

ESTIMATION OF EXCHANGE RATE ELASTICITY AND ITS PASS-THROUGH EFFECT ON PRODUCER PRICE INDEX IN NIGERIA

Semirah Ngozi Hanafi¹, Egwaikhide Christian Imoudu², Yakubu Alfa³ and Major Auwal Abubakar Muhammad⁴

¹²³Department of Economics, Nigerian Defence Academy, Kaduna.

⁴Department of Accounting, Nigerian Defence Academy, Kaduna.

Corresponding Author: ngozisemirah@gmail.com

Abstract

This study examines the exchange rate elasticity and its pass-through effect on producer price index in Nigeria for the period 2010-2024. Used monthly data covering the period of January 2010-December 2025. Data for the study were obtained from the Central Bank of Nigeria's Statistical Bulletin (2006). The data were analyzed using the Polynomial Distributed Lag (PDL) model and pass-through elasticity model. Findings from PDL reveal that money supply has a positive and statistically significant effect on producer prices, indicating that increases in liquidity contribute to rising production costs and producer price inflation. Also, the prime lending rate exerts a positive and statistically significant influence on producer prices, suggesting that higher borrowing costs are transmitted to firms through increased production costs. Results of exchange rate pass-through shows that while the contemporaneous effect of exchange rate on PPI is weak, the pass-through becomes stronger between the fifth and tenth lags, implying that exchange rate shocks are gradually transmitted to domestic producer prices. The cumulative lag coefficient (0.00552) is positive and statistically significant, confirming the existence of a long-run exchange rate pass-through to producer prices. Based on the findings of this study, it is recommended that monetary and fiscal authorities should pursue policies that reduce excessive exchange rate volatility through improved foreign exchange management, increased export earnings, and stronger external reserves in Nigeria.

Keywords: Exchange rate, Producer Price Index, Money Supply, PDL, Nigeria.

1. Introduction

One of the longest standing debates in the contemporary monetary economics literature has been on the degree of pass-through of exchange rate to other macroeconomic variables. Thus, studies on exchange rate pass-through to different macroeconomic variables have received much attention, and the focus had been on knowing the degree of responsiveness of prices to movements in exchange rate as

well as the speed of exchange rate transmission pass-through to domestic prices (Alfa et al., 2024). This is against the backdrop that the degree of responsiveness of prices to changes in exchange rate has significant implications for the formulation of optimal monetary policy to offset exchange rate shocks that may affect the economy. When exchange rate shock affects the economy, it could lead to changes in the relative prices, and could produce expenditure-switching effect between home and foreign goods. As domestic prices of imported goods respond to exchange rates changes, the initial effect of the shock may be partly absorbed in the short run and may likely be offset over the long run (Gatawa et al., 2018).

The relationship between exchange rate and its pass-through to producer price index has been demonstrated in most empirical studies such as Osumare (2019) and Ucak (2020). Evidences from some of these studies shows that commodity prices (producer prices indexes) respond quickly to any slight adjustment in exchange rate than consumer prices. For example, Akin and Ucak (2020) show that depreciation in exchange rates increases producer price index (PPI) by increasing costs, especially over energy and raw material prices, and the effect is more serious in the short run than in the long run. An increase in PPI is a signal to high consumer prices and could lead to interest rate hikes. As a result, spending money becomes costlier because consumers would effectively be losing out on the higher interest rate when they choose to spend money instead of saving (Osumare, 2019). This implies that high PPI is likely to discourage producer from producing and supplying more goods to the market in the short run, and could lead to commodity shortages and increased consumer goods over the long run (Alfa, 2019).

PPI is a level of measuring how the selling price of the producers of the output has changed over a period of time. Many products and some services have the first commercial transaction as their prices in producer price index (PPI). The PPI considers the inflation in the industry and business perspective. This is a technique that determines the price change prior to consumer consumption. Given that producer price index measures price changes before they reach the consumers, it is considered predictor of inflation than consumer price index (Auta et al., 2021). Data on producer price index (PPI) is gathered by systemic sampling of producers and published monthly or annually. However, volatile prices such as those in energy sector are often ignored to keep the index more stable.

Globally, the producer price index (PPI) has shown steady growth overtime, averaging about 1.67% in 1990, and rising to 1.88% in 2010. A further rise in PPI to 2% was recorded in 2013, and 3.8% and 6.8% rises in PPI were recorded in 2017 and 2018

respectively. By 2022 global producer price index reached all-time high of about 14.3% (Food and Agricultural Organization, 2022).

One of the reasons for the focus on PPI as measure of inflation is the limitation of using the consumer price index (CPI). A major drawback of CPI is that it does not consider all the bundles of goods produced and consumed in the country over the period of computation. Hence, estimates of inflation figures using the consumer price index (CPI) measures may be far different from the actual figures.

In Africa, like the world over, producer price index (PPI) has also increased steadily over the years with an average increase of about 3% in 2016. By 2017 and 2019, producer price index has risen to 3.3% and 3.7% respectively but fell slightly to 3.68% in 2022. The main cause of increase in producer price index is rainfall deficit which reduces the produce of agricultural food commodities in Africa (Food and Agricultural Organization, 2022). In Nigeria, like in Africa, producer price index has also risen since 2009, reaching a high record of 1.7% in March 2022 and a low record of -1.3% in 2020 (Food and Agricultural Organization 2022).

Producer price index in Nigeria is the index of agricultural producer prices, which are used in measuring the average yearly changes over time in the selling prices received by farmers. It includes the single items price index, commodity group index and the agriculture producer price index. The PPI assigns dissimilar weight to certain goods and minimal weight to others depending on the dollar worth of the industry and ultimate user. These dollar values are then converted to percentages which are added up to 100 percent of each group. This is done through coming up with the best possible image of the significance of a product to the economy. The index gives out the numbers that include and exclude such variables as energy, trade services and food. In Nigeria the degree of exchange rate pass-through to price indices is fundamental to the design and implementation of optimum monetary policy. This is against the backdrop that achieving stable exchange rate is a key monetary policy objective. In other words, the implementation of monetary policy in response to inflationary exchange rate shocks requires information about the degree and the speed of pass-through of exchange rate to prices (Alfa et al., 2020). For example, low pass-through give policymakers the opportunity to pursue an independent monetary policy (Choudhri & Hakura, 2006). Following the introduction, the rest of the paper is structured as follows: section two reviews relevant literature while section three focuses on methodology of the study. Section four discusses the results of the analysis of data and section five consists of the conclusion and the recommendations.

2. Literature Review

2.1 Conceptual Review

Exchange Rate Pass-through

According to Goldberg and Knetter (1997), the exchange rate pass-through is defined as the change in the price of imports in the local currency that occurs as a result of a one percent change in the exchange rate between the importing and exporting country.

Exchange rate pass-through is said to be the transfer of the exchange rate change to the prices of import goods in the domestic market. That is, the appreciation or depreciation in the exchange rates are directly transferred over to the inflation by changing the relative price of the domestic and foreign goods and indirectly via the economic activities (Bimeier & Bonato, 2002). It is the rate of elasticity of prices of imports concerning domestic currency one percent changes in the exchange rate. Classic exchange rate pass-through normally has two phases. The initial stage indicates that the nominal exchange rate changes are incorporated in the local currency prices of imports. The second stage is where these changes are transferred to the consumer in full or in part (Chew et al., 2011).

Producer Price Index (PPI)

Producer price index was called wholesale price index until 1978, it is among the oldest continuous systems of statistical data published by the Bureau of Labor Statistics (BLS), and also one of the oldest economic time series compiled by government of a nation. At the time it was first published in 1902, it discussed 1890-1901. The history of the index can be traced to a United State Senate resolution of 1891 that gave the Senate Committee on Finance the mandate to examine the impact of tariff acts on the imports and exports, the growth, development, production, and the prices of agricultural and manufactured goods both domestically and internationally. This was the original index that was published, based on 1890-1899, an unweighted average of price relatives of approximately 250 commodities. Since then, a lot has changed on the sample of commodities, the base period and the way the index is calculated.

2.2 Theoretical Literature

This study is anchored on the international fisher effect (IFE) theory of exchange rate, which is credited to Fisher (1930). According to the theory, the difference in the nominal interest rates of two countries is expected to be nearly equal, when there is an expected difference between the exchange rate and the two currencies.

This means that the change in exchange rates can be predicted by the differences in the nominal interest rates of any two countries.

The relevance of the theory to this study lies on the fact that the different variables employed in this study prove the key debates of the IFE theory. The theory explains the relationship that exists between interest rate (real interest rate and nominal interest rate) and inflation rate that may act as the proxy of producer price index, consumer price index or wholesale price index in addition to the exchange rate and money supply.

The international fisher effect theory is the global analog of the fisher effect. It may be regarded as a fusion of the generalized version of the fisher effect, as well as the relative version of the purchasing power parity (PPP). According to the generalized version of the fisher effect, interest rate between nations will be equal because arbitrage can be made. When there is an equal interest between the different countries, it will imply that the difference between the observed nominal rates should increase in differences between expected inflation.

2.3 Empirical Literature

Alfa et al. (2024) uses both annual and monthly data to investigate exchange rate dynamics and its pass-through effect on balance of payments (BOP) in Nigeria over a period between 1980 - 2023. The data for the study were analyzed using the mixed data sampling (MIDAS) model. Findings of the MIDAS model shows that exchange rate has a double-edge impacts on balance of payments, which implies that appreciation of exchange rate could, at different times, have both positive and negative impacts on BOP. The result further shows that inflation has a negative impact on BOP for a period of twelve months of every year investigated. The result shows that inflation is a drag on the Nigeria's balance of payments. Total trade on the other hand has a positive and significant impact on BOP both in the short run and in the long-run. However, in terms of the sizes of the estimated coefficients, the impact of total trade on BOP is higher in the short run than in the long run.

In their model, Adebisi and Modi (2023) used the pass-through effect of exchange rate to domestic inflation in Nigeria based on a quarterly data that spanned between the periods of 1980 - 2024 to estimate the effects of exchange rate on domestic inflation. The effect of inflation rate to exchange rate shock is determined to be positive and significant in the short-run analysis. It indicates that exchange rate has almost zero pass-through to domestic inflation in Nigeria with a small incomplete pass through of 0.09 in quarter 1 and increased to 0.18 in quarter 2 and decreased to 0.07 and 0.01 in quarter 3 and quarter 4 respectively. This is less as compared to

the results derived in other places by other researchers. The low pass-through has been partly related to the low, stable, and predictable rate of inflation brought about by the improved credibility of policy environment.

To examine exchange rate pass-through to Japanese imports price, Kamel et al. (2021) apply monthly data between the year 1998: 1 and 2010: 12. The result indicate that there is a decreasing exchange rate pass-through to Japanese import prices on the bilateral level in certain categories of products, and an increase in the same on other products. Nevertheless, no data on the changes in exchange rate pass-through of manufacturing, machinery, and the general product level indicated that each of these results sheds light on the fall in exchange rate pass-through to Japanese multilateral import prices and assists in calibrating its trade relationship with its partner countries.

Khyareh (2021) analyzes the exchange rate pass-through to price indices in Iran in 2004: Q1-2018: Q4. The recursive VAR model is used in the study to examine the dynamic relationship between the study variables. The findings show the exchange rate transmission into price indices is not perfect, whereby the exchange rate trend through to consumer, producer, and import prices is 14.68, 15.55, and 18.22 in the first period is translated to 51.78, 53.15 and 88.14 in the 13th period. Besides, the findings show that the path-through exchange rate declines as one shifts up the chain of distribution and the largest exchange rate is through the import prices, producer prices and consumer prices respectively. Also, it was revealed that money supply has positive impact on producer prices.

3. Methodology

Types and Sources of Data

The study used monthly time series data to model exchange rate pass-through to producer price index in Nigeria. Data for all the variables of the study were collected from the Statistical Bulletin of the Central Bank of Nigeria (CBN) (2025) and the data covers the period of 2010M₁ - 2024M₁₂. This implies that the data begin from January, 2010 to December, 2024, covering 180 observations. The variables on which data were collected are nominal interest rate (INT), nominal effective exchange rate (EXR), broad money supply (M₂) and producer price index (PPI).

In this study, PPI measures the rate of change in the prices of products sold by producers over a period of time. EXR is the price of one currency expressed in terms of another currency. EXR is used in this study as nominal effective exchange rate. INT is the cost of capital and it is expressed as a percentage of the capital

borrowed. M2 is the totality of assets hold as short- term investment in bank accounts and it is measure in billions of Naira.

Model Specification and Estimation Procedure

This study used the polynomial distributed lag model (PDL) model to estimate the dynamic response of PPI to exchange rate changes. The pass-through of exchange rate changes to PPI was also estimated using the elasticity model. This approach is different from most previous studies that used the autoregressive distributed lag (ARDL) model to estimate exchange rate pass-through on different macroeconomic variables. The PDL model is originally credited to Almon (1965), but was extensively used and modified by subsequent scholars, including Louis (1968) and Ghysels (2004). A major advantage of PDL over the conventional ARDL model is that in ARDL specification, the successive lags of the variable are likely to be highly correlated with each other and this had often resulted to severe problem of multicollinearity. Unfortunately, the ADRL model does not have the inbuilt capacity to address this problem (Almon, 1965).

Louis (1968) was the first to modify and apply the PDL model to economic research, following his study on the relative impact of monetary and fiscal actions on economic activities. In a series of equation, known as the Louis equations, Louis (1968) demonstrated how changes in nominal GNP responds to changes in money supply, exchange rate and federal government high-employment revenue. The Louis (1968) original equation was given as:

$$\Delta Y = \alpha + \sum_{i=0}^3 (\beta_i \Delta M_{t-i}) + \sum_{i=0}^3 (\gamma_i \Delta E_{t-i}) + \sum_{i=0}^3 (\pi_i \Delta R_{t-i}) + \mu_t \quad (1)$$

Where;

Y = nominal GNP; M = money supply, E= exchange rate, R = federal government high-employment revenue, Δ = first difference parameter, α = intercept parameter, β , γ and π are partial slope parameters

$\sum_{i=0}^3$ = summation operator showing a maximum lag lenght of three

Adapting the Louis's (1968) model stated in equation (1), this study will replace Y and R with PPI and INT respectively, but will retain exchange rate (E) and money supply (M) in the equation. Hence, the study will take exchange rate as EXR and money supply as M2. These modifications are necessary because R which captures fiscal policy actions in equation (1) and Y which captures economic activities do not form

part of the objective of this study and as such, they are not required. Hence, the PDL model for the study is given as;

$$\Delta PPI = \alpha + \sum_{i=0}^3 (\beta_i \Delta EXR_{t-i}) + \sum_{i=0}^3 (\gamma_i \Delta INT_{t-i}) + \sum_{i=0}^3 (\pi_i \Delta M_{t-i}) + \mu_t \quad (2)$$

Where;

PPI = producer price index, M = money supply, EXR = nominal effective exchange rate
INT = nominal interest rate. Other variables are as defined earlier in equation (1)

The PPP specification is a simple long-run equation express as:

$$PPI_t = \varphi_0 + \varphi_1 EXR_t + \varphi_2 INT_t + \varphi_3 M_t + \varphi_4 T + \mu_t \quad (3)$$

However, one of the basic limitations of equation (3) is that it does not express the coefficients of the independent variables in term of elasticities. This is despite that exchange rate pass-through coefficients are always measure in terms of elasticities. Therefore, in order to circumvent this limitation, equation 3 is transformed into its logarithmic form given as;

$$PPI_t = \varphi_0 + \varphi_1 \ln EXR_t + \varphi_2 \ln INT_t + \varphi_3 \ln M_t + \varphi_4 T + \mu_t \quad (4)$$

From the equation 4, the trend component (T) was not logged because it is a structural factor that could take on random values. Also, PPI and INT are not logged because they are already in percentage. From the equation 4,

T = trend component. $\varphi_1 - \varphi_4$ are the elasticities of the respective independent variables. φ_0 is the intercept.

φ_1 = the exchange rate pass-through (ERPT) coefficient which captures the overall exchange rate impact on the PPI through exchange rate-induced changes in domestically produced tradable goods. Given the equation (4), the pass-through to producer price index over T periods is defined as the accumulated effect of a structural one standard deviation shock to the nominal exchange rate in period t on domestic producers' prices in period T. this approach is in line with Rafindadi (2006). Hence, the dynamic pass-through elasticity can be calculated using the ratio:

$$ERPT = \frac{\% \Delta PPI_t}{\% \Delta EXR_0} \quad (5)$$

Where;

$\% \Delta PPI$ = percentage change in the Producer price level between period 0, when the initial exchange rate shock hits, and time t; $\% \Delta EXR$ = percentage change in the exchange rate at time t

Pre-Estimation Diagnostics

In this study, the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) was applied to test the data set in terms of its stationarity. This is contrary to most of the past research like Sanusi (2010), Asgar and Hussain (2014) which apply augmented dickey-fuller (ADF) and Phillips-Perron (PP) to test the unit root. Besides the necessity of comparing the results and finding their consistency, the decision to use KPSS and ERS was made to prevent the issue of high size distortion in the ADF and PP unit root tests variants. According to Zivot and Andrews (1992), ADF and PP tests have serious sizing distortion as KPSS performs effectively in the presence of serial correlation and heteroskedasticity.

$$\Delta X = \gamma_0 + \gamma_1 + \gamma_2 X_{t-1} + \sum_{k=0}^n \lambda \Delta X + \mu_t \quad (6)$$

Where;

$\gamma_0, \gamma_1, \gamma_2, \lambda$ = parameters to be estimated

μ_t = the error term.

4. Results and Discussions of Findings

Table 1

Result of Descriptive Statistics

	EXR	INT	M2	PPI
Mean	536.3321	15.79266	36935127	13.20984
Median	361.5350	16.53000	24051833	11.70000
Maximum	14472.40	19.05000	1.24E+08	27.34000
Minimum	151.8500	11.13000	10446374	6.600000
Std. Dev.	1079.641	2.080110	31251183	5.370078
Skewness	11.33281	-0.892694	1.606104	1.329787
Kurtosis	146.1615	2.826933	4.389340	3.955161
Jarque-Bera	168071.7	25.74049	97.98841	63.88537
Probability	0.000000	0.000003	0.000000	0.000000

Source: Researchers computation using E-views 12

Table 1 shows the result of descriptive statistics of the variables of study over a period of 2010:M1 to 2025:M12. The result shows that exchange rate (EXR) has an average value of 536.33, with a minimum of 151.85 and a maximum of 14,472.40. The large difference between the minimum and maximum values, together with a high standard deviation of 1,079.64, indicates substantial fluctuations in the exchange rate over the study period. The mean exceeds the median (361.54), suggesting a

positively skewed distribution. The skewness coefficient of 11.33 and kurtosis of 146.16 indicate an extremely positively skewed and highly leptokurtic distribution. The prime lending rate (INT) has an average value of 15.79 percent, ranging from 11.13 percent to 19.05 percent. The relatively low standard deviation of 2.08 indicates that lending rates remained comparatively stable during the study period. The negative skewness coefficient (-0.89) suggests that the distribution is slightly skewed to the left, while the kurtosis value of 2.83 is close to the normal benchmark of three, indicating a distribution that is approximately mesokurtic. Nevertheless, the Jarque-Bera test (25.74; $p = 0.000003$) indicates that the series deviates significantly from normality.

Broad money supply (M2) recorded an average value of approximately ₦36.94 trillion, with values ranging from ₦10.45 trillion to ₦124.40 trillion. The relatively large standard deviation of approximately ₦31.25 trillion reflects substantial growth in money supply over the sample period. The positive skewness coefficient (1.61) indicates that the distribution is skewed to the right, while the kurtosis value of 4.39 suggests a leptokurtic distribution characterized by relatively heavy tails.

The Producer Price Index (PPI) has an average value of 13.21, with a minimum of 6.60 and a maximum of 27.34. The standard deviation of 5.37 indicates moderate variability in producer prices during the study period. The mean exceeds the median (11.70), indicating a positively skewed distribution. The skewness coefficient of 1.33 and kurtosis of 3.96 suggest that the PPI distribution is moderately positively skewed and leptokurtic.

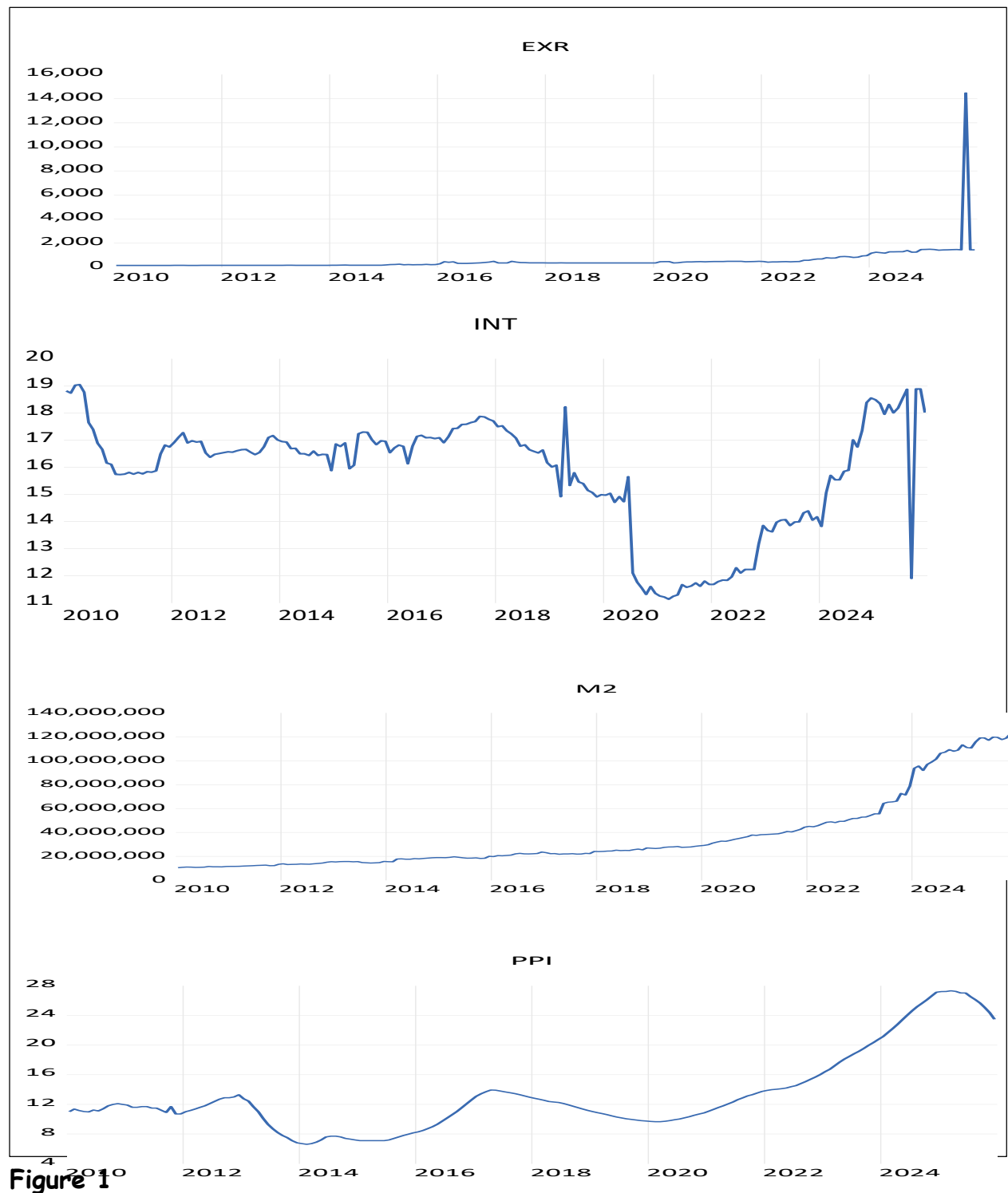


Figure 1

Result of Trend Analyses

Figure 1 shows the result of the trend analyses of the variables of the study. The trend of exchange rate shows an overall upward trend throughout the study period, although with considerable short-run fluctuations.

Like EXR, interest rate followed a fluctuating pattern throughout the study period. Interest rates were relatively high during the early years of the sample, remained broadly stable between 2013 and 2019, and declined to their lowest levels during 2021-2022.

M2 followed a consistent upward trend throughout the study period. Beginning at approximately ₦10.45 trillion in 2010, M2 increased steadily despite occasional short-run fluctuations, reaching over ₦124 trillion by the end of 2025.

PPI followed a fluctuating but generally upward trend over the study period (2010-2025). After remaining relatively stable during 2010-2012, the index declined significantly between 2013 and 2015 before rising sharply from 2016 onward.

Table 1: Result of Kwiatkowski-Phillips-Schmidt-Shin (KPSS) Unit Root Test

H_0 : The variables are stationary

Variables	KPSS Level	KPSS Difference	Order of integration
EXR	0.225*	-----	I (0)
INT	0.405*	-----	I (0)
M2	1.282	0.318*	I (1)
PPI	0.976	0.255*	I (1)
KPSS Critical Value at 5% = 0.463			

* denotes stationary at 5%

Source: Computed by the Researcher Using Eviews12

Table 2 shows the results of KPSS unit root test. The KPSS results, at 5%, indicate that EXR and INT were stationary at levels because their calculated values were less than the critical value, hence H_0 was not rejected. Therefore, EXR and INT are integrated of order zero [I(0)].

However, M2 and PPI becomes stationary only at first difference. Hence, M2 and PPI are integrated of order one $[I(1)]$. Therefore, it could be inferred from the result that the variables of the study are integrated of mixed orders of both $I(0)$ and $I(1)$. This mixed order of integration satisfies the condition for the use of PDL model used for this study.

Table 3

Selection of Optimal Lag length for Co-Integration

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-6272.547	NA	4.87e+22	66.42907	66.51483	66.46382
1	-4779.752	2890.810	8.75e+15	50.89685*	51.41141	51.10531
2	-4631.139	279.9280	2.37e+15*	49.58877	50.53214*	49.97095*
3	-4592.917	69.97142*	2.06e+15	49.44886	50.82103	50.00476

* indicates lag order selected by the criterion;

Source: Computed by the Researcher Using Eviews12

Table 3 shows the result of the traditional lag selection criteria (AIC, SIC, HQ, LR, FPE), obtained from the empirical VAR lag structure for deciding the optimal lag length for cointegration test. From table 3, FPE, SC and HQ criteria suggest an optimal lag of 2, while AIC and LR selected lag 1 and lag 3 respectively. Therefore, the study uses a lag length of 2 for cointegration model and the result is reported in table 4.

Table 4

Result of Bound Co-integration Test

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Significant.	$I(0)$	$I(1)$
			Asymptotic: n=1000	
F-statistic	11.12375	10%	2.37	3.2
K	3	5%	2.79	3.67
		1%	3.65	4.66

Source: Researcher's Computation using e-views 10

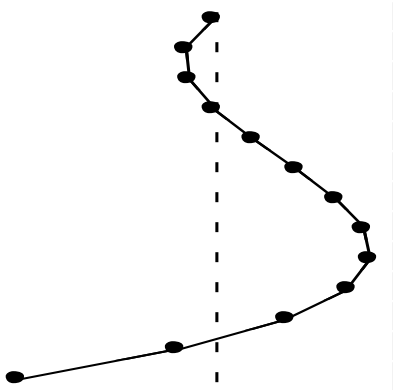
The result of F-bound co-integration in table 4 revealed that the F-statistics is 11.12 is greater than the lower and the upper bound at 5% asymptotic critical values. Therefore, the null hypothesis of no co-integration is rejected in favour of the alternative hypothesis of the presence of co-integration among the variables. Based

on the result in Table 4, it can be concluded that the variables of the study bear a long-run equilibrium relationship.

Table 5

Result of Polynomial Distributed lag Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
M2	1.09E-07	2.34E-08	4.643738	0.0000
INT	0.206709	0.074442	2.776788	0.0061
EXR	-0.002530	0.000479	-5.286250	0.0000
PDL01	0.001582	0.000619	2.555408	0.0115
PDL02	0.000455	0.000158	2.884295	0.0044
PDL03	-8.08E-05	3.84E-05	-2.102654	0.0370
PDL04	-1.86E-05	8.15E-06	-2.280678	0.0238
R-squared	0.889509	Mean dependent var		13.32828
Adjusted R-squared	0.885012	S.D. dependent var		5.525776

-Lag Distribution of...	i	Coefficient	Std. Error	t-Statistic
	0	-4.2E-05	0.00045	-0.09380
	1	-0.00039	0.00015	-2.59798
	2	-0.00034	0.00016	-2.18814
	3	-8.8E-06	0.00025	-0.03491
	4	0.00050	0.00036	1.36513
	5	0.00106	0.00050	2.14825
	6	0.00158	0.00062	2.55541
	7	0.00194	0.00069	2.80531
	8	0.00202	0.00067	3.02888
	9	0.00172	0.00052	3.28681
	10	0.00092	0.00039	2.38828
	11	-0.00049	0.00080	-0.61085
	12	-0.00261	0.00170	-1.53414
Sum of Lags		0.00586	0.00223	2.63230

Source: Computed by the Researcher Using Eviews12

Table 5 shows the result of polynomial distrusted lag model. The result shows that money supply has a positive and significant impact on PPI. This implies that one per cent increase in money supply increases producer prices by about 0.0000009 per cent. Although the coefficient appears numerically small because M2 is measured in very large monetary units, it is economically meaningful in the sense that the finding agrees with Fisher's monetary theory. This finding also agrees with Khyareh (2021).

The result also shows that prime lending rate has a positive and significant impact of about 0.21 on PPI. This implies that one per cent increase in prime lending rate increases producer prices by about 0.21 per cent. Although many studies on prime lending rate expect higher interest rates to reduce inflation, a positive coefficient is not unusual in Nigeria. It may reflect cost-push inflation, signaling higher borrowing costs that raise production costs, or policy responses where interest rates are increased after inflation has already risen.

However, exchange rate has a negative but significant impact of about 0.0025 on PPI. This implies that one per cent appreciation in EXR rate depreciates producer prices by about 0.0025 per cent. The negative sign may indicate that exchange rate movements reduce imported production costs if the variable is defined in terms of exchange rate appreciation. This finding agrees with Adebisi and Modi (2023) but disagrees with Alfa et al, (2024).

The Polynomial Distributed Lag variables (PDL01 to PDL04) in table 5 capture the dynamic effects of the lagged dependent variable over time. The coefficient of PDL01 is positive (0.0016) and is statistically significant at the 5%. This positive coefficient suggests that short-run past changes exert a positive influence on current producer prices. Similarly, PDL02 has a positive coefficient of 0.000455, which is statistically significant ($t = 2.884295$; $p = 0.0044$), indicating that the second lag also contributes positively to producer price movements. These findings imply that shocks to producer prices persist into subsequent periods, reflecting inflation persistence within the Nigerian economy.

Conversely, PDL03 has a negative coefficient ($-8.08E-05$) but statistically significant at the 5%. Furthermore, PDL04 has a negative coefficient ($-1.86E-05$) and is also statistically significant. The negative coefficients indicate that after the initial positive effects, the longer-term lagged impacts gradually diminish. This suggests that while monetary and macroeconomic shocks initially increase producer prices, their influence weakens over time as economic adjustments, monetary policy responses, and market corrections occur. The combination of positive early lag coefficients and negative later lag coefficients reflects the dynamic adjustment process captured by the polynomial distributed lag model.

Furthermore, the lag distribution of i ($i = 0, 1, 2, \dots, 12$) in table 5 shows how the effects of explanatory variables on the dependent variable are distributed over several time periods rather than occurring immediately. The lag distribution consists of 13 lag periods (Lag 0 to Lag 12). Lag 0 represents the contemporaneous (current-period) effect, while Lags 1 - 12 represent the delayed effects over the subsequent

months. From the results, lag 0 has a negative coefficient of -0.000042 but statistically insignificant. This indicates that the explanatory variables do not exert an immediate influence on the Producer Price Index (PPI). Rather, its effect materializes gradually over time.

To estimate the pass-through of exchange rate to producer price index, the dynamic pass-through elasticity is given as:

$$ERPT = \frac{\% \Delta PPI_t}{\% \Delta EXR_0} \quad (5)$$

Where;

$\% \Delta PPPI$ = the percentage change in the Producer price level between period, when the initial exchange rate shock hits, and time t;

$\% \Delta EXR$ = the percentage change in the exchange rate at time t. Using the first and last observations for PPI:

PPI (January 2010) = 11.01. PPI (December 2025) = 23.49. Percentage change in PPI = $(23.49 - 11.01) / (11.01) \times 100 = 113.35\%$.

Using the first and last observations for EXR:

January 2010 = ₦153.55/\$. December 2025 = ₦1451.21/\$. Percentage change in EXR = $(1451.21 - 153.55) / (153.55) \times 100 = 844.80\%$.

Therefore,

$$ERPT = 113.35 / 844.80 = 0.134$$

The estimated exchange rate pass-through coefficient is approximately 0.13. This means that 1% depreciation of the naira is associated with only about a 0.13% increase in the Producer Price Index. Since $0.13 < 1$, the exchange rate pass-through is said to be incomplete (partial). This result suggests that exchange rate depreciation is not fully transmitted into producer prices in Nigeria. This could be attributed to monetary policy interventions where the Central Bank of Nigeria (CBN) often raises interest rates or implements liquidity management measures to contain inflationary pressures arising from exchange rate depreciation.

Table 5: Post-estimation Statistics

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	3.77470	Prob. F(2,44)	0.4520
Heteroskedasticity Test: ARCH			

F-statistic

2.67292 Prob. F(2,46)

0.4421

Source: Computed by the Researcher Using Eviews 12

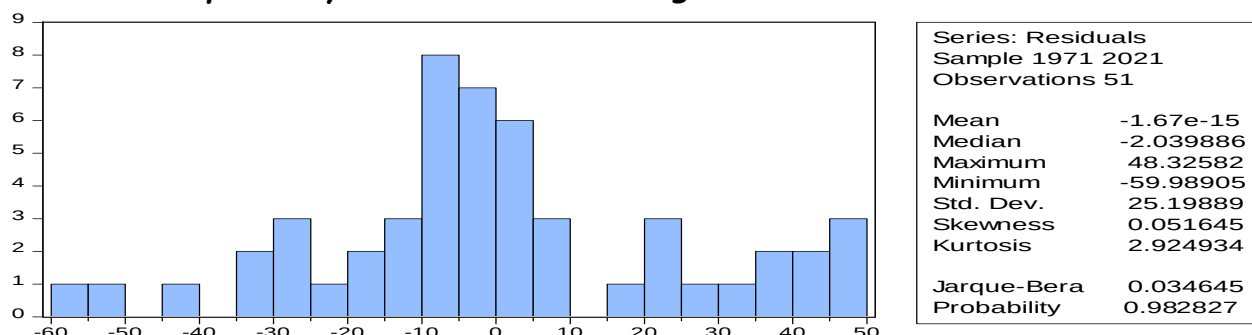


Figure 2: Test of normality

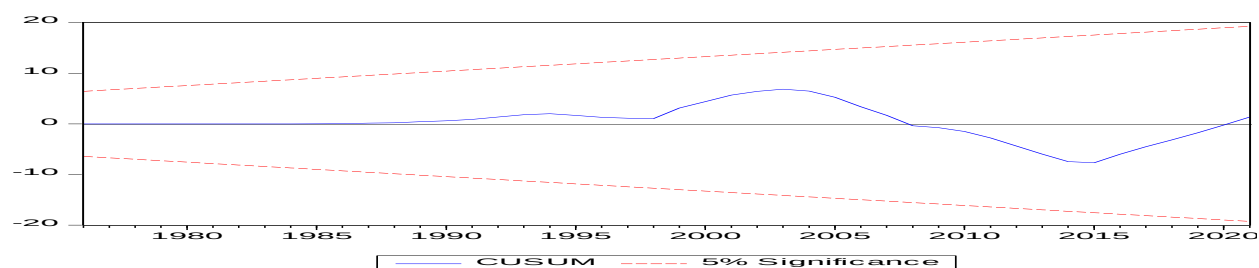


Figure 3: Test of stability

Table 4 shows the post estimations statistics. The serial correlation LM test has a probability value of 0.452, which is greater than 0.05. This suggests that the null hypothesis of the absence of autocorrelation in the model cannot be rejected. Similarly, the probability value for the test of heteroscedasticity is 0.442 implying that the null hypothesis of absence of heteroscedasticity in the model cannot be rejected. The result passed the test of normality, as the normality plot reported in figure 2 shows that the Jarque-Bera value and its probability are 0.035 and 0.928 respectively. Hence, the null hypothesis that the error terms of the data used in the study are normally distributed cannot be accepted. Furthermore, the result passed the test of stability. This is because the CUSUM of square plot reported in figure 3 does not cross either of the 5% critical lines. Therefore, it could be concluded that the estimated parameters for the study are stable for the period under investigation.

5. Conclusion and Recommendations

Findings from the analysis of this study show that money supply has a positive and statistically significant effect on producer prices, indicating that increases in liquidity contribute to rising production costs and producer price inflation. Similarly,

the prime lending rate exerts a positive and statistically significant influence on producer prices, suggesting that higher borrowing costs are transmitted to firms through increased production costs. Results of exchange rate pass-through shows that while the contemporaneous effect of exchange rate on PPI is weak, the pass-through becomes stronger between the fifth and tenth months, implying that exchange rate shocks are gradually transmitted to domestic producer prices. The cumulative lag coefficient (0.00552) is positive and statistically significant, confirming the existence of a long-run exchange rate pass-through to producer prices. Also, the estimated exchange rate pass-through elasticity was shown to be less than one, suggesting that exchange rate pass-through in Nigeria is incomplete (partial). This suggests that producers absorb a substantial proportion of exchange rate shocks rather than passing them fully to domestic prices. Based on the findings of this study,

- i. It is recommended that monetary and fiscal authorities should pursue policies that reduce excessive exchange rate volatility through improved foreign exchange management, increased export earnings, and stronger external reserves in Nigeria.

References

- Adebiyi, M. A., & Mordi, N.O. (2020). A dynamic stochastic general equilibrium (DSGE) model of exchange rate pass-through to domestic inflation in Nigeria. *Central Bank of Nigeria Occasional Paper*, 1(39), 1- 65.
- Aisen, A., & Simione, F. (2019). Towards a new monetary policy in Mozambique. *Journal of Applied Business and Economics*, 21(6), 12-24.
- Akin, U. & Ucak, D. (2020). The effect of exchange rate on CPI and PPI. *Business and Economics Research Journal*, 11(2), 323-334.
- Alfa, Y., Ugah, A. & Ayodeji, S. (2020). Impact of money supply on economic growth in Nigeria: evidence from vector autoregressive model. *Bingham Journal of Economics and Allied Studies (BJEAS)*, 4(2), 47 - 62
- Alfa, Y., Naankar, D.A., Ikubor, O.J., Buari, A.A., & Haladu, G. (2024). Exchange rate dynamics and the impact on balance of payment in Nigeria. *Journal of Economics and Studie*, 21(2), 1 - 22
- Almon, S. (1965). The distributed lag between capital appropriations and expenditures. *Econometrica* 33, 178-196.
- Alptekin, V., Yilmaz, K., & Taş, T. (2016). Exchange Rate Pass Through On Prices: The Case of Turkey. *Selçuk Ün. Sos. Bil. Ens. Der.*, (35), 1-9.
- Asghar, N., & Hussain,

- Z. (2014). The lags in effect of monetary policy: A case study of Pakistan. *Pakistan Economic and Social Review*, 52(1), 1-14.
- Auta, A.E., Usman, S.G., Alfa, Y. & Ya'u S. (2021). Estimating inflation threshold-growth nexus in Nigeria (1980 - 2020). *Dutse International Journal of Social and Economic Research*, 6(3), 1 - 12.
- Aydogus, O. Deger, C. Caliskan, E. T. & Gunal, G. G. (2018). An input-output model of exchange rate pass-through. *Economic System Research*, 30(3), 323-336.
- Bada, A. S., Olufemi, A. I., Tata, I. A., Peters I, Bawa S, Onwubiko A. J., & Onyowo U. C. 2016) Exchange rate pass-through to inflation in Nigeria. *CBN Journal of Applied Statistics*, 7(1), 49-70.
- Bilgin, B. (2020). Exchange rate and import price pass-through in Turkey. *Business and Economics Research Journal*, 11(3), 609-620
- Cassel, O. (1918). Abnormal deviations in international exchanges. *Economic Journal*, December.
- Channary, K., Sokchea, L., & Hem, C. B. (2021). Exchange rate pass-through into Japanese import prices, evidence at both bilateral and product levels. *American Business Review*, 24(2), 115 - 132.
- Fisher, I. (1930), 'The theory of interest, New York: Macmillan.
- Friedman, M. (1960). The lag in effect of monetary policy. *Journal of Political Economy*, 69(4), 447-466.
- Food and Agriculture Organization (2022).
- Frankel, J. A. (1979). On the mark: A theory of floating exchange rates based on real interest rate differentials. *American Economic Review* 69 (June), 610-22.
- Goldberg, P. K., & Michael, M. K. (1997). Goods prices and exchange rates: What have we learned?. *Journal of Economic Literature*, 35(3), 1243-1272.
- Goktas, P. (2019). Asymmetric transition on effects exchange rate on consumer prices in Turkey. *Sosyoekonom*, 27(42), 29-50.
- Hajeka, J. & Horvath, R. (2016). Exchange rate pass-through in an emerging market: The case of the Czech Republic. *Emerging Markets Finance and Trade*, 52(11), 2624-35.
- Haryo, K. (2015). Inflation targeting exchange rate pass-through and monetary policy rule in Indonesia. *International Journal of Business, Economics and Law*, 7(3), 2289-1552.
- Helali, K., Kalai, M. & Boujelben, T. (2015). Exchange rate pass-through to domestic prices in Tunisia: A short and long run analysis. *MPRA Paper*, (62204).

- Helmy, O., M. Fayed & K. Hussien (2018). Exchange rate pass-through to inflation in Egypt: A structural VAR approach. *Review of Economics and Political Science*, 3(2), 2-19.
- Ito, T. & Sato, K. (2008). Exchange rate changes and inflation in post-crisis Asian Economies: Vector autoregression analysis of the exchange rate pass-through. *Journal of Money, Credit and Banking*, 40(7), 1407-1438.
- James G Mackinnon & Halbert White (1985). Some heterosdasticity- consistent covariance matrix estimators with improved finite sample properties. *Journal of Econometrics*. 29(3), 305-325.
- Jarque, M. Carlos & Bera, K. Anil (1982). Model specification test: A simultaneous approach. *Journal of Econometrics*, 20(1), 59-82.
- Jhinghan, M. L. (2005). *The economic development and planning*. New Delhi: Urindi Publishers Ltd.
- Justel, S. & Sansone, A. (2015). Exchange rate pass-through to prices: VAR evidence for Chile. *Central Bank of Chile Working Paper*, 747.
- Kara, A. H., Ogunç, F., Sarikaya, C., & Ozmen, M. U. (2017). Exchange rate pass-through: Is there a magical coefficient. *Rome-Italy*, Vol 5(2).
- Kaygisiz, A. D. (2018). Pass-through effects of exchange rate fluctuations on inflation: Turkey. *International Review for Economics and Management*, 6(2), 117-137.
- Khyareh, M. M. (2021). Exchange rate pass-through to price indices in Iran. *Janus.net, E-journal of International Relations*, 12(1).
- Kuncoro, H. (2015). Inflation targeting, exchange rate pass-through, and monetary policy rule in Indonesia. *International Journal of Business, Economics and Law*, 7(3), 14-25.
- Kwiatkowski, D., Philips, P. C. B., Schmidt, P., & Shin, Y. (1992). Testing the null hypothesis of stationarity against the alternative of a unit root. *Journal of Econometrics*, 54, 159-178.
- Levich, R.M., (2001). The importance of emerging capital markets. *Brookings-Wharton Papers on Financial Services*, 2001(1), 1-45.
- Liu, H. Y. & Chen, X. L. (2017). The imported price, inflation and exchange rate pass-through in China. *Cogent Economics and Finance*, 5(1), 1279814.
- McCarthy, J. (2000). Pass-through of exchange rates and import prices to domestic inflation in some industrialized economies. *BIS Working Paper*, 79.

- Menon, J. (1996). The degree and determinants of exchange rate pass-through: Market structure, non-tariff barriers and multinational corporations. *The Economic Journal*, 106(435), 434-444.
- Obstfeld, M. & Rogoff, K. (1995). Exchange rate dynamics redux. *Journal of Political Economy*, 103(3), 624-660.
- Ogunc, F., Ozmen, M. U., & Sarikaya, C. (2018). Inflation dynamics in turkey from a bayesian perspective. *CBRT Working Paper*, No: 18/10.
- Ozmen, M. U & Topaloglu, M. (2017). Disaggregated evidence for exchange rate and import price pass-through in the light of identification issues, aggregation bias and heterogeneity. *CBRT Working Paper*, No: 17/08.
- Ponomarev, Y., Trunin, P. & Uluykaev, A. (2016). Exchange rate pass-through in Russia. *Problems of Economic Transition*, 58(1), 54-72.
- Rahman, M.N. (2016). Impact of foreign direct investment inflows on India's balance of payment (BOP). Ph.D. Thesis (Unpublished), Department of Commerce, Aligarh Muslim University Aligarh 202002, India.
- Rincón, H. & Rodríguez, N. (2016). Nonlinear pass-through of exchange rate shocks on Inflation. A bayesian smooth transition VAR approach. *Central Bank of Colombia Working Paper*, 930.
- Sanusi, A. R. (2009). Aid, reform and exchange rate management in Ghana: 1983-2005. PhD thesis, Lancaster University, United Kingdom.
- Sanusi, A.R. (2010). Exchange rate pass-through to consumer prices in Ghana: evidence from structural vector auto-regression. *MPRA Paper*, 29491, 25-47.
- Utku Altunoz (2020). Pass-through effects of exchange rate on inflation: The case of Turkey. *Journal of Ekonomi*, 2 (2), 71-75.
- Zivot, E. & Andrews, K. (1992). Further evidence on the great crash, the oil price shock and the unit root hypothesis. *Journal of Business and Economic Statistics*, 10 (10), 251-270