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Exchange Rate Changes and Price Differential at the Nigerian Border Markets

Olusola Oloba*

Independent Researcher, UK

***Corresponding Author:**
Olusola Oloba, Independent Researcher, UK.

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Abstract

The study investigates the extent to which frequent fluctuations in exchange rates contribute to the price differentials observed in the Nigeria-Benin border markets. This inquiry is warranted due to the fact that different prices are being charged on the same staples of same quality across the Nigeria-Benin borders as evident from the literature. The Nigeria-Benin border lays claims to several efficient border markets involving two distinct nationalities with different currencies. The prevailing payment system in these markets still requires conversion from one currency to the other; however, the conversion of these currencies is fraught with challenges and is not readily accessible through conventional channels, potentially resulting in varied valuations for commodities traded on opposing sides of the border markets. Findings from the price cointegration analysis indicate the existence of a price adjustment mechanism that enables the two prices to converge towards their long-term equilibrium relationship, thereby implying the presence of linear and symmetric price transmission across the borders and consequently negating the likelihood of asymmetric price transmission. The research, employing the Autoregressive Distributed Lag (ARDL) model, concludes that a significant inverse relationship exists between the appreciation of the real effective exchange rate and the border value of a product, both in the short run and long run, thereby suggesting that as the currency strengthens, the prices of goods at the border decrease. This investigation advocates for enhanced efforts to be directed towards the implementation of an effective appreciation policy, as this would likely normalise the price of similar products at the in cross-border market.

Keywords: Cross- Border Markets, Exchange Rate, Price Cointegration, ARDL

Introduction

Cross-border trade is one of the major ways through which regional integration is facilitated especially when countries involved belong to the same regional bloc. Over the decades, the Nigeria-Benin borders have accommodated a handful number of self-functioning border markets involving different nationals selling all types of goods and services. The busiest and the most commercial border region in West Africa is the frontier between Nigeria and Benin, and by implication, the most widely spent indigenous currencies in the West African border markets are the Naira and CFA franc [1]. However, evidence shows that these currencies are not substitutable without difficulty and not readily available through official means, and this might attract different values to the commodities being sold at the opposite sides of the border markets. On the other hand, each currency's individual exchange rate with a third currency such as the popular US Dollar might be or serve as a potential source of price differential [2].

Apart from the obvious absence of natural barriers such as language differences, diverse ethnicity, and geographical features limiting border interactions, and social conflict, Nigeria-Benin border markets are facilitated and backed up by the treaty of the Economic Community of West African States (ECOWAS) and the African Continental Free Trade Area

(AfCFTA) Agreement, which promote free trade. In addition, the two countries discussed a new bilateral agreements in 2024. This discussion rekindled the existing free trade relations as the volume of informal cross-border sales almost doubled even before the agreements entered into force in June, 2025. However, it is worthy of note that despite these trading platforms, trading via informal channels dominate the border markets' trade volume. While informal cross-border trade (ICBT) serves as a pragmatic response to formal trade impediments, mitigating supply or demand imbalances for border communities, it imposes significant costs, including lost tax revenues, undermined social contracts, and perpetuated corruption, thereby hindering effective policy making [1-4].

While extant studies report a number of similar household staples being sold at both the Nigerian side of the border and the Beninoise frontier, data reveals constant and sustained price differential of these commodities [4]. This raises a serious objection to the Law of One Price which should ordinarily prevail in a near-perfect free trade environment such as Nigeria-Benin border community [5]. For the purpose of this study, the emphasis is on the most traded staple foods across the Nigeria-Benin borders, which are Grains (Rice and Maize) and Palm Oil.

Theoretically, the link among market, price and exchange rate is emphasized by the traditional market integration model. The techniques of traditional market integration are built on purchasing power parity (PPP)--law of one price which suggests a symmetric price transmission [6]. Despite the theoretical expectation of price convergence, empirical studies have only consistently investigated the effects of exchange rates changes on aggregate price while their impacts on price differentials at Nigerian borders have not been adequately explored [4,6-18].

While most studies have focussed on investigating the effects of transport cost, exchange rate population, economy sizes, and more recently border effects on cross-border trade using the traditional gravity equation model that establishes a direct link of these key variables, this study leverages a built-in market-pair analysis model emanating from the PPP hypothesis to examine the effect of exchange rate changes on border price differential unlike Gopinath et al., (2011) and Aker et al., (2010, 2014) that adopt same model to investigate how border effects such as ethnicity and geographical distance influence border price [6,9].

On this note, this paper has two major objectives. First, since available evidence and current realities suggest that a handful of self-regulated border markets free of any form of trade barriers involving mostly nationals from Benin Republic and Nigeria exist along Nigeria-Benin borders, it becomes necessary to retest the validity of the Law of One Price (LOP) against asymmetric price transmission by examining the long-run relationship between prices at both sides of the border. Second, based on the different prices being charged on the same staples from the opposite side of the border and the empirically verified role of interest rates in determining cross-border price, this study empirically investigates the effect of exchange rate changes on border price differential at the cross-border markets. The rest of the paper is organised as follows; section 2 gives some stylized facts on exchange rate dynamics and border staples in Nigeria while section 3 presents the model specification and results and section 4 concludes the study.

Stylised Facts About Exchange Rate Dynamics in Nigeria and Border Staples

Exchange Rate Dynamics in Nigeria

Nigeria has experimented with various exchange rate regimes over the years, including fixed, managed float, and multiple exchange rate systems, since 1986. However, none of these approaches have yielded sustainable stability for the Naira. The long-standing practice of maintaining multiple exchange rate windows, particularly the gap between the official Nigerian Foreign Exchange Market (NFEM) and the parallel Bureau De Change (BDC) windows, has been a prominent feature of the financial landscape. It would be recalled that the current administration announced a harmonised rate between the official window and parallel market upon assumption of office in 2023. The aim was to reduce the incessant harm arbitrage had already caused to the economy.

While recent efforts in 2025 have aimed at a continual narrowing of the gap between these windows, this discrepancy has historically created significant opportunities for arbitrage and undermined investor confidence. The CBN's historical attempts to mechanically manipulate the exchange rates using foreign reserves have led to a multiplicity of exchange rate windows, raising fundamental questions about the true value of the Naira and its convertibility [19].

Achieving sustainable exchange rate stability in Nigeria therefore necessitates a more fundamental shift. It requires not just managing the exchange rate itself through interventions or regime changes, but crucially addressing the underlying structural issues such as economic diversification, boosting domestic productivity, and reducing import dependence, while also ensuring policy coherence, transparency, and market-friendliness to break this cycle of distortion and informality. Figure 1 explains the trend and volatility of exchange rate in Nigeria since the inception of the 4th republic

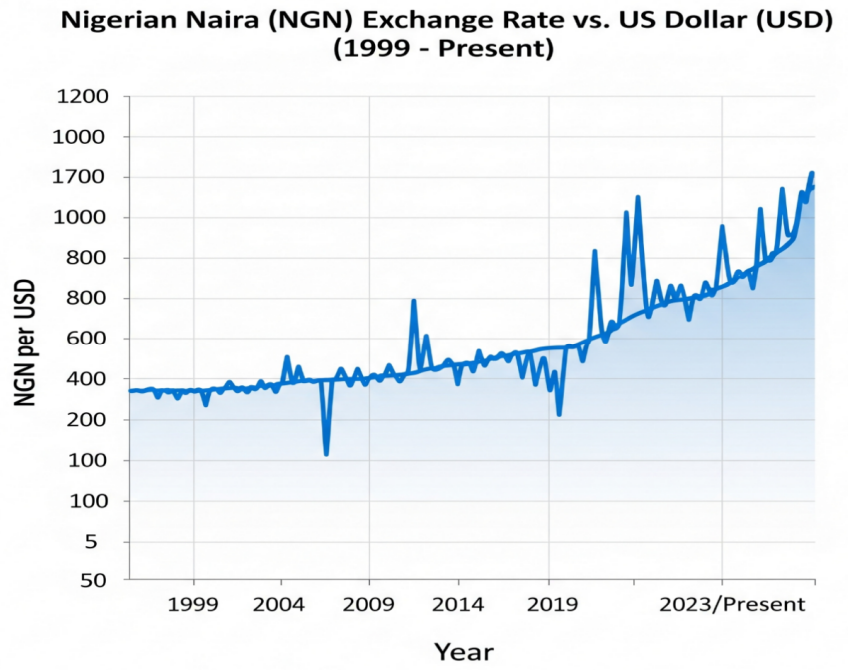

Figure 1: NG Naira (NGN) Exchange Rate vs. US Dollar (USD)(1999 Till Date)

Source: Generated by AI based on Federal Reserve Economic Data, 2025

The Nigerian Naira has experienced a significant and consistent depreciation against the US dollar since 1999, driven by various economic and policy factors. The trend in Figure 2.1 can be broken down into distinct periods:

- **1999-2008:** Historical data indicates that in 1999, the parallel (black) market rate was approximately ₦88–₦90 per US dollar. Records show that by 2007 and 2008, the parallel market rates had weakened to around ₦120 and ₦115.50–₦120, respectively. Central Bank of Nigeria officially began the Wholesale Dutch Auction System on February 20, 2006. The adoption of Wholesale Dutch Auction System (WDAS) marked a move toward greater liberalization and helped bring the official and parallel market rates closer together for the first time in decades [20].
- **2009-2015:** Following the global financial crisis, the Naira experienced renewed depreciation pressures, moving from around ₦145 per US$ in 2009 to a range of ₦199-₦300 per US$ by 2015. This period was marked by the reintroduction of the Retail Dutch Auction System (RDAS) and later the closure of the official forex window to curb speculative trading [21].
- **2016-2022:** The exchange rate continued to depreciate sharply, with the official rate reaching around ₦390-₦489 per US$ in 2016 and further to ₦423 per US$ by 2022. Policy measures during this time included allowing authorized dealers to sell foreign currency from remittances to Bureau De Change operators.
- **2023-Present:** This period has seen the most dramatic depreciation. In June 2023, the central bank abandoned its currency peg, causing a sharp drop to ₦600 per US$. The Naira continued to fall, reaching new lows of ₦1,483 per US$ in early 2024 and ₦1,532 per US$ by August 2025 (The Republic, 2023, Exchange UK, 2025).

Significance of Rice, Maize, and Palm Oil in Nigerian and Beninoise Economies

Rice, maize, and palm oil are not merely commodities but fundamental dietary staples and economic drivers for both Nigeria and Benin. These three products form the bedrock of household consumption and agricultural livelihoods. Their significance presence is seen both in border markets and household consumption. Nigeria, as country often referred as monocultural economy, is anchoring its diversification agenda on the agricultural sector especially embarking on policies that will boost the production of staples such as Rice, Maize and Palm Oil where it has proven comparative advantage especially for palm oil and rice. For Benin, these staples are equally vital, serving as both domestic consumption goods and, crucially, as commodities central to its unique economic model, which often involves re-exportation [4,22]. The border markets between Nigeria and Benin are key hubs for trade in these commodities, facilitating both domestic and regional consumption. Table 1 below shows the mapping of household staples popularly sold at the Nigerian border markets with Rice, Maize and Palm Oil topping the list.

Commodity	Nigeria → Benin	Benin → Nigeria	Reason for Two-Way
Grains (e.g., Rice, Maize, Millet)	Locally grown grains move to Benin (especially millet, maize).	Informal rice trade to Nigeria (for the reason of import ban).	Price arbitrage
Palm Oil	Nigerian palm oil is in high demand in Benin when production is high.	Beninese palm oil (sometimes from other West African countries) flows into Nigeria when Nigerian prices rise.	Price arbitrage and taste/ quality preferences.

Vegetables & Fruits	Nigeria's vegetables move to Benin.	Beninese fruits move to Nigeria.	Differences in harvest time.
Livestock & Meat	Nigerian goats, poultry, and eggs move into Benin.	Frozen poultry (imported via Benin) moves into Nigeria.	One side supplies fresh/ local, the other side supplies frozen/imported.
Cassava Products	Nigerian gari and processed cassava go to Benin.	Beninese processed cassava (sometimes from surplus production) goes to Nigeria.	Processing methods and consumer preferences differ.
Beverages	Nigerian soft drinks, beer, and malt drinks go to Benin.	Imported beverages through Cotonou go into Nigeria.	Brand variety and pricing differences.
Source: Author's analysis based on the literature			

Table 1: Most Traded Commodities on the Both Sides of the Nigeria- Benin Borders

Model Specifications and Results

Model Specifications

In an attempt to model the effect of exchange rate changes on price at both sides of the cross-border market, I employ the traditional Law of One Price—an integral of the Purchasing Power Parity (PPP) hypothesis. Its specified form is the market-pair analysis model employed by Gopinath et al., (2011) and Aker et al., (2014) [6,9]. The PPP, as mentioned earlier stipulates that in the absence of an ideal world devoid of trade barriers and transportation costs, exchange rates between two currencies should adjust to equalize the prices of an identical basket of goods and services in different countries. In the context of the foregoing, I begin by modelling a real world scenario of price differential that encourages arbitrage. Following Aker et al., (2014), I generate a model depicting a scenario of one staple of same quality being traded in two countries at the same time [6]. As stipulated by the Law of One Price, in the absence of trade impediments, prices of similar staples should be equal when one price is expressed in terms of the other currency. Consider a staple A traded at the opposite sides of the border with the following specification;

Nigeria's Side: N Beninoise's Side: B
P_n = Price of Staple A on the Nigerian side of the border
P_b = Price of Staple A on the Beninoise side of the border
R_{nb} = Prevailing exchange rate between the two currencies
Assume goods are identical in a frictionless market, then;

P_n (in terms of Nigeria's currency) = $R_{nb}P_b$ (1)

Furthermore, in order to argue for the presence of arbitrage as a potential consequence of price differential in the absence of transport cost (i.e markets are close geographically and price arbitrage is more plausible over shorter distances), I introduce a conversion mechanism to (1) in the following way;

$$P_n = R_{nb}P_b \quad (2)$$

$$\text{If } P_n > R_{nb}P_b$$

Based on (2), a household would buy one unit at Beninoise side at P_b and pay $R_{nb}P_b$ in domestic currency upon conversion and then resell at the Nigerian side at P_n so he makes a profit expressed as;

$$\pi = P_n - R_{nb}P_b > 0 \quad (3)$$

On the other hand;

$$\text{If } P_n < R_{nb}P_b \quad (4)$$

Then, the reverse action holds to leave the profit as positive

My objective is to run a final model that keeps the profit, π at zero. I proceed by introducing an 'n' case scenario, depicting more than one tradable goods as stipulated by the PPP hypothesis. On this occasion, prices of the staples of interest are treated as vector quantity while the singular exchange rate is a scalar such that;

$$p_N, p_B \in R^n \nabla R_{nb} \quad (5)$$

By implication; prices p_N and p_B are element of R_{nb} such that;

$$p_N = R_{nb} p_B \quad (6)$$

If P_n in (1) is a function of p_N such that $P_n = \mathrm{h}(p_N)$ then the absolute form of the PPP hypothesis reflecting price indices is;

$$P_n = R_{nb} P_b \quad (7)$$

Compare (7) to (1)
For the purpose of this study, (7) can be expressed in the form of;

$$\frac{P_n}{P_b} = R_{nb} \quad (8)$$

Equation (8) presents a new form of market-pair analysis model which builds upon the PPP hypothesis and Law of One Price. Consistent with a typical market model employed by Engles and Rogers (1996), Gorodnichenko and Tesar (2009), Gopinath et al., (2011) and Aker et al.,(2014), I introduce border effects as exogenous variable [6,7,9,23]. I then proceed to incorporate exchange rate, alongside other key variables, into a new vector. This is in line with literature on border effects in industrialised countries [14,24].

$$\frac{p_{nt}}{p_{bt}} = f\left(Border_{nb}, X_{it}^{'}\right) \quad (9)$$

Where p_{nt} and p_{bt} are prices at time, t in market 'n' and 'b' respectively. According to Aker (2010) and Aker et al., (2014), I define one price as a reciprocal function of the exchange rate of the other currency and vice versa [6]. $\mathrm{Broder}_{\mathrm{nd}}$ represents border effects (dummy variables) such as ethnicity, presence or absence of geographical features such as hills, river, etc. that can impede trade on one hand or presence or absence of border's militant activities or closure on the other hand. It represents 0 in the absence of these impediments and 1 otherwise. $X_{it}^{'}$ is a vector of time invariant observables shared by market 'n' and 'b' such as exchange rate between the two markets, distance (proxied as transport cost) and home country's trade openness (tdop). While trade openness assumes its traditional definition as the proportion of GDP determined by trade, exchange rate definition remains consistent with (1), defined as the rate at which Nigeria Naira and Beninoise CFA Franc exchange for each other. The exchange rate is expected to be highly dependent on the US Dollar value of the both currencies. The model is specified thus;

$$\ln\left(\frac{p_{nt}}{p_{bt}}\right) = \left|\ln p_{nt} - \ln p_{bj}\right| = \alpha_0 + \alpha_1 Border + \alpha_2 \ln Distance_{nb} + \alpha_3 \ln R_{nbt} + \alpha_4 \ln tdop + \varepsilon_t \quad (10)$$

From (10), it is possible to separate the exchange rate into appreciation and depreciation regimes. By doing this, I can discover the degree of responsiveness of price to variation in each regime.

$$\ln\left(\frac{p_{nt}}{p_{bt}}\right) = \left|\ln p_{nt} - \ln p_{bj}\right| = \alpha_0 + \alpha_1 Border + \alpha_2 \ln Distance_{ij} + \alpha_3 \ln posexr_t + \alpha_4 \ln negexr_t + \alpha_5 \ln tdop + \varepsilon_t \quad (11)$$

Data

This study heavily relies on annual time-series data for the analysis of the specified model. Annual consumer price data covering the period 2009-2023 for Rice, Maize and Palm Oil were collected from the FAOSTAT database, aggregated and converted in terms of foreign price (Benin Price in Cephas). Apart from data availability, the choice of the three staples is informed by the fact that have been part of the most consumed and traded food substance and have come to occupy significant positions in the both countries commodity market. Data on exchange rates, transport cost, and trade openness were sourced from the World Development Indicators (WDI) database covering same period.

Pre-Analysis Tests

Unit Roots Test

Testing for non-stationarity in the form of unit roots has become a clip of the time series econometrics. Studies have shown that most microeconomics time series behave like a random walk and are therefore not stationary at their levels. These time series are therefore said to be integrated of order one and are denoted as I (1) if they yield stationary series after first differencing. The level of such variables can be arbitrarily large or small so that there is tendency for them to revert to their mean level. The test for stationarity of variables is therefore known as the unit root test.

Formal testing for stationarity and the order of integration of each variable are therefore undertaken mainly, using Augmented Dickey-Fuller (ADF) and Philip-Perron methods of unit root test with intercept only and intercept with trend using automatic lag length selection based on Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC). Table A1 and A2 in the Appendix present the unit root test using ADF and PP approach. Each of the two (2) tests shows that some of the variables are stationary at level. That is, they were integrated of order zero, I(0) while other variables became stationary after first difference all at 5% level of significance respectively.

Market Price Cointegration Test

In line with the work of Sanogo and Amadou (2010), I proceed to conduct the price cointegration test [8]. Balke and Fomby (1997) recommend an approach whenever there are strong indications that responses of price to shocks may not be symmetric as a result of economic integration, especially when the two countries involved belong to the same regional body (in the case of Nigeria and Benin Republic) [25]. It is based on Engle and Granger (1987) cointegration tests. The test is run on the prices to test the possibility of a long-term cointegrating association, assuming a symmetric transmission effect taking into consideration that asymmetric responses to price change may exist.

The standard model of spatial price transmission is based on price correlations between two markets. Consider a bivariate cointegration test as follows;

$$P_n = \pi_0 + \pi_1 P_b + \varepsilon_t \qquad (12)$$

According to Engle and Granger (1987), cointegration of the two markets can be verified when both prices P_n and P_b exhibit the same order of integration. The price adjustment mechanism within the two markets as shown in equation (12) is estimated using the Ordinary Least Square (OLS) method. Unit roots tests are then conducted on the residual of the estimation. If the residual is stationary, the two market prices are understood to have long-run relationship. This serves as an empirical test for a smooth price transmission mechanism within the border markets and establishes the basis for further investigation of the impact of exchange rate dynamics on price differential at the border market.

Results

Asymmetric Price Cointegration Analysis

Based on the unit root tests conducted (see Table A1 and A2 in the Apendix), prices at both sides of the Nigerian borders display the same order of integration. According to Engle and Granger (1987), cointegration of the two markets can be tested if the prices display the same order of integration. On this occassion, I have mainly investigated the presence of linear and symmetric price transmission effects and concluded that its absence would connote the presence of asymmetric price transmission effects. This is in line with Sanogo and Amadou (2010) [8].

I begin the process of testing for market price cointegration by running an OLS regression where the residual of the OLS results is obtained (see Table A5 in the Appendix). In summary, the price adjustment mechanism between the two markets, as specified in (12), is estimated through the ordinary least squares (OLS) technique (See Table A5 in the Appendix). Unit root test is then applied to the residual of the estimation. The results however show that the residual becomes stationary after first difference using Augmented Dickey-Fuller approaches to unit roots (see Table A6 in the Appendix). According to Sanogo and Amadou (2010); Aker et al., (2014), the two markets prices are said to be cointegrated if the residual is stationary, suggesting that there is a price adjustment mechanism between the two series, which makes them converge to their long-term equilibrium relationship [6,8]. The result suggests the presence of linear and symmetric price transmission at the borders suggesting that markets on both sides of the border are well-integrated and therefore rules out the possibility of asymmetric price transmission. Intuitively, this means price shocks in one market are transmitted proportionally to the other market. This result is however contrary to what is reported in Sanogo and Amadou (2010), where it is found that asymmetric responses to price changes exists in India-Nepal borders [8].

Exchange Rate Changes and Prices at the Border Markets (ARDL Approach)

Following Bahamani-Oskooee and Halicioglu (2016), since the interest of this study is to determine the long-run price differential occasioned by exchange rate dynamics, I proceed by estimating (11) with Autoregressive Distributed Lag (ARDL) [12]. The choice of ARDL is based on the fact that the model yields constant estimates of the long-run normalized coefficients irrespective of whether the underlying regressors are stationary at I(1) or I(0) or a mixture of both. In other words, it ignores the order of integration of the variables [26]. Another justification for the choice of ARDL is that ARDL does well in elucidating the long-run phenomena of variables. The model provides unbiased estimates of the long-run model as well as valid t-statistics even when some of the regressors are endogenous. Also the model is good in estimating small sample since it yields robust results even when the sample size is small.

Since it has been established earlier that in the long-run, prices move together, suggesting a smooth linear transmission at the border, it becomes necessary to investigate the dynamic effect of exchange rate changes on prices at the Nigerian borders. Table A4 in the appendix displays the estimated results of both short and long-run relationship among border prices (LOGPBD), border effects (BORDER), distance, proxied as transport cost (LOGTRANS), trade openness (LOGTDOP), real effective exchange rate depreciation (LOGREER_P) and real effective exchange rate appreciation (LOGREER_N) while Table A4a presents the raw results. The short-run estimation result reveals that the explanatory

variables jointly account for 97% of the variation in border price with lag length 2 based on Table A3 in the Appendix. Table A4 further shows that real effective exchange rate appreciation has a significant impact on border price and the coefficient is negative. This means a percentage appreciation in the real effective exchange rate decreases border price by 4.1% in the short-run. This is in line with the traditional trade theory which states that all things being equal, exchange rate appreciation makes import attractive due to an immediate fall in price in the short-run [27]. Also, of interest to know in the short-run is that transport cost exhibits a positive relationship with border but the evidence is weak (10% level of significance). However, border has no short-run effect on border price variation as shown from the short-run column of the results.

Furthermore, in the long-run, border exhibits little or no effect on border price in Nigeria. This is, however, not surprising mainly because of inter-ethnic behavior and in most cases less language barriers among the traders at the Nigeria's border markets, suggesting a broad level of cultural integration in the border community. This finding conforms to that of Aker et al., (2014) [6]. Trade openness on the other hand indicates a significant positive relationship with border price in the long-run. Precisely, 1% increase in the openness to trade will increase value of a product at the border by 0.67%. This relationship is significant at 5% level. The reason for this positive relationship is not far-fetched. Openness to trade is measured as the ratio of trade to GDP and Nigeria is a country that engages massively in regional trade under the existing ECOWAS trading platform and the newly implemented continent-wide AfCFTA Agreement. The large economic mass of Nigeria is one of the factors that attract traders from neighboring countries to participate in cross-border trade with Nigeria thereby improving trade. This automatically has a positive long-run impact on the value of a product at the border. Just like in the short-run, real effective exchange rate appreciation is negatively related to border price in the long-run. A percentage increase in exchange rate appreciation (LOGREER_N) will reduce the value of a product at the border by about 2.9% at 5% level of significance. Also exchange rate depreciation (LOGREER_P) exhibits a non-significant positive relationship with border price in the long-run. The above results conform to some trade theories such as the traditional trade theory and two goods-two countries theory. The error-correction term is negative which validates its role of error correcting mechanism and it is significant at 5% level. Results show that the speed of adjustment to long-run equilibrium from short-run disequilibrium is about 64%. Finally, Figure A1 in the Appendix confirms the stability of the ARDL model

Conclusion and Policy Recommendation

This study reports the effect of exchange rate changes on price differential at the Nigeria-Benin border markets. Having found that prices at both sides of the Nigerian borders display the same order of integration, cointegration of the two markets is tested and the results show that there is a price adjustment mechanism between the two series, which makes them converge to their long-term equilibrium relationship suggesting the presence of linear and symmetric price transmission at the border and therefore rules out the possibility of asymmetric price transmission. This symmetric border price transmission is consistent with the Law of One Price because it ensures that exchange rate changes are passed on equally in both directions, preventing persistent cross-country price gaps for identical goods.

The study also shows that a significant negative response occurs between real effective exchange rate appreciation and border value of a product both in the short-run and long-run. This immediately implies that as the currency strengthens, the prices of goods at the border decrease. This suggests that effective appreciation policy drives down the price and increases consumers demand for the staples of interest at the cross-border markets.

In the light of the above, the study concludes that the absence of asymmetric price transmission at the Nigeria's cross-border markets indicates that prices respond the same way at both sides of the border. In other word, markets at the Nigerian borders have become so integrated that speculations of future rise in price by cross-border traders from either side of the border may not be realistic. Any perceived increases in price of staples may be absolutely temporary and has no link with empirical evidence according to this study. Study also concludes that a significant negative response to real effective exchange rate appreciation of border value of a product both in the short-run and long-run connotes that sellers would adjust their prices downward to align with long-run equilibrium relatively more quickly in the case of currency appreciation than they would adjust it upward in the case of depreciation. This also means that the upward price adjustment mechanism in periods of depreciation is not instantaneous and much slower.

The foregoing has two major implications for policy. First, policy makers need to pursue an effective appreciation policy and keep this at upward trajectory to serve dual goals of border price harmonization and stability. Second, government is better prepared to study closely the short-run interplay between effective appreciation policy and border price and leverage this to pursue policy aimed at reducing food inflation that constitutes the largest proportion of the overall inflation rate in Nigeria.

References

1. Iliyasu, W. (2014). Toward a regional integration along Nigeria-Niger border: a case study of Katsina-Maradi Crossing. The Business & Management Review, 4(3), 134.
2. Greenaway, D., & Nelson, D. (2022). COVID-19, trade and trade policy. World Economy, 45(2).
3. Oloba, O., & Amusan, L. (2020). Exploring the effect of Women Cross-Border Trade (WCBT) on food security in the border towns of the South Western Nigeria. Gender and Behaviour, 18(2), 15892-15900.

4. International Monetary Fund. (2024). Benin: Selected issues (IMF Country Report No. 24/45). International Monetary Fund.
5. Asplund, M., & Friberg, R. (2001). The law of one price in Scandinavian duty-free stores. American Economic Review, 91(4), 1072-1083.
6. Aker, J. C., Klein, M. W., O'Connell, S. A., & Yang, M. (2014). Borders, ethnicity and trade. Journal of Development Economics, 107, 1-16.
7. Gorodnichenko, Y., & Tesar, L. L. (2009). Border effect or country effect? Seattle may not be so far from Vancouver after all. American Economic Journal: Macroeconomics, 1(1), 219-241.
8. Sanogo, I., & Amadou, M. M. (2010). Rice market integration and food security in Nepal: The role of cross-border trade with India. Food Policy, 35(4), 312-322.
9. Gopinath, G., Gourinchas, P. O., Hsieh, C. T., & Li, N. (2011). International prices, costs, and markup differences. American Economic Review, 101(6), 2450-2486.
10. von Cramon-Taubadel, S., & Zorya, S. (2014). Proximity and price co-movement in West African rice markets. African Journal of Agricultural and Resource Economics, 9(1), 53–67.
11. Yusuff, O. (2015), Gender Dimensions of Informal Cross-border Trade in the West African Sub-Region (ECOWAS) Borders; Regional Economic Communities.
12. Bahmani-Oskooee, M., & Fariditavana, H. (2016). Nonlinear ARDL approach and the J-curve phenomenon. Open Economies Review, 27(1), 51-70.
13. Arize, A. C., Malindretos, J., & Igwe, E. U. (2017). Do exchange rate changes improve the trade balance: An asymmetric nonlinear cointegration approach. International Review of Economics & Finance, 49, 313-326.
14. Hayakawa, K. (2017). Domestic and international border effects: The cases of China and Japan. China Economic Review, 43, 118-126.
15. World Bank. (2018). Regional integration and informal trade in Africa: Evidence from Benin's borders with Nigeria. World Bank.
16. CILSS, & IFPRI. (2018). Barriers to trade in Sub-Saharan Africa food markets. International Food Policy Research Institute.
17. International Monetary Fund. African Dept. (2022). Formal and Informal Trade Ties with Nigeria: Evidence from Border Closure. IMF Staff Country Reports, 2022(246), A003.
18. Clingendael Institute. (2024). Northern Benin – North West Nigeria: Cross-border trade. Clingendael Institute.
19. CBN (2024), Central Bank of Nigeria Update.
20. Umar, A. (2010). GARCH and ARDL model of exchange rate: Evidence from Nigeria's Retail Dutch Auction System. International Research Journal of Finance and Economics, 49, 7-14.
21. CBN (2016). Central Bank of Nigeria Annual Report.
22. Bensassi, S., Joachim J., & Mitaritonna, C. (2019) Regional Integration and Informal Trade in Africa: Evidence from Benin's Borders, Journal of African Economies, Volume 28, Issue 1 Pp 89–118.
23. Ch, E., & Rogers, J. H. (1996). How wide is the border. The American Economic Review, 86(5), 1112-1125.
24. Beck, G. W., Kotz, H. H., & Zabelina, N. (2020). Price gaps at the border: Evidence from multi-country household scanner data. Journal of International Economics, 127, 103368.
25. Balke, N. S., & Fomby, T. B. (1997). Threshold cointegration. International economic review, 627-645.
26. Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. Journal of applied econometrics, 16(3), 289-326.
27. Boke, S., & Doganay, S. (2014). Trade and real exchange rate: permanent and transitory components. Erişim adresi.
28. Friberg, R. (2001). Two monies, two markets?: Variability and the option to segment. Journal of International Economics, 55(2), 317-327.
29. Head, K., & Mayer, T. (2014). Gravity equations: Workhorse, toolkit, and cookbook. In Handbook of international economics (Vol. 4, pp. 131-195). Elsevier.
30. Krugman, P. (2002). Ricardo's difficult idea: why intellectuals don't understand comparative advantage. In The economics and politics of international trade (pp. 40-54). Routledge.

Appendix

Critical Values

Statistics / Variables	Statistics at Level		Statistics at First Difference		Order of Integration
	Intercept	Intercept and Trend	Intercept	Intercept and Trend	
Logpbd	0.5126	-2.0400	-4.8729	-4.7228	I(1)
Logtrans	-2.5686	-2.5895	-4.4610	-4.3208	I(1)
Logtdop	-2.9552	-2.8633	-5.3745	-5.3004	I(1)
Exvol	-4.0926	-4.5705	-6.9810	-3.6099	I(0)
Logreer_n	0.2024	-3.6460	-3.6579	-3.5893	I(1)
Logreer_p	-1.7924	-1.0871	-4.3589	-2.8299	I(1)
Pbn	0.2500	-4.3336	-5.0513	-5.0104	I(1)
Png	0.1979	-2.1345	-4.2932	-4.8812	I(1)

Table A1: Unit Root Test Using Augmented Dickey-Fuller (ADF) Technique (ARDL Data Series)

Critical Values

1%	-3.8887	-4.6162	-3.9204	-4.6678	
5%	-3.0522	-3.7105	-3.0658	-3.7332	
10%	-2.6666	-3.2980	-2.6735	-3.3103	

Statistics / Variables	Statistics at Level		Statistics at First Difference		Order of Integration
	Intercept	Intercept and Trend	Intercept	Intercept and Trend	
Logpbd	0.7193	-2.0619	-4.8729	-4.7227	I(1)
Logtrans	-2.5516	-2.4953	-5.8779	-5.5649	I(1)
Logtdop	-2.9468	-2.8056	-5.7360	-6.3052	I(1)
Exvol	-4.0937	-4.7961	-16.5129	-16.5452	I(0)
Logreer_n	0.6213	-2.3620	-3.6355	-3.5840	I(1)
Logreer_p	-1.9520	-1.0871	-4.3371	-4.5538	I(1)

Table A2: Unit Root Test Using Phillip-Peron Technique (ARDL Data Series)

Critical Values

1%	-3.8867	-4.6678	-3.9204	-4.6667	
5%	-3.0522	-3.7333	-3.0656	-3.7332	
10%	-2.6666	-3.3103	-2.6735	-3.3103	
Source: Author's calculation based on Eviews					

VAR Lag Order Selection Criteria
Endogenous variables: LOGPBD
Exogenous variables: C LOGTRANS LOGREER_P LOGTDOP LOGREER_N LOGYBN BORDER
Date: 01/07/25 Time: 20:22
Sample: 1999 2023
Included observations: 20

Lag	LogL	LR	FPE	AIC	SC	HQ
0	11.26858	NA	0.005770	0.364189	1.025036	0.357150
1	14.50985	2.593016	0.007924	0.465353	1.315013	0.456302
2	32.36152	9.520890*	0.001936*	-1.381536*	-0.343063*	-1.392598*
3	32.99138	0.167963	0.008259	-0.932184	0.295103	-0.945258

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion

Table A3: VAR Lag Order Selection Criteria

Panel A: Short-run Estimates based on ARDL			
	Lags		
	0	1	2
∆logreer_n	-4.093*** (-4.30)		
∆logreer_n		0.205 (0.39)	
∆logtrans			0.107* (2.46)
∆logreer_p	0.691 (1.78)		
Panel B: Long-run Estimate based on ARDL			
Constant	-3.327*** (-4.125)		
Logpbd		-0.645** (-3.93)	
Border	0.003 (0.167)		
Logtrans		0.093 (1.428)	
Logtdop		0.663*** (4.577)	
Logreer_p		0.27 (1.47)	
Logreer_n		-2.93*** (-4.99)	
Note: *, **, *** implies 10%, 5%, and 1% level of significance respectively Source: Author's computation based on Eviews Objects in parenthesis are the various t-statistics			

Table A4: Results from the Autoregressive Distributed Lag (ARDL) Model

Dependent Variable: D(LOGPBD)
Method: Stepwise Regression
Date: 07/07/25 Time: 00:56
Sample (adjusted): 2004-2023
Included observations: 20 after adjustments
Number of always included regressors: 7
Number of search regressors: 15
Selection method: Uni-directional
Stopping criterion: p-value = 0.05

Stopping criterion: number of search regressors = 5

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
C	-3.327061	0.806406	-4.125787	0.0145
LOGPBD(-1)	-0.644999	0.163957	-3.933947	0.0170
BORDER	0.002659	0.015871	0.167522	0.8751
LOGTRANS(-1)	0.092997	0.065101	1.428507	0.2263
LOGTDOP(-1)	0.663583	0.144985	4.576895	0.0102
LOGREER_P(-1)	0.279445	0.189499	1.474650	0.2143
LOGREER_N(-1)	-2.934970	0.588155	-4.990132	0.0075
DLOGREER_N	-4.093620	0.951260	-4.303366	0.0126
DLOGREER_N(-1)	0.205529	0.527617	0.389542	0.7167
DLOGTRANS(-2)	0.107317	0.043597	2.461586	0.0696
DLOGREER_P	0.691240	0.387847	1.782249	0.1493
R-squared	0.969123	Mean dependent var		0.095770
Adjusted R-squared	0.891930	S.D. dependent var		0.058182
S.E. of regression	0.019127	Akaike info criterion		-4.930542
Sum squared resid	0.001463	Schwarz criterion		-4.411305
Log likelihood	47.97906	Hannan-Quinn criter.		-4.936073
F-statistic	12.55451	Durbin-Watson stat		2.807874
Prob(F-statistic)	0.013164			
	Selection Summary			
Added DLOGREER_N				
Added DLOGREER_N(-1)				
Added DLOGTRANS(-2)				
Added DLOGREER_P				
*Note: p-values and subsequent tests do not account for stepwise selection.				

Table A4a: Raw Regression Results from the ARDL Model

Dependent Variable: LOGPBN
Method: Least Squares
Date: 07/07/25 Time: 01:44
Sample: 1999 2023
Included observations: 25

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LOGPNG	0.245247	0.008853	27.70349	0.0000
C	3.502947	0.042921	81.61388	0.0000
R-squared	0.979578	Mean dependent var	4.682593	
Adjusted R-squared	0.978302	S.D. dependent var	0.155259	
S.E. of regression	0.022870	Akaike info criterion	-4.613535	
Sum squared resid	0.008369	Schwarz criterion	-4.514605	
Log likelihood	43.52182	Hannan-Quinn criter.	-4.599894	
F-statistic	767.4833	Durbin-Watson stat	0.727923	
Prob(F-statistic)	0.000000			

Table A5: Raw Result form OLS Regression for Price Cointegration

Null Hypothesis: D(PBDRESID) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-5.594128	0.0004
Test critical values:	1% level		-3.920350	
	5% level		-3.065585	
	10% level		-2.673459	
*MacKinnon (1996) one-sided p-values. Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 16				

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(PBDRESID,2)
Method: Least Squares
Date: 07/07/25 Time: 01:50
Sample (adjusted): 2002 2023
Included observations: 22 after adjustments

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(PBDRESID(-1))	-1.360323	0.243170	-5.594128	0.0001
C	0.012116	0.021245	0.570290	0.5775
R-squared	0.690910	Mean dependent var	0.011074	
Adjusted R-squared	0.668832	S.D. dependent var	0.147664	
S.E. of regression	0.084976	Akaike info criterion	-1.976417	
Sum squared resid	0.101094	Schwarz criterion	-1.879844	
Log likelihood	17.81134	Hannan-Quinn criter.	-1.971472	
F-statistic	31.29427	Durbin-Watson stat	1.930874	
Prob(F-statistic)	0.000066			

Table A6: Raw Unit Root Test for Residual of OLS Regression in Table 5

Stability Test

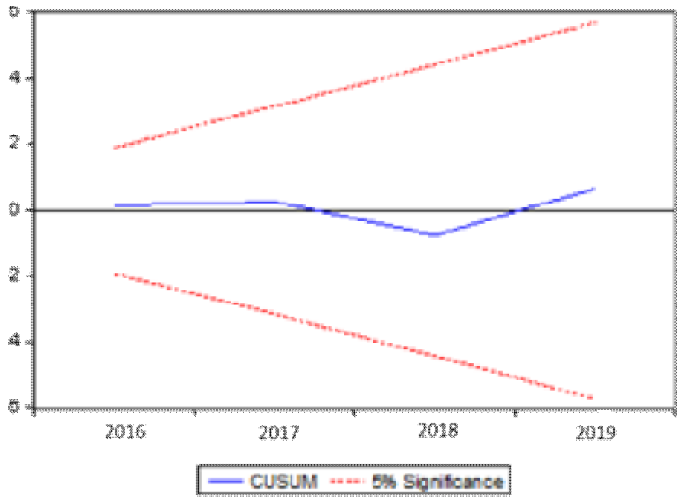

Figure A1: Cumulative Sum of Recursive Residual 2