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Financial dollarization and exchange rate volatility in Ghana

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Abstract

This paper provides evidence on the effects of dollarization on the volatility of nominal and real Ghana cedi/U.S. dollar exchange rate for the period January 1990 to March 2015 using exponential Generalized Autoregressive Conditional Heteroskedasticity (E-GARCH) model. The results provide evidence of a positive impact of dollarization on the volatility of nominal bilateral GHS/USD exchange rates. This suggests that as the demand for U.S. dollars becomes more extensive, the cedi/dollar exchange rate becomes more volatile and unstable. The asymmetry parameter implies that a positive shock in the underlying error term has the same effect as a negative shock of the same magnitude on the volatility function of the bilateral exchange rates. Addressing the increasing dollarization of the Ghanaian economy would be an appropriate policy to stabilise the cedi.

Keywords: *Dollarization, exchange rate, volatility, exponential GARCH, Ghana*

JEL: E41, F3, O24

1. Introduction

Major fluctuations associated with exchange rates continue to be a concern for academics, financial analysts, and policy makers due to its importance for macroeconomic management. Such developments in the foreign exchange market hold implications for the welfare of households, firms' profitability, price stability, and the susceptibility of the general economy (Lizondo and Montiel, 1989; Pindyck, 1982; Towbin and Weber, 2011; Setzer, 2006). The implications of exchange rate movements for security valuation, investment analysis, profitability, and risk management are enormous. In addition, exchange rate dynamics play a significant role in international trade and the degree of external sector competitiveness of the economy.

Depreciation of the domestic currency has some implications for the path of fiscal position and the trade balance. Rapid depreciation increases the burden of servicing external debt, necessitating issuance of new debt, which further increases the burden of future debt-servicing (Tille, 2003). Also, for certain values of physical quantities (volume) of imports and exports, depreciation of the domestic currency increases the value of imports measured in domestic currency units over exports. If import demand and export supply elasticity are sufficiently low, then this effect is likely to dominate the demand and switching effect that currency depreciation is expected to cause in order to restore equilibrium in the trade position (Giovannini, 1988; Chowdhury, 1993; McKenzie and Brooks, 1997; Dell'Ariccia, 1999; McKenzie, 1999).

A major challenge in Ghana since the adoption of flexible exchange rate regime in 1986 has been the persistent depreciation of the Ghanaian cedi against most of the major international currencies. The cedi, which at the time of the most recent redenomination in July 2007 was exchanged at less than GH¢0.95 for US$1.00 has experienced a continuous downward trend, reaching GH¢3.52/US$1.00 in 2014. Over the first nine months of 2014, the inter-bank exchange rate market recorded a depreciation of 31.19 per cent against the US dollar, compared to a depreciation of 4.12 per cent recorded during the corresponding period in 2013 (Terkper, 2014). According to Terkper (2014), the Ghana cedi also depreciated by 29.32 per cent and 23.63 per cent against the pound sterling and the Euro, respectively in the same period, and that compared with 16.73 per cent and 20.05 per cent depreciations respectively, against those currencies at the end of 2013, with higher depreciation in the black market.

This rapid trend of depreciation of the cedi has attracted a lot of concern over the past few years. The negative implications of the fragile currency forced the Bank of Ghana to implement some foreign exchange rules in February 2014 in a bid to avert further deterioration of the currency. One of the arguments put forward by the Bank of Ghana for the implementation of foreign exchange restrictions was the suspicion that the rising trend of dollarization in the economy was the cause of the free fall of the Ghanaian cedi. There is certainly some theoretical underpinnings and empirical evidence in the literature that dollarization leads to exchange rate volatility. Unfortunately, however, the directives had limited success which was partly attributed to the limited empirical research undertaken on Ghana. The debate on the relationship between dollarization and exchange rate volatility has not settled due in part to the differing evidence which has usually been based on the structure of an economy, the type of exchange rate regime, its monetary policy, and the extent of dollarization in that economy.

The impact of dollarization on macroeconomic fundamentals can depend on the form of dollarization that exists in a given economy, especially when comparing *full* dollarization and *partial* dollarization. For monetary zones such as the Euro area,

there is evidence of a decline in exchange rate volatility by Schnabl (2007), Bartram and Karolyi (2006), and Clark et al. (2004). Savvides (1996) also shows that exchange rate volatility is loweri n the Franc zone than non-Franc zone. Some studies such as Akofio-Sowah (2009), Barrell et al. (2009), Schnabl (2007), Lange and Sauer (2005), Bogetic (2000), Savvides (1996) and others; have also shown that full dollarization minimizes the volatility of exchange rates particularly in Latin American countries. However, evidence based on partially dollarized countries by Mengesha and Holmes (2013) for Eritrea, Yinusa (2008) for Nigeria, Akcay et al. (1997) for Turkey and Calvo and Carlos (1996) suggest that an increase in dollarization increases exchange rate volatility. It has been argued that dollarization is the main cause of instability in flexible exchange rates and has been a significant destabilizing force in the world economy (see, for instance, Willett & Banaian, 1996; McKinnon, 1993; 1982; Bofinger, 1991). According to McKinnon (1996), the concept of international dollarization is useful for explaining why floating exchange rates have been so volatile.

This study empirically explores the effects of dollarization on exchange rate volatility in Ghana over the floating exchange rate regime using exponential GARCH (E-GARCH) modelling approach. Although the issue of dollarization has usually been linked to exchange rate volatility in developing countries practising floating exchange rates, empirical evidence in Africa is still limited. The subject is expected to be more engendering in Africa considering the extent of openness, the rising trend of foreign currency demand, and the rate at which exchange rate instability has strangled most productive sectors of import dependent economies in the continent. It is an important research endeavour since broadening our understanding of the relationship between dollarization and exchange rate fluctuations would be very useful for monetary and fiscal policymaking, academic research, risk management practices, and investment analysis.

The E-GARCH model is robust in capturing the effects of dollarization in both the mean and the time-varying variance of exchange rate depreciation. Consistent with the behaviour of the exchange rate process exhibiting excess kurtosis, the asymmetry is captured by assuming a flexible structure for the underlying data generating process in the model (see, Nelson, 1991). The results provide evidence of a positive effect of dollarization on exchange rate volatility. This suggests that as the demand for foreign currencies becomes more extensive, the cedi/dollar exchange rate becomes more volatile. Further, there is leverage effect which means that a positive shock in the underlying error term has the same effect as a negative shock of the same magnitude on the volatility function.

The remainder of the paper is structured as follows: section 2 is a historical re-

view of exchange rate policies in Ghana. Section 3 is a description of the data and the methodology employed. Section 4 is the presentation of the results and analysis and the last section is the conclusion and policy prescriptions for ensuring stability of exchange rates in a dollarized environment.

2. A historical review of exchange rate policies in Ghana[1]

Although Ghana inherited huge foreign exchange reserves from the colonial era, the massive industrialisation and modernisation programme implemented by the government in the early 1960s depleted the country's external reserves and Ghana began to see the signs of foreign exchange constraints (see, Sowa and Acquaye, 1998). The first Exchange Control Act was passed in 1965 to regulate the foreign exchange market. The colonial economy prior to 1983 maintained a controlled fixed exchange rate regime characterised by surrender laws, foreign exchange rationing and currency inconvertibility (see Mumuni and Owusu-Afriyie, 2004 and Gyimah-Brempong, 1992). Under this regime, exporters were required by law to surrender all their foreign exchange earnings to the Bank of Ghana (BoG) at the fixed official rate, and the purchase of foreign exchange for capital transaction was illegal.

The move from fixed exchange rate system to flexible exchange rates (or market-determined) system has seen a number of episodes. Major features that characterised Ghana's foreign exchange market in the years before the Economic Recovery Programme (ERP) included overvalued official exchange rate, a flourishing black market, and the allocation of official foreign exchange based on import licensing arrangements. With the launching of the Structural Adjustment Programme (SAP) and the ERP from 1983 to 1986, the government made a series of devaluations of the cedi. In an attempt to remove these imbalances in the system and gradually shift to flexible regimes, the cedi was mostly devalued to realign the domestic currency to other currencies, boost exports, and reduce the deficit in the balance of payments. In particular, the cedi was devalued in stages from ¢2.75: US$1.00 in 1983 to ¢90.00: US$1.00 by the third quarter of 1986. The attempt to encourage traditional exports brought about an exchange rate policy characterized by a scheme of *bonuses* on exports (exchange receipts) and *surcharges* on imports (exchange payments) between April and October of 1983.

In September 1986, an auction market system was introduced which resulted in a two-tiered exchange rate system. There was a fixed exchange rate system (called window 1 or first-tier), and a flexible exchange rate system (called window 2). The Bank of Ghana was responsible for setting the rates for window 1, which was intended for official transactions. Traditional exports, imports of crude oil, essential raw

[1] *For a detailed history of exchange rate reforms in Ghana, see Dordunoo (1994).*

materials, basic foodstuffs, and capital goods were also based on the first-tier rate. The window 2 rate was basically applied to non-official foreign exchange transactions, non-traditional exports and all other imports. The rate for the second-tier was determined through a weekly auction conducted by the Bank of Ghana. This indicates that, with the exception of foreign exchange earnings from exports of cocoa, residual oil, imports of petroleum products, essential drugs, and service payments on government debt contracted before 1986 that followed the fixed rate, all foreign transactions that went through the official banking system were subjected to the auction rate.

In February 1987, the two windows were unified and the auction market was applied to all officially-funded transactions. The dual-retail auction was adopted and was based on the marginal pricing mechanism which required successful bidders to pay the marginal price. A second auction - the Dutch auction - was introduced and under it, successful bidders were supposed to pay the bid price. At the same time, the incorporation of customer goods into the auction market was announced, and by 1988 it was fully implemented. In the latter part of 1988, a policy for the establishment of privately-owned foreign exchange bureaux was introduced in an attempt to absorb the parallel market into the legal foreign exchange market.

In March 1990, the wholesale auction was introduced to replace the weekly retail auction. Under this system, a composite exchange rate system was operated, namely the inter-bank and a wholesale system. Under the wholesale system, eligible Forex bureaux and authorised dealer banks were allowed to purchase foreign exchange from the Bank of Ghana for sale to their end-user customers and also to meet their own foreign exchange needs. The merger of the auction and bureaux rates narrowed the difference between the official and parallel market rates to less than 10%. This attempt accelerated the elimination of incentives for trade malpractices that the existence of the two rates provided. Since then, the flexible exchange rate policy has continued to be the exchange policy in Ghana in a more liberalized market mechanism. The free-market adjustment mechanism has allowed prices to be set through the interplay of market (demand and supply) forces, and promoted export-oriented growth. This has created greater incentives for export led activities, the switch of demand from imports to domestic products and ensures that the exchange rate is set at a competitive level for exports.

The transition period – 1983 to 1992 – required the fulfilment of some operational, institutional and technical requirements including the attainment of fiscal discipline, development of a better regulated and supervised financial sector, as well as a deeper money market with market determined interest rates (Sanusi, 2010; Duttagupta et al. 2004). Successful exit from a peg requires (i) a sufficiently deep and liquid foreign exchange market, (ii) formulating an intervention policy consistent with the new re-

gime, (iii) establishing an alternative nominal anchor in the context of the new policy framework, (iv) building the capacity of market participants to manage exchange rate risks and supervisory capacity to regulate and monitor them (see Agenor, 2004; and Duttagupta et al. 2004).

It was also believed that, flexible exchange rates would make adjustments somehow automatic and enhance external competitiveness of the economy. Again, a flexible exchange rate regime was meant to eliminate the need for devaluations. The result of all these policy reforms is that the nominal exchange rate depreciated from 2.75/$ in April 1983 to about 2,250/$ by December 1997, and further to 9,130.42/$ by December 2005. Over the period of implementing the above exchange rate policies, the parallel market premium, which reached 1,718.18% in 1981, was almost completely eradicated to 1.97% by 1997.

3. Data and Methodology

3.1 Model Specification

It has become common practice in a large body of the finance literature that attempt to model volatility patterns of financial and economic time series to make use of GARCH models as proposed by Engel (1982), Bollerslev (1986) and Taylor (1986) or one of its variants such as the integrated GARCH (IGARCH) originally described in Engle and Bollerslev (1986), exponential GARCH (EGARCH) by Nelson (1991), power ARCH (PARCH) generalized in Ding, Granger and Engle (1993), threshold GARCH (TGARCH) proposed by Zakoian (1994) and Glosten, Jagannathan and Runkle (1993), and component GARCH (CGARCH), among others. These techniques are specifically designed to model and forecast conditional variances. The variance of the dependent variable is modelled as a function of past values of the dependent variable and independent or exogenous variables.

The EGARCH model allows for asymmetric shocks to the volatility in which the variance responds exponentially to shocks and forecasts of conditional variance are guaranteed to be nonnegative. Akcay et al. (1997) and Mengesha and Holmes (2013) have adopted the EGARCH-M (1, 1) to model exchange rate volatility in Turkey and Eritrea respectively, by accounting for the effect of currency substitution or currency substitution in the conditional variance equation. Both studies include the ARCH-M term as suggested by Engle, Lilien, and Robbins (1987). The ARCH-M model is often used in financial applications where the expected return on an asset is related to the expected asset risk. The estimated coefficient on the expected risk is a measure of the risk-return trade-off.

According to Akcay et al., (1997), the model is specified as follows:

$$x_t = \alpha_0 + \alpha_1 x_{t-1} + \alpha_2 x_{t-2} + \ldots\ldots\ldots + \alpha_p x_{1-p} + \delta \ln h_t + \mu_t \quad (1)$$

$$\mu_t = \sqrt{h_t} \times v_t$$

$$\ln h_t = \gamma + \psi z_t + \sum_{i=1}^{r} \beta_i \ln h_{t-1} + \sum_{j=1}^{m} \theta_j \left\{ \left| v_{t-j} \right| - E\left| v_{t-j} \right| + \aleph v_{i-j} \right\} \quad (2)$$

where x_t is the exchange rate deprecation and z_t is a proxy of dollarization. μ_t is the random error term and v_t is independent, identical distribution (i.i.d.) with zero mean and unit variance. $\alpha_0 \ldots\ldots \alpha_p, \delta, \gamma, \psi, \beta_i, \theta_j, E, \aleph$ are the parameters to be estimated from the model. h_{t-1} is the logarithm of conditional variance at time *t*-1. $|v_{t-j}|$ stands for the absolute value of the residuals of the previous period. A modification on the above model has been made to suit this study. Instead of using exchange rate depreciation as in the model above, the return on exchange rate has been used.

Slight modification of this model was made by changing the independent variable of the mean equation and also changing the variance equation. Specifically, the return on the exchange rate of the previous years was excluded from the mean equation and log of the conditional variance alone has been included. In the variance equation the presentation of the error term has also been changed. The modifications of the equations are shown below.

$$\varepsilon_t = \alpha + \phi \ln \sigma_t^2 + \mu_t \quad (3)$$

$$\ln \sigma_t^2 = \omega + \delta h_t + \varphi \frac{|u_{t-1}|}{\sqrt{\sigma_{t-1}^2}} + \gamma \frac{u_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \psi \ln \sigma_{t-1}^2 \quad (4)$$

where ε_t is the return on exchange rate (e) calculated as $\ln e_t - \ln e_{t-1}$. $\ln \sigma^2_t$ is the natural logarithm of the conditional variance, u_t is a random error term, h_t is a variable for the hard currency index used as a measurement of dollarization. The structure of the error term is assumed to have a generalized error distribution; $\alpha, \phi, \omega, \delta, \varphi, \gamma, \psi$ are the parameters to be estimated where α captures the conditional mean. γ captures the asymmetric effects of the positive and negative shocks on exchange rate volatility. If γ is statistically significant and negative, it indicates that a positive shock will have different effect as the negative shock of the same level in the exchange rate volatility. If it is statistically insignificant, however, a positive shock will have the same effect as a negative shock in the exchange rate volatility.

The parameter φ determines the size effect of the shock on volatility. The impact of the lagged conditional variance is captured by ψ. δ determines the effect of dollarization on exchange rate volatility. If the parameter δ is positive and statistical-

ly significant, it would imply that an increase in dollarization increases the exchange rate volatility in the economy. If it is negative and statistically significant, however, it would imply that an increase in dollarization decreases exchange rate volatility in the economy. On the other hand, if it is negative or positive yet statistically insignificant, then it indicates that dollarization has no effect on exchange rate volatility in the economy. The effect of the conditional variance on exchange rate returns is determined by *Ø*.

3.2 Data description and sources

Monthly data on exchange rate (defined as national currency per U.S. dollar) from January 1990 to March 2015. The period under consideration is assumed to cover flexible exchange rate system in Ghana. The real exchange rate is determined by deflating the nominal exchange rates based on the purchasing power parity condition as follows:

$$q_t = e_t + p_t^f - p_t^d \tag{5}$$

where q_t, e_t, p_t^f and p_t^d are the real exchange rate, nominal exchange rate, foreign price and domestic price levels respectively at time t. All the variables are defined in logarithm form. The consumer price index in Ghana and that of the U.S. (for all cities) are used to generate the price levels. The measure of dollarization follows the usual definition as the monthly foreign currency deposits in the banking sector as a share of broad money supply. Since the foreign currency deposit is measured in U.S. dollars, the figures have been multiplied by the nominal exchange rate to make the equivalent comparable to the monetary aggregate which is measured in domestic currency. With the exception of foreign currency data which was collected from the Research Department of the Bank of Ghana, the rest were extracted from the International Financial Statistics database (International Monetary Fund, 2015).

4. Empirical Results

4.1 Time series properties

We begin the analysis by exploring the properties of the data under consideration. The descriptive (summary) statistics indicate that both the nominal and real exchange rates have positive mean returns. The standard deviation is relatively higher for the nominal exchange rate in levels. In terms of distributional properties, both nominal and real exchange rates are positively skewed, with positive kurtosis in excess of the threshold of 3. This implies that the returns have fatter tails as compared to a normally distributed variable. The Jarque-Bera (JB) test rejects the normality assumption for the returns of both nominal and real exchange rates. The departure from this normality assumption suggests that there is a possibility of dependence in the data generating process (d.g.p). The LBQ also rejects the null hypothesis that all

autocorrelations up to the 12th lag are jointly zero. Both tests give clues to second moment dependence. These are presented in **Table 1**.

Table 2 is the results of tests for integration and stationary properties using the ADF, PP and KPSS tests. Both ADF and PP have a null hypothesis of unit root, whereas the KPSS test has a null of a stationary d.g.p. We find that the returns of both the nominal and real series are integrated of order 0. This means that the returns series follow a mean-reverting process as can be deduced from the graphs in **Figure 1**.

Table 1: Descriptive statistics of levels and first differences

	levels		*returns*	
	nominal	*Real*	*nominal*	*real*
Mean	-0.83	-0.36	0.12	0.00
Std. Dev.	1.34	0.25	0.02	0.03
Skewness	-0.57	-0.06	2.35	1.43
Kurtosis	2.07	2.44	9.77	9.66
Jarque-Bera	27.43*** [0.00]	4.14 [0.13]	855.06*** [0.00]	660.47*** [0.00]
Ljung-Box Q (12)	3220.90*** [0.00]	2597.5*** [0.00]	323.96*** [0.00]	149.28*** [0.00]

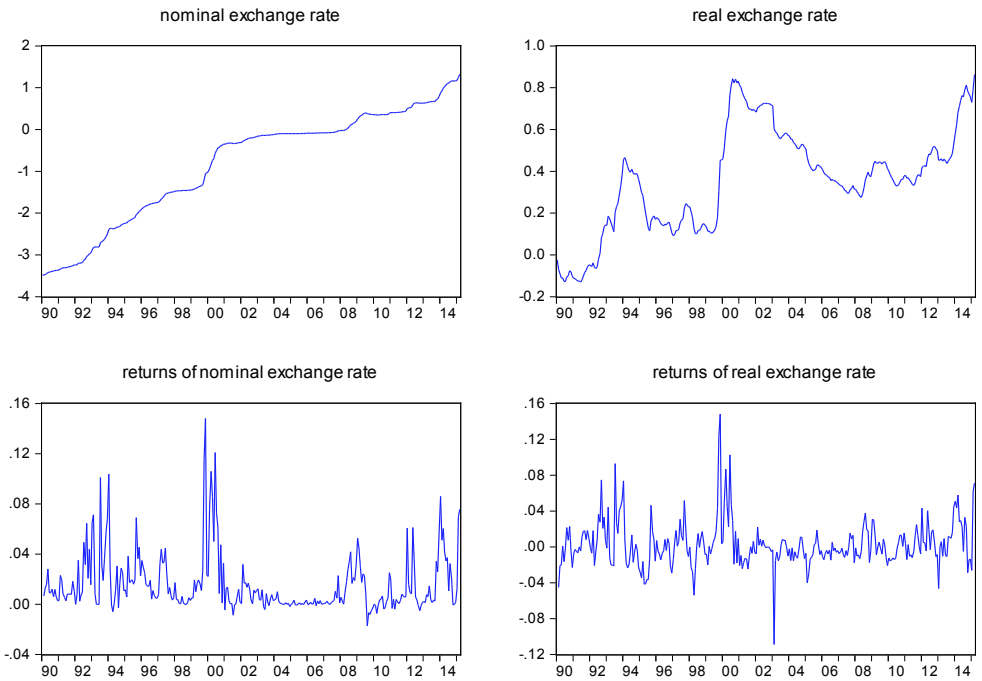
Note: *Prob for JB and LBQ tests are reported in parenthesis. *** indicate rejection at the 1% level*

Table 2: Unit root and stationary tests

Test	ADF		PP		KPSS	
	levels with intercept	levels with trend	levels with intercept	levels with trend	levels with tend	levels without trend
Levels of series						
nominal exchange rate	-0.89 [0.79]	-1.96 [0.62]	-1.36 [0.60]	-1.52 [0.82]	2.00***	0.45***
real exchange rate	-1.39 [0.59]	-1.91 [0.65]	-1.39 [0.59]	1.96 [0.62]	0.92***	0.22***
dollarization	-4.70 [0.00]	-4.24 [0.00]	-7.19 [0.00]	-7.44 [0.00]	1.08***	0.36***
Returns						
nominal exchange rate	-4.23 [0.00]	-4.22 [0.00]	-8.95 [0.00]	-8.91*** [0.00]	0.24	0.11
real exchange rate	-9.42*** [0.00]	-9.40*** [0.00]	-9.67*** [0.00]	-9.66*** [0.00]	0.08	0.08
dollarization	-9.26*** [0.00]	-9.52*** [0.00]	-21.91*** [0.00]	-22.78*** [0.00]	0.88***	0.27**

*Note: *, **, and *** indicate rejection at the 10%, 5% and 1% significance levels. Critical values for ADF & PP are: -3.45 (1%) and -2.87 (5%) with intercept; and -3.99 (1%) and -3.43 (5%) with intercept & trend. The critical values for KPSS are 0.46 (5%) with intercept; and 0.15 (5%) with intercept & trend.*

Figure 1: Graph of exchange rate and returns



4.2 Estimates of GARCH models

The EGARCH estimates are presented in **Table 3**. The estimate for the conditional variance (*f*) is positive and significant at least at the 5% level for the bilateral nominal exchange rates. The positive sign suggests that an increase in the conditional variance will increase the returns (depreciation) series itself. Consistent with the findings of Akcay et al (1997) and Mengesha and Holmes (2013), it indicates that the more volatile the exchange rate, the weaker the value of the domestic currency. In the case of the effective exchange rates, the parameter is positive, but not statistically significant to influence the direction of movement.

In the case of the variance equation, the estimate for d is both positive and statistically significant for the nominal bilateral exchange rates, but not for the real and effective exchange rates. This result suggests that an increased reliance on foreign currency leads to a high volatile nominal bilateral exchange rates. This finding is consistent with the theoretical predictions of Girton and Roper (1981) and empirical findings of the majority of the literature on the impact of partial dollarization on exchange rate volatility.

4.2.1 Persistence (ψ)

The parameter ψ is used to capture the impact of the lagged conditional variance. It is a measure of persistence or *long memory* in the variance. According to the estimates, it is positive and statistically significant throughout although with marginal differences in magnitudes. The estimates are large and close to 1, suggesting that the variance moves slowly through time. As a measure of persistence it implies that a movement in the conditional variance away from its long-run mean lasts a long time. This evidence of long memory indicates that the volatility is mean-reverting, albeit it possesses a hyperbolic decay characteristic which takes a long time to establish equilibrium. The estimate for the real exchange rate is slightly lower, although closer to 1 than 0.

4.2.2 Leverage effect (γ)

A stylized fact in financial markets is that a downward movement is usually followed by higher volatility. This feature which was first suggested by Black (1976) for stock returns claims that price movements are negatively correlated with volatility such that predictable volatility is higher after negative shocks than after positive shocks of the same magnitude. Black (1976) attributed asymmetry to leverage effects. The feedback hypothesis is also applied whereby in the case of foreign exchange market, a shock which increases the volatility of the market increases the risk of holding the currency (Longmore and Robinson, 2004).[2]

Our estimates of γ does not support this notable characteristic of equity markets for the bilateral exchange rates. For the bilateral cedi/dollar exchange rates, there is evidence of symmetric volatility, such that past positive and negative shocks of the same magnitude have similar effects on future volatility. This is consistent with some literature on foreign exchange markets (for example, Laurent, Rombouts, and Violante, 2011; Hansen and Lunde, 2005; Andersen, Bollerslev, Diebold, and Labys, 2001; Diebold and Nerlove, 1989). Bollerslev, Chou and Kroner (1992) conclude after reviewing a large body of empirical evidence as follows: "*whereas stock returns have been found to exhibit some degree of asymmetry in their conditional variances, the two-sided nature of foreign exchange markets makes such asymmetries less likely*" (p. 38). Although, some empirical studies do find evidence of asymmetry for some exchange rates (see Oh and Lee, 2004 and McKenzie and Mitchell, 2002), others such as Andersen et al. (2001), Diebold and Nerlove (1989), Hsieh (1988), and Taylor (1986) among others, support the claim that exchange rates exhibit symmetric features in the volatility dynamics. On the other hand, past positive and negative shocks of the same magnitude have disparate effects on future volatility for the effective exchange rates.

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[2] *Empirical evidence on leverage effects can be found in Nelson (1991), Gallant, Rossi and Tauchen (1992, 1993), Campbell and Kyle (1993) and Engle and Ng (1993).*

4.2.3 Residual Diagnostics and robustness checks

To check the adequacy of the model and ensure that it is well-specified, we report the Ljung-Box Q statistics on the squared standardized residuals of the estimated EGARCH-M model in Table 3. The results establish that the specification of the variance equation is correctly done since all *Q*-statistics are not significant. This indicates that there is no ARCH remaining in the variance equation. The ARCH LM test based on Lagrange multiplier tests confirm that there is no ARCH left in the standardized residuals.

Table 3: Results of E-GARCH Estimation & Diagnostics

Parameters	Nominal exchange rate	Real exchange rate	Nominal effective exchange rate	Real effective exchange rate
α	-2.78*** [0.00]	4.63 [0.25]	-27.87 [0.17]	-23.77 [0.15]
ϕ	0.00*** [0.00]	-0.00* [0.07]	0.00[0.67]	0.01 [0.16]
Lag1	0.59*** [0.00]	0.43*** [0.00]	0.36 [0.00]	0.31 [0.00]
Lag 2	0.15*** [0.00]	na	-0.12 [0.08]	-0.08 [0.22]
ω	-0.48*** [0.00]	-0.88** [0.02]	-1.77 [0.01]	-2.71 [0.00]
φ	0.02 [0.70]	0.19** [0.02]	0.11 [0.21]	0.21 [0.07]
γ	0.61*** [0.00]	0.12** [0.03]	-0.14 [0.02]	-0.15 [0.04]
Ψ	0.94*** [0.00]	0.92*** [0.00]	0.80 [0.00]	0.69 [0.00]
δ	0.12*** [0.00]	-0.06 [0.26]	-0.08 [0.23]	-0.12 [0.21]
GED Parameter	0.73 [0.00]	0.90 [0.00]	1.40 [0.00]	1.36 [0.00]
DW	1.6310	1.8474	1.8921	2.0574
AIC	-6.0783	-5.2438	-4.8954	-4.7159
SBC	-5.9549	-5.1330	-4.7720	-4.5925
HQC	-6.0290	-5.1995	-4.8460	-4.6665
LL	921.75	798.20	744.32	717.39
ARCH (12)	0.08 [1.00]	0.14 [1.00]	0.12 [0.73]	0.55 [0.88]
Q^2 (12)	1.12 [1.00]	1.83 [1.00]	9.92 [0.62]	7.29 [0.84]
Q^2 (24)	12.59 [0.97]	4.21 [1.00]	20.33 [0.68]	11.08 [0.99]
Q^2 (36)	18.18 [0.99]	5.62 [1.00]	25.62 [0.99]	21.32 [0.98]

*Note: *, ** and *** indicate significance at 10%, 5% and 1% levels respectively. Probabilities are in parenthesis. LL is log likelihood; DW is Durbin Watson test statistics; AIC, SBC, and HQC are Akaike, Schwarz, and Hannan-Quinn Information Criteria; ARCH is ARCH test for heteroskedasticity.*

5. Conclusion and policy recommendations

This paper has considered the role of dollarization in the high variability of exchange rates experienced in Ghana since the adoption of the flexible exchange rate regime as part of the economic reforms in the 1980s. The study fills important gaps and makes a contribution to the limited literature on the subject in Africa by specifying a model that accounts for conditional heteroscedasticity, persistence, and asymmetry in the volatility process of the foreign exchange market.

The results point out important stylized facts such as symmetric, leptokurtic and persistence behaviour in the dynamics of nominal and real exchange rates. Also, we find that the more volatile the cedi/dollar exchange rate, the weaker the value of the nominal cedi/dollar exchange rate becomes. This implies that the volatile behaviour of the exchange rate makes the cedi weaker, which also leads to loss of confidence in the domestic currency as a store of value, as a unit of account, and eventually as a means of settlement. On the other hand, a more stable exchange rate strengthens the cedi, and therefore its credibility is enhanced. On the effects of dollarization on exchange rate instability, there is evidence that volatility increases with increasing trend of dollarization in the case of nominal bilateral exchange rates. The implication is that the increased demand for, and use of foreign currency in the Ghanaian economy exerts downward pressure on the domestic currency which invariably propagates further depreciation of the cedi.

The findings support that a de-dollarization strategy is appropriate in the fight against the volatile trend of the currency. However, it is recommended that monetary authorities should employ market-based policies rather than the counter-productive forced de-dollarization strategies resorted to in February 2014 which yielded limited results. Ensuring stability in macroeconomic fundamentals such as inflation and budgetary imbalances is pertinent to boost the credibility of government policies and invigorate confidence in the domestic currency to serve the functions of money.

Other policy measures aimed at developing the financial markets in Ghana can provide alternative hedges against the erosion of wealth propagated by high inflationary trends and currency depreciation. Also, it is imperative to reduce the high dependence on imported products. The tastes and preferences of Ghanaians for foreign products should be discouraged by promoting the competitive position of local industries that can produce quality products at competitive prices.

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