Is Exchange Rate Pass-through to Import Prices in Nigeria A Short-run Phenomenon?

I.D. Poloamina
M. Adetunji Babatunde
M. Abimbola Oyinlola
Department of Economics, University of lbadan, Nigeria

The study examines the extent of exchange rate pass-through into import prices for Nigeria between 1980 and 2006. The recently developed Unrestricted Error Correction Model (UECM) - Bounds test proposed by Pesaran et al. (2001) was adopted. A price model that recognized the developments in the tradable and non-tradable sectors of the economy was used. At the aggregate level, exchange rate pass-through to import prices was found to be complete. However, only the short-run effect of exchange rate pass-through was evident, but occurred with a lag. There was, however, no long-run relationship among the variables. In the short run, a 1% depreciation of the exchange rate led to 1% increase in import prices. In addition, the immediate past values of world export price and tariff rate explains some of the variation in import prices in Nigeria.

Keywords: exchange rate, pass-through, short-run

Introduction
The rapid movements in exchange rate became apparent in Nigeria after the Structural Adjustment Programme (SAP) was introduced in 1986. From 1986, there was a significant shift in exchange rate and trade policy direction towards greater liberalization. This informed the fall in the nominal effective exchange rate between 1985 and 1989 at an average of 41% annually as well as an average depreciation of 71% annually of the official exchange rate. The parallel exchange rate market rate was even worse; it depreciated by an average of 114% annually between 1986 and 1993. In recent years, measures like the Dutch Auction System (DAS)1

mechanism of determining exchange rate that later metamorphosed into the Wholesale Dutch Auction System (WDAS) on February 20, 2006,2 are directed towards moving the economy further into liberalization. The resulting impacts are evident on the continued appreciation and stability of the exchange rate since its commencement. In addition, other efforts are directed towards moving the

1 DAS is a method of exchange rate determination through auction where bidders pay according to their bid rates and where the ruling rate is the last bid rate that clears the market.

2 The exchange rate has been stable since the commencement of DAS particularly in the year 2004. Year 2004 opened with a rate of N137.00/$1 and closed with an exchange rate of N132.85/$1, indicating an appreciation of N4.15 (or 3.03%). There was further improvement in 2005 as the naira appreciated by 2% from N132.00/$1 to N129/$1 as at end December, 2005. The exchange rate under the new WDAS has also stabilized and continued to improve the operations of the foreign exchange market. As, at March 20, 2006 the exchange was N128/$1. The naira further appreciated in 2007 closing at N116/$1 in December, 2007.
domestic price closer to international prices. These events occurred in line with the period of average annual increase in the consumer price index (CPI) of about 78% between 1985 and 1989. This statistics however does not reveal the volatility of changes in CPI as the period entails years of rapid fall and increase in inflation. It was found that annual change in inflation actually rose well above 300% in 1988 relative to the previous year. This volatility has significant implications for the appropriate conduct of monetary policy in an open economy, and hence the management of consumer price inflation and balance of payment which are affected by exchange rate movement through its effect on prices of import.

It is therefore imperative to examine the extent of pass-through of exchange rate to the import price. Such investigation will assist in understanding the process of price determination in Nigeria. Thus, the significance of this study lies in the argument that the knowledge of the extent of pass-through to import prices could influence monetary authorities' forecasts of the future path of inflation, a key element in the conduct of monetary policy. Indeed, the successful implementation of monetary policy presupposes that monetary authorities have not only a good understanding of price determination, but that they are also relatively successful at predicting the future path of inflation. The critical role played by other key factors in price determination cannot be underestimated. If inflation forecasts are based on estimates of exchange rate pass-through that do not take other factors such as tariff into account, these forecasts could be overestimating the effects of changes in the exchange rate on domestic price. Moreover, the conduct of an optimal monetary policy aimed at price stability depends on the extent, source and the duration of price shock. Hence, the design of an optimal monetary policy should differ across countries and product groups, depending on the extent of exchange rate pass-through. The determination of the extent of pass-through is therefore crucial for the formulation of an optimal monetary policy.

Furthermore, there is still a paucity of research on the empirical estimates of pass-through for small open and developing economies. Moreover, most of these studies focus on the US, Germany, Canada, Belgium, Italy, Austria, Switzerland, Ireland (Baldwin, 1988; Hooper and Mann, 1989; Feenstra, 1989; Kim, 1990; Kenny and MacGettigan, 1996; Hänninen, 1998), Asia (Atheyorala and Menon, 1994; Mallick and Marques; 2007) and Latin America (Garcia and Restrepo; 2001), leaving a glaring gap for developing countries. Although, there are few empirical studies on some Sub-Saharan African (SSA) countries (Bhundia, 2002 for South Africa; Kiptui, Ndolo and Kaminiclia 2005 for Kenya; and Oladipo, 2007 for Nigeria), but these cannot be generalized for all SSA countries because of their peculiar problems and economic conditions which are country-specific and therefore responsible for the heterogeneous nature of pass-through estimates as obtained in the study by Barhoumi (2005) on few developing countries. Thus, the need for more country specific studies on the subject matter so as to further contribute to the debate and assist in the formulation of appropriate monetary policies is crucial, especially for Nigeria where studies in this area are scarce. Moreover, most of these studies employed open macroeconomic models based on perfectly competitive market structure which is not applicable to a developing economy such as Nigeria. Finally, many of the previous studies have either ignored the need for testing the time-series properties of the variables entering the import function, or have used the Engle and Granger (1987) or Johansen (1988, 1991) cointegration methods, both of which presuppose that all the series contain a unit root.

For example, Oladipo (2007) applied the Johansen (1988) cointegration technique to sectoral data, using the mark-up model that sets export prices as a mark-up on production costs of the foreign exporters and established the existence of incomplete pass-through for Nigeria. The study, however, suffers from one major analytical issue. A small open economy like Nigeria takes the price of exports as given. As a "price taker", modelling import price using this type of framework may not be appropriate. Import price setting in Nigeria does not consider how
the exporters determine their export price. The export price is simply taken as given. In addition, the Johansen cointegration framework has been argued to suffer from certain shortcomings. This is because there are limitations to this technique. For example, while the most obvious advantage of the Johansen method is that it allows estimation of multiple cointegrating vectors where they exist, researchers fail to recognize that the application of the Johansen technique presupposes that the underlying regressors are all integrated of order one (Pesaran et al., 2001). This is necessary because in the presence of a mixture of stationary series and series containing a unit root, standard statistical inference based on conventional likelihood ratio tests is no longer valid. Harris (1995), for example, notes that the trace and maximum eigenvalue tests from the Johansen procedure may lead to erroneous inferences when I(0) variables are present in the system since stationary series are likely to generate spurious cointegrating relations with other variables in the model (De Vita et al, 2005). This study therefore applies a price decomposition method used by Sharma (2003) to investigate the extent of pass-through in Nigeria in a bound testing error correction model. It serves as our contribution in the study of pass-through in Nigeria. A merit of the ARDL bounds testing approach (Pesaran and Shin, 1999; Pesaran et al., 2001) that we employ, is that it allows testing for cointegration when it is not known with certainty whether the regressors are purely I(0), I(1) or cointegrated.

The study covers a period of twenty-seven years. This is between 1980 and 2006. The choice of the period is guided by data availability considerations. The sequence of this study is clear. The background study of Inflation and Exchange Rate in Nigeria is carried out in Section II. A brief review of the literature is contained in Section III. Section IV discusses the Model. Estimation issues are the pre-occupation of Section V. Empirical results are discussed in Section VI while Section VII rounds off the study with concluding summary.

### Inflation and Exchange Rate Movement in Nigeria

Table 1 describes the movement of domestic price and exchange rate indicators in Nigeria. The periods are categorized based on the episodes of movements shown in Figure 1.

<table>
<thead>
<tr>
<th>Exchange rate</th>
<th>Domestic price</th>
<th>Nominal Effective Exchange Rate</th>
<th>Real Effective Exchange Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980-1986</td>
<td>0.894286</td>
<td>13.23857</td>
<td>7357.877</td>
</tr>
<tr>
<td>1987-1995</td>
<td>19.92889</td>
<td>40.91556</td>
<td>624.6756</td>
</tr>
<tr>
<td>1996-2000</td>
<td>87.904</td>
<td>13.42</td>
<td>159.024</td>
</tr>
<tr>
<td>2001-2006</td>
<td>125.6317</td>
<td>13.695</td>
<td>77.08667</td>
</tr>
<tr>
<td>Percentage change</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1996-2000</td>
<td>4.406598</td>
<td>9.02489</td>
<td>-8.43662</td>
</tr>
<tr>
<td>2001-2006</td>
<td>6.569158</td>
<td>18.83053</td>
<td>-8.53521</td>
</tr>
</tbody>
</table>

*Source: World Development Indicator CD-ROM, 2007*

The first period (1980-1986) shows the episode of waxing inflationary trend and relatively stable exchange rate. The period witnessed two years overshoot of inflation above 20 per cent mark, thereby overwhelming the relatively lower inflationary years. The average domestic price of the period stood at 13.2 percent. The nominal exchange rate during this period hovered around 0.89.³ The developments of both domestic price and exchange rate showed growth rate of 23.8 and 29.7 percent, respectively. The other measures of exchange rate, nominal and real effective exchange rates, indicated high growth rate of -5.6 and 2.4 percent, respectively. The second period hovered around 0.89.⁴ The developments of both domestic price and exchange rate showed growth rate of 23.8 and 29.7 percent, respectively.

³ A rise (fall) in the values of nominal exchange rate indicates depreciation (appreciation).

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The other measures of exchange rate, nominal and real effective exchange rates, indicated high growth rate of -5.6 and 2.4 percent, respectively. The second period, 1987-1995, coincided with the period of high domestic price volatility and gradual rise in nominal exchange rate. The domestic price hit the highest historical inflation rates of 54.5, 57.2, and 72.8 per cent in 1988, 1993, and 1995, respectively. These rates shore up the average domestic price level to 40.9 per cent with a growth rate of 84.7 per cent within the period.

Exchange rate also showed signs of depreciation. Average exchange rate value climbed to 19.9 with an average growth rate of 65.5 per cent within this period, an outcome of further pursuit of exchange rate liberalization that started after the introduction of Structural Adjustment Programme in 1986. The trend of domestic price showed great decline after 1995. Inflation stood at 13.6 percent between 1996 and 2000; however, exchange rate maintained a persistent depreciation. The average exchange rate stood at 87.9 during the period. It further depreciated between 2001 and 2006 to reach an average value of 125.6. Inflation also maintained a stable trend but still in its double digit region of 13.7 per cent.

Nevertheless, exchange rate policy in Nigeria have undergone significant changes over the past four decades. It shifted from a fixed regime in the 1960s to a pegged arrangement between the 1970s and the mid-1980s, and finally, to the various types of the floating regime since 1986, following the adoption of the Structural Adjustment Programme (SAP). A regime of managed float, without any strong commitment to defending any particular parity, has been the predominant characteristic of the floating regime in Nigeria since 1986. However, the autonomous foreign exchange market (AFEM) was introduced in 1995. Thereafter, with the failure of AFEM, an Inter-Bank Foreign Exchange Market (IFEM) was introduced on October 25, 1999. The IFEM was designed as a two-way quote system, and intended to diversify the supply of foreign exchange in the economy by encouraging the funding of the inter-bank operations from privately-earned foreign exchange.

Arising from Nigeria’s high import propensity of finished consumer goods, the foreign exchange earnings from oil continued to generate output and employment growth in other countries from which Nigeria’s imports originated. Consequently, this development necessitated a change in policy on 22nd
July 2002, when the demand pressure in the foreign exchange market intensified and the depletion in external reserves level persisted. The CBN thus, re-introduced the Dutch Auction System (DAS) to replace the IFEM. The DAS has also oscillated between the Retail Dutch Auction System (RDAS) and the Wholesale Dutch Auction System (WDAS). The WDAS is currently being pursued by the Central Bank of Nigeria.

A Brief Review of the Literature

Investigations carried out on the nature of exchange rate pass-through in small and large open economies have led to the establishment of a number of theoretical models (Krugman, 1987). There are arguments that there is no single coherent theory of devaluation (or revaluation) but rather a fusion of reasons behind non-responsive prices in the face of exchange rate shock (Magee, 1975). The mechanism behind the theoretical models is the strategic interaction between firms in an imperfect competition framework. When the exchange rate depreciates, the demand curve becomes more elastic and foreign competitors lower their price in foreign currency terms, implying that import prices increase by less than the magnitude of the exchange rate fall. Recent theoretical literature builds on the concept of market segmentation (although incomplete pass-through is not necessarily an evidence of a lack of market integration). Even in situations where we have perfect competition and product homogeneity, the degree of pass-through may be different from unity due to non-price elasticity of demand and the supply side effects of exchange rate changes. Of course, reasons abound why national or regional markets might be segmented, namely; transportation costs, custom duties, non-tariff barriers, physical differences in product characteristics, and brand loyalty of consumers.

Given segmented markets, Krugman (1987), and Dornbusch (1987) initiated a number of models examining variations in mark-ups, in response to exchange rate changes in oligopolistic settings. In Dornbusch’s (1987) model, domestic and foreign firms engage in a Cournot type competition, which yields as equilibrium import prices, a weighted average of the marginal costs of domestic and foreign firms (times the exchange rate). Froot and Klemperer (1989) introduce a dynamic model in which market shares today have an impact on profits tomorrow. During an appreciation, firms therefore face a trade-off between decreasing their profit margins now and leaving them unchanged, the latter coming at the cost of lower market shares and therefore lower profits tomorrow. In a model like Baldwin (1988), there are barriers to entry, which gives firms a certain monopoly power in the short-run. A key element in these models is therefore whether an exchange rate is permanent or temporary. In practice, however, it is very difficult for the econometrician to observe expectations, such that the difference between (expected) permanent or temporary exchange rate changes may not be feasible in practice. Baldwin (1988) and Dixit (1989) and Baldwin-Krugman (1989) emphasised hysteretic effects arising from the sunk costs of entering a market that firms cannot recoup when they leave the market. Baldwin and Baldwin-Krugman revealed, in an oligopolistic setting, that large exchange rate movements can alter a country’s market structure and that a change in market structure permanently shifts import prices and trade volumes.

The degree of exchange rate pass-through can depend on several factors, which can be classified into two groups (microeconomic and macroeconomic factors), following Campa and Goldberg (2002). The first category of factors relates to the industrial structure of the economy. The microeconomic environment may influence the exporters pricing strategies. When homogeneous goods are traded in an integrated market, arbitrage eliminates price differentials. However, when markets are imperfect and segmented, wide ranges of pricing responses are possible. In this situation if exporters seek to maximise profit, pass-through is likely to be high, but if exporters seek to maximise market share rather than profit, pass-through may be incomplete (Hooper and Mann, 1989). Also, the market structure may equally create an opportunity to discriminate between markets, in which pricing-to-market (PTM) may
occur (Krugman, 1987; and Gagnon and Knetter, 1992). In addition, in the Dornbusch (1987) paper, pass-through depends on product substitutability, market structure and the number of foreign firms respective to local firms. In the Marston (1990) model, the degree of pass-through to export prices depends on the convexity of the demand curve in the export market and changes in marginal costs resulting from changes in the output level in the exporting country. In other words, when we assume away shocks for expository purposes, the relative price elasticities are the principal determinants of pass-through. For imports, as the degree of pass-through increases, the lower is the elasticity of demand and the greater the elasticity of supply.

The second category of factors highlights the macroeconomic environment and, in particular, the role of monetary policy. One can mention, in particular, the contributions of Betts and Devereux (1996, 2000), who introduced pricing-to-market to the earlier model of Obstfeld and Rogoff (1995). The key concepts in this literature are those of local currency pricing and producer currency pricing (LCP and PCP, respectively), which refer to the case where exporters preset their prices in the currency of the importing country or in their own currency, respectively. Bacchetta and van Wincoop (2005) present a model where the invoicing choice of exporting firms depends on the market share in the importing country and on the extent to which products of domestic firms are substitutes for those of competing foreign firms. Meanwhile, the perceived decline, in the 1990s, of pass-through in industrial countries motivated a line of research that attempted to explain this phenomenon. Taylor (2000) relates the decline in pass-through to a tightening and enhanced credibility of monetary policy. Additional contributions further exploring the relation between pass-through and the inflation environment include Choudhri and Hakura (2001), Devereux and Yetman (2002), and Devereux, Engel and Storegaard (2004). The influence of inflationary environment and other aforementioned factors are discussed in detail in the subsequent sub-sections. The upshot of these theories is that exchange rate pass-through may be complete or partial, depending on the prevailing economic environment.


The empirical works can also be characterized into two strands — the micro and macro levels. According to their perspectives, the data and methodology vary a lot among those works even in the same strand. As Monen (1995) pointed out, the significant differences in the estimate of pass-through obtained by different researchers studying the same country, commodity and time period highlight the importance of choice of data and methodology. He
presented an overview of 43 empirical studies of ERPT, and found incomplete ERPT in most of the studies and that openness and size of a country influence the degree of pass-through. While some of the authors who investigated the ERPT reviewed made use of the micro approach, others concentrate on the macro perspective.

These approaches have been examined here based on four categories: (i) the speed and magnitude of pass-through; (ii) pass-through across countries and products; (iii) Country-specific studies. In addition to studies on speed and magnitude of pass-through, a large and growing body of empirical research has appeared that investigates the asymmetry of ERPT, although with much focus on industrialised nations such as the USA, the UK and other members of the European Union. This represents the fourth category. Nevertheless, a sizeable number of these empirical works made use of estimation techniques that either ignored the need for testing the time-series properties of the variables entering the import function or have used the Engle and Granger (1987) or Johansen (1988, 1991) cointegration methods, both of which presuppose that all the series contain a unit root. These omission may affect the estimates of the exchange rate pass through reported for these studies.

The Model
The theoretical foundation on which the relationship between prices and exchange rate is based evolve from the doctrine of purchasing power parity (PPP) an offshoot of the law of one price (LOOP) with the assumptions that there are no trade barriers and transport cost. The understanding of the background knowledge of price determination in Nigeria informs the specification of the model. The basic relationship linking the domestic price to exchange rate follows from the Law of One Price (LOOP) which states that at equilibrium, the price of tradable goods in two markets cannot differ when expressed in the same currency and thus, guaranteeing a complete pass-through. The price of tradeables is sub-divided into prices of importable and exportable. The focus of this study is on the importable side and we therefore specify the traded price as import price. Following Rangasamy (2003), the purchasing power parity doctrine with no transport costs and tariffs is stated as:

\[ P^m_t = E W^p_t \]  \hspace{1cm} (1)

where \( P^m_t \) is import price at time \( t \), \( W^p_t \) is foreign price level (assumed to be exogenous), \( E_t \) is exchange rate, measured in units of the domestic currency per unit of the foreign currency, thereafter \( EW^p_t \), represents the domestic-currency price of the imported good.

Empirical studies, however, show that there is incomplete pass-through and hence, LOOP fails to hold. Possible explanations to the failure of the law of one price are, according to Engel and Rogers (2001), impediments to international trade such as tariff and other distribution services that are part of final goods prices. Nigeria is assumed to be a small country because of its share in the world market and therefore regarded as a 'price taker'. Thus, we expect movements in exchange rate to be reflected in the traded goods prices. However, the protective trade policy in Nigeria leads to a departure from the tenets of PPP with the existence of tariffs. The price of imported goods will therefore increase by the value of tariffs, thereby creating a wedge between goods prices in the domestic and foreign markets\(^5\). Assuming the existence of tariffs in the framework translates equation (1) into:

\[ P^m_t = W^p_t E (1 + \tau) \]  \hspace{1cm} (2)

where \( \tau \) is tariff rate\(^6\).

The long run relationship can be estimated from a log-linear transformation of equation (2) which allows a constant (\( \beta \)) and is expressed as:

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5 This specification of the deviation from the Law of One Price is obtained from Haskel and Wolf (2000) and Frankel, Parsley and Wei (2004), and decomposition model for traded price in Sharma (2003).

6 The tariff rate was obtained from UNCTAD TRAINS.
\[ P_t = \beta_0 + \beta_1 \ln WEXP_t + \beta_2 \ln E_t + \beta_3 \ln(1 + \tau) + \epsilon_t \]  

(3)

where \( \epsilon_t \) is the stochastic term and \( \beta_0 \) is the elasticity of world prices while \( \beta_1 \) and \( \beta_2 \) represent the pass-through for exchange rate and tariff changes to import prices. The stochastic error term is represented by \( \mu \). Under the small country assumption with perfect competition, importers would be price takers and the world price \( (WEXP) \), exchange rate \( (E) \) and tariff changes \( (1 + \tau) \) should be fully absorbed into domestic import prices \( (\beta_1 = \beta_2 = 1) \). However, where the coefficients are less than unity \( (0 < \beta_1, \beta_2, \beta_3 < 1) \) the implication of this is that foreign exporters hold some degree of market power and can therefore independently influence domestic currency prices. In addition, if for example, \( (\beta_3 < 1) \) is less than unity, the total effects of tariff change have not been passed on to prices. A-priori, we expect \( \beta_1 > 0, \beta_2 > 0, \beta_3 > 0 \).

Import prices \( (P_t) \) is measured as aggregate import price, exchange rate \( (E) \) is measured as real effective exchange rate, \( WEXP \) is the export price index of foreign producers of Nigeria’s imports. This is a mean of export price indexes for China, UK, US, Netherlands, France, Germany and Italy. Finally, \( (\tau) \) is measured as the average tariff rate. Annual time series data were collected on import prices, exchange rate, tariff rate and price index of Nigerian trading partners for Nigeria. The annual data covers the period 1980 to 2006. The choice of this period was guided by data availability considerations. The data were obtained from the Central Bank of Nigeria Statistical Bulletin (2005), Annual Report and Statement of Accounts (2006), National Bureau of Statistics Annual Abstract of Statistics and International Monetary Fund International Financial Statistics.

Estimation technique

In this study, we use the bounds test proposed by Pesaran et al. (2001), which is based on the unrestricted error correction model (UECM). This is because the Pesaran et al’s approach has certain advantages over the common practice of univariate and multivariate cointegration analysis (Engle and Granger, 1987; Johansen, 1988; Johansen and Juselius, 1990).

Firstly, endogeneity problems and inability to test hypotheses on the estimated coefficients in the long-run associated with the Engle-Granger method are avoided. Secondly, the long and short-run parameters of the model are estimated simultaneously. Thirdly, all variables are assumed to be endogenous. Fourthly, the econometric methodology is relieved of the burden of establishing the order of integration amongst the variables and of pre-testing for unit roots. In fact, whereas all other methods require that the variables in a time-series regression equation are integrated of order one, i.e., the variables are I(1), only that of Pesaran et al. could be implemented regardless of whether the underlying variables are I(0), I(1), or fractionally integrated. Finally, the methodology can be applied to studies that have a small sample size, such as the present study.

For a given significance level of \( \alpha \), if the F-statistic falls outside the critical bound, a conclusive inference can be made without considering the order of integration of the underlying regressors. For instance, if the F-statistic is higher (lower) than the upper (lower) critical bound, then the null hypothesis of no cointegration is rejected (accepted). In cases where the F-statistic falls inside the upper and lower bounds, a conclusive inference cannot be made. Here, the order of integration for the underlying

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7 Real effective exchange rate is the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs.

8 A wide range of econometric techniques have been proposed in the investigation of long run relationships (cointegration) among time-series variables. The fully modified Ordinary Least Squares (OLS) procedures of Phillips and Hansen’s (1990) and the Engle-Granger (1987) approach are examples of univariate cointegration while the Johansen (1988) and Johansen and Juselius (1990) procedures and Johansen’s (1996) full information maximum likelihood procedures are examples of multivariate cointegration.
explanatory variables must be known before any conclusion can be drawn.

The cointegration relationship for the import price function for Nigeria is estimated based on the following unrestricted error correction model (UECM):

\[ P_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i \Delta \ln P_{t-i} + \sum_{i=0}^{q} \alpha_i \Delta \ln WEXP_{t-i} + \alpha \ln WEXP_{t-i} + \alpha \ln \ln (1 + t)_{t-1} + \alpha \ln \ln (1 + t)_{t-1} + \epsilon_t \quad (4) \]

where \( \Delta \ln P_t, \Delta \ln WEXP_t, \) In \( E_t, \) \( \Delta \ln (1 + t) \), are the first differences of the logarithms of the price of imports, foreign price level, exchange rate and tariff rate respectively.

Through the estimated UECM, the long-run elasticities are the coefficients of the explanatory variables lagged one period (multiplied by a negative sign) divided by the coefficient of the dependent variable also lagged one period (Bardsen, 1989). Thus, the long-run foreign price elasticity, exchange rate elasticity and manufacturing output prices elasticity are \(- (\alpha_1 / \alpha_2); - (\alpha_4 / \alpha_2), - (\alpha_4 / \alpha_3)\), respectively. The short-run effects will be captured by the coefficients of the first differenced variables in the UECM model.

**Empirical Analysis**

We examine the effect of exchange rate shocks, world export prices and tariff rate on import prices by estimating an unrestricted error correction model. We find that exchange rate shocks have a positive effect on import prices, implying that exchange rate depreciation increases import prices. In the short-run, 1% depreciation in the immediate past period leads to 1% increase in import prices, implying that all the exchange rate shocks are passed on to import prices. In other words, exchange rate pass-through is perfectly complete in the short run. World export prices in the immediate past period also have significant positive effects on import prices. A one per cent increase in world export prices results in 2.4% increase in import prices, suggesting that suppliers pass on substantial additional costs by selling their products at higher prices. In addition, the tariff rate in the immediate past period was found to have a positive and significant relationship with import prices in Nigeria. A one percent reduction in tariff is expected to lead to a 4.70% reduction in import prices in Nigeria.

**Table 2. The Estimated UECM for the Nigerian Import Price Function**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>t-statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>10.6365*</td>
<td>1.6446</td>
</tr>
<tr>
<td>( \Delta WEXP )</td>
<td>-4.0264</td>
<td>-1.5659</td>
</tr>
<tr>
<td>( \Delta WEXP_{t-1} )</td>
<td>2.4601***</td>
<td>1.8390</td>
</tr>
<tr>
<td>( \Delta WEXP_{t-2} )</td>
<td>4.0902</td>
<td>-1.072</td>
</tr>
<tr>
<td>( \Delta E )</td>
<td>4.0902</td>
<td>1.5441</td>
</tr>
<tr>
<td>( \Delta E_{t-1} )</td>
<td>1.0020**</td>
<td>2.1526</td>
</tr>
<tr>
<td>( \Delta E_{t-3} )</td>
<td>0.7540</td>
<td>1.6511</td>
</tr>
<tr>
<td>( \Delta (1 + t) )</td>
<td>0.7330</td>
<td>0.2809</td>
</tr>
<tr>
<td>( \Delta (1 + t)_{t-1} )</td>
<td>4.7052***</td>
<td>1.8543</td>
</tr>
<tr>
<td>( \Delta (1 + t)_{t-2} )</td>
<td>2.5549</td>
<td>0.9650</td>
</tr>
<tr>
<td>( \Delta P^*_{t-1} )</td>
<td>-0.6852</td>
<td>-1.6851</td>
</tr>
<tr>
<td>( \Delta P^*_{t-2} )</td>
<td>-0.9955**</td>
<td>-2.1428</td>
</tr>
<tr>
<td>( P^*_{t-4} )</td>
<td>-0.2296</td>
<td>-0.7342</td>
</tr>
<tr>
<td>( WEXP_{t-1} )</td>
<td>-3.6240</td>
<td>-1.4128</td>
</tr>
<tr>
<td>( (1 + t)_{t-1} )</td>
<td>-1.0725**</td>
<td>-2.1437</td>
</tr>
<tr>
<td>( E_{t-4} )</td>
<td>-4.7639</td>
<td>-1.7823</td>
</tr>
</tbody>
</table>

*Note:* Significant at *1%, **5%, ***10%.

Dependent Variable is \( \Delta MP \)
R-squared: 0.71248; Durbin-Watson: 2.5918
LM = 6.3622[0.012]; RESET: 3.7022[0.054]
Normality: 0.56820[0.753]

In addition, tables 2 presents diagnostic tests of our model and suggests an absence of major diagnostic problems such as serial correlation, non-normality and specification errors. These results indicate that our estimated import price model is well specified. Thereafter, it is necessary to check for the stability of the import price function. This is because of the importance of the stability of the import price function for an effective trade policy. This therefore makes it necessary to test whether the estimated
Import price equation has shifted over time as an important part of this empirical study. As can be observed from figures 2 and 3, the CUSUM and CUSUM Square tests of parameter stability indicate that the parameters are stable during the sample period.

![CUSUM test of parameter stability](image)

**Figure 2.** CUSUM test of parameter stability

![CUSUM squares test of parameter stability](image)

**Figure 3.** CUSUM squares test of parameter stability

With respect to the long-run analysis of import prices and its determinants, the bounds test result is reported in Table 3. The computed F-Statistics of 3.4890 was found to lie between the lower bounds critical value of 3.23 and the upper bounds critical value of 4.35 for a significance level of 5%; and below the lower and the upper bounds critical value of 4.29 and 5.61 for a significance level of 1% respectively. Table 3 gives the estimates of the aggregate import price function.

### Table 3. Bounds testing for cointegration analysis

<table>
<thead>
<tr>
<th>Computed F-statistic: 3.4890 (lag structure, k = 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical bound's value at 5% Lower: 3.23 and Upper: 4.35</td>
</tr>
<tr>
<td>Critical bound's value at 1% Lower: 4.29 and Upper: 5.61</td>
</tr>
</tbody>
</table>

(Three regressors and no trends in the model)

Pesaran et al. (2001), p. T.2, Table Cl. iii: Case III.

**Note:** The lag length k=2 was selected based on the Schwarz criterion (SC).

Since the bounds test shows that the calculated F statistic for aggregate import price lies in the inconclusive range, we need to conduct unit root test with respect to the dependent and independent variables before we can draw any valid conclusion. Tables 4 and 5 present the Augmented-Dickey Fuller and the Phillips-Perron (1988) test results for unit roots. The null hypothesis of unit root of first differenced forms of all the variables are rejected at 1 and 5% levels of significance in both tests. Therefore, we can validly conclude that import prices, world export prices, real effective exchange rate and tariff rate are integrated of order one. That is, the first differenced forms of the above-mentioned variables are stationary. Consequently, we can conclude that there is no cointegration relationship between import prices, exchange rate, world export prices and tariff rate. This is because the computed F-Statistics of 3.489 falls below the upper critical bounds of 4.35 at 5% level of significance since all the variables in the model are integrated of order one. This therefore implies that import prices and its determinants; exchange rate, world export prices and manufacturing output prices are not cointegrated or co-moving in the case of Nigeria. The use of an advanced econometric procedure, which has taken care of weaknesses in the previous enquiries, may be
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responsible for this result. Exchange rate pass-through to import prices is complete in the short-run. As earlier argued from econometric evidence, a 1\% depreciation of the exchange rate in Nigeria automatically translates to a 1\% increase in import prices. Exchange rate pass-through is complete in the short-run and can therefore be regarded as a short-run phenomenon in Nigeria.

Table 4. Augmented Dickey Fuller test (ADF)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Levels</th>
<th>First Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMP</td>
<td>Model 1 Model 2 Model 3</td>
<td>Model 1 Model 2 Model 3</td>
</tr>
<tr>
<td></td>
<td>-1.733</td>
<td>-1.9170</td>
</tr>
<tr>
<td>EXR</td>
<td>-1.455</td>
<td>-1.4878</td>
</tr>
<tr>
<td>WEXP</td>
<td>-1.415</td>
<td>-2.395</td>
</tr>
<tr>
<td>TRF</td>
<td>-0.808</td>
<td>-2.4981</td>
</tr>
</tbody>
</table>

Note: *The Null Hypothesis is the presence of unit root. Model 1 includes a constant, Model 2 includes a constant and a linear time trend while Model 3 includes neither in the test regression as exogenous. Lags were selected based on Schwarz Information Criterion. *, **, *** indicate significance at 1\%, 5\%, and 10\% respectively.

Table 5. Phillips-Perron Test (PP)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Levels</th>
<th>First Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMP</td>
<td>Model 1 Model 2 Model 3</td>
<td>Model 1 Model 2 Model 3</td>
</tr>
<tr>
<td></td>
<td>-1.746</td>
<td>-1.7226</td>
</tr>
<tr>
<td>EXR</td>
<td>-1.547</td>
<td>-1.6847</td>
</tr>
<tr>
<td>WEXP</td>
<td>-0.813</td>
<td>-1.9517</td>
</tr>
<tr>
<td>TRF</td>
<td>-0.627</td>
<td>-2.4981</td>
</tr>
</tbody>
</table>

Note: *The Null Hypothesis is the presence of unit root. Model 1 includes a constant; Model 2 includes a constant and a linear time trend, while Model 3 includes neither in the test regression as exogenous. The Bandwidth was chosen using Newey-West method with Bartlett Kernel spectral estimation*. **, *** indicate significance at 1\%, 5\%, and 10\% respectively.

It is interesting to see how the estimates obtained in this study compare with other published elasticity estimates of exchange rate pass-through. In comparison to past studies, we found divergent results with the studies of Athukorala and Menon (1994) for Japan; Kenny and MacGettigan (1996), for Ireland; Lee (1997), for Korea; Kiptui, Ndolo and Kaminchia (2005), for Kenya; Oladipo (2007) for Nigeria; and Mallick and Marques (2007), for India. Adopting the mark-up model, the studies found that pass-through is incomplete. The result from this study therefore refutes the outcome of other studies on exchange rate pass-through. However, we believe our empirical results are more reliable due to the use of more advanced econometric techniques. Nevertheless, we found supportive evidence with respect to the studies of Feenstra (1989), for United States; and Gagnon and Knetter (1992) for United States, Germany and Japan, that import pass-through can be complete when mark-up and marginal cost of a firm are constant, and that pass-through is virtually complete for US exporters, with no price discrimination respectively.

Conclusion

The study examines the extent of exchange rate pass-through in Nigeria in order to gauge the country's vulnerability to external shocks, and therefore inform monetary policy implementation to mitigate such shocks. The objective of the study was to estimate the level of exchange rate pass-through for Nigeria, between 1980 and 2006 using the UECM-Bounds test proposed by Pesaran et al. (2001). The empirical findings from this study reveal that exchange rate pass-through is complete in the short-run, and that import price, world export prices and tariff rates are not cointegrated. The implication of this result is that exchange rate pass-through is a short-run phenomenon in Nigeria. Exchange rate pass-through however occurs with an adjustment lag of one period. In addition, a 1\% increase in foreign costs of production results in 2.46\% increase in import prices, suggesting that foreign suppliers pass on additional costs by selling their products at higher prices. In addition, the immediate past value of tariff rate explain some of the variations in import prices in Nigeria. Commitment to supply-side policies is therefore desirable in order to boost domestic production of goods, and lessen dependence on imports. This would moderate the effect of exchange rate shocks on import prices.
References


Biographical Notes
I.D. Poloamina is a senior lecturer in the Department of Economics, University of Ibadan. He has a Ph.D degree from the University of Ibadan. He has served as resource person in several institutions.
E-mail: id.poloamina@mail.ui.edu.ng

M. Adetunji Babatunde holds a doctoral degree from the University of Ibadan and lectures in the Department of Economics, University of Ibadan. His specialization interests are international economics, time series econometrics and macroeconomics.
E-mail: tunjiyusuf19@yahoo.com
Mutiu A. Oyinlola teaches at the Department of Economics, University of Ibadan. He specialises in international finance. His current research interests include exchange rate dynamics and trade policy-related issues. E-mail: mutiu_oyinlola@yahoo.com

*Dr. M. Adetunji Babatunde is the correspondence author*