Review of theoretical and empirical literature economics essay

Economics

Abstract

This paper uses the Impulse Response from an estimated Structural Autoregressive Model of the inflation process to estimate the dynamic exchange rate pass-through to consumer prices for Nigeria, using quarterly data for the period 1986-2010. Results suggest that the exchange rate pass-through is incomplete, low and fairly slow. On impact, for instance, the elasticity of inflation to exchange rate changes is about 0. 02, and it takes about eight quarters to reach its full-impact of only 0. 26. We argue that given the large share of import in Nigeria's consumption basket, this surprisingly low pass-through indicates that importers practice the so-called pricing-to-market strategy of price setting for the Nigerian market. The variance decomposition analysis suggests that money supply has contributed more to the Nigeria's inflation process relative to the exchange rate. This suggests that policy makers must beep up efforts at achieving monetary stability.

Keywards: Exchange rate pass-through, Structural Vector-Autoregression, Inflation

JEL Codes: F41, F31, E31, E41

Introduction

Inflation has continued to be a central issue to policy analysts. It is an impediment to growth and a source of distortions in the economy. To sustain macroeconomic stability, inflation must be tackled from all its sources. In Nigeria, the rate of inflation was so high in the 1980s and 1990s, that it reached a peak of 72. 8 per cent in 1994. Despite the significant decline in the last one decade, the single digit inflation objective has proven elusive. For instance, inflation rates were 15. 4, 12. 2, 12. 1 and 10. 3 per cents in 2000, 2002, 2010 and 2011 Q3 respectively. Although the Nigeria's inflation process is generated by several processes including money supply and supply rigidities, exchange rate changes are thought to play an important role as well. Indeed, apart from the ample empirical evidence across the world that exchange rate depreciations play a role in the inflationary process, it can be argued that it has been historically the thinking of policy makers in Nigeria. This is because of their reluctance to allow the exchange to be fully market determined, as reflected by the various attempt to fix the exchange rate since 1986 when the fixed exchange rate regime was abandoned. The historical data on bilateral (Naira to Dollar) shows a number of periods of fixity even in the post deregulation period (see Figure 3 below). This is the so-called fear of floating, where authorities de jure declare that they float, but they de facto implement some form of peg (see Oshilaja, 2008; Calvo and Reinhart, 2002). According to this literature, authorities fear floating for two reasons. First, nominal depreciations are likely to accelerate inflation, and second, sudden upward movements in the NER can have undesired balance sheet effects especially in dollarized or externally indebted economies. Because of the first reason, it is therefore conceivable that a central bank whose mandate is to ensure price stability would keep a close watch at nominal exchange rate changes, intervening whenever changes appear to be a threat to its inflation objective. At the extreme, central banks can hold the nominal exchange rate fixed for fear of its inflationary consequences, especially when the market pressure tends towards depreciation. This position, i. e. intervening to defend a depreciating currency can be costly and ineffective in the long-run. This is because central banks have only a finite foreign exchange reserves, therefore cannot intervene indefinitely. For an effective conduct of monetary policy, therefore, a clear empirical knowledge of the exchange rate pass-through to domestic inflation is pertinent. Exchange rate pass-through refers to the extent to which changes in the exchange rate translate into domestic price changes. On the one hand, a large and fast exchange rate pass-through to domestic inflation would suggest that a free float that results in more depreciations than appreciation of the nominal exchange rate would be a threat to the central banks low (single digit) inflation targets hence explains the fear of floating that the central bank exhibits. On the other hand, low and slow exchange rate pass-through would suggest that a de facto free float would neither threaten the attainment of low inflation targets, not be costly to the central bank as it occasionally intervenes to smoothen out temporary market fluctuations. In addition, the knowledge of the extent of exchange rate pass-through to domestic prices would provide an insight into the international transmission of shocks and the effectiveness of exchange rate policy measures on external adjustment. As an open economy, Nigeria’s domestic inflation can, to some extent, be influenced by foreign factors in the long run. The empirical question that arises here is therefore the magnitude and speed of the exchange rate pass-through in Nigeria. Literature on exchange rate pass-through on African countries, particularly Nigeria is very scanty. The recent two studies are Essien (2005) and Aliyu et al. (2009). Both studies found contrasting results on the extent of pass-through in Nigeria. While

Aliyu, et al, (2009) found pass-through to be low, consistent with a number of other empirical studies in Sub-Saharan African (SSA) countries, Essien (2005) found the pass-through to be complete in the long-run. The findings that exchange rate pass-through is low in African countries, Nigeria inclusive, is surprising for a number of reasons: first, their import share of GDP, hence domestic prices, is conceivably large. So any changes in exchange rate that lead to changes in the import price should have substantial effect on the domestic price level. Secondly, and anecdotally, if indeed the exchange rate changes have no effect on inflation, why do central banks still fear to float? Contesting similar finding that the exchange rate pass-through is low in Ghana, Sanusi (2010) uses a different empirical approach (Structural VAR) to find that the exchange rate pass-through to consumer price in Ghana was indeed substantially larger than it is found in Frimpong and Adam (2010) and Devereux and Yetman (2003) but incomplete. One question that arises from this debate is therefore whether the pass-through is indeed large in Nigeria. This study therefore attempts to participate in this debate by using a different, yet, more appropriate, approach of Structural Vector Autoregression (SVAR) Model of the inflation process to estimate both the static and dynamic pass-through elasticities of exchange rate changes to domestic prices. This approach will help us determine both the short-run and long-run magnitude of the pass-through, as well as its speed. The model incorporates the country-specific features of the Nigerian economy that appear to be important in the inflationary process. In addition, this approach allows the examination of the relative importance of the various sources of inflationary pressures in Nigeria. The rest of the paper is organised as follows: section two reviews the theoretical and empirical literature on exchange rate pass-through. Section three discusses the data and methodology, while section four presents the results. Section five summarizes and concludes the paper.

2. Review of Theoretical and Empirical Literature

2. 1 Theoretical Literature

Exchange rate pass-through (ERPT) refers to the effect of a change in the exchange rate on domestic prices. In other words, exchange rate appreciation or depreciation passes through to inflation directly, by altering the relative price of domestic and foreign goods and indirectly through the changes in economic activities (Bimeier and Bonato, 2002). Classic exchange rate pass-through typically has two stages. In the first stage, changes in the nominal exchange rate are reflected in the prices of imports in local currency terms. These changes are then passed on – in whole or in part – to the consumer in the second stage (Chew et al., 2011). An associated concept in ERPT definition is pricing-to-market (PTM), which refers to the pricing behavior of firms exporting their products to a destination market following an exchange rate change. Broadly defined, pricing-to-market refers to the percentage change in prices in the exporter's currency due to a one percent change in the exchange rate. This idea is used as the theoretical explanation of the low degree of exchange rate pass-through that is found in countries with huge import share in GDP. It is argues that exporting firms change their destination market prices in response to exchange rate changes by allowing their markup to absorbed the effects of the exchange rate changes. This allows the prices of imported goods to be stable despite changes in the exchange rate, thereby making the domestic price level less sensitive to exchange rate changes (see Sanusi, 2010). The greater the degree of pricing-to-market, the lower the extent of exchange rate pass-through will be. If import prices change by the same proportion as the change in the exchange rate, the result is full or complete pass-through and hence no pricing-to-market. On the other hand, if exporters adjust prices in their own currency by the same proportion as the exchange rate change but in the opposite direction, the result is full pricing-to-market but no or zero pass-through of the exchange rate changes into the destination market prices. More generally, if exporters alter the export prices in their own currency by a proportion smaller than the exchange rate change, then exchange rate pass-through is said to be partial or incomplete. The degree of exchange rate pass-through and pricing-to-market behavior has important bearings on economic policy. If pricing-to-market is high and exchange rate pass-through low, then any exchange rate-based adjustments to improve the trade balance for economies may be less effective, as nominal exchange rate changes do not translate into real exchange rate changes. The size of the export market and the degree of competition the exporter faces in that market is important in determining the extent of exchange rate pass-through. If the export market for the product is large, then exporting firms are often willing to absorb a proportion of the exchange rate change so as not to lose market share. This is particularly so if the industry is highly competitive. The presence of a large number of suppliers selling similar goods in the market provides domestic consumers with a choice of many substitutes, making them relatively price-sensitive. On the other hand, if the industry is highly differentiated and exporters do not face much competition for their products, then exporter prices may be somewhat less responsive to exchange rate changes. In this situation, pricing-to-market will be lower and the corresponding pass-through will be higher. According to Knetter (1993), exports to certain competitive industries in the U. S., such as autos and alcoholic beverages, showed relatively high pricing-to-market and corresponding lower exchange rate pass-through as exporters try to preserve market share. As noted by Krugman (1986), where either the market is segmented or the products are differentiated the perception of the exporters about the nature of the exchange rate effect, i. e., whether the exchange rate depreciation is temporary or permanent could be relevant. Exporting firms, therefore, discriminate prices across their destination markets. Prices are set as a product of a (common) marginal cost and destination-specific mark-ups. Firms therefore adjust the destination-specific mark-ups in response to changes in exchange rate, thereby absorbing part, or all, of the exchange rate change through their destination specific mark-ups. This adjustment of destination-specific mark-ups provides the microeconomic explanation of the empirical findings of incomplete pass-through (see Goldberg and Knetter, 1997). The direction, duration, and magnitude of exchange rate changes also affect pass-through. If the currency of the destination market depreciates, then exporters may be willing to absorb this exchange rate change to keep local currency price of their products stable and retain market share. In this situation, exchange rate pass-through may be low or incomplete. However, if the currency of the destination market strengthens, the exporting firm may engage in complete exchange rate pass-through. The high costs of changing prices, as well as the possibility that frequent changes in unit sales prices (in the destination market's currency) can adversely affect a firm's reputation, may prevent firms from passing through temporary fluctuations in exchange rates. When exchange rate changes are large or appear to be permanent, however, exporting firms are more likely to pass through the changes to avoid a sharp reduction in their profit margins. Exchange rate pass-through generally has a greater effect on import prices than on a nation's consumer price index (CPI). This is because the latter includes non-tradables that are less responsive to exchange rate changes. While most of the research has focused on developed countries, where more data is available, recent studies suggest that the conclusion holds for developing countries as well (Ghosh and Rajan, 2006). Exchange rate pass-through may also depend on a country's monetary and exchange rate policies. The more stable a country's monetary policy and the lower its rate of inflation, the lower the extent of exchange rate pass-through will be, as it is less likely that foreign exporters will pass through exchange rate changes (Taylor, 2000). This in turn helps to sustain low inflation and makes monetary policy more effective. Hence, there seem to be an indirect relationship between stable monetary policy and low exchange rate pass-through. The theoretical literature shows that the magnitude of exchange rate pass-through to consumer prices depends on the inflation environment and volatility of the exchange rate itself (Taylor, 2000). It is argued that firms tend to pass-on increased production costs due to exchange rate depreciation in a high-inflation than in a low-inflation environment due mainly to higher inflation expectations the former breeds.

Similarly, pass-through is higher when exchange rate is more volatile, chiefly because firms expect the rising costs to be permanent. The theoretical channels of transmission of ERPT to domestic inflation are direct (prices of imported consumption goods and domestically produced goods priced in foreign currency) and indirect (prices of imported intermediate goods where exchange rate movement affects domestic prices by changing the cost of production). For the direct channel, exchange rate depreciation translates directly into import prices as shown in the following theoretical relationship derived from the law of one price or Purchasing Power Parity (PPA).

Pd = e* Pf

Where Pd = price of the imported good in domestic currency, e = exchange rate (domestic currency units per foreign currency), and Pf = price of the same imported good in foreign currency. Many microeconomic monetary models of exchange rate and balance of payment assume a one-to-one relationship between exchange rate changes and changes in domestic prices (see Goldberg and Knetter, 1997) mainly on the basis of law of one price, however, empirical research on exchange rate pass-through has rejected this hypothesis.

2. 2 Empirical Literature

The bulk of the empirical literature on pass-through indicated that the exchange rate pass-through is incomplete and varies across countries depending on the size and openness. The pass-through to import prices also tends to be higher in both magnitude and speed than to consumer prices. A number of some studies have shown a decline in the extent of pass-through in the late 1990s and 2000s, this was attributed to sustained low inflation achieved in most developed countries (Campa and Goldberg, 2005; Gagnon and Ihrig, 2001; Menon, 1995). Krugman (1986) shows that 35 - 40 per cent of the real appreciation of the dollar since 1980 has been absorbed by foreign exporters thus reducing the extent of import price rise in the U. S. than in other markets. The methodology often used in the estimation of the pass-through are both single equation and system based approach. McCarthy (1999) using a VAR model, revealed a decline in exchange rate pass-through for all nine of the OECD countries examined for the period 1983-1998 compared with the period 1976-1982. According to those estimates the pass-through declined by 50 per cent or more in the United States, United Kingdom, France and Japan, and by a smaller amount in Germany, Belgium, Netherlands, Sweden and Switzerland. Ito and Sato (2007) uses monthly series of data consisting of the natural logarithms of nominal effective exchange rate, oil prices, money supply, domestic prices and the output gap for the period 1990 to 2006, to analyse the degree of domestic price responses to exchange rate changes in crisis hit countries in East Asian and Latin American countries and Turkey. They use the Structural Vector Autoregression (SVAR) model and that the degree of exchange rate pass-through is higher in Latin American countries and Turkey than it is in East Asian countries with the notable exception of Indonesia. Following the framework of Campa and Goldberg (2005) on the relationship between import prices and exchange rate after adjusting for foreign production costs and domestic demand factors, Liu and Tsang (2008), estimate the elasticity of pass-through from exchange rate to import prices and from import prices to domestic inflation. Using a Phillips-Curve model on quarterly Hong Kong data for the period of 1984 to 2007, they found that Hong Kong's exchange rate pass-through to import prices is relatively high compared to the OECD average. With respect to exchange rate pass-through to domestic prices, they find that a 10 per cent depreciation of the US dollar against all currencies except for the Hong Kong dollar would lead domestic prices to increase by 0. 82 and 1. 61 per cent in the short run and medium run respectively. Naqvi and Rizvi (2006), attempt to quantify a possible link between exchange rate pass-through and inflation targeting framework in Asian inflation targeting (IT) and non IT economies since 1990s. By adopting a structural VAR model with non-recursive contemporaneous restrictions imposed on covariance matrix, they identify the impulse response of domestic inflation to the shocks of exchange rate and world commodity prices. The empirical evidence suggest that ERPT is absent in Asian IT and non-IT economies since 1990s. Auer (2011) estimates the response of US import and producer prices to changes in the Chinese Yuan. In a monthly panel spanning December 2003 to December 2009 and covering 110 sectors, the analysis reveals that a 1. 0 per cent appreciation of the Yuan increases the U. S. import prices by roughly 0. 8 per cent. Subsequently, import prices, in turn, pass through into producer prices at an average rate 0. 6 per cent. He noted that because such an appreciation would also influence the overall skewness of the distribution of price changes at the sectoral level, it would likely also impact the U. S. equilibrium inflation. Ouliaris and Tan (2011) investigate exchange rate pass-through in Singapore using band-pass spectral regression techniques, allowing for asymmetric effects over the business cycle. Using data spanning 1980: Q3 – 2010: Q3, their results find significant evidence of such asymmetries in Singapore. Specifically, importers pass on a smaller share of the cost savings arising from a stronger exchange rate amidst robust economic growth, than when costs increase as a result of a weaker exchange rate during a downturn. At the second stage, retailers would tend to be more aggressive in passing on import cost increases amidst strong economic growth. Zorzi et al (2007), examines the degree of Exchange Rates Pass-Through to prices in 12 emerging markets in Asia, Latin America, and Central Europe. Their results based on three alternative vector autoregressive models, partly overturn the conventional wisdom that ERPT into both import and consumer prices is always higher in " emerging" than in " developed" countries. For emerging markets with only one digit inflation (most notably the Asian countries), pass-through to import and consumer prices is found to be low and not very dissimilar from the levels of developed economies. The paper also finds robust evidence for a positive relationship between the degree of the ERPT and inflation, in line with Taylor's hypothesis once two outlier countries (Argentina and Turkey) are excluded from the analysis. Also, the presence of a positive link between import openness and ERPT, while plausible theoretically, finds only weak empirical support. The literature on ERP for Sub-Sahara Africa (SSA) tends to be few. Kiptiu et al (2005) find that pass-through in Kenya was incomplete during the period 1972-2002 using a cointegration and error correction approach. They found that an exchange rate shock leads to a sharp increase in inflation that dies out after four quarters, with the exchange rate explaining 46 per cent of inflation variability. Mwase (2006) used an SVAR model to estimate the exchange rate pass-through for Tanzania using quarterly data for the period 1990-2006. His findings reveal a decrease in exchange rate pass-through despite the depreciation of the currency. Literature on exchange rate pass-through on West African Countries is very scanty. The empirical approach can be broadly grouped into two. The first involves specific attempt of estimating the exchange rate pass-through. The empirical models in these studies are therefore are either based on theoretical models of the inflationary process (such as in Sanusi, 2010), or the so-called models of supply chain (such as in Aliyu et al., 2009). The second group consists of those studies that attempt to examine the relationship between inflation and exchange rate. In this group, the attention is often not on the exchange rate pass-through, so the coefficients estimated of the relationship may only cautiously be interpreted as the exchange rate pass-through. Such studies in this group include Nnanna (2002). In his studies on " Monetary Policy and Exchange Rate Stability in Nigeria" using a VAR model, with a Cholesky-type identification scheme, he established a positive relationship between exchange rate and inflation. However, for the first group of studies that specifically attempt to measure the exchange rate pass-through in Nigeria, there are only two that we know of. These included Essien (2005) and Aliyu, et al., (2009). Essien, (2005) examines the inter-relationship between exchange rates and inflation in Nigeria. His study on ‘’Exchange Rate Pass-through to inflation in Nigeria’’ with quarterly data 1960 – 2003, used Ordinary Least Square (OLS) bivariate regression equation and error correction model with exchange rate and domestic price level as the variables considered. His finding reveals that there was long-run relationship between Exchange rate and Domestic price level. The coefficient of the long-run static equation (1. 05) suggests complete pass-through in the long-run, but the dynamic equation suggests an incomplete and low pass-through in the short run. Aliyu et al., (2009) however investigate the pattern of exchange rate pass-through to import and consumer prices in Nigeria, using quarterly data for the period 1986-2007. The estimation was done using a VEC model. Their result shows that exchange rate pass-through was incomplete and low, in contrast to that of Essien (2005). These contrasting findings further suggest that the results may be sensitive to the methodology used. In a similar case, Sanusi, (2010) uses SVAR approach to find contrasting results to that of Frimpong and Anokye (2010) and Devereux and Yetman in the case of Ghana. His study reveals that an exchange rate pass-through to domestic price in Ghana is substantial but incomplete.

Methodology

A methodology that has become very popular in exchange rate pass-through studies is the one advanced by McCarthy (1999). A supply shock, demand shock and external shock together with domestic price indices are employed in a recursive VAR framework. The effect of exchange rate shocks is examined by means of Cholesky decomposition. However, the limitation of this approach is based on the shortcoming of Cholesky decomposition which imposes restrictions on the residual variance covariance matrix, and assumes that the errors are orthogonal, and hence renders the impulse response functions and variance decompositions highly sensitive to the ordering of the variable in the VAR. In cases where the covariance between innovations is empirically non-zero, the common component of the disturbances will be wrongly attributed to the first variable in the recursive VAR. This renders the impulse response functions (IRFs) and variance decompositions (VDs) obtained highly sensitive to the ordering of the variables in the VAR (Enders, 2002). Therefore, the SVAR approach will be used to address the deficiency of the latter approach (see Mwase, 2006; Stulz, 2006 and Sanusi, 2010.) The advantage of structural decomposition is that the identifying restrictions have some economic foundations and also can be used to identify structural shocks. The study uses the framework of SVAR using impulse response functions and variance decompositions with quarterly data for the period 1986 to 2010. The SVAR model is theoretically motivated, incorporated specific features of the Nigerian economy including fiscal dominance, supply rigidities, import and oil export dependence. The first step in the estimation of the SVAR is the stationarity tests (Augmented Dickey-Fuller and Philips-Perron tests), to determine order of integration of the variables. Having found some of the variables to be I(1), a Co-integration test was then conducted to find out whether a long-run relationship exists between those I(1) variables. Having found no cointegration, we proceeded to estimate the empirical VAR in the first differences of all the variables. The empirical shocks from the estimated VAR were then decomposed using structural factorization, from which impulse response (IR) functions were estimated and variance decomposition analysis conducted. The IR from the estimated SVAR were used to calculate the pass-through from exchange rate to domestic prices. The IR traced out the effect over time on prices of a shock to the exchange rate equation. The VD enables us to examine the relative importance of the various shocks for fluctuations in domestic prices. The pass-through elasticities (both static and dynamic) were estimated using the IR functions.

3. 1Model and Data

To access the impact of exchange rate changes on domestic prices, we estimate a VAR model in line with previous studies such as McCarthy (2000), Hahn (2003), Ito and Sato (2006) and Sanusi (2010). A VAR model is useful in allowing for endogenous interactions between the exchange rate and other macroeconomic variables. The pass-through relationship assumes a causal direction from the exchange rate to domestic variables. However, a reverse causation – impact of domestic prices on the exchange rate may exist. As suggested by the standard monetary model, for example, an increase in domestic prices most likely leads to exchange rate depreciation. Ito and Sato (2007) study motivates the ordering as well as choice of the variables included in our model. The multivariate SVAR contains five variables. These are the natural log of oil prices (op), output gap (y_sa_gap) which is generated by applying the Hodrick-Prescott (HP) filter, and the natural log of money supply (m), that of exchange rate or nominal effective exchange rate (ne), and that of domestic price inflation (p) proxied by changes in the consumer price index. The exchange rate and domestic price inflation are the key variables of interest. A preliminary look at the data on the selected variables suggests that there may indeed be a relationship to be uncovered between the exchange rate and domestic prices. Figure 1 shows that trend decline (depreciation) in the nominal effective exchange rate is associated with a trend increase in the domestic price level. This trend relationship is also shown to hold between bilateral nominal exchange rate and price level in Figure 3. It should be noted here that the several (short) periods of fixed exchange rate has rendered the bilateral rate less variable hence less suitable for this analysis than the nominal effective rate. In Figure 2, the link between price level and the other variables included in the model is depicted. The general trend relationship seems to be positive between domestic price level and oil price, but difficult to discern, without a formal analysis, between domestic prices and output gap. Figure 1. Trend in Money Supply, Exchange Rates and Consumer Price IndexFigure 2. Trend in Output Gap, Oil Price and Consumer Prices in NigeriaFigure 3 Bilateral Exchange Rate and Price LevelIn order to properly capture structural shocks, the endogenous variables are systematically ordered. The change in oil prices is included in the VAR model to identify the supply shock. Ito and Sato (2007) notes that the reduced-form residuals of oil prices are unlikely affected contemporaneously by any other shocks except the supply (oil price) shock per se, while the supply shock likely affects all other variables in the system contemporaneously. Hence, oil price is ordered first in the VAR model. The output gap is placed second in the ordering of the VAR model. The demand and supply shocks that affect the output gap are assumed to be largely predetermined i. e., exchange rate, money supply and local prices affect the output gap with a lag. Output gap is only contemporaneously affected by the oil price (Ito and Sato, 2007). The money supply M2 is included in the VAR to allow for the effect of monetary policy in response to a large swing of the exchange rate or devaluation. The money supply is ordered third and ahead of the exchange rate, while the domestic price variable is placed last. The study used quarterly data for the period 1986 Q1 to 2010 Q4. The data source is the Central Bank of Nigeria (CBN) and National Bureau of Statistics (NBS) publications. While monthly frequency is desirable in carrying out this study, a key variable such as the GDP is available only quarterly. However, most studies of exchange rate pass-through as discussed in the empirical literature used quarterly data. Hence, the unrestricted VAR is in the form: A(L)xt = et where A(L) = Σpj= 0 AjLjxt is a column vector of the endogenous variables, i. e., xt =[Δopt, Δy_sa_gapt, Δmt , Δnet, Δpt]; where Δ represents the first difference operator. A(L) is a 5 ×5 matrix polynomial in the lag operator L and e is a column vector of serially independent errors: et = [eopt ey_sa_gapt emt enet ept]

4 Estimation Results

4. 1 Unit Root Tests

Table 1 reports the results of the Augmented Dickey Fuller (ADF) and Phillips Perron (PP) unit root tests. The tests on the levels of the variables with intercept and trend on the equations show that only output gap is stationary. However, all the variables are stationary at the first difference, suggesting that they are all I (1) except output gap which is I(0). Although ADF suggests that the NEER may be stationary at level at 5% level of significant, we take the results of PP test as I(I) given the well-known lack of power and size that ADF suffers in small samples. This implies that the test for cointegration shall include only the four integrated variables, rather than the five variables in the model.

Table 2: Augmented Dickey-Fuller and Phillips Perron Unit Root Tests

Level

First Difference

Variable

ADF Stat

PP Stat

ADF Stat

PP Stat

Comment

Oil Price-2. 653912-2. 70129-9. 0132-10. 5259I(1)Output Gap-3. 5313-4. 6417-5. 3138-17. 1835I(0)M2-2. 6095-2. 6809-9. 8789-9. 8791I(1)NEER-3. 4856-3. 0826-7. 6870-7. 6870I(1)CPI-2. 0027-0. 7520-2. 4123-6. 6928I(1)The 5% Critical Value are as follows: ADF level is PP is -3. 45584 at first difference is -2. 8912

4. 3 Cointegration Tests

Table 2 presents the results of the Johansen cointegration test. We included all the variables except the output gap because it was found to be stationary. According to both the trace and maximum eigenvalue statistics, there is no evidence of cointegration among the variables. This is because the tests suggest that the number of co-integrating equations (r) is equal to the number of variables in the model (n), hence violating the rule that r ≤ n-1. Therefore, we proceed to estimate the VAR in first-difference of all the integrated variables and the stationary output gap. Prior to the conduct of cointegration test, optimal lag length test was conducted which suggests a lag of one as the optimal. At this lag, the residuals of the underlying VAR were free of autocorrelation and normal.

Table 3: Johansen Cointegration Tests

Maximum Eigenvalues (λmax)

No. of CE (s)

NoneAt most 1At Most 2At most 3

Eigein Value

0. 3970. 3340. 2790. 139

(λmax) Statistic

48. 61639. 08131. 46714. 471

Critical Value

27. 58421. 13114. 2643. 841

Trace (λTrace)

No. of CE (s)

NoneAt most 1At Most 2At most 3

Eigein Value

0. 3970. 3340. 2790. 139

(λmax) Statistic

133. 63685. 02045. 93914. 471

Critical Value

47. 85629. 79715. 4943. 841

The Estimated System of Shocks from SVAR

Equation i-v below show the estimated system of shocks from the SVAR extracted from the estimated residuals from our unrestricted VAR. The p-values figures are reflected in the parenthesis. The coefficient on ene in equation (v) shows effect of exchange rate changes on price level at impact. To formally estimate its magnitude however, we need the IRFs. eop = 0. 181εop(i)(0. 000)ey_gap = 0. 024εy_gap(ii)(0. 000)em = 0. 097ey_gap + 0. 066εm(iii)(0. 713) (0. 000)ene = 0. 626ey_gap + 0. 065em + 0. 141εne(iv)(0. 279) (0. 000) (0. 000)ep = 0. 108ey_gap + 0. 266em + 0. 019ene + 0. 053εp(v)(0. 620) (0. 001) (0. 617) (0. 000)

Estimation Results

The dynamic pass-through elasticity is estimated using the ratio below: PTt = % ΔPt/% ΔSoWhere PTt = Pass-through at time T, % ΔPt = is the percentage change in the price level between period 0, when the initial exchange rate shocks hits, and % ΔSo , is the percentage change in the exchange rate at time 0. The proportionate change in price level, % ΔPt, is provided by the IRFs, while the proportionate change in the exchange rate, % ΔSo, is the standard deviation of the exchange rate (Sanusi, 2010). Using this formula, therefore, table 4 shows the dynamic elasticities of the exchange rate pass-through over a horizon of 20 quarters.

Table 4: Dynamic Elasticities of Inflation in Nigeria for the period

(1986 Q1 – 2010 Q4)

Shocks to:

Period

Oil

Output gap

Money Supply

Exchange Rate

Inflation

t= 10. 010. 120. 26-0. 021. 00t= 40. 00-0. 250. 65-0. 231. 20t= 80. 03-0. 510. 70-0. 261. 27t= 200. 03-0. 510. 70-0. 261. 27Structural S. D. 0. 1810. 0240. 0660. 1410. 053The dynamic elasticities of inflation in Nigeria as shown in Table 3 above signifies the accumulated shock of all the five variables at different time horizons. In other words, it shows percentage change in inflation as a result of a one percent change in each of the variables. Column 5 shows the dynamic exchange rate pass-through elasticity. For instance, at impact, it stood at 0. 02 suggesting that a 10 percent depreciation of the naira only raises inflation by 0. 2 percent. The pass-through however increases to 0. 23 at quarter four. The total impact of the shock on exchange rate is settled at 0. 26 after eight quarters. This suggests that 10 percent depreciation raises inflation only by 2. 6 in the long-run. This shows that the exchange rate pass-through in Nigeria is incomplete and quite slow as depicted in Figure 4. These results are quite in line with the findings Aliyu, et al (2009), who found low pass-through in Nigeria, but at variance with that of Essien (2005) who found a complete long-rum pass-through to domestic prices in Nigeria. This result suggests that foreign firms exporting to Nigeria practice substantial degree of pricing-to-market. This is plausible because Nigeria is a large market for most exporting firms, and most firms would therefore prefer to allow the exchange rate variations to eat into their profit margin, rather than change their relative position in the domestic market. Figure 4 Dynamic Elasticity of the Exchange Rate Pass-Through

Table 4: Variance Decomposition of Inflation (1986Q1-2010Q4)

Shocks:

Period

S. E.

Oil

Output gap

Money

Exchange Rate

Inflation

t= 10. 060. 000. 299. 590. 2389. 89t= 40. 071. 021. 8316. 2410. 8770. 04t= 80. 071. 622. 2616. 0510. 9969. 08t= 200. 071. 622. 2616. 0511. 0069. 07Results from the variance decomposition in Table 4, shows the importance of each random innovation in affecting domestic prices. From the results, inflation is shown to be persistent, explaining about 90 percent of its historical variations in the first quarter, and declining only to 70 at 20 quarters. In addition, money supply has had greater historical influence on domestic prices than exchange rate movements. This implies that monetary factors have historically been more important in explaining Nigeria's inflationary process. This result confirms the assertion in the literature that inflation in Nigeria is to a greater extent is a monetary phenomenon. See Figure 5.

Figure 5 Variance Decomposition of Inflation (1986Q1-2010Q4)

Note: Shocks 1 = Oil Price; 2 = Output Gap; 3 = Money Supply; 4 = Nominal Effective Exchange Rate and 5 = Consumer Price Index

5. Conclusions and Recommendations

The paper has estimated the exchange rate pass-through static and dynamic elasticities for Nigeria using SVAR approach. The major finding is that, in line with Aliyu et al., (2009), exchange rate pass-through in Nigeria is incomplete and low. This is in contrast with the findings of Essien (2005) who found that the pass-through is complete in the long run. Secondly, the total impact is attained after eight quarters, suggesting that it is quiet slow. This is consistent with the literature on African countries, for example Ghana as found in Sanusi (2010). One interpretation of this low and slow exchange rate pass-through is that exporters to Nigeria practice a substantial degree of pricing-to-market strategy. Instead of allowing their naira price of their products to vary whenever there are changes in the exchange rate, these firms allow their mark-ups to vary as they change their local currency prices in the opposite direction of the exchange in exchange rate. We argue that this is plausible in Nigeria being a large market for fairly all its imported commodities. Firms would therefore strive to keep their competitive advantage in the domestic market as exchange rate changes. This explains the low pass-through observed. One implication of this finding is that the cost of true float may not be as large as it would under complete pass-through. There is therefore a good potential for de facto float, since only a small fractions of the excessive variations in the exchange rate that such regime would entail will be passed onto inflation. In other words, the fear of floating that the authorities exhibit in Nigeria may be unfounded. The paper recommends the need for continued strengthening of the domestic production will assist in reducing the level of the imported component thereby reducing the level of pass-through. As the results of the variance decomposition suggest, there is also the need to continue to pursue stable and predictable monetary and fiscal policies, since historically, money had played greater role in the inflationary process than exchange rate variations. It is imperative to state that, achieving this would go a long way in ensuring that the CBN achieve its mandate of maintaining price and monetary stability, as well as sustained economic growth.

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