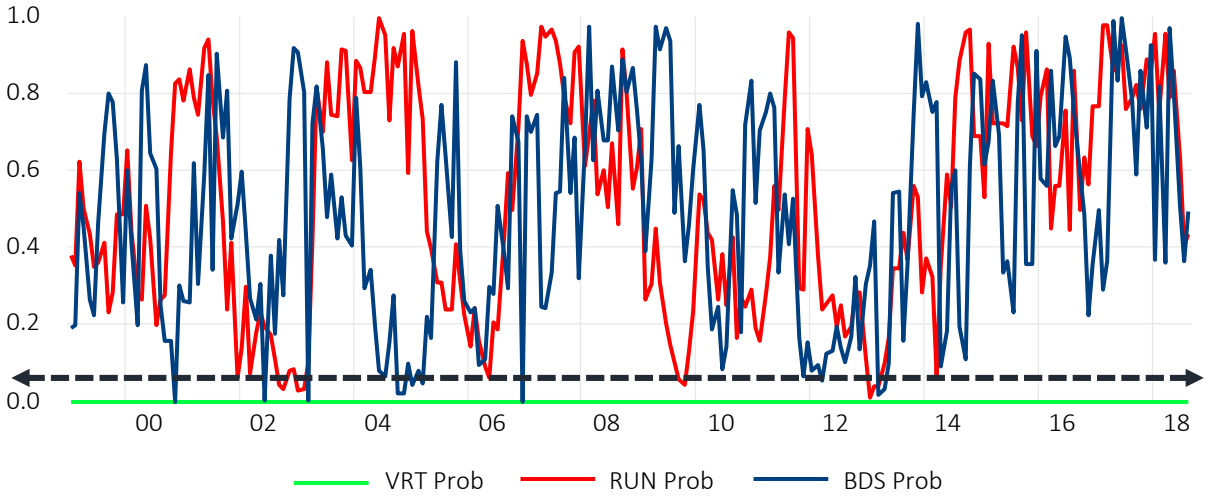

Figure 2. ZARCNY VR, runs and BDS p-values (2-year window, rolled by 1-month)

ZAR/USD regression results are presented in the first section of Table 1. From the VR-based regression, both the bull and bear conditions suggest high linear predictability, but the latter indicates higher predictability than former, given its more positive coefficients. The global financial crisis and consumer price index exert no effect on linear predictability, while the GDP growth accounts for low linear predictability. The runs test-based regression suggests that none of the bull, bear, global financial crisis and economic conditions is responsible for the non-parametric linear predictability as the variables produce coefficients that are not statistically significant at the 5% level of significance. The BDS regression output suggests that high non-linear predictability can be found in the bull and bear period, but the exchange rate is more predictable in the bear period, considering its more negative coefficient. This high non-linear predictability in the bull and bear period must be treated with caution, considering that they are only statistically significant at 10%. The result shows that the GDP growth rate accounts for low non-linear predictability at 5%.

ZAR/CNY regression results are presented in the second section of Table 1. Like the ZAR/USD VR regression, both the bull and bear conditions are connected to high linear predictability. However, the VR linear predictability is higher during the bull than the bear condition. In addition, the global financial crisis and consumer price index remain significant, while GDP growth rate accounts for low predictability. On the other hand, non-parametric runs test- and nonlinear BDS test-based regression outputs reveal that the non-parametric linear predictability and nonlinear predictability of ZAR/CNY, respectively, cannot be traced to the bull, bear, global financial crisis and economic conditions, since coefficients are not statistically significant at the 5% level of significance.

4. DISCUSSION

This article investigated the return predictability in the emerging African forex market by evaluating South African Rand against her major trading partners, namely the US Dollar (USD) and the Chinese Yuan (CNY), within the AMH framework. The study applies the linear and nonlinear tests to daily exchange rates from January 1999 to July 2020 and uses a rolling window approach to generate *p*-values for each test as measures of the degree of return predictability. The study finds mixed results. On the one hand, South Africa's foreign exchange market is weak-form inefficient throughout the monthly rolling estimations based on parametric linear VR tests. This is not consistent with AMH of Lo (2004, 2005). On the other hand, the research findings suggest that South African foreign exchange market is deemed weak-form efficient with very few periods of inefficiency based on the non-parametric runs test and nonlinear BDS test. This provides little support for AMH.

It is usually difficult to draw conclusion when series of tests yield conflicting results. Seetharam (2016), however, provides criteria for decision making in such situations, which is "to select one being an improvement over the other or argue the theoretical merits of each test before selecting the more appropriate one" (p. 307). Taking this argument into consideration, runs test being a non-parametric, and BDS test being a nonlinear test are superior to the variance ratio test. Consequently, this study finds that the South African forex market is adaptively efficient, based on the runs and BDS tests. This is consistent with Charles et al. (2012) who found that UK, Australian, Swiss, Canadian and Japanese forex markets are unpredictable for most periods, albeit a few episodes of inefficiency.

The regression results show that the global financial crisis poses an insignificant effect on the predictability of ZAR/USD and ZAR/CNY exchange rate. This finding is consistent with the finding of Zhou and Lee (2011) in the US REIT market but contradicts Charles et al. (2012) who found inefficiency in UK, Australian, Swiss, Canadian and Japanese forex markets during recession. This study finds that economic growth rate is the primary driver of forex market efficiency, while inflation has no significant explanation for forex market efficiency. These findings contradict the position of Zhou and Lee (2011) who showed that inflation spurs US REIT efficiency, while economic output is not essential.

ZAR/USD is more linearly predictable in the bear regime, while ZAR/CNY is more linearly predictable in the bull regime. This is in consonance with the AMH, however, none of the market condition studied significantly affects non-parametric linear predictability (runs test) and nonlinear predictability (BDS) of both ZAR/USD and ZAR/CNY, albeit GDP in the latter. Based on the argument for nonparametric and nonlinearity tests, it is safe to conclude that the South African forex market is not significantly influenced by market conditions examined in this study. This suggests that it can be difficult to take advantage of the few periods of predictability in the South African forex market by observing the studied market conditions.

CONCLUSION

The aim of this study is to examine the implications of AMH for an emerging foreign exchange market by investigating whether the South African foreign exchange market exhibits cyclical efficiency, as well as exploring the possibility of cyclical efficiency being dependent on market conditions. The study finds that the South African foreign exchange market is deemed weak-form efficient with very few episodes of inefficiency. In addition, the findings suggest that while financial crisis, inflation and bull and bear conditions are not significantly associated with efficiency, GDP does. Overall, the study concludes that the foreign exchange market is adaptive and, in most cases, efficient. Furthermore, the degree of economic development stimulates the efficiency of the foreign exchange market. The study adds to the thin AMH literature on forex markets in the emerging markets. The findings of this study are limited to the South African forex market and cannot be generalized to other emerging markets. Therefore, there is a need for further research on foreign exchanges in other emerging markets. There are also researchable gaps in how other market conditions and unanticipated events, such as the COVID-19 pandemic, affect the performance of foreign exchange markets.

AUTHOR CONTRIBUTIONS

Conceptualization: Adefemi A. Obalade.
Data curation: Adefemi A. Obalade.
Formal analysis: Adefemi A. Obalade.
Funding acquisition: Adefemi A. Obalade.
Investigation: Adefemi A. Obalade.
Methodology: Adefemi A. Obalade.
Project administration: Adefemi A. Obalade.

http://dx.doi.org/10.21511/imfi.18(2).2021.31

Resources: Adefemi A. Obalade.
Software: Adefemi A. Obalade.
Supervision: Adefemi A. Obalade.
Validation: Adefemi A. Obalade.
Visualization: Adefemi A. Obalade.
Writing – original draft: Adefemi A. Obalade.
Writing – review & editing: Adefemi A. Obalade.

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