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Does Economic Policy Uncertainty Explain Exchange Rate Movements in the Economic Community of West African States (ECOWAS): A Panel ARDL Approach

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Abstract: Research proposes that economic policy uncertainty (EPU) leads to exchange rate fluctuations. Given that African countries experience higher levels of uncertainty in developed/emerging markets, we examine the extent to which domestic and foreign EPU affect exchange rates for a panel of 12 ECOWAS countries covering the period 1996–2018. In order to account for non-stationarity, cross-sectional dependence, and heterogeneity, the paper employs the dynamic heterogeneous panel approach. The ECOWAS has a dual currency arrangement ranging from a common currency union (CFA) to floating exchange rates (Non-CFA). To account for this, this study splits the sample data into CFA and Non-CFA areas. In addition, this study considers the role of the global financial crisis in the exchange rate-EPU nexus. Our results show that domestic EPU has a positive effect on exchange rates in the long run for Non-CFA areas. Different from the existing literature, our results suggest that domestic EPU does not explain exchange rate fluctuations in the short run. For all countries, foreign EPU leads to appreciation in the long run and depreciation in the short run. Interestingly, foreign EPU has a more dominant effect on exchange rate fluctuations in the selected countries than domestic EPU. This may reflect the weak institutional framework in these countries, which allows external fluctuations to have a greater impact. Moreover, this could be attributed to the increase in foreign capital flows during the sample period. Thus, these countries must develop effective policies to effectively absorb these external shocks. Results are robust to different proxies of EPU.

Keywords: economic policy uncertainty (EPU); exchange rate; ECOWAS; panel ARDL; VIX; GDP

JEL Classification: C23; F31

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1. Introduction

The Economic Community of West African States (ECOWAS) has attempted for decades (in the past 30 years) to stabilize the currencies among member states. This has led to the creation of a single currency; however, this has failed mostly due to macroeconomic instability, including a relatively volatile exchange rate. Exchange rate stability is important for building a robust economy and, more importantly, for the implementation and introduction of a common currency (Flood and Rose 1999). Empirically, however, exchange rate stability is more costly in developing countries than in developed countries. Typically, it is more costly and crucial for the introduction of a single currency (Giannellis and Papadopoulos 2011). Exchange rate fluctuations can affect business operations and the entire economy, as well as delay decisions, leading to macroeconomic instability (Krol 2014).

In light of that, several researchers have sought the use of different fundamental variables to predict exchange rate movement (Adams and Chadha 1991; Engel and West 2005; Korley and Giouvris 2021); nevertheless, the determinants of exchange rate variability still remain an open research question as existing exchange rate determination models are unsatisfactory (Baku 2019). For instance, Adams and Chadha (1991) argue that both monetary and portfolio balance models are not robust for predicting changes in the exchange rate. Chen and Chou (2015) and Flood and Rose (1999) support this assertion. These authors are of the view that macro-fundamentals such as purchasing power parity have failed to predict exchange rate movements. Meanwhile, recent studies have provided evidence in favor of (or otherwise on the assumption that) transitory/unobservable factors such as economic policy uncertainty (hereafter, EPU) are a key determinant of economic activity (Abid 2020). EPU refers to frequent changes or uncertainties surrounding economic policies, which include fiscal policy, monetary policy, and/or regulations (Dakhlaoui and Aloui 2016; Adjei and Adjei 2017; Baker et al. 2016). Bernanke (1983) provided a theoretical proposition based on the theory of investment under uncertainty that is useful for understanding the impact of uncertainty shocks. This theory is further extended by Rodrik (1991). Empirically, the relationship between EPU and various economic variables has been given much attention in recent times because of its policy relevance. These studies attempt to determine how EPU affects economic variables such as unemployment (Baker et al. 2016), investment (Julio and Yook 2012), the stock market (Bekiros et al. 2016), and output (Bloom 2009). EPU has been strongly affecting economic activity during the past years and is a critical topic for both developed and developing countries. Nevertheless, studies on uncertainty shocks in developing countries are limited. This study aims to fill this gap.

In a related study, Bacchetta and Van Wincoop (2013) posit that unobservable factors (uncertainty) may lead to movements in the exchange rate rather than observed macroeconomic factors. Poor economic performance has been shown to increase uncertainty (Krol 2014). Therefore, macro-economic instability coupled with the frequent and sudden policy changes surrounding the pending adoption of a single currency is likely to generate uncertainties that may influence the behavior of individuals and firms in the ECOWAS countries. At the same time, these uncertainties surrounding future government actions and policies may affect the exchange rate. Bartsch (2019) explains that uncertainties surrounding government policies may affect prices via expectations about cost and benefit among market agents. These expectations are likely to affect both demand and supply, which may inevitably affect currency prices. Krol (2014) suggests that economic policy uncertainty influences the path of the exchange rate. Conversely, the exchange rate is expected to be more volatile in times of high economic uncertainty. According to Krol (2014), an increase in economic policy uncertainty in a country causes risk-averse investors at home and abroad to reduce their holdings of assets in that country, causing a depreciation of their currency. Obstfeld and Rogoff (1996), in another study, mention that higher levels of economic policy uncertainty may lead economic agents to adjust expectations about policy and the economy, which may lead to fluctuations in the exchange rate. In particular, consumers and firms are reluctant to invest in order to protect themselves against any risk that may occur due to uncertainty; this has an adverse effect on corporate investments and thereby leads to movement in the exchange rate. This is confirmed in Engel et al. (2007), who emphasize how exchange rate movement is linked to economic policy uncertainties. Taken together, these papers provide evidence that greater uncertainty can adversely impact the movement of the exchange rate. In this study, therefore, we examine the role of EPU on the exchange rate. Our paper distinctively differs from previous studies as it is focused on developing countries, particularly in Africa. The central idea of this paper is that if an increase in uncertainty shocks tends to cause fluctuations in the (local) currency, then the adoption of a single currency can be affected due to fluctuations in the exchange rate. Therefore, understanding uncertainties as far as economic policy is concerned with reference to the exchange rate is important for implementing strategies aiming to stabilize the exchange rate and assessing regulatory policies to address macroeconomic imbalances between the ECOWAS nations.

Considering that globalization has led to 'few-to-no' barriers, this causes unexpected events/conditions in developed countries to spillover to developing/emerging countries, and as a result, these developing/emerging countries then suffer macroeconomic instabilities for reasons independent of their own domestic policies (Dakhlaoui and Aloui 2016; Jiang et al. 2019). Yet, with few exceptions, empirical exploration has ignored the spillover effect of foreign EPU on the exchange rate. Jiang et al. (2019) argue that the domestic economy can be at risk of foreign uncertainty shocks, although domestic levels of uncertainty remain stable. Krol (2014), in another study, shows that exchange rate fluctuations can be attributed to domestic and foreign EPU. Taking into account that external shocks are often explicitly or implicitly blamed for volatile performance and/or macroeconomic instability, we examine the joint impact of domestic and foreign EPU on exchange rates among the ECOWAS countries, unlike previous studies. In addition, a recent report by the IMF mentions that much of the macroeconomic instability in developing countries is attributable to external shocks (IMF 2003).

This study thereby contributes to the growing empirical evidence on uncertainty by investigating the effect of domestic and foreign economic policy uncertainty on the exchange rate in 12 ECOWAS countries. In this study, our focus is on Africa. We focus on Africa for two reasons: first, to respond to the dearth of detailed studies between EPU and the exchange rate in Africa. Policymakers in Africa are unsure what interventions to put in place, as researchers seem to have focused on developed/emerging countries. We acknowledge the fact that developing countries in Africa are subject to a highly unstable economic environment and thus experience higher levels of uncertainty compared to developing/emerging countries (Bloom 2014). In addition, the IMF[1] mentions in a report that uncertainty is a significant factor in weaker economic performance in many countries, especially developing economies in Africa, which suffer large shocks due to the unavailability of policy measures to help mitigate these shocks. (see Ahir et al. 2018). Secondly, 50% of export revenues in Africa emanate from a single commodity, and most of these countries in Africa rely heavily on a narrow range of primary commodities, resulting in strong currency movements (Kassouri and Altıntaş 2020). Likewise, the foreign exchange market in Africa is underdeveloped compared to emerging/developing countries; hence, these countries react differently to shocks.

Consequently, the objective of this paper is to determine the extent to which domestic and foreign economic policy uncertainty affects exchange rates in 12 ECOWAS countries. This study therefore addresses the following questions. First, what is the effect of domestic EPU on the exchange rate among the selected countries? Second, do the exchange rates in the selected countries respond to foreign EPU shocks? By addressing these questions, this study will help inform policy and investment decisions.

This paper differs from other studies in the following ways: While previous empirical studies on the link between policy uncertainty and exchange rate were mainly on developed or emerging markets, our focus is on developing countries in Africa. Previous studies have mainly focused on how the exchange rate responds to domestic EPU, with limited information on how the exchange rate reacts to foreign EPU. However, in this study, we focused on the impact of both domestic and foreign EPU on the exchange rate. In the few studies on Africa, the EPU variable has mainly been measured using political events (Steinberg et al. 2015; Suleman and Berka 2017; Ngwakwe and Sebola 2019). For instance, Ngwakwe and Sebola (2019) found that uncertainties surrounding political elections have a significant influence on the Rand exchange rate. This approach, despite its rationality, is limited since it fails to capture the implementation of new government policies over time (Krol 2014). In recent times, the EPU index by Baker et al. (2016) has been shown to be a better and more accurate measure of policy uncertainty since it offers a continuous measure of economic policy uncertainty over time (Krol 2014). Unlike Ngwakwe and Sebola (2019), in this study, the Baker et al. (2016) EPU index for the United States is employed as a measure for foreign EPU, while domestic EPU has been constructed using the variance of inflation since the EPU index for the countries under study is not available.

Second, unlike other studies, we perform the analysis on the whole sample (the ECOWAS region). And then, given that the ECOWAS countries consist of two sub-regional blocs: the CFA, with a common currency pegged to the Euro, and the Non-CFA, with a flexible arrangement, we split the sample data into two areas: the CFA area and the Non-CFA area, to explore whether the relationship between the variables may be dissimilar due to the exchange rate arrangement. In addition, this has been explained in an earlier study by Mussa (1986), who states that exchange rate arrangements can affect the behavior of exchange rates. This study further considers the role of the global financial crisis and divides the data period into two: the pre-crisis and post-crisis periods. To determine if the effect between the variables before the crisis might differ after the crisis Moreover, Adjei and Adjei (2017) mention that economic policy uncertainty has a higher impact on economic activity during recessionary periods than during non-recessionary periods.

Third, from a methodological point of view, instead of using a single time series model, this paper aims to explore the extent to which cross-sectional dependence between countries can affect the relationship between the variables under consideration; hence, we employed the panel autoregressive distributed lag (ARDL) model proposed by Pesaran et al. (2001) to jointly investigate the impact of domestic and foreign EPU shocks on the exchange rate. While we acknowledge that time series modeling is relevant, it relies on country-by-country application and has been deemed to be wasteful and provide misleading results (Westerlund and Sharma 2019). The panel ARDL model allows us to capture both long-run and short-run estimates between the variables. Other advantages of using the Panel ARDL are that it is more robust to omitted variables, endogeneity biases, and heterogeneity effects across all panel members (Kassouri and Altıntaş 2020; Pesaran et al. 1999). To the best of our knowledge, this is the first empirical study to investigate the short-run and long-run EPUs effect on exchange rates in 12 ECOWAS countries employing the Panel ARDL model. Further, we account for the terms of trade in the exchange rate-uncertainty relationship to reduce estimation bias.

Overall, the results of this paper demonstrate that domestic EPU has an impact on the exchange rate only in the long run, and this is valid for the Non-CFA (floating) area with less evidence for the CFA (common currency) area. We find that foreign EPU has an impact on the exchange rate both in the short run and the long run. Specifically, a significant positive effect in the long run (appreciation of the exchange rate) and a negative effect in the short run (depreciation of the exchange rate). Consequently, this study is in favor of foreign EPU having a greater impact on the exchange rate than domestic EPU. Further, it appears that the financial crisis plays a role in the nexus, as we find that the response of the exchange rate to uncertainty surrounding economic policies is stronger before the crisis than after the crisis for the CFA area, and the reverse is observed for the Non-CFA area.

The rest of this study is organized as follows: Section 2 presents an overview of relevant studies on economic policy uncertainties, including a brief review of the spillover effect of foreign EPU on exchange rates. Section 3 explains the research methodology, including details of the econometric model adopted, while Section 4 outlines the results of the statistical test analysis and the outcome of the econometric model. Finally, Section 5 provides the conclusions of this study.

2. Literature Review

2.1. Theoretical Overview

Economic policy uncertainties have been under extensive investigation from both academic scholars and economists due to their perceived impact on the economy as well as their policy implications, especially after the subprime crisis and the following great recession (Jiang et al. 2019). Earlier studies have well established that uncertainties in economic policies generate reductions in economic development and hinder real activity (Keynes 1937; Bernanke 1983). A similar argument is made by Bloom (2009), who mentions that economic policy uncertainty has dire consequences for economic activity and thus becomes an important economic factor. Discussions on uncertainties are mostly based on the theory of investment under uncertainty (see Bernanke 1983). According to this theory, when firms face uncertain economic conditions, they delay making investment decisions and wait for further information, as the risk posed is often irreversible. The same argument is made for consumer expenditures, as noted in Edelstein and Kilian (2009). Specifically, these authors documented that high uncertainty raises concerns about staying employed, and thus, economic agents become reluctant and prefer to increase precautionary savings to protect themselves against any risk since transitory shocks may be perceived as a permanent shock.

2.2. Evidence on Economic Policy Uncertainties

There is a growing body of literature on the effects of economic policy uncertainty shocks on economic activity. Following the literature, there has been a disagreement as to what exactly uncertainty corresponds to due to its intangible nature (Carrière-Swallow and Céspedes 2013); therefore, different studies have employed different measures to capture economic policy uncertainty, such as political events and some constructed indices (Krol 2014). Among the different measures, the EPU index, recently developed by Baker et al. (2016), has become a benchmark for measuring economic policy uncertainty (Das and Kumar 2018). In the existing literature on the EPU index, the focus has been on two main strands: the first is the impact of uncertainty on output, and the second is the relationship between uncertainty and the stock market (Cheng 2017; Ko and Lee 2015; Colombo 2013). First, most studies have found an inverse relationship between uncertainty and output in some developed countries, such as the EU suggesting that output is reduced in response to rising uncertainty shocks (Colombo 2013). For the latter, a number of studies have demonstrated that higher EPU is associated with negative stock market returns (Christou et al. 2017; Ko and Lee 2015). For instance, Ko and Lee (2015) documented a reverse relationship between EPU and stock prices. Similar results are reported for US and G7 countries, as noted by Christou et al. (2017) and Guo et al. (2018), respectively.

While most studies explore the links between EPU and output and/or the stock market, it is clearly perceived that in the presence of higher economic uncertainty, economic agents would prefer to invest in foreign currency-denominated assets rather than domestic assets, which in turn may affect the exchange rate movement (Balcilar et al. 2016). There is also evidence that EPU transmits risk through commodity prices such as gold, which in turn affects the exchange rate markets (Raza et al. 2018). However, only a few studies have investigated the impact of economic uncertainty on the exchange rate. For instance, Abid (2020) mentions that EPU helps to explain currency movement and found that the exchange rate falls in response to higher EPU in emerging countries (South Korea, Brazil, India, Mexico, and Chile) both in the long-run and short-run using an ARDL model. Similarly, employing quantile regression on 13 different countries Christou et al. (2018) found that EPU is useful for predicting exchange returns and volatility. Bartsch (2019) employed GARCH models and provided evidence that EPU contributes to exchange rate volatility.

Although few studies focus on the link between EPU and exchange rate, the focus has been on developed countries, and some emerging countries like BRICS and developing countries in Africa are disregarded. Moreover, studies have shown that developing economies are slow to recover following uncertainty shocks since they suffer much more severe falls in investment and private consumption than developed economies (Carrière-Swallow and Céspedes 2013). Hence, the focus of this study is West Africa. In addition, our paper employs the panel approach, which allows for cross-sectional dependence. This deviates from the time-series-based approaches adopted by existing studies. Westerlund and Sharma (2019) showed that capturing both time series and cross-sectional dependence is more efficient than time series models since the time series may be misleading and wasteful. Further, unlike previous studies, apart from domestic uncertainty shocks, we account for international/foreign uncertainty spillovers.

2.3. Evidence on Foreign Economic Policy Uncertainties

In this subsection, we briefly discuss a number of articles on foreign economic policy uncertainty spillovers. Identifying foreign uncertainty spillovers is motivated by the empirical evidence in Colombo (2013). According to Colombo (2013), domestic economic activities can be adversely affected by foreign uncertainty shocks. The author found that industrial production in EU countries negatively reacts to US EPU shocks and further claims that the impact of US EPU is greater compared to domestic EPU. Likewise, Cheng (2017) highlighted that uncertainties surrounding foreign and domestic policies exert a negative and significant impact in South Korea; however, foreign EPU shocks are found to be more dominant. Regarding foreign policy uncertainty on local stock market returns, Hu et al. (2018) documented that stock markets in China react negatively to US EPU shocks. The same is reported by Nguyen et al. (2020); these authors found that US EPU imposes a negative effect on stock returns in most EU countries. Dakhlaoui and Aloui (2016) also confirm that US EPU is able to predict BRIC stock market returns and document a negative spillover between the two variables. Das and Kumar (2018), in another study on the impact of foreign economic policy uncertainty on stock markets for developed and emerging countries, reported that developed countries are more sensitive to foreign EPU than domestic EPU, while emerging countries are more sensitive to domestic EPU compared to foreign EPU.

There are relatively few studies that are particularly relevant to this study on the impact of foreign policy shocks on the exchange rate, with the exception being those focusing on developed/emerging economies. For example, Krol (2014) examined the effect of domestic and foreign EPU indices on the exchange rate volatility of ten industrial and emerging economies. The author found mixed results. However, during bad economic times, Krol (2014) finds that foreign EPU has an effect on exchange rate volatility among the industrial countries, while (s)he finds no effect of foreign EPU on the exchange rate for emerging countries. Using GARCH_Midas, Zhou et al. (2020) provide evidence that foreign EPU has a significant effect on Chinese exchange rate volatility. Chen et al. (2020) also find the same for China using Quantile regression. In another study, Kido (2016) uses dynamic conditional correlation GARCH from January 2000 to December 2014 to analyze the spillover effects of US EPU on real effective exchange rates. The author reported that the correlation between US EPU and the returns of high-yielding currencies is negative, while the correlation between US EPU and the returns of Japanese Yen is positive. Moreover, the correlations intensified during the US financial crisis.

Overall, the above literature indicates that economic policy uncertainty has a significant impact on general economic activity as well as on the currency market. While we acknowledge the fact that these studies have predominantly focused on developed countries, whether their findings are valid and applicable to developing countries is the focus of this study. Specifically, we use African countries and try to disentangle the relationship between economic policy uncertainty shocks and the exchange rate system.

Early research on exchange rate determination documented that exchange rate fluctuation is dependent on the type of exchange rate system (floating/fixed). Under this light, several authors examined macroeconomic performance under different exchange rate arrangements (Chia and Alba 2006). For example, Chia and Alba (2006) examined the effect of terms of trade shocks on exchange rate regimes and reported that the effect of terms of trade shocks on exchange rates depends on the exchange rate system. Another study on developing countries revealed that shocks to real exchange rates are dependent on the exchange rate regime Broda (2004). In a related study, Hoffmaister et al. (1998) compared 8 CFA and 15 non-CFA sub-Saharan countries to provide evidence on the effect of domestic and external shocks on the real exchange rate and other macroeconomic indicators. Specifically, the authors used terms of trade and the world interest rate to represent external shocks and employed fiscal and monetary variables to represent domestic shocks. The authors employed the VAR approach and emphasized that real exchange rate changes in CFA countries are driven mostly by external shocks. While the real exchange rate for Non-CFA countries is not explained by external shocks but only driven by domestic shocks, Sissoko and Dibooglu (2006) examine the effect of domestic versus external shocks in driving the real exchange rate and macroeconomic fluctuations in SSA under alternative exchange rate systems. This study used 30 SSA countries from both the CFA and Non-CFA and examined the impact of terms of trade, real money balances, and the price level on the real exchange rate and output. The authors reported that the main source of real exchange rate fluctuations for the CFA is trade balances, whereas real exchange rate fluctuations for Non-CFA are attributed to trade balances and terms of trade. They further revealed that the bulk of output fluctuations in SSA are due to trade shocks.

Opposed to the related literature, we use domestic and foreign economic policy uncertainty to examine the effect of domestic and external shocks on the real exchange rate for CFA and Non-CFA countries. We use indices of economic policy uncertainty for the United States calculated by Baker et al. (2016) to represent foreign/external shocks and the variance of inflation as a proxy for domestic uncertainty shocks. This study employs the panel ARDL model proposed by Pesaran et al. (2001). The advantage of using Panel ARDL is that it accounts for cross-sectional dependence, non-stationarity, and heterogeneity often inherent in time series. The panel ARDL helps in understanding the level of dependence both in the long run and the short run. This is useful to investors and policymakers when making investment decisions. Hence, the findings of this study will offer important policy and practical implications for developing countries in Africa.

3. Research Methodology

3.1. Data and Descriptive Statistics

3.1.1. Data Employed

This section describes the variables used in this study: the exchange rate, domestic economic policy uncertainty, foreign economic policy uncertainty, and terms of trade.

Exchange rate: The exchange rate variable used in this study is the real effective exchange rate (REER) data provided by Bruegel, which is retrieved from (https://www.bruegel.org (accessed on 10 December 2020)). According to Kido (2018), financial variables expressed in real terms are better than variables expressed in nominal terms since the former provides more direct information on real economic activities. Also, the REER series takes into account the relative prices of the destination country against the major trading partners (Sharma and Paramati 2021).

Foreign economic policy uncertainty (FEPU): To account for foreign policy uncertainty, we used the EPU indices calculated by Baker et al. (2016). We relied on the EPU indices for the US as a proxy for foreign EPU since they are a benchmark for international policy uncertainty (Das and Kumar 2018). Also, we selected the US since it is the largest trading partner for most of the countries in our data set. Foreign policy uncertainty is constructed as a weighted average of three components (see Baker et al. 2016). The first component comprises a search count of newspaper articles that refer to "uncertainty", "economy", and "policy". The second is based on the number and size of expiring federal tax provisions, while the third is a measure of monetary and fiscal uncertainty. Specifically, the dispersion in economist forecasts about inflation and government spending levels (Baker et al. 2016; Krol 2014). Other studies have also addressed the response of exchange rates on the basis of uncertainty; however, they did not consider uncertainty in this regard. The uncertainty component in these studies was captured by volatility measures such as GARCH (Salisu and Mobolaji 2013), while others simply relied on Volatility index (VIX) and/or the OVX (Lu et al. 2017; Korley and Giouvris 2022). The foreign economic policy uncertainty index is retrieved from (https//www.policyuncertainty.com (accessed on 1 February 2021)).

Domestic economic policy uncertainty (DEPU): This variable has been constructed using inflation (measured by the consumer price index for each country), which has been obtained from the World Bank databases, and its computation is described in the next sub-section.

Terms of Trade (TOT): Terms of trade are added as a control variable to reduce omitted variable bias. The terms of trade data employed are the country-specific commodity terms of trade indices provided by Gruss and Kebhaj (2019). The selected index is advantageous since it offers a comprehensive measure of terms of trade indices based on 45 individual commodities (Kassouri and Altıntaş 2020). In addition, Chen et al. (2020) suggested that in investigating the response of the exchange rate to changes in economic policy uncertainty, macroeconomic factors must be controlled. Although several macroeconomic variables such as GDP, interest rate, capital flows, and monetary policy have been used as control variables in previous related studies (see Gelman et al. 2015; Mueller et al. 2017), we adopted the terms of trade due to data constraints for all the selected countries. Also, our empirical analysis uses monthly frequency data, and most of the variables are not available at this frequency for the selected countries.

All series have been transformed into logarithms, as is customary. Logarithmic transformation reduces trend and seasonality if present (Koopman and Lee 2009).

Domestic Policy Uncertainty Estimation

There are various ways of constructing 'economic policy uncertainty' indices in empirical studies. This can be based on discrete observations such as elections (Leblang and Bernhard 2006), GDP (Aizenman and Marion 1993), inflation (Feng 2001), and more recently constructed indices (Krol 2014). Although the constructed indices offer a continuous measure of economic policy uncertainty and perform a better job than the discrete observations (see Krol 2014), there are no constructed indices for the countries sampled. In addition, Feng (2001) is of the view that inflation is caused mostly by political uncertainty and is thus a good proxy for policy uncertainty.

A number of studies have documented various methods for deriving uncertainty measures for discrete observations. Some studies use the variance of the unpredictable part of a stochastic process, while others use General Autoregressive Conditional Heteroskedastic (GARCH) type modeling (see Lensink et al. 1999). For instance, studies such as Grier and Tullock (1989), De Gregorio (1993), and Feng (2001) employed the variance of inflation as a proxy for macro-economic policy uncertainty. Theoretically, the GARCH type of modeling does a better job in that it allows the time dependence of the second moment of random variables, as mentioned by Lensink et al. (1999). However, the GARCH[2] models require a longer time series and higher frequency observations, and our sample data does not fit this requirement. Due to data restrictions, this study employs the variance of the unpredictable part of a stochastic process, which is more flexible and has no restriction on data length. In addition, there is no consensus yet in the literature as to the best method for deriving economic policy uncertainty. This method has been employed by Aizenman and Marion (1993) and Lensink et al. (1999). Thus, our measure of uncertainty follows Aizenman and Marion (1993). The domestic policy uncertainty variable was calculated by fitting a first-order autoregressive process specified as follows:

$$P_t = \alpha_0 + \alpha_1 P_{t-1} + \varepsilon_t \quad (1)$$

where, P is inflation, α_1 is the autoregressive parameter, and ε_t is the error term. The unexpected component of the policy is the standard deviation of the residuals. The standard deviation of the residuals is taken as the variable for policy uncertainty.

3.1.2. Descriptive Statistics

The data series employed are monthly observations covering the period 1 January 1996–31 December 2018 for 12 ECOWAS[3] countries, namely Benin, Burkina Faso, Cote d'Ivoire, Gambia, Ghana, Guinea-Bissau, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo. The sample period is based on data availability for all countries in the sample. The selected countries were divided according to monetary and exchange rate arrangements, notably the common currency union (CFA) and Non-CFA countries. The CFA area includes Benin, Burkina Faso, Cote d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal, and Togo. While the Non-CFA area includes Gambia, Ghana, Nigeria, and Sierra Leone, The sample periods yield 276 observations for each cross-section unit for the full period. The sample period is also divided into pre-crisis (1 January 1996–31 August 2008) and post-crisis (1 September 2008–31 December 2018). These subsample periods are consistent with Berger and Uddin (2016) and Korley and Giouvris (2021). Table 1 presents descriptive statistics for all the variables under study for the ECOWAS (all countries), CFA area, and Non-CFA area. This study also considers the sub-sample periods (pre- and post-crisis) for ECOWAS, CFA, and Non-CFA. Comparing the CFA and Non-CFA areas, the mean statistic for the real exchange rate for the full sample period is 4.52% for the CFA area and 4.48% for the Non-CFA area. As expected, the CFA (common currency) reveals a higher mean and a lower standard deviation compared to the Non-CFA (floating), implying that the exchange rate in the Non-CFA (floating) area is more volatile than the CFA area. Over the period under investigation, the exchange rate in the CFA area performed better on average and exhibited less volatility than in the Non-CFA area. The statistics also indicate that foreign EPU and domestic EPU are positively skewed, while terms of trade and the real exchange rate are negatively skewed. All series show high values of Kurtosis. We note that all series rejected the null hypothesis of normality at the 1% significance level, as indicated by the JB test. Hence, the series are not normally distributed.

Table 1. Descriptive Statistics. Descriptive statistics for exchange rate, domestic EPU, foreign EPU, and terms of trade. ** Null hypothesis is rejected at the 5% significance level. * Null hypothesis is rejected at the 10% significance level.

Full	**Period**	**1996m01-**	**2018m12**			
Pre-GFC	**1996m01-**	**2008m08**	**Post-GFC**	**2008m09-**	**2018m12**	
Country	**Mean**	**St dev**	**Skewness**	**Kurtosis**	**J-B Test**	**obs**
Real	**Exchange**	**Rate**				
Full sample	4.630	0.363	−5.081	51.792	341554.9 *	3300
Pre-crisis	4.497	0.475	−3.939	31.060	64136.71 *	1812
Post-crisis	4.573	0.199	−0.184	6.131	656.124 *	1584
CFA area	4.552	0.073	−2.074	15.611	16217.43 *	2208
Pre-crisis	4.527	0.079	−2.296	16.276	9999.541 *	1216
Post-crisis	4.583	0.049	−0.375	2.725	26.382 *	992
Non-CFA area	4.486	0.619	−2.859	17.586	11291.79 *	1104
Pre-crisis	4.441	0.813	−2.143	10.257	1800.035 **	608
Post-crisis	4.541	0.195	0.335	2.722	10.883 *	496
Domestic	EPU					
Full sample	0.046	0.831	35.286	1515.58	0.0000008	3300
Pre-crisis	0.084	1.120	26.144	832.8091 *	52194454	1812
Post-crisis	0.002	0.059	3.236	12.113	8246.449 *	1584
CFA Area	0.000	0.000	26.345	857.282	671527.49 *	2200
Pre-crisis	0.000	0.000	19.931	484.7378	11760904 *	1208
Post-crisis	0.000	0.000	3.402	18.948	12427.83 *	992
Non-CFA Area	0.140	1.436	20.371	506.328	11687489 *	1100
Pre-crisis	0.251	1.931	15.090	278.636	1934977 *	608
Post-crisis	0.005	0.009	1.322	3.047	144.599 *	496
Foreign	EPU					
Full sample	4.684	0.369	0.190	2.582	46.276 *	3300
Pre-crisis	4.514	0.336	0.626	3.385	129.323 *	1812
Post-crisis	4.878	0.295	0.290	2.445	656.124 *	1584
CFA area	4.684	0.369	0.192	2.572	30.533 *	2208
Pre-crisis	4.514	0.335	0.620	3.397	86.112 *	1216
Post-crisis	4.892	0.293	0.248	2.470	21.854 *	992
Non-CFA area	4.684	0.369	0.192	2.572	15.266 *	1104
Pre-crisis	4.514	0.335	0.620	3.397	43.056 *	608
Post-crisis	4.892	0.293	0.248	2.470	10.927 *	496

Table 1. *Cont.*

Full	Period	1996m01-	2018m12			
Pre-GFC	**1996m01-**	**2008m08**	**Post-GFC**	**2008m09-**	**2018m12**	
Country	**Mean**	**St dev**	**Skewness**	**Kurtosis**	**J-B Test**	**obs**
Real	**Exchange**	**Rate**				
Terms of	Trade					
Full sample	4.602	0.067	−1.792	8.172	5445.629 *	3300
Pre-crisis	4.600	0.082	−1.684	6.136	1501.121 *	1812
Post-crisis	4.603	0.041	−1.105	5.272	583.194 *	1584
CFA area	4.612	0.047	−0.499	4.133	210.11 *	2208
Pre-crisis	4.611	0.058	−0.438	3.120	39.632 *	1216
Post-crisis	4.614	0.029	−0.065	3.345	5.646 *	992
Non-CFA area	4.581	0.092	−1.462	4.823	546.36 *	1104
Pre-crisis	4.578	0.114	−1.253	3.454	164.4271 *	608
Post-crisis	4.585	0.054	−0.904	3.116	67.836 *	496

3.2. Econometric Model

The Panel ARDL Model

In determining the response of the exchange rate to changes in domestic and foreign economic policy uncertainty both in the long run and in the short run for the selected countries, we employed the dynamic heterogeneous panel regression (Panel ARDL) suggested by Pesaran et al. (1999). The panel ARDL is advantageous to the traditional approach since it is able to capture the dynamic interaction between the variables involved and simultaneously consider the cross-sectional characteristics between countries (Eregha and Mesagan 2020). The panel ARDL is specified as

$$y_{it} = \sum_{j=1}^{p} \omega_{ij} y_{i,t-j} + \sum_{j=0}^{q} \beta_{ij} x_{i,t-j} + \rho_i + \varepsilon_{it} \tag{2}$$

where $i = 1, 2, \ldots, N$ denotes number of countries, $t = 1, 2, \ldots, T$ signifies number of months, y_{it} is the dependent variable (exchange rate) for country i, $x_{i,j}$ is k × 1 vector of explanatory variables for ith country, β_{ij} denotes k × 1 coefficient vectors, ρ_i is unit specific fixed effects. p and q are the lag orders. In this study, we based our lag length on literature and assigned one lag to each variable, thus a Panel ARDL (1,1,1) (see Salisu and Ndako 2018). Salisu and Ndako (2018) stated that it is computationally cumbersome to choose the optimal lag combination for panel data.

Equation (2) is better represented as a VECM process in a reparametrized form as follows:

$$\begin{aligned}\Delta y_{it} &= (\theta_i\, y_{i,t-1} + \lambda_i x_{i,t-1}) \\ &\quad + \sum_{j=1}^{p-1} \omega^*{}_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \beta^*{}_{ij} x_{i,t-j} + \rho_i + \varepsilon_{it}\end{aligned} \tag{3}$$

where λ_i and θ_i are the long-run coefficients and the error correction coefficients, respectively.

This is computed below as:

$$\theta_i = -\left(1 - \textstyle\sum_{j=1}^{p} \omega_{ij}\right), \tag{4}$$

$$\lambda_i = \textstyle\sum_{j=0}^{q} \beta^*_{ij}, \tag{5}$$

$$\Delta y_{it} = y_{it} - y_{i,\,t-1}. \tag{6}$$

In both Equations (2) and (3), y_{it} is the dependent variable and represents the real effective exchange rate, while, $x_{i,j}$ is the vector of explanatory variables, which represents domestic EPU, foreign EPU, and terms of trade. Further details on panel ARDL can be found in Pesaran et al. (1999).

Regarding the use of the panel ARDL, we employed two estimators. The choice of estimators is the Mean Group (Pesaran and Smith 1995) and the Pooled Mean Group (Pesaran et al. 1999). Accordingly, this study employs both the Mean Group (MG) and the Panel Mean Group (PMG) to estimate [Equation (3)]. The PMG is similar to the MG, as both estimators account for cross-sectional heterogeneity. The PMG, however, assumes long-run slope homogeneity and allows only the short run coefficients and the error variances to vary across groups, while the MG estimator allows all the relevant coefficients, both in the long-run and short-run, to vary across groups (Pesaran et al. 1999; Eregha and Mesagan 2020). Consequently, both MG and PMG estimators for cointegration in the model assume the null hypothesis of no cointegration $H_0 : \theta_j = 0$. The alternative hypothesis for MG, however, is, $H_a : \theta_j < 0$ which suggests that at least one group is cointegrated. Whereas the alternative hypothesis for PMG estimator $H_a : \theta_j = \theta < 0$, suggests cointegration for the entire group. In this study, the Hausman test proposed by Pesaran et al. (1999) is used to determine the most appropriate estimator, i.e., either MG or PMG. For Hausman tests' the null hypothesis is that both MG and PMG are consistent, but MG is inefficient against the alternative hypothesis, PMG is inconsistent. If p-value > 5%, PMG is used, while if p-value < 5%, the MG estimator is more appropriate.

4. Results and Analysis

4.1. Correlation Matrix

Table 2 presents the Pearson correlation matrix of all variables for all countries (ECOWAS region). Although the null is rejected, which implies correlation among some of the variables, it clearly shows a weak correlation among the variables (especially among explanatory variables).

Table 2. Correlation matrix. (Notes: Figures in () are the associated p-values. REER (which denotes the real exchange rate).

	REER	**Domestic EPU**	**Foreign EPU**	**Terms of Trade**
REER	1.0000			
Domestic EPU	−0.3312(0.000)	1.0000		
Foreign EPU	−0.0095(0.586)	−0.0375(0.031)	1.0000	
Terms of Trade	−0.1467(0.000)	0.0458(0.008)	0.0144(0.407)	1.0000

4.2. Panel Data unit Root

Next, the variables are subjected to a panel unit root test. Table 3 (Panels A, B, and C) shows the unit root and/or stationarity test for the ECOWAS region, CFA, and Non-CFA areas. To test for both unit root and/or stationarity in the levels and at first difference, this study employs different panel unit root tests. We first applied the Levin et al. (2002) test, which assumes a unit root under the null hypothesis with a common process. Additionally, we employed the Im et al. (2003) and ADF Fisher panel unit root test. These tests equally assume unit root under the null hypothesis, but with individual unit root processes (see Im et al. 2003). We further applied the panel unit root test developed by Hadri (2000); this test assumes that the series are stationary under the null hypothesis (see Hadri 2000). Finally, the Pesaran CD test developed by Pesaran (2007) is employed to check for cross-sectional dependence. The null hypothesis assumes no cross-sectional dependence.

Table 3. Panel unit root test results.

Full	**Period**	**1 January 1996**	**-31/**	**December/2018**				
Pre-crisis	Period	1 January 1996	-31/	August/2008				
Post-crisis	Period	1 September 2008	-31/	December/2018				
	Exchange Level	Rate 1st Diff	Dom. Level	EPU 1st Diff	Foreign Level	EPU 1st	Terms of Level	Trade 1st Diff
Panel A:	ECOWAS	region						
Homogenous	Unit root	process						
Levin et al. (2002)	−2.434 [a]	−15.167 [a]	−13.097 [a]	0.964 [a]	0.228	9.528	−0.400	−10.661 [a]
Heterogeneous	Unit root	process						
Im et al. (2003)	−4.029 [a]	−22.200 [a]	−18.614 [a]	−40.781 [a]	−6.975 [a]	−31.606 [a]	−1.366	−22.689 [a]
ADF Fisher	67.783 [a]	603.616 [a]	386.68 [a]	1118.5 [a]	96.940 [a]	823.93 [a]	28.9272	515.60 [a]
Null Hypothesis:	No unit	root						
Hadri Z-stat	12.669 [a]	−2.242	11.274 [a]	0.222	11.822 [a]	−2.569	24.686 [a]	−1.291
Pesaran CD	35.483 *	23.126 *	9.213 *	9.213 *			1.907 *	18.473 *
Panel B:	CFA	area						
Homogenous	Unit root	process						
Levin et al. (2002)	−2.323 [a]	−51.315 [a]	−44.649 [a]	−84.971 [a]	−12.779 [a]	−65.615 [a]	0.793	−37.604 [a]
Heterogeneous	Unit root	process						
Im et al. (2003)	−3.127 [a]	−45.803 [a]	−40.513 [a]	−77.773 [a]	−15.160 [a]	−61.829 [a]	−0.076	−35.558 [a]
ADF Fisher	48.520 [a]	986.43 [b]	884.29 [a]	843.32 [a]	251.52 [a]	1082.5 [a]	13.215	788.73 [a]
Null Hypothesis:	No unit	root						
Hadri Z-stat	14.767 [a]	1.375	12.550 [a]	−2.714	9.653 [a]	−2.097	17.867 [a]	−1.214
Pesaran CD	61.458 *	46.295 *	5.109 *	5.109 *			6.018 *	27.686 *
Panel C:	Non-CFA	area						
Homogenous	Unit root	process						
Levin et al. (2002)	−0.812	−37.756 [a]	−20.051 [a]	−42.496 [a]	−9.036 [a]	−46.397 [a]	0.4373	−24.567 [a]
Heterogeneous	Unit root	process						
Im et al. (2003)	−1.515	−32.110 [a]	−17.788 [a]	−37.729 [a]	−10.720 [a]	−43.720 [a]	0.158	−24.666 [a]
ADF Fisher	15.759 [b]	487.86 [a]	259.18 [a]	514.31 [a]	125.76 [a]	541.27 [a]	4.940	386.42 [a]
Null Hypothesis:	No unit	root						
Hadri Z-stat	7.209 [a]	−1.331	6.509 [a]	0.128	6.825 [a]	−1.483	15.048 [a]	−0.669
Pesaran cd test	10.133 *	0.561	17.433 *	17.433 *			−4.763 *	−3.994 *

Notes: [a] and [b] indicate statistical significance at 1% and 5%, respectively. The Pesaran CD test, developed by Pesaran (2007), is used to check cross-sectional dependence and suggest the null hypothesis of no cross-sectional dependence. The CD is not conducted for foreign EPU since it is considered to be homogenous since it is cross-sectional invariant, i.e., the same variables are used for all countries. * The null hypothesis of no cross-sectional dependence is rejected at the 1% significance level.

Panel A presents the results for the ECOWAS region. From the results in *Panel A*, the Levin et al. test rejects the null hypothesis of unit root in all series except for foreign EPU and terms of trade, suggesting that the series are stationary at level. Likewise, the Im et al. and ADF Fisher test suggest that all series are stationary at level except for terms of trade. However, using the Hadri test, the test rejects the null hypothesis of stationarity in levels of all series, suggesting that the series are non-stationary. But after taking the first difference, the test fails to reject the null hypothesis, suggesting that all series are stationary at the first difference.

In *Panel B*, all the series for CFA are stationary at levels (I(0)) except for terms of trade, which are stationary at first difference (I(1)), as indicated by the Levin et al. test. The joint consideration of the Im et al. (2003) test and the ADF Fisher test shows that all the series are stationary at levels except for terms of trade. However, results from the Hadri test show that all the series are not stationary at level but stationary at first difference.

For *Panel C*, the results for Non-CFA are similar to those for CFA, except that the Levin et al. test indicates that both the real exchange rate and terms of trade are not stationary at certain levels.

Overall, testing at 1% and 5% significance levels, all four tests confirm that the series are stationary at either I(1) or I(0) for the ECOWAS region, CFA, and Non-CFA areas. These variations further motivate the use of the Panel ARDL model in this study.

4.3. Panel ARDL Model Results

This study employs the panel ARDL to detect the response of the exchange rate to changes in domestic and foreign economic policy uncertainty, both in the short and long run, for the ECOWAS region, CFA area, and Non-CFA area.

We present the results in Tables 4–6 for the ECOWAS region, CFA area, and Non-CFA area, respectively. We first estimate the panel mean group (MG) and panel pooled mean group (PMG) estimators. Next, we subject the results from these estimators to the Hausman test to determine the most appropriate/preferred estimator. Thus, discussion of the results depends on the choice of estimator by the Hausman test.

Table 4. ARDL model for the ECOWAS region.

Full Period:	**1 October 1996**	**-31 December 2018**				
Pre-crisis:	1 January 1996	-31 August 2008				
Post crisis:	1 September 2008	-31 December 2018				
Long-run	estimates					
Variable	Full	Sample	Pre-crisis		Post-crisis	
	MG	PMG	MG	PMG	MG	PMG
LDEPU	−9.1073 (10.8293)	0.06414 *** (0.0106)	−33.2712 (25.1408)	0.0664 *** (0.0147)	9.6822 (31.9714)	0.3493 (0.8180)
LFEPU	−0.0162 (0.0217)	0.0040 ** (0.0017)	−0.0414 (0.0518)	0.0150 *** (0.0029)	0.0033 (0.0051)	−0.0040 ** (0.0018)
Lctot	−0.2331 *** (0.0795)	−0.0502 (0.0625)	−1.7480 (1.5568)	0.0368 (0.1101)	−0.1803 ** (0.0825)	−0.0586 (0.0624)
Panel B:	Short-run	estimates				
ECT	−0.9274 *** (0.0205)	−0.9198 *** (0.0225)	−0.8418 *** (0.0489)	−0.8349 *** (0.0495)	−0.9794 *** (0.0581)	−0.9605 *** (0.0573)
d. LDEPU	8.8592 (9.0919)	5.0290 (5.8995)	23.6253 (17.6029)	10.6396 (8.1871)	3.0746 (16.9902)	7.8742 (16.1054)
d. LFEPU	0.0054 (0.0086)	−0.0041 ** (0.0017)	0.0137 (0.0201)	−0.1125 *** (0.0035)	−0.0020 (0.0025)	0.0013 (0.0009)
d. Lctot	0.1070 (0.0740)	−0.0227 (0.0671)	0.4412 (0.4465)	−0.7551 (0.6699)	0.0688 (0.0503)	0.0211 (0.6660)
constant	−0.0027 (0.0032)	−0.0033 (0.0031)	−0.0046 (0.0071)	−0.0055 (0.0059)	−0.0036 (0.0032)	−0.0011 *** (0.0003)
Hausman test		37.34 [0.00]		4.48 [0.21]		11.61 [0.01]

Note: () Standard error in parenthesis; [] are the chi-square probability values of the Hausman test in brackets. ***, ** indicate 1%, 5% significance levels, respectively.

Table 5. ARDL model for the CFA Area.

Full Period:	**1 October 1996**	**-31 December 2018**				
Pre-crisis:	1 January 1996	-31 August 2008				
Post-crisis	1 September 2008	-31 December 2018				
Long run	estimates					
Variable	Full	period	Pre-crisis		Post-crisis	
	MG	PMG	MG	PMG	MG	PMG
DEPU	−13.5589 (16.3597)	−0.1551 (1.2366)	−375.283 (264.185)	−23.479 (23.7521)	161.654 ** (81.5347)	66.804 (80.925)
FEPU	0.0050 *** (0.0013)	0.0036 ** (0.0018)	0.5154 * (0.2770)	0.1785 *** (0.0646)	0.0120 (0.0082)	0.0015 (0.0128)
TOT	−0.1422 (0.0872)	−0.0282 (0.0644)	1.8899 (2.481)	−2.0822 *** (0.5767)	−0.5668 ** (0.2590)	−0.5307 *** (0.1323)
Panel B:	Short run	estimates				
ECT	−0.9343 *** (0.0213)	−0.9248 *** (0.0234)	−0.0320 *** (0.0079)	−0.0282 *** (0.0066)	−0.1136 *** (0.0164)	−0.0978 *** (0.0162)
d. DEPU	11.3385 (13.7762)	5.7916 (8.8340)	27.501 (18.6353)	17.2315 (12.3250)	−10.0782 (11.6131)	−6.3992 (11.1049)
d. FEPU	−0.0026 *** (0.0006)	−0.0019 *** (0.0004)	0.0007 (0.0011)	0.0017 (0.0014)	−0.0009 (0.0009)	−0.0008 (0.0009)
d. TOT	0.1333 (0.0765)	0.0759 (0.0550)	−0.1316 (0.0858)	−0.0984 (0.0898)	0.0580 (0.0737)	0.0659 (0.0755)
constant	0.0010 (0.0011)	0.0004 (0.0002)	0.1903 (0.1615)	0.3787 *** (0.0892)	0.8410 *** (0.1971)	0.6868 *** (0.1148)
Hausman test		8.74 [0.03]		3.52 [0.17]		20.97 [0.00]

Note: () Standard error in parenthesis; [] are the chi-square probability values of the Hausman test in brackets. ***, **, and * indicate 1%, 5%, and 10% significance levels, respectively.

Table 6. ARDL model for Non-CFA Areas.

Full Period	**1 January 1996**	**-31 December 2018**				
Pre-crisis	1 January 1996	-31 August 2008				
Post-crisis	1 September 2008	-31 December 2018				
Long-run	estimates					
Variable	Full	Period	Pre-crisis		Post-crisis	
	MG	PMG	MG	PMG	MG	PMG
DEPU	−0.2039 (0.0653)	0.0642 *** (0.0106)	−0.9818 ** (0.5166)	0.0665 *** (0.0146)	12.2566 (104.95)	0.4663 (0.7571)
FEPU	−0.0588 (0.0653)	0.0124 (0.0837)	−0.1572 (0.1509)	−0.0023 (0.0153)	0.0171 (0.1338)	0.0233 *** (0.0083)
TOT	−0.4147 *** (0.1328)	−0.3559 (0.2508)	−5.0117 (4.6100)	−0.4689 (0.5825)	−0.3713 *** (0.1412)	−0.3480 ** (0.1720)
Panel B:	Short-run	estimates				
ECT	−0.9137 *** (0.0493)	−0.9134 *** (05194)	−0.7677 *** (0.1275)	−0.7757 *** (0.1280)	−0.8419 *** (0.1505)	−0.8312 *** (0.1432)
d. DEPU	3.9007 (3.3660)	3.9269 (3.7788)	3.8611 (4.0164)	4.2133 (3.7793)	27.0376 (44.2364)	33.1031 (41.2638)
d. FEPU	0.0217 (0.0262)	−0.0121 ** (0.0050)	0.0588 (0.0584)	−0.0109 (0.0100)	−0.0116 *** (0.0043)	−0.0128 *** (0.0017)
d. TOT	0.0544 (0.1777)	−0.1068 (0.1144)	1.2693 (1.3443)	−1.8905 (1.9434)	−0.0459 (0.0985)	−0.0626 (0.1519)
constant	−0.0105 (0.0089)	−0.0108 (0.0091)	−0.0220 (0.0195)	−0.0192 (0.0171)	−0.0079 (0.0104)	−0.0023 * (0.0014)
Hausman test		1.15 [0.76]		6.99 [0.07]		0.30 [0.96]

Note: () Standard error in parenthesis; [] are the chi-square probability values of the Hausman test in brackets. ***, **, and * indicate 1%, 5%, and 10% significance levels, respectively.

From Table 4, the preferred estimator for the full sample period and the post-crisis period for the ECOWAS region is the MG. In both sample periods, no significant relationship was observed among the variables. While for the pre-crisis period, the chosen estimator is the PMG. The result shows that both domestic and foreign EPU have a positive effect on the exchange rate in the long run. Thus, there is a real appreciation of the exchange rate in the long run. This is in conflict with the prediction of the theory under uncertainty (see Bernanke 1983). Based on the theory of uncertainty, one may expect a depreciation of the currency when uncertainty is high. In the short run, however, only foreign EPU causes the real exchange rate to depreciate.

Turning to the CFA area in Table 5, For the full sample period, the preferred estimator is the MG. The results show a significant positive relationship between foreign EPU and REER in the long run. This observation is consistent with Kido (2016), who found that foreign (US) economic policy uncertainty leads to the appreciation of the Japanese Yen. The author attributed the appreciation of the Japanese Yen to carrying out trade activities. A negative relationship is observed between foreign EPU and the real exchange rate in the short run. This result is, however, consistent with Kido (2016) for high-yielding currencies such as the Euro. For the pre-crisis period, the preferred estimator is PMG. The result reveals a significant positive relationship between foreign EPU and the exchange rate in the long run. For the post-crisis period, the appropriate estimator is MG. We find evidence that, in the long run, domestic EPU causes the exchange rate to appreciate. The result is contrary to Balcilar et al. (2016). Balcilar et al. (2016) find evidence that high domestic uncertainty causes agents to invest in foreign-denominated assets, leading to the depreciation of the local currency.

For the Non-CFA area in Table 6, PMG is the preferred estimator for the full sample period. Unlike the CFA area, domestic EPU has a positive impact on the real exchange rate in the long run. Contrary findings are reported in Abid (2020). The author reports that economic policy uncertainty leads to currency depreciation in five emerging countries (South Korea, India, Brazil, Mexico, and Chile). While, in a similar vein to the CFA area, foreign EPU exerts a negative impact in the short run, during the pre-crisis period, MG was the selected estimator. The results show that domestic EPU has a negative impact on REER. The result seems to be in line with the intuition that high uncertainty leads to lower macro-economic activity (Pastor and Veronesi 2012), which inevitably may cause the real exchange rate to suffer depreciation. Similar findings were reported in Abid (2020) for five emerging countries and Juhro and Phan (2018) for Malaysia. For the post-crisis period, the preferred estimator is the PMG. We observed that foreign EPU has a positive impact on REER in the long run, whereas short-run coefficients are negative. This observation is consistent with Kido (2016).

Looking at our control variable, we find evidence that the sample countries will suffer real depreciation in the long run following changes in terms of trade, with no significant effect in the short run. Moreover, this relationship is independent of the exchange rate arrangement and sample period. Our results are contrary to Cashin et al. (2004) and Coudert et al. (2015). This behavior in the long run makes sense since these countries are highly dependent on the exports of primary commodities (see Kassouri and Altıntaş 2020). Moreover, this behavior in the long run may be to their advantage, as it may lead to stronger competitiveness and positively influence their exports. For instance, Kassouri and Altıntaş (2020) contend that real depreciation with respect to terms of trade shocks could boost exports and may help preserve foreign reserves.

4.4. Summary

In all, domestic EPU only affects the exchange rate in the long run, with no significant relationship in the short run. The absence of a short-run effect is surprising since high uncertainty risks affect demand, production, investment, and hence the exchange rate (Sharma and Paramati 2021). In the long run, however, the nature of the impact varies along with the time horizons (pre/post-crisis) and the exchange rate arrangement. For instance, domestic EPU leads to a real appreciation of the currency in the Non-CFA area. While no significant relationship is found for the CFA area, we may cautiously infer that the impact of domestic economic policy uncertainty on exchange is more pronounced in Non-CFA areas than CFA areas. The difference in impact for CFA and Non-CFA areas could be attributed to regulatory differences due to capital controls and exchange rate arrangements. Specifically, the CFA area adopts a strict exchange rate arrangement (pegs its currency to the Euro).

In relation to time horizons, domestic EPU leads to a depreciation of the exchange rate during the pre-crisis, while it causes the exchange rate to appreciate after the crisis. The appreciation of the exchange rate due to changes in domestic EPU in the long run seems to be contrary to the intuition that domestic EPU leads to a depreciation of the exchange rate in the long run (Abid 2020). The author explains that as uncertainty provides firms with an incentive to delay their investment, these firms adopt a "wait and see attitude," which may cause financial markets to become less attractive to both domestic and foreign investors and hence cause the exchange rate to depreciate.

Our findings also show that, irrespective of the sample period and exchange rate arrangement, foreign economic policy uncertainty has a positive effect on the real exchange rate in the long run and a negative effect in the short run. However, the intensity of the relationship differed according to the sample period (pre/post-crisis). For the CFA area, the relationship between foreign economic policy and the exchange rate was stronger before the crisis than after the crisis. In the Non-CFA area, the relationship between the variables intensified after the crisis period. This evidence is not surprising, as it is consistent with the idea that a financial crisis may alter the relationship among economic/financial variables (Kido 2016).

Surprisingly, we found that foreign EPU has a more dominant effect on the exchange rate than domestic EPU. This makes sense since these countries are not able to absorb these external shocks due to weak institutional frameworks (Loayza et al. 2007; Ahir et al. 2018). This, however, could be attributed to the surge of foreign capital inflows to Africa over the sample period (Kassouri and Altıntaş 2020; Combes et al. 2012). Combes et al. (2012) mention that a significant increase in capital flows could make the financial system vulnerable, which they describe as the 'transfer problem'[4]. For example, in 2018, foreign direct investment in Africa was projected to reach 57 billion USD due to increasing Greenfield investment (African Economic outlook, 2017). Nevertheless, as these countries pursue economic openness, there is a higher tendency to be influenced by foreign economic policies, resulting in a higher impact on their exchange rate.

4.5. Robustness Tests: Results Obtained Using an Alternative Variable

This section further evaluates the sensitivity of the regression results to variable measurements since there is no consensus yet in the literature as to the best variable that captures uncertainties in macroeconomic policies. Bloom (2009) mentions that there is no perfect measure of uncertainty; instead, there is a range of proxies, such as the volatility of the stock market or GDP. First, we consider an alternative variable, the implied volatility index (VIX), to verify if our result is not induced by our measure of a foreign EPU variable. Thus, we replaced the proxy for foreign EPU (Baker et al. 2016′s US EPU) variable with the VIX. The VIX measures investor sentiment and implied market volatility. This has been used as a proxy for economic uncertainty in other studies (Bloom 2009, 2014; Lu et al. 2017; Bartsch 2019). Secondly, we replaced the proxy for domestic economic policy uncertainty with GDP. Thus, we used the variance of real GDP to proxy for domestic economic policy uncertainty following Price (1995). The domestic policy uncertainty variable follows Aizenman and Marion (1993), as described earlier. GDP has been used as a proxy for economic uncertainty in other studies (Price 1995; Rossi and Sekhposyan 2015).

The results for VIX are shown in Table 7. We present results for the full sample for the ECOWAS, CFA, and Non-CFA areas, respectively. From Table 7, the preferred estimator for the ECOWAS region and CFA area is the MG, while the Non-CFA is the PMG. Looking at the variables of interest, the new results for the ECOWAS region are not in contrast with the previous findings. For CFA, the new results show that foreign EPU has a positive effect on the exchange rate in the long run, while a negative effect is observed in the short run, which is consistent with the previous conclusion. The only noticeable difference is in terms of magnitude, which is expected. There are only small differences for Non-CFA, as the new results are different from the previous findings in that foreign EPU does not have a significant effect on the exchange rate in the short run.

Table 7. ARDL model for ECOWAS/CFA AREA/N0N-CFA AREA.

Full Period:	**1 October 1996**	**-31 December 2018**				
Long-run Variable	estimates ECOWAS MG	PMG	CFA area MG	PMG	Non-CFA MG	area PMG
LDEPU	−9.2709 (10.8337)	0.0640 *** (0.0106)	−13.8951 (16.3452)	−0.1234 (1.2238)	−0.0224 (1.2356)	0.0641 *** (0.0106)
LVIX	−0.0071 (0.0237)	0.0095 *** (0.0023)	0.0113 *** (0.0026)	0.0086 *** (0.0024)	−0.0442 (0.0742)	0.0284 ** (0.0111)
Lctot	−0.2527 *** (0.0816)	−0.0824 (0.0633)	−0.1886 ** (0.0928)	−0.0591 (0.0652)	−0.3809 ** (0.1577)	−0.4015 (0.2526)
Panel B:	Short-run	estimates				
ECT	−0.9290 *** (0.0209)	−0.9186 *** (0.0229)	−0.9356 *** (0.2150)	−0.9234 *** (0.0236)	−0.9158 *** (0.0507)	−0.9112 *** (0.0515)
d. LDEPU	9.3178 (8.9566)	5.6786 (5.5834)	12.3108 (13.5324)	6.7708 (8.3483)	3.3331 (3.1513)	3.6167 (3.6151)
d. LVIX	0.0131 (0.0185)	0.0046 (0.0070)	−0.0029 ** (0.0201)	−0.0016 ** (0.0008)	0.0452 (0.0571)	0.0094 (0.0211)
d. Lctot	0.0687 (0.0737)	−0.0039 (0.0693)	0.1487 ** (0.7446)	0.0841 (0.0529)	−0.9116 (0.1457)	−0.0509 (0.1571)
constant	−0.0028 (0.0033)	−0.0033 (0.0031)	0.0011 (0.0011)	0.0004 (0.0002)	−0.0107 (0.0091)	−0.0108 (0.0091)
Hausman test		22.82 [0.00]		14.42 [0.00]		0.96 [0.81]

Note: () Standard error in parenthesis; [] are the chi-square probability values of the Hausman test in brackets. ***, ** indicate 1%, 5% significance levels, respectively.

Similarly, we present results for the full sample for ECOWAS, CFA, and Non-CFA areas, respectively, in Table 8. From Table 8, the preferred estimator for the ECOWAS is the MG, and the CFA and Non-CFA are the PMG. When compared with the main results, no significant relationship was observed among the variables in the ECOWAS region, thus no contrast with the main results. For CFA, the sign and significance of the coefficient are the same in both the long run and short run. For Non-CFA, the only difference is that foreign EPU does not have any effect on the exchange rate in the short run; rather, it has a negative effect on the exchange rate in the long run. This implies our results are consistent with the main findings. Overall, the results are almost unchanged with an alternative variable for foreign EPU and domestic EPU. Thus, in other words, regardless of the choice of EPU proxy, the conclusion remains the same.

Table 8. ARDL model for ECOWAS/CFA AREA/NON-CFA AREA.

Full Period:	**1 October 1996**	**-31 December 2018**				
Long-run Variable	estimates ECOWAS MG	PMG	CFA area MG	PMG	Non-CFA MG	area PMG
LDEPU	3.2319 (30.4139)	8.2090 (5.2137)	31.3281 *** (11.4423)	7.8433 (5.3074)	−52.9604 (89.6304)	−65.6798 ** (32.8198)
LFEPU	0.0689 (0.1537)	0.1103 *** (0.0265)	0.07069 *** (0.0213)	0.1129 *** (0.0268)	0.0655 (0.5076)	−0.8223 *** (0.2820)
Lctot	−0.9933 (0.6975)	−0.2042 (0.2150)	−0.5702 (0.4074)	−0.2794 (0.0644)	−1.8396 (2.0540)	1.9185 (1.4093)
Panel B:	Short-run	estimates				
ECT	−0.1303 *** (0.0194)	−0.1067 *** (0.0160)	−0.1440 *** (0.0213)	−0.117 *** (0.0234)	−0.1029 ** (0.0493)	−0.0721 ** (0.0379)
d. LDEPU	−2.0073 (1.1765)	−1.1029 (0.7647)	−2.9306 * (1.5649)	−1.6711 (0.9521)	−0.1605 (1.4488)	0.5821 (0.7236)
d. LFEPU	0.0032 (0.0145)	−0.0028 (0.01465)	−0.0064 *** (0.0023)	−0.0072 *** (0.0023)	0.0225 (0.0459)	0.0383 (0.0361)
d. Lctot	−0.0838 (0.1115)	−0.2218 ** (0.0993)	−0.1099 (0.0728)	−0.1677 * (0.0905)	−0.0316 (0.3326)	−0.2542 (0.2738)
constant	1.3076 ** (0.5806)	0.5217 *** (0.0773)	1.0677 *** (0.0011)	0.6208 *** (0.0949)	1.7874 (1.7188)	−0.0396 (0.0312)
Hausman test		8.44 [0.037]		3.64 [0.3027]		3.52 [0.317]

Note: () Standard error in parenthesis; [] are the chi-square probability values of the Hausman test in brackets. ***, **, and * indicate 1%, 5%, and 10% significance levels, respectively.

5. Conclusions

This study investigates the impact of domestic and foreign economic policy uncertainty on the exchange rate for 12 African countries (ECOWAS) from 1996:01 to 2018:12. This paper departs from previous studies that focused on individual countries as well as developed economies. Conversely, this study employs the Panel ARDL approach to examine the long- and short-run impact of domestic and foreign EPU on the exchange rate. The panel ARDL accounts for both time and cross-sectional dimensions to give more robust results.

In this paper, we focus on the response of the exchange rate to domestic and foreign economic policy uncertainty for all countries (ECOWAS), as well as the response(s) produced under different exchange rate regimes: the CFA area and the Non-CFA area. We further divided the sample data into two periods: pre-crisis and post-crisis. Our panel ARDL was based on the Mean Group and Pooled Mean Group, which were subject to the Hausman test criteria.

Our findings can be summarized in the following three points: First, our results validate the assertion of Mussa (1986) on exchange rate restrictions; we observed that the response of the exchange rate to domestic economic policy uncertainty depends on the exchange rate arrangement since we found that the impact of domestic economic policy uncertainty on the exchange rate is more dominant in Non-CFA areas than CFA areas.

Second, our results show that the response of the exchange rate to foreign economic policy uncertainty is stronger before the crisis than after the crisis in the CFA area, and the reverse is found in the Non-CFA area, which validates the claim that the relationship among economic/financial variables is different during recessionary and non-recessionary periods. Third, while domestic economic policy uncertainty matters, its effect is dominant only in the long run, and foreign economic policy uncertainty has a stronger impact on the exchange rate both in the long run and in the short run.

Implications for the Countries Concerned and Generalizability of Results

Overall, our findings offer useful insights for policymakers, investors, and academics. First, the long-term real appreciation of the exchange rate as a result of domestic EPU requires attention. The real appreciation of the exchange rate, to some extent, is in favor of the sample countries, as these countries are more import-oriented. However, policymakers should take extra caution as these countries also depend heavily on the export of primary commodities. Thus, policymakers should rather implement strategies and adopt appropriate policies, especially in the long run, in order to stabilize the currency market. They should aim to reduce the negative impact of a real appreciation of the exchange rate in order to prevent the loss of external competitiveness. Kassouri and Altıntaş (2020), for example, argue that coordination of monetary and fiscal policies can effectively absorb the extra foreign reserves and ensure exchange rate equilibrium in order to limit the loss of external competitiveness associated with real appreciation. In addition, the optimal response to domestic economic policy uncertainty shocks depends, to some extent, on the exchange rate arrangement. Therefore, policymakers in CFA should adopt policies that will help contain the real appreciation during expansionary periods, while those in Non-CFA areas should focus on policies that will prevent further depreciation of their currencies during recessionary periods.

Second, the significant effect of foreign economic policy uncertainty on the exchange rate both in the long and short run is indicative of the fact that the selected countries are integrated with global markets. This has important implications for hedging strategies and exchange rate policies. The sample countries will suffer a long-run appreciation due to foreign uncertainty risk; one possible intervention by policymakers could be to increase the use of locally produced goods. Guzman et al. (2018) contend that making use of locally produced goods is essential in order to limit the effect of real appreciation pressure. Further, the depreciation of the exchange rate in the short run has implications for exchange rate policies. It is important that policymakers make the necessary adjustments and measures to prevent the depreciation of their currencies since these countries are relatively more import dominant.

Finally, governments and policymakers could benefit from providing sound and clear economic policies, as this could improve efficiency and promote economic prosperity. In particular, this could reduce the impact of domestic economic policy uncertainty risk on the exchange rate in the long run. To be more explicit, policymakers in CFA areas should be more cautious when formulating policies during expansionary periods than in Non-CFA areas during recessionary periods. Further, policymakers should monitor and make the necessary adjustments that will reduce the exposure to foreign economic policy uncertainty risk in order to bring about stability in the exchange rate market. We believe that the results obtained here (specifically the effect of foreign EPU, which appears to be ubiquitous in the countries under examination) could be generalizable to other countries, not necessarily on the same continent, regardless of pegged or floating rates. Similarly, domestic EPU seems to play a role in exchange rate fluctuations in Non-CFA countries. It is particularly interesting to note that exchange rate responses to domestic shocks in Non-CFA countries are in line with those of other developing countries in the Sub-Saharan Africa Subregion (see Hoffmaister et al. 1998).

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Notes

1. See for example 2017 IMF country report for Nigeria.
2. See Lensink et al. (1999) for the comparison of the GARCH-type modelling and the variance of the unpredictable part.
3. The ECOWAS is made up of 15 countries, which includes Carbo Verde, Guinea and Liberia, however these countries are not included in the data sample due to missing values.
4. Transfer problem refers to 'the impact of capital inflows or outflows on the domestic economy which is captured mainly through the real exchange rate' (Combes et al. 2012)

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