EXCHANGE RATE PASS-THROUGH TO DOMESTIC PRICES IN NIGERIA FROM (1980Q1-2009Q4).

BY

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Declaration

I hereby declare that the work presented in this thesis *titled "Exchange Rate Pass-through to Domestic Prices in Nigeria (1980Q1-2009Q4)"* was performed by me in the department of Economics, under the supervision of Dr. A.R. Sanusi and Dr. P.P. Njiforti. All works consulted for the purpose of this research are fully acknowledged. No part of this research has been presented for another degree or diploma at any institution. Errors committed in this research are strictly mine.

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This thesis titled *"Exchange Rate Pass-Through to Domestic Prices in Nigeria"* meets the regulations governing the award of the degree of Masters of Science Economics of the Ahmadu Bello University, and is approved for its contribution to knowledge and literary presentation.

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Dedication

This research work is dedicated to my creator, God Almighty, the giver of knowledge and wisdom.

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I wish to express my deepest appreciation and allegiance to God almighty, for his grace, love, providence and faithfulness throughout the period of study.

I also wish to show my gratitude to my supervisors Dr. A. R. Sanusi and Dr. P.P. Njiforti for their immense contributions and constructive criticisms toward the success of this research.

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Abstract

The study examines the degree of exchange rate pass-through to domestic prices in Nigeria. The objectives of the study are: to determine whether changes in exchange rate have any significant long term effects on domestic and import prices in Nigeria; to examine, if any, the magnitude of the impact; and to determine the speed of the pass-through. Using time series quaterly data from 1980Q1 to 2009Q4 and Vector Autoregressive(VAR) estimation technique,the study finds that there is no long run link between exchange rate and import prices, or between exchange rate and domestic prices. This is consistent with the argument that in the long run, all nominal variables don't matter. Also the pass-through effect from exchange rate to import price is incomplete and low. This is also consistent with the principle of pricing to market.The pass-through effect of exchange rate to import prices takes about 7 quarters to fully manifest, suggesting a relatively slow pass-through effect which is the first stage.The second stage pass-through effect, from import price to domestic price is also incomplete, low and slow. It takes even longer time of 17 quarters to fully manifest. The total (or direct) pass-through effect of exchange rate to domestic price is also incomplete, low and slow, taking up to about 17 quarters to fully manifest. This is consistent with the general finding in the literature especially for developing economies. One possible explanation of the predominance of this pricing to market phenomena is that as global firms compete for market in these developing countries, depreciating exchange rate that would otherwise cause import and domestic prices of these goods to rise, would rather cause a decline in the profit margin of these firms. There has also been the argument of reduced product specifications/quality to allow firms maintain the domestic price of their goods in these markets when currencies depreciate. Based on the above empirical findings, the study recommends that emphasis has to be placed on reducing volatilityand moderating the speed of adjustments. Also, Government should pursue monetary policy as an instrument to influence import prices in order to attain complete exchange rate pass-through to domestic prices in Nigeria.

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CHAPTERONE

1.0 Background to the Study

The study of Exchange Rate Pass-through to domestic prices has acquired excessive attention during the last two decades due to its far reaching implications for monetary policy. There are various reasons identified in literature for this trend: First and the foremost reason is the inability of monetary authorities in forecasting inflation in the presence of high exchange rate pass-through in to domestic prices (Taylor, 2000). Second, exchange rate movements in addition to affecting the prices of imported goods and inputs also change the current account position which in turn affects aggregate demand (Woo & Hooper, 1984). Third, a high degree of exchange rate pass-through (ERPT) is often a reason for a country to 'Fear' floating exchange rate and is thus a given rationale for the intervention in the foreign exchange market ((Ball & Reyes, 2008).

Consequently, Exchange Rate Pass-through (ERPT) is a constraint for independent monetary policy and its knowledge is important for effective monetary management. A high inflation environment would tend to increase the exchange rate pass-through. In this view, the pass-through depends on the policy regime: a credible low inflation regime will automatically achieve a low pass-through. Higher Pass-through estimates mean greater exposure of an open economy to the external shocksin the world prices. The exposure implies volatile local prices due to the exchangerate changes. For the monetary authorities, it is crucial to know the exact amountof pass-through effects (PTE) to predict domestic inflation of the import share of consumer goods andintroduce adequate targeting policies.Pavlo (2010).

It is therefore important to assess the impact of exchange rate on domestic prices in particular as Nigeria moves to an inflation targeting (IT) regime.

One of the characteristics of inflation targeting is the forward-looking nature of the policy stance. IT requires central banks to react promptly when the inflation forecast deviates from target. Various tools are used to forecast inflation: structural macroeconomic and short-term models, asset prices, and leading indicators(Daniels, 2002).

In an open economy therefore like Nigeria, the exchange rate can have a potentially large impact on inflation and inflation expectations. A fuller understanding of the impact of exchange rate movements on different prices (wholesale and consumer prices) both in terms of length and magnitude is therefore important in assessing monetary policy stance in the context of inflation targeting (Daniels, 2002).

One of the major goals of monetary policy in developing countries like Nigeria, is to keep the rate of inflation (defined as the general rise in the price level) within a single digit; with the lowest attainable level of the single digit as most desirable and one channel of keeping inflation on target is by maintaining a stable exchange rate. Routinely therefore, the government of Nigeria through the Central Bank (CBN) changes the official exchange rate in order to meet its goal of price stability and to bring inflation back to the target. This means for monetary policy to be effective in inflation targeting, and any other policy of combating undesirable shocks in the economy, exchange rate stability is a key.

Traditionally, exchange rate pass-through is defined as "the percentagechange in the local currency price of an imported good resulting from a oneper centchange in the nominal exchange rate between the exporting and importing countries.

According to Anokye (2000),the expression 'exchange rate pass-through' is generally used to refer to the effect of exchange rate changes on one of the following: (1) import and export prices, (2) consumer prices, (3)investments and (4) trade volumes.

Sanusi (2010) defines ERPT as the extent to which changes in the exchange rate are reflected in prices of goods and services. He however distinguished it into two stages: the *first-stage* (i.e., from exchange rate to import prices) and *second-stage* (i.e., from import prices to domestic consumer prices).

In the context of this research, we refer to ERPT as the extent of the effects of changes either favourable or otherwise in exchange rate on domestic prices.

According to Sanusi in Olivei (2002) and Campa and Goldberg (2005), three factors may determine the extent of pass-through of exchange rate todomestic prices: the pricing behaviour by exporters in the producer countries, theresponsiveness of mark-ups to competitive conditions and the existence of distributioncosts that may drive a wedge between import and retail prices. For instance, when exchange rates changes, foreign firms canchoose to pass exchange rate changes fully to their selling prices in export markets(complete pass-through), to bear exchange rate changes to keep selling prices unchanged(zero pass-through), or some combination of these ,(partial pass-through).

The pass-through occurs in two stages. In the first stage, exchange rate variations affect prices of imported consumption and intermediate (inputs) goods. Increase in prices of intermediate goods affects the cost of production and hence prices of domestically produced goods. In addition to this, the domestic prices can also increase due to a shift in demand away from the now expensive imported goods to the local ones. The second stage happens through prices of domestically produced goods through supply and demand channels. Oyinlola (2008).

The degree to which changes in the exchange rate pass through to prices is an important issue in debates about appropriate monetary and exchange rate policies. A low exchange rate

pass-through is thought to provide greater freedom for pursuing an independent monetary policy and to make it easier to implement inflation targeting (Ehsan and Dalia, 2003).

To this effect Nigeria has undergone several exchange rate regimes in order to maintain exchange rate stability that is, avoiding its fluctuations and misalignment, over the past decades which were geared towards setting inflation at a pre-determined level.More so the increased openness of the Nigerian economy and the incidence of large fluctuations in nominalexchange rates requires a better understanding of the determinants of the transmission of exchange rate changes into import pricesand the size and speed of exchange rate pass-through into inflations as this understanding of the impact of exchange rate movements on prices would help to gauge the appropriate monetary policy response to currency movements.

1.1 Statement of the Research Problem

Evidence from past studies on ERPT in Nigeria come up with two basic problems: one is, the determination of the actual size and speed of pass-through. This is evident in the fact that different studies of ERPT on Nigeria produced very different pass-through estimates. For example,Oyinlola (2008) estimates the ERPT to domestic prices to be complete where the co-efficient of the estimate of pass-through is1.005.However, Aliyu et al (2008) finds ERPT to be low or incomplete. Using the VECM model, he estimates ERPT of less than one for Nigeria.

Next is the problem of measurement. This stems from arguments in some quarters that the exchange rate pass-through (ERPT) concept is a long-run phenomenon (Barhoumi, 2005). However, there are contentious evidences in the case of Nigeria. While Oyinlola (2008) finds evidence of long-run relationship and no short-run,Omisakin (2009) found no evidence both in the short and long-run.

In the light of the above, this paper re-examine the dynamics and magnitude of exchange rate pass-through to domestic prices in Nigeria, using the Vector Auto-regression(VAR) approach. The approach incorporates the short-run dynamics of the model.

This is because in an inflation targeting framework which Nigeria is trying to adopt, the extent and timing of the pass-through is important in terms of forecasting inflation and monetary policy making decision. The understanding of this gives the central bank the ability to respond adequately to different shocks required for the transmission mechanism of monetary policy more especially where exchange rate provides an important transmission channel for monetary policy.

1.3 Research Questions

From the above stated problem, the following then arise.

i. To what extent does a change in exchange rate impact domestic and import prices in Nigeria?
ii. What is the magnitude of this impact?
iii. How fast does a change in exchange rate take to manifest on prices?

1.4 Objective of the Study

The main objective of this study is to analyse exchange rate pass through to domestic prices in Nigeria while the specific objectives are:

i. To determine whether changes in exchange rate have any significant long term effects on domestic and import prices in Nigeria.
ii. To examine if any, the magnitude of the impact.
iii. To determine the speed of the exchange rate pass-through to domestic and import prices in Nigeria.

iv. To deduce policy recommendations

1.5 Hypothesis

The main hypothesis that will be tested is whether there is a significant effect of exchange rate changes on domestic prices of tradable and non-tradable consumer and producer goods and services in Nigeria therefore:

$H_0$1: there is no significant long term effect of exchange rate changes on domestic and import prices in Nigeria.

$H_1$1: there is a significant long term effect of exchange rate changes on domestic and import prices in Nigeria

$H_0$2: The magnitude of the impact of exchange rate on domestic and import prices is not significant.

$H_1$2: The magnitude of the impact of exchange rate on domestic and import prices is significant.

$H_0$3: Change in exchange rate does not take time to manifest on domestic and import prices in Nigeria.

$H_1$3: Change in exchange rate takes time to manifest on domestic and import prices in Nigeria.

1.6 Justification of the Study

The estimation of exchange rate pass through (ERPT) sheds light on the extent to which fluctuations in nominal exchange rate affect inflation. Therefore in an inflation targeting framework, the extent and timing of the pass-through is important in terms of forecasting inflation and monetary policy making decision.

There is therefore the need to provide new up-to-date estimates of exchange rate pass through (ERPT) for the Nigerian economy. This is important as there is relatively little empirical work done on assessing exchange rate pass through (ERPT) for the economy, certainly in relation to the vast amount of studies done in other developing and advanced economies hence

the need to revisit the subject matter because of its relative importance to policy makers and the Nigeria economy as a whole. The paper attempts to re-examine the relationship between exchange rate and domestic prices, using the Vector Error Correction Model (VECM) approach. The outcome of this model is crucial in setting monetary policy targets and also for determining the optimal monetary policy that is consistent with such targets.

1.7 Scope and Limitation of the Study

This study covered the period between1980Q1-2009Q4. This is because Nigeria has practiced different exchange rate regimes (rigid and flexible) within this period. And the limitation for this study is time and money.

1.8 Organization of Study

The thesis has five chapters. Chapter one is the general introduction and contains the background of the study, statement of research problem, objective of the study, justification of the study, hypothesis of the study, scope of the study and organization of the study.

Chapter two contains a review of conceptual, empirical and theoretical literature.

Chapter three presents the methodology of the study. It contains the model specification, analytical techniques and type of data collected.

Chapter four contains the presentation of data and analysis of empirical results.

Chapter five presents the summary, conclusion and recommendation of the thesis.

CHAPTER TWO

LITERATURE REVIEW

2.0 Definition of Concepts

2.1 Exchange Rate Pass-Through

Traditionally, exchange rate pass-through is defined as "the percentage change in the local currency price of an imported good resulting from a one percent change in the nominal exchange rate between the exporting and importing countries. Anokye (2000) defined the expression 'exchange rate pass-through' as the effect of changes in exchange rate on one of the following: (1) import and export prices, (2) consumer prices, (3) investments and (4) trade volumes. Sanusi (2010) defines exchange rate pass-through as the extent to which changes in the exchange rate are reflected in prices of goods and services. He however distinguished it into two stages: the *first-stage* (i.e., from exchange rate to import prices) and *second-stage* (i.e., from import prices to domestic consumer prices).

In the context of this research, we refer to exchange rate pass-through (ERPT) as the extent of the effects of changes either favourable or otherwise in exchange rate on domestic prices.

2.2 Exchange Rate

Exchange rate is generally defined as the price of one currency in relation to another over a given period of time. For instance, the Nigerian currency, which is the Naira and the US Dollar, or the European currency, the Euro.

2.3 Exchange Rate Regimes, Nigerian Experience

Exchange rate arrangements in Nigeria have undergone significant changes over the past 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 was the predominant characteristic of the floating regime in Nigeria since 1986.

The fixed exchange rate regime induced an overvaluation of the naira and was supported by exchange control regulations that engendered significant distortions in the economy which gave vent to massive importation of finished goods with the adverse consequences for domestic production, balance of payments position and the nation's external reserves level. The period was bedevilled by sharp practices perpetrated by dealers and end-users of foreign exchange and this informed the adoption of a more flexible exchange rate regime in the context of the SAP, adopted in 1986.

Following the failure of the Autonomous Foreign Exchange Market (AFEM) in 1995, an Inter-Bank Foreign Exchange Market (IFEM) was introduced on October 25, 1999 which 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. The IFEM also aimed at assisting the naira to achieve a realistic exchange rate. The operation of the IFEM, however, experienced similar problems and setbacks as the AFEM, owing to supply-side rigidities, the persistent expansionary fiscal operations of government and the attendant problem of persistent excess liquidity in the system.

But the Nigerian foreign exchange earnings are more dependent on crude oil export receipts such that volatility of the world oil market prices has a direct impact on the supply of foreign exchange.

As a result of Nigeria's high import propensity of finished consumer goods, the foreign exchange earnings from oil sector which contributes more than 80 per cent of government revenue, continued to generate output and employment growth in other countries from which Nigeria's imports originated. 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 was designed to achieve a realistic exchange rate of the naira that would stem the excessive demand for foreign exchange, conserve the dwindling external reserves and achieve a realistic exchange rate for the naira. The DAS was conceived as a two-way auction system in which both the CBN and authorised dealers would participate in the foreign exchange market to buy and sell foreign exchange. The CBN is expected to determine the amount of foreign exchange it is willing to sell at the price buyers are willing to buy. The marginal rate, which by definition is the rate that clears the market, represents the "ruling" rate at the auction.

Since its introduction in July 2002, the DAS has been largely successful in achieving the objectives of the monetary authorities, for instance it assisted in narrowing the arbitrage premium from double digit to a single digit, until the emergence of irrational market exuberance in the fourth quarter of 2003. Secondly, the DAS enhanced the relative stability of the naira, vis-à-vis the US dollar-the intervention currency. Specifically, the naira fluctuated within a single digit band, since the DAS was introduced in July 2002.

Thirdly, it also assisted in stemming the spate of capital flight and curbing rent-seeking amongst market operators. We experienced an unsustainable demand for foreign exchange in the early

1980s when the government resorted to exchange control mechanism to support the over-valued naira

A realistic exchange rate would also ensure that the naira is not overvalued in real terms, and that our external sector remains competitive. In our quest for a realistic naira exchange rate, the CBN employs the Purchasing Power Parity (PPP) model as a guide to gauge movements in the nominal exchange rate and to determine deviations from the equilibrium exchange rate. Although the PPP as a relative price does not provide clear criteria for choosing a base period, and is generally criticized for its insensitivity to short-term policy actions, it nonetheless, provides a reasonable framework for a comparative analysis of trading partners' performances.

Exchange rate under the DAS represents an improvement over the previous mechanisms for determining the exchange rate of the naira, and its operation is in line with current global trends. Indeed, viewed against other currencies in the world, the naira has been reasonably stable. For example, between July, 2002nand February 20, 2004, the naira depreciated by 11.5 per cent against the dollar, the intervention currency, compared with the 15 per cent band allowed under the protocol of the West African Monetary Zone on exchange rate, to which Nigeria is a signatory (Sanusi, 2004).

2.4 Determinants of Exchange Rate Pass-Through

Among the most important factors that determine the extent of exchange rate pass-through are the size of the export market and the degree of competition the exporter faces in that market. 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. Conversely, 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 (Knetter, 1993).

2.5 Transmission Mechanism of Monetary Policy and Exchange Rate Pass-Through

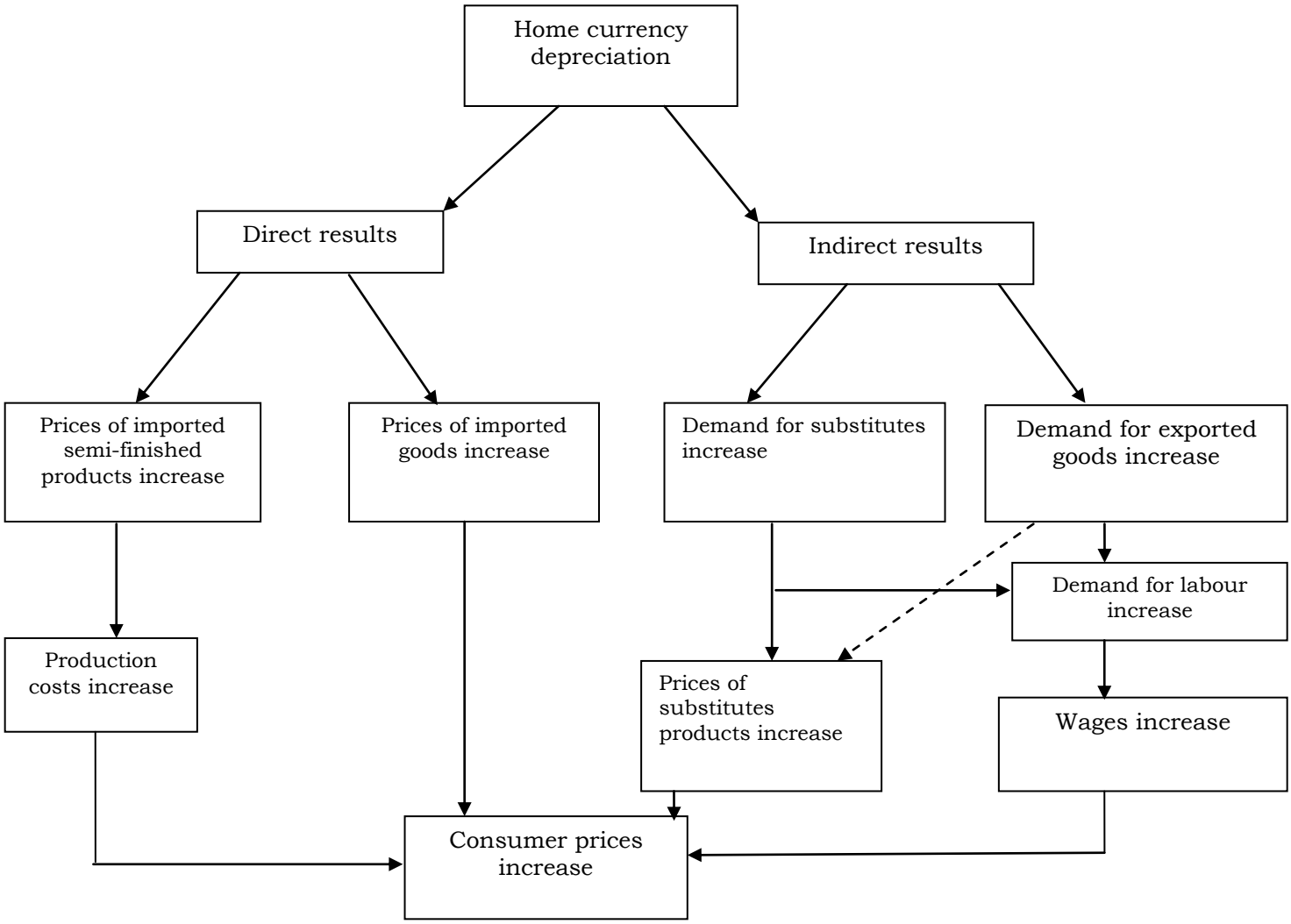
Policy-induced changes in interest rates can affect the exchange rate. The exchange rate is the relative price of domestic and foreign money, so it depends on both domestic and foreign monetary conditions. The precise impact on exchange rates of an official rate change is uncertain, as it will depend on expectations about domestic and foreign interest rates and inflation, which may themselves be affected by a policy change. However, other things being equal, an unexpected rise in the official rate will probably lead to an immediate appreciation of the domestic currency in foreign exchange markets, and *vice versa* for a similar rate fall. The exchange rate appreciation follows from the fact that higher domestic interest rates, relative to interest rates on equivalent foreign-currency assets, make the Naira assets more attractive to international investors. The exchange rate should move to a level where investors expect.

From the central bank's point of view, effective monetary policy is essential in explaining the transmission mechanism of monetary policy on the real zone of the economy.

In an open economy, floating exchange rates create the additional transmission mechanism of monetary impulses, from the standard channel of aggregate demand. The exchange rate changes in direct way affects the inflation level through influence on the prices of imported goods. Exchange rates changes also affect the prices of imported semi-finished goods and raw materials, which determine the production costs.

Moreover changes in exchange rates influence also indirectly on the home inflation through aggregate demand. It takes place through the influence of exchange rate changes on relative change of national goods prices in relation to foreign goods prices and in effect on the aggregate demand. However the aggregate demand influences the domestic inflation rate through changes in aggregate supply (*the Philips curve*). Therefore in an open economy, inflation is in large degree determined by the factors affecting exchange rate changes. The direct results of depreciation appear in the growth prices of imported semi-manufactured articles, which are used for home production, and in the growth prices of imported final products. However the indirect results are the growth of national demand on substitution goods in relation to import goods and the growth of foreign demand on export goods. Consequently all of the above is as a result of depreciation leading to general growth of prices in the domestic economy

Figure 2.1: Effects of depreciation on domestic prices



Source: Adopted from Sanusi in Lafleche (1996).

2.6 Theoretical Literature

2.6.1 The Theory of Absolute Purchasing Power Parity

Explanation on exchange rate pass-through phenomenon leans on the equality (or otherwise) of prices of traded goods in two markets when expressed in the same currency, a law of purchasing power parity. Pass-through is said to be complete if this equality holds and incomplete if it does not. In other words, less than one to one response of prices to exchange rate

is referred to as incomplete exchange rate pass-through. The underlining theoretical underpinning of exchange rate pass-through is the Purchasing Power Parity (PPP) hypothesis. Goldberg and Knetter (1996)'s literature survey on exchange rate pass-through suggested that one can surmise a semblance between the failure of PPP to hold and the general in that pass-through is incomplete. Exchange rate pass-through is generally regarded as the extent to which changes in the exchange rate are reflected in prices of goods and services. It is generally distinguished into two stages: the first stage (i.e., from exchange rate to import prices). However, it is also common in the literature to the direct pass through of exchange rate changes to consumer prices.

This direct approach is popular chiefly because the disaggregated data on import prices and composition is generally unavailable especially in the Sub-Saharan African (SSA) countries.

The effects of exchange rate movements are transmitted to consumer prices via three major channels: (i) prices of imported consumption goods, (ii) domestically produced goods priced in foreign currency, and (iii) prices of imported intermediate goods. While the effect of exchange rate movements is direct in the first two channels, in the last channel exchange rate movements affect domestic prices less directly by changing the cost of production (sahminan, 2002) cited in Sanusi. Many monetary models of the exchange rate and balance of payments assume a one-to-one relationship between the exchange rate and domestic prices, based on the law of one price (or purchasing power parity, PPP). However, empirical evidence almost unanimously concludes that the exchange rate pass-through is incomplete. The literature suggests that pass-through to import prices (the first-stage) tends to be greater, albeit incomplete, than the pass-through to consumer prices. These findings have motivated numerous theoretical models aimed at explaining the incompleteness of the exchange rate pass-through.

One of such models is based on the pricing behaviour of exporting firms. It argues that because of market and product segmentations, exporting firms discriminate prices across destination market. It is assumed that exporting firms set their prices as the sum of marginal cost and destination specific mark-up. These destination specific mark-up are adjusted in response to exchange rate changes, thereby absorbing part or all of the exchange rate change. The pricing behaviour is referred to as pricing- to-market (PTM) Krugman (1986) and provides the microeconomic explanation of the empirical findings of incomplete pass-through.

If however exporting firms set prices in the currency of their production location (Producer Currency Pricing, PCP), exchange pass-through to import prices will be complete. Past-through to domestic prices will be equal to the share of imported goods in the total consumption basket. In Betts and Devereux's (1996) model, aggregate pass-through depends on the combination of firms practising PCP and local currency pricing (LCP). The greater the number of firms that set their prices in destination countries' currency, the smaller will be the pass-through to domestic prices. In the extreme, if all firms discriminate prices across countries pass-through to domestic prices will be zero. In this model (as demonstrated in Devereux and Engel, 2003 and Engel 2002), a flexible exchange rate regime cannot deliver the optimal relative price changes.

A major argument suggested by Taylor (2000), who put forward the hypothesis that the responsiveness of prices to exchange rate fluctuations depends positively on inflation. The rationale for this involves a positive correlation between the level and persistence of inflation coupled with a link between inflation persistence and pass-through. The later link can be expressed as follows: the more persistent inflation is, the less exchange rate movements are perceived to be transitory and the more firms might respond via price adjustment.

2.6.2 The Theory of Relative Purchasing Power Parity

Relative Purchasing Power Parity is an economic theory which predicts a relationship between the inflation rates of two countries over a specified period and the movement in the exchange rate between the two currencies over the same period. It is a dynamic version of the absolute PPP theory. It is an idea that the rate of change in the price level of commodities in one country relative to the price level in another determines the rate of change of the exchange between the two countries' currencies. This differs from the absolute form of purchasing power parity, which states that the purchasing power between two currencies is the same. However, the concepts are similar because RPPP holds that the absolute form would be true if there were no interference of taxes, quality of products, and other circumstances that change the market. One must take into account all these circumstances to calculate the proportional rate by which the purchasing power changes.

Suppose that the currency of Country A is called the A$ (A-dollar) and the currency of country B is called the B₦ (B-naira).The theory states that if the price P in country A of a basket of commodities and services is P A-dollars, then the price Q of the same basket in country B will be C×P A-dollars, where C is a constant which does not vary over time, or, equivalently, C×P×S B-dollars, where S is the (variable) number of B-dollars required to buy one A-dollar, i.e. the exchange rate.

If (1) and (2) denote two different dates, then it follows that

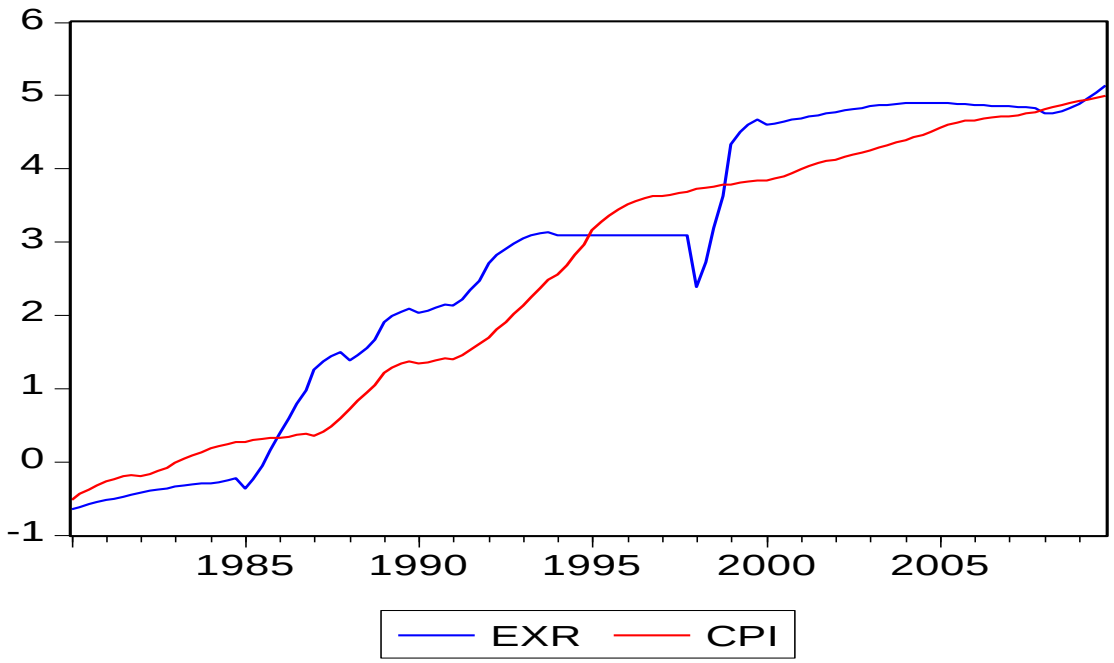
$1/C = P(1)\times S(1)/Q(1) = P(2)\times S(2)/Q(2)$ and hence……..2.1

$S(2)/S(1) = (Q(2)/Q(1))\div(P(2)/P(1))$…….2.2

Or, in words, the factor representing the movement in market exchange rates is equal to the ratio of the inflation factors (changes in price levels) of the two countries (as one would intuitively expect). An expansion of the purchase power parity theory, which suggests that prices in countries vary for the same product but that they differ by the same proportional rate over time. The reasons suggested for this price difference include taxes, shipping costs and differences in product quality.

Relative PPP describes differences in the rates of inflation between two countries. Specifically, suppose the rate of inflation in Nigeria is higher than that in the US, causing the price of a basket of goods in Nigeria to rise. Purchasing power parity requires the basket be the same price in each country, so this implies that the Nigerian Naira must depreciate vis-a-vis the U.S. dollar. The percentage change in the value of the currency should then equal the difference in the inflation rates between the two countries. The idea is that the rate of change in the price level of commodities in one country relative to the price level in another determines the rate of change of the exchange rate between the two countries ‘currencies (Rogoff, 1996).

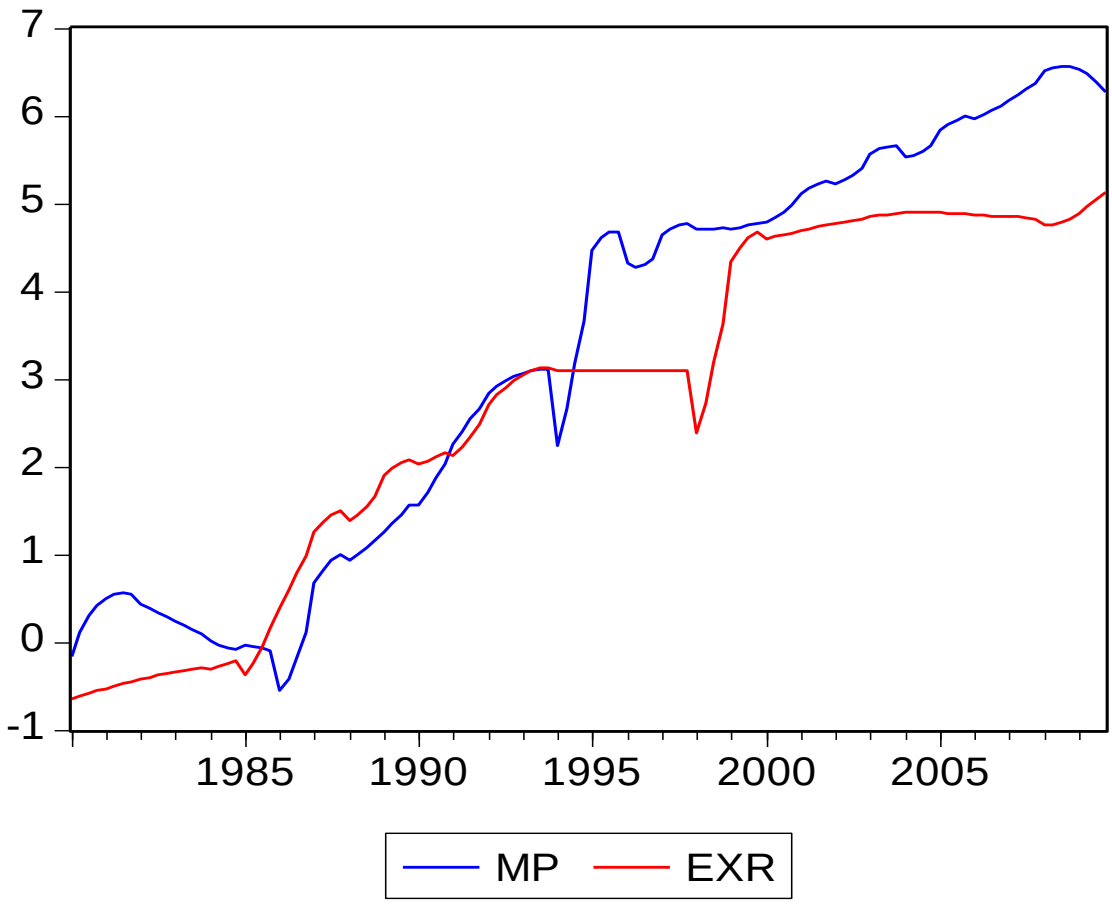
Figure 2.2 Relationship between Exchange Rate and Domestic prices in Nigeria between 1985 and 2005



Source: author's computation (see appendix G for data)

Considering the graph above, it is evident that changes in exchange rates does not significantly affect consumer price index. This implies that monetary authorities cannot effectively use exchange rate policy to control domestic prices.

Figure 2.3 Relationship between Exchange rate and Import prices in Nigeria from 1985 to 2005.



Source: author's computation (see appendix G for data)

Considering the graph above, there seems to exists a relationship between import prices and exchange rate though not in the same proportion more especially in 1985, 1990 and 2000 respectively

2.7 Limitations of the Literature

An important limitation of the empirical evidence that indicates the extent of a change, on average, in consumer price inflation when the exchange rate depreciates is that it is unconditional

in nature: It does not tell how the relationship may vary depending on which shocks hit the economy. Furthermore past debates on pass-through only focused on import price pass-through to domestic prices in Nigeria, for example, Omisakin and Oladipo (2008). This study shall contribute to this debate by going a step further to investigate the degree of exchange rate pass-through to domestic inflation in Nigeria, by first investigating exchange rate pass-through to import prices and then assess import prices pass-through to domestic inflation as well as up-dating the data set.

2.8 Theoretical Framework

The basic relationship linking the domestic price to exchange rate follows the tenets of 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 tradable goods is sub-divided into prices of importable and exportable. But since Nigeria is an open economy heavily dependent on imports whose prices are determined exogenously in the world market and are valued domestically according to the level of the exchange rate, the protective trade policy in Nigeria leads to a departure from the tenets of absolute PPP with the existence of tariffs. The price of imported goods will therefore increase by the value of tariffs and other distributional costs, thereby creating a wedge between goods prices in the domestic and foreign markets, oyinlola (2007).

Given this view therefore, the theoretical frame-work for which this work will be anchored on is the principle of Relative Purchasing Power Parity (RPPP), which recognizes the existence of trade barriers and transport cost. It also provides the theoretical foundation on which the relationship between prices and exchange rate evolves. The principle is based on the neo-classical assumption where prices of homogenous products are eventually equalized across

countries. The choice of this theory derives from the understanding of price determination in Nigeria. Also relationship between exchange rate and import prices evolves from the model of price determination which incorporates both demand and supply factors. The economy is divided into two inflation-generating sectors namely: tradable and non-tradable sectors. The tradable sector captures shocks from the foreign sector (mainly import prices) whereas the non-tradable sector represents disequilibria in the money market. The price of non-traded goods responds to disequilibria in the money market and movements in the exchange rates and foreign prices govern the price of traded goods.

Generally, we identify in this study two stages through which changes in exchange rates affect domestic prices. The first-stage shows how exchange rate directly affects import prices while second-stage shows the link between import prices and consumer prices. In other words exchange rate affects domestic prices via import prices of foreign goods and services. However, a hand full of literature have estimated a direct relationship between exchange rate and consumer prices, which implies that there is a direct pass-through effect of exchange rate changes to consumer prices. Sanusi (2010) noted that, the direct approach is popular chiefly because the disaggregated data on import prices and composition is generally unavailable especially in the SSA countries. This study shall however make use of the two stage transmission of exchange rate changes via import prices to consumer prices. The rationale behind this is that, Nigeria is an open economy which is often affected by external shocks of world price commodities. Consequently, these external prices have tendency to influence domestic prices through the process of importation

Literature suggests that the pass-through of exchange rate to import prices (the first-stage) tends to be greater, even if incomplete, than pass-through form exchange rate to consumer

prices. Sanusi (2010) While, empirical evidences unanimously conclude that the exchange rate pass-through is incomplete, Odusola (2008).

2.9 EMPIRICAL LITERATURE REVIEW

Several researchers have empirically examined the sensitivity of domestic prices to exchange rate movements in several economies of the world including Nigeria. We shall thus consider a few of these studies in greater detail to enhance our idea about their methods and findings.

In a study conducted by Piotr (2000)on incomplete Exchange Pass-through to Inflation and Monetary Policy in Poland where he deals with a monetary policy of the central bank in situation of incomplete exchange rate pass-through to inflation. The author presents how the degree of exchange rate pass-through to prices determines the range, in which monetary policy can use direct channel of exchange rate to stabilize inflation. He showed that in the situation of depreciation (appreciation) of home currency, monetary policy of National Polish Bank should be somewhat less restrictive (more restrictive), than in the situation of complete exchange rate pass-through to the CPI.

José (2000) work examines the way dollarization affects the transmission channel of nominal exchange rate fluctuations into domestic inflation for 13 countries in Latin America between 1980-2000 using two alternative methodologies: (i) long run pass-through is estimated using an Error Correction Model and a Yearly pass-through coefficients were computed and regressed in a panel framework using dollarization and inflation as explanatory variables. The purpose was to test the reality of the “conventional wisdom” belief that as a country became more dollarized nominal exchange rate devaluations translate more fully and faster into increases in the domestic price level.

Contrary to the “conventional wisdom” he found that dollarization across countries is not positively associated with a higher degree of exchange rate pass-through. Moreover, within a country, increases in dollarization are not associated with an increase in pass-through.

Marta and Anita (2001) examine monetary policy in Albania during the transition period. Estimates from a vector auto regression model (VAR) of key macroeconomic variables demonstrate the weak link between money supply and inflation up to mid-2000. However, the move during 2000 from direct to indirect instruments of monetary control has been associated with greater predictability of the transmission link from money supply to inflation. Their findings are exchange rate stability plays a key role in keeping inflation low for most of the transition period. Second, the range of monetary policy instruments available to the authorities can be widened with more stable and predictable changes in money supply and the price level. The paper concludes that a move to formal inflation targeting could help promote the transparency and credibility of monetary policy, but that such a move should be introduced only when the country is ready for it.

Eric (2004) in his study of Inflation Targeting and Exchange Rate Rules in an Open Economy provides a simple dynamic neo-Keynesian model that can be used to analyse theimpact of monetary policy that considers inflation targeting in a small open economy. The mainfindings of the paper are that, depending on what shocks affect the economy, the effects of inflation targeting on output and inflation volatility depend crucially on the exchange rateregime and the inflation index being targeted.

In a paper by Mishkin at the Norges Bank Conference 2008, he found from the empirical evidence on exchange rate pass-through that sizeable depreciations of the nominal exchange rate exert fairly small effects on consumer prices across a wide set of industrial countries. Exchange

rate depreciations are thus likely to have less adverse effects on inflation than they have had in the past. The empirical evidence also indicates that pass-through from exchange rates to import prices is low suggesting that there may be a weaker relationship between exchange rate fluctuations and nominal demand, which may make it easier for monetary policy to stabilize inflation and real activity.

In another study by Karim (2007) on Exchange Rate Pass-Through and Structural Macroeconomic shocks in Developing Countries investigating the exchange rate pass-through in twelve developing countries during the period 1980-2001 by adopting a new formulation rather than considering the traditional approach based on the exogenous exchange rate movement through correlation between exchange rate and prices, the study focused on fundamental macroeconomic shocks that affect both exchange rate and prices. The study employed long-run restrictions by à la Blanchard and Quah (1989) to identify the different shocks through an open economic macroeconomic model (ISLM framework).

Two empirical methodologies were used: Structural VECM methodology used by Jang and Ogaki (2004) and the common trends approach proposed by Warne et al (1992). This allowed them to calculate the pass-through as the responses of the exchange rate, CPI and import prices to the supply, the relative demand, the nominal and the foreign prices shocks. They showed that the pass- through ratio in developing countries is different when considering different structural shocks. In particular, they found that the pass-through resulting from demand shock was the highest. These results are consistent with the results of Frankel, Parsley and Wei (2005), Barhoumi (2006) and Barhoumi and Jouini (2006), which showed that inflation is an important exchange rate determinant and the pass-through ratio is higher in developing countries characterized by higher inflation level.

Kamin and Klau (1998) using an error correction technique estimated a regression equation linking the output to the real exchange rate for a group of twenty seven countries. They did not find that devaluations were contractionary in the long term. Additionally, through the control of the sources of spurious correlation, reverse causality appeared to alternate the measured contractionary effect of devaluation in the short term although the effect persisted even after the introduction of controls.

Ndung (1993) estimated a six-variable VAR-money supply, domestic price level, exchange rate index, foreign price index, real output, and the rate of interest in an attempt to explain the inflation movement in Kenya. He observed that the rate of inflation and exchange rate explained each other. A similar conclusion was also reached in the extended version of his study (Ndung, 1997).

Valderrama (2006) Carried out a study on 'The Exchange Rate-Consumer Price Puzzle' finds that the insensitivity of consumer prices to exchange rate fluctuations represents a price puzzle to economists. According to him, while distance and transportation costs might seem natural solutions to the puzzle, research suggests that non-tradable costs of distributing goods domestically and adjusting profit margins of imperfectly competitive firms are two more plausible explanations.

Amiti, et*al.,* (2013). Develop a theoretical framework that combines variable mark-ups due to strategic complementarities and endogenous choice to import intermediate inputs and find that firms with high import shares and high market shares have low exchange rate pass-through.

Kamas (1995) study on Colombia extended the works of Montiel (1989) and Dornbusch, Sturzenbegger, and Wolf (1990) by separating the base money into domestic credit and

reserves, with a view to identifying the domestic monetary impulses as well as analysing their effects on the balance of payments. He observed that exchange rates did not play an important role in explaining the variation in inflation in Colombia and that inflation appeared to be primarily inertial with respect to the exchange rate but largely determined by demand shocks.

A study by Oyinlola and Festus (2010) on Exchange rate pass-through to different measures of domestic price in Nigeria using the vector error correction model that incorporates exchange rate, money supply, world export price, income and tariff rate on annual data from 1980-2008. This study observes that long run relationship exist between exchange rate and domestic price level; nevertheless, the short run impact is not elusively evident. Short run variations in exchange rate might be anticipated and hence, the impact would be dampened. Domestic price in the study was captured by three different measures: Consumer price index, gross domestic product deflator and aggregate import price.

Odusola and Akinlo (2001) in their study carried out in 2001 using the VAR on Output, Inflation, and Exchange rate in developing economies-an Application to Nigeria, examined the link among the naira depreciation, inflation, and output in Nigeria. Evidence from the study revealed the existence of mixed results on the impacts of the exchange rate depreciation on the output. The impulse response functions exerted an expansionary impact of the exchange rate depreciation on the output in both medium and long terms. The opposite (contractionary impact) was however observed for the short-term horizon. These results tend to suggest that the adoption of a flexible exchange rate system does not necessary lead to output expansion, particularly in the short term. Results from the contemporaneous models also showed a contractionary impact of the parallel exchange rate on the output but only in the short term.

In another study on Exchange Rate Pass-through in Nigeria by Aliyu *et al*.,(2009) *wh*ere they investigated the degree of exchange rate pass- through to import and consumer prices in Nigeria between 1986Q1 and 2007Q4 on the basis of vector error correction methodology. The paper found that exchange rate pass-through in Nigeria during the period under review was low, although slightly higher in the import than in the consumer prices, significant and persistent. A one per cent shock to exchange rate, for instance, results in 14.3 and -10.5 per cent pass-through effect to import and consumer prices four quarters ahead, respectively. This, among other things, suggests that exchange rate pass-through in Nigeria declines along the price chain, and partly overturns the conventional wisdom in the literature that ERPT is always considerably higher in developing and emerging economies than in developed economies. Although pass-through effect is envisaged to increase with greater integration of the economy into the global world in future, but, the fact that it was found to be incomplete implies that prices react less proportionately to exchange shock in Nigeria.

In a study by Masha (1995) on another perspective to the inflationary trend in Nigeria that incorporates monetarist, open economy and structural features of the economy. The main argument is that variation in the parallel market exchange rate was one of the determinants of price level behaviour in Nigeria during the period, 1971 -I 995.**A** partial equilibrium model based on micro foundations was solved for the price level and the solution estimated through two stage Least Squares (2SLL) instrumental variable method, using annual data. The results confirm the inzporiance of parallel market exchange rate dynamics, in addition to the traditional monetarist variables in the period under review.

Oyinlola (2008) investigates the impact of exchange rate movements on prices of disaggregated imports in Nigeria during 1980-2006 taking trade policy into consideration. The

study observes that exchange rate exhibits positive and more pass-through to import prices of consumer and capital product groups, while the results of intermediate products are mix. The study shows that depreciation of exchange rate overwhelms the impact of tariff reduction on prices of some products.

Odedokun **(**1995**)** identifies in his studies' causes of inflation in sub-Sahara Africa' employed econometrics to analyse annual reports data for 35 countries from 1971- 1990. The findings suggest that monetary growth, the rate of domestic currency depreciation, and the expectation of inflation have positive effects on inflation, while expansion of per capita food production as well as overall economic growth serve to reduce inflation rates but he was unable to detect positive effects of fiscal deficit variables, foreign inflation rates, or the growth of import prices on the domestic inflation rates.

Onosewalu and Taofeek (2009) examined the impact of exchange rate on inflation in Nigeria between 1970 and 2007 using the co-integration analysis. They also considered the relationship that exists among government expenditure, money supply, exchange rate, oil revenue and inflation in Nigeria. The study revealed that, most variables are correlated, which means the impact of each variable on the rate of inflation in the economy is inseparable. Moreover, there is strong long relationship among the variables, though inflation and exchange rate show no long relationship.

Imimole (2010) also examined the impact of exchange rate depreciation on inflation in Nigeria for the period 1986–2008, using Auto Regressive Distributed Lag (ARDL) Co-integration Procedure. The research found that exchange rate depreciation, money supply and real gross domestic product are the main determinants of inflation in Nigeria, and that Naira depreciation is positive, and has significant long-run effect on inflation in Nigeria. The research

paper therefore concluded that exchange rate depreciation can bring about an increase in inflation rate in Nigeria.

In another study carried out by Olusanya and Rasheed (2009)on Modelling The Inflation process In Nigeria, analysing the main sources of fluctuations in inflation in Nigeria using the framework of error correction mechanism, found that the lagged CPI, expected inflation, petroleum prices and real exchange rate significantly propagate the dynamics of inflationary process in Nigeria. The results from the study showed that the lagged CPI, expected inflation, real exchange rate and petroleum price significantly influence the dynamics of the consumer price index in Nigeria.

There is a good reason to believe that the different outcomes of these investigations might have come from the different methodologies used. While Oladipo (2007) and Oyinlola (2009) used the Johansen multivariate estimation technique, Omisakin (2009) used the vector autoregressive model which is criticized for its inability to capture the potential long run relation among variables. There are arguments in some quarters that the Exchange Rate Pass-through (ERPT) concept is a long run phenomenon (Barhoumi, 2005). Therefore, Omisakin's result of no short run impact is not surprising. The figures below lend support to the theoretical evidence of exchange rate pass-through effects to the two major channels in Nigeria.

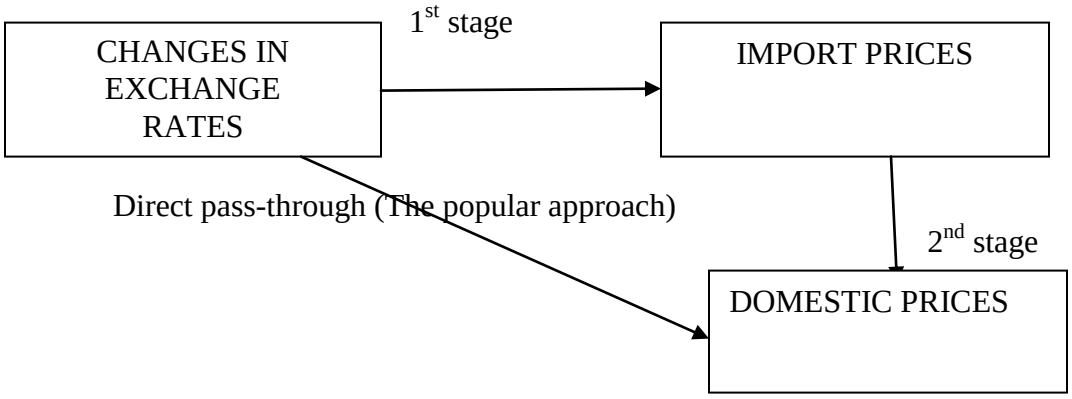
CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter focuses on the methodology of the study, which includes flow chart of exchange rate pass-through, analytical framework, justification for the use of the technique, model specification, estimation and evaluation procedure, sources of data descriptive analysis and a priori expectation.

Figure 3.1: Flow Chart of Exchange Rate Pass-through



Source: Computed By The Author.

3.1 Analytical Framework

From the foregoing therefore, theVAR/VECM approach was adopted for the estimation of pass-through in order to generate the dynamics of pass-through with a view to minimizing the mean square forecast error. However, it was observed that there was no longrun relationship between the key variables (exchange rate and import prices) we therefore reverted to the use of Vector Autoregressive (VAR) model. The Study examines exchange rate pass-through and its significant long term effects on domestic and import prices in Nigeria. However, this work

intends to estimate ERPT in Nigeria through the following channels. As stated earlier the effects of exchange rate movements are transmitted to consumer prices via three major channels which this work intends to estimate, these are: (i) prices of imported consumption goods, (ii) domestically produced goods priced in foreign currency, and (iii) prices of imported intermediate goods.

3.2 Justification for the Use of the Technique

Most economic theories are based on equilibrium models which require the economy to get back to an equilibrium relation in the long run. This relation imposes the condition that none of the dependent or independent variables can wander away from each other for an extended period of time, implying that the error term associated with the corresponding equilibrium relation has to be white noise. But since we found that there exists no longrun relationship between the key variables (EXR and MP), the VAR model becomes more appropriate.

3.3 Model Specification

We adopted the model by Egwaikhide and Oyinlola (2011). It was modified by including more variables in order to give it more strength. This is to help us detect other macro-economic variables that are likely to be impacted by exchange rate- pass-through.

The model is therefore specified as follows:

$$\Delta y_t = \alpha\beta' y_{t-1} + \sum_{i=1}^{g-1} \Gamma_i \Delta y_{t-i} + \pi + \zeta_t, t = 1,\ldots,T \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3.1)$$

where, y_t is a vector of endogenous variables (domestic price captured by CPI, Export prices captured by EXPP, Import prices by MP, Wholesale prices captured by WHP, Nominal Effective Exchange Rate captured by EXR, Tariff Rate captured by TAR and Money supply captured by M2).The α_s parameters measure the speed at which the variables in the system adjust to their long run values and the β' vectors are estimates of the long run co-integrating relationships

between the variables in the model. Next comes the drift parameter, π and can also be expressed as a matrix of parameters associated with the exogenous variables while the stochastic error term is ζ.

We adopted the following specification for estimating the degree of exchange rate pass-through to domestic prices in Nigeria. The specification emanates from a price generating process that $lnDPL_t=a_{0+}\ a_1 lnDPL_{t-1}+\ a_2 lnWHP+\ a_3 lnMP_t+a_4 lnTAR+a_5 lnM2+a_6 lnEXP+\ a_7 lnEXR_{-1}+\zeta_t$ incorporates other factors such as money supply and tariff rate. Our model is specified as:

Where:

Domestic price is captured by CPI

Import prices

Export price

Nominal effective exchange rate

Tariff rate and MS is money supply at time t

Summarily, a VAR/VECM model in matrix form is such that,

$\Delta Y_t = \mu + A(L)\ \Delta\ Y_t\ +\ \alpha\ \beta^1\ [Y_{t-1}]+ U_t$ ……(3.3)

Where Y_t is an (n x I) vector of I(1) endogenous variable (i.e domestic price captured by CPI, Export prices captured by EXP, Import prices by MP, Wholesale prices captured by WHP, Nominal Effective Exchange Rate captured by EXR, Tariff Rate captured by TAF and Money supply at time t captured by M2), A(L) is (n xn) matrix of the estimated parameters. The α parameters measure the speed of adjustment in which the variables in the system adjust to restore a long run equilibrium and β^1 contains the cointegrating vectors with estimates of long run relationship between

the variables in the model. All variables in the VAR are in log form in order to capture nonlinear elements.

The pass-through channels to be investigated using VARare:

i. Wholesale Prices channel
ii. The Export price channel
iii. The nominal effective exchange rate channel
iv. The money supply channel
v. The Tariff Rate channel
vi. The Domestic Price channel
vii. Import prices

The baseline model which seeks to explain the effects of exchange rate pass-through (ERPT) to shocks on endogenous variables is written as:

Summarily, a VAR model in matrix form is such that,

$$\Delta Y_t = \mu + A(L)\,\Delta Y_t + \alpha\,\beta^1\,[Y_{t-1}] + U_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.3)$$

This can be further simplified as follows:

$$\begin{pmatrix} \Delta Whp_t \\ \Delta wExp_t \\ \Delta EXR_t \\ \Delta TAR_t \\ \Delta M2_t \\ \Delta MP_t \\ \Delta DP_t \end{pmatrix} = \mu + A_1 \begin{pmatrix} \Delta Whp_{t-1} \\ \Delta wExp_{t-1} \\ \Delta EXR_{t-1} \\ \Delta TAR_{t-1} \\ \Delta M2_{t-1} \\ \Delta MP_{t-1} \\ \Delta DP_{t-1} \end{pmatrix} + \ldots + A_p \begin{pmatrix} \Delta Whp_{t-p} \\ \Delta wExp_{t-p} \\ \Delta EXR_{t-p} \\ \Delta TAR_{t-p} \\ \Delta M2_{t-p} \\ \Delta MP_{t-1} \\ \Delta DP_{t-p} \end{pmatrix} + \alpha\,\beta^1 \begin{pmatrix} w_{t-1} \\ w_{t-1} \\ E_{t-1} \\ T_{t-1} \\ M_{t-1} \\ I_{t-1} \\ P_{t-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \\ \varepsilon_{6t} \\ \varepsilon_{7t} \end{pmatrix} \ldots\ldots\ldots\ldots\ldots (3.4)$$

The above variables must be non- stationery in order to run VECM; this might lead to spurious regressions unless if there is at least one co-integration relationship.

3.4 Estimation and Evaluation Procedure

The analysis wascarried out in the following order. Firstly, a stationarity test of the variables was carried out. This was done through the Augmented Dickey Fuller (ADF) and the Phillips-Peron tests. Secondly, the cointegration of the variables was tested through the application of Johansen cointegration tests. In the pursuit of the exchange rate-domestic price nexus, this study employed annual data series of the following variables: Exchange rate (EXR), captured by the nominal effective exchange rate (a fall in its value implies appreciation while an increase is depreciation); Domestic Price was captured by three measures; Consumer Price Index (CPI), Wholesale prices and Aggregate Import Price (MP), Money Supply (M2), measured by broad money supply, Tariff rate (TAR), World Export Price (EXP).

3.5 Sources of Data and Descriptive Analysis

Quarterly macroeconomic time series data for the period 1980Q1 to 2009Q4 were used in this study. All of them were sourced from various issues of the Central Bank of Nigeria (CBN) Statistical Bulletin and National Bureau of Statistics (NBS). The data consist of quarterly observations, covering the period from 1980Q1 to 2009Q4. The sample span is chosen so as to exclude the period of rigidly fixed exchange rate regime. Hence, the beginning of the sample corresponds with the launch of the ERP. Although between 1983Q3 and 1986Q3 a crawling peg was adopted, the nominal devaluations were substantial and regular such that the exchange rate was never fixed between any two quarters. The variables used here are tied with the data that are used in the empirical estimation. The choice of the dataset is guided by the previous literature experience and data availability for Nigeria. We start with the dependent variable, CPI, which represents price level in Nigeria. For the purpose of this work the price level is modelled in two

ways. First, we use quarterly Consumer Price Index (CPI) and wholesale Price Index (WHP) data reported by National Bureau of Statistics in Nigeria.

The choice of the nominal effective exchange rate hinges on the fact that, works that research the pass-through in developing countries, however, have to face the difference between the official exchange rate and the market rate.

This is the case for Nigeria where official exchange rate stayed constant for period before the period under consideration. Thus, alternative measures are adopted in the literature. The most common is to use the nominal effective (trade weighted) exchange rate time series computed by the NBS or CBN. But there is a penalty for this convenience: it's more logical to think that economic agents react to the changes in the exchange rate which are announced, i.e. official or interbank rates. Therefore the usage of nominal effective (trade weighted) exchange rate time series exhibits the long-run trend but could provide inexact short time estimates; still it's the second best solution for the economies with less variable exchange rate.

3.6 A priori Expectation

Purchasing power parity (PPP) is a theory which states that exchange rates between currencies are in equilibrium when their purchasing power is the same in each of the two countries. This means that the exchange rate between two countries should equal the ratio of the two countries' price level of a fixed basket of goods and services. When a country's domestic price level is increasing (i.e.country experiences inflation), that country's exchange rate must depreciate in order to return to PPP, therefore we expect that the co-efficient A1 in equation (3.4) will be equal to one.

CHAPTER FOUR

4.0 PRESENTATION AND ANALYSIS OF RESULTS

This section analyses the changes in exchanges rate to domestic prices in Nigeria. The pass-through is in two stages, (i.e. direct and indirect). The direct pass-through is from exchange rate to domestic prices (captured by the Consumer price index (CPI)), while the indirect pass through is from exchange rate to domestic prices via import prices. In the course of the analysis, both the size and speed of the pass through have been determined.

4.1 The First Stage Pass-Through (Indirect Channel)

In order to determine the size and speed of exchange rate pass-through to domestic prices which is our key objective, the Vector Auto-regression (VAR) technique was adopted. But in using the VAR technique there are several steps to be taken which this work undertook. First was to determine the time series property of the variables which include the determination of the order of integration using both the Augmented Dickey Fuller (ADF) and Phillip-Perron (PP).Both tests statistics indicated that all the variables are stationary of order one, that is I*(1)* as shown in table 4.1: below.

Table 4.1: Unit Root Test Results

	LEVELS		FIRST DIFFERENCE		
VARIABLES	ADF	PP	ADF	PP	ORDER OF INTEGRATION
TAR	-2.1968686	-3.454676	-6.513985**	-11.97532**	1(1)
WHP	-0.709765	-4.046185	-4.423948**	-12.51006**	1(1)
M2	-2.460540	-2.710794	-6.792299**	-4.81651**	1(1)
EXPP	-1.76983	-2.772616	-4.953850**	-7.118423**	1(1)
MP	-2.460540	-1.898717	-7.100142**	-7.430803**	1(1)
EXR	-1.650004	-1.516738	-5.535192**	-7.020999**	1(1)
CPI	-2.030632	-0.553065	-5.185193**	-3.699630**	1(1)

Note: For the levels, we included trend and intercept, as the line plots of the series indicate; the 5% critical value is -3.4466.

Source: Eviews 4.0

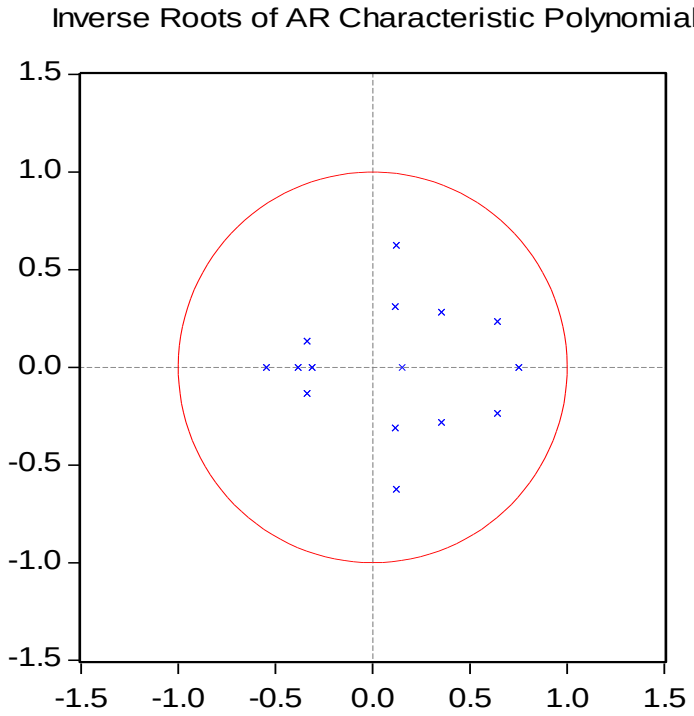
Since the test for unit root above found that all variables are 1(1), we proceeded to test for Cointegration amongst the variables to investigate the long-run relationship between nominal effective exchange rate, export prices, tariffs, money supply, whole sale prices, and import prices. The aim of co-integration analysis is to establish the extent to which fluctuations in the nominal effective exchange rate are passed on to import prices in Nigeria. We therefore tried the Johansen Cointegration test with lag 1 for parsimony, but observed the autocorrelation properties of the residuals. The result suggests that there is one Cointegration equation. But although the trace statistics and the Eigenvalueindicate one cointegration vector the adjustment coefficient of the long-run equation does not support evidence of long run relationship. This is shown in appendix B.

From the result in table 4.1, it becomes impossible to estimate the Vector Error Correction Model (VECM) since the adjustment coefficient of the long-run equation does not support evidence of long-run.We therefore proceeded to estimate a VAR in first difference of all the variables and make inference from the Impulse Response Functions.

To ensure the reliability of the coefficient of the VAR model, we therefore employed the stability test in order to test the robustness of the model, the inverse roots of characteristic polynomial are all within the unit circles as shown in figure 4.1.3 below suggesting that the VAR model has satisfied the stability condition.

4.2 VAR Stability Test

Figure 4.1



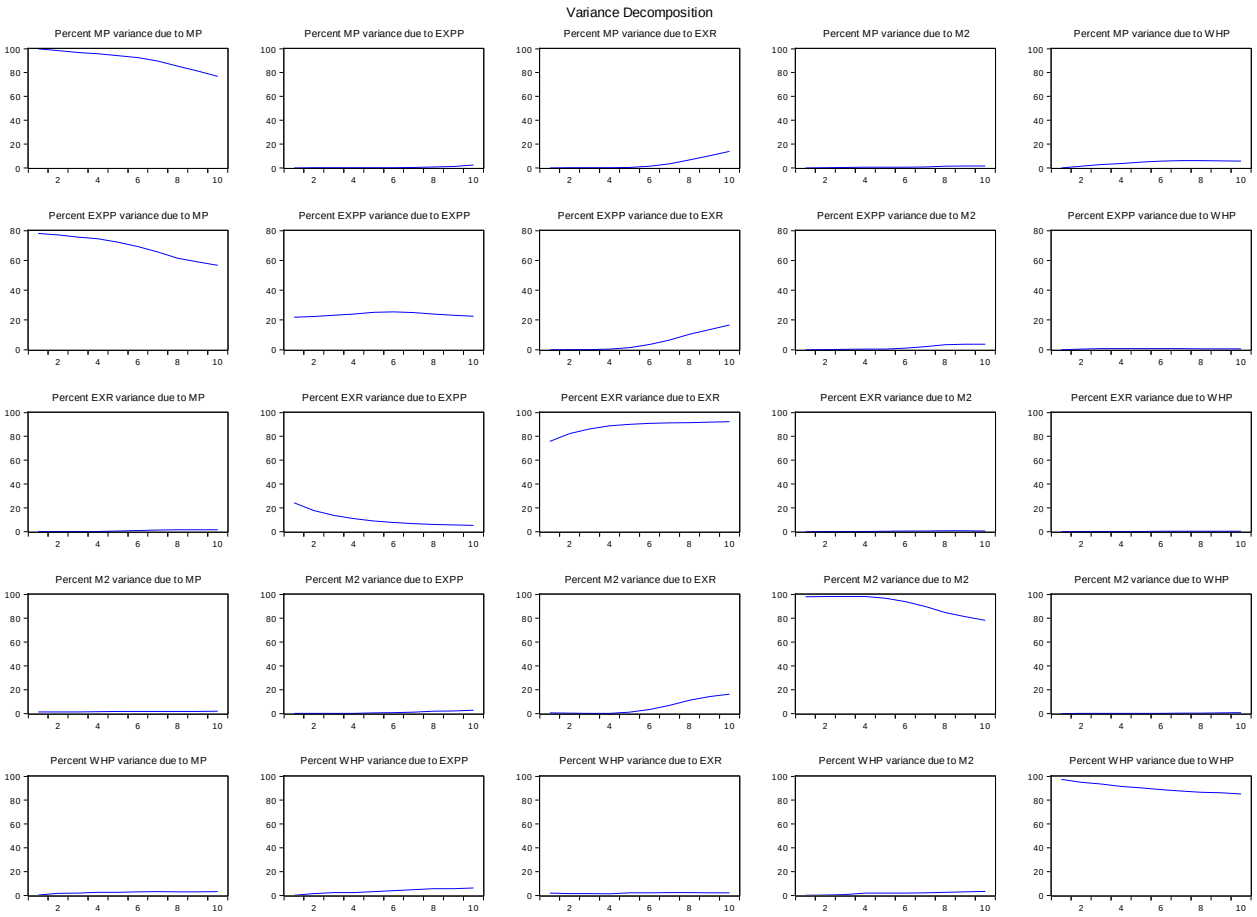
In the VAR model above, even though all the variables are endogenous, our variables of interest are exchange rate and domestic prices captured by consumer price index (CPI). The coefficient of exchange rate thoughpositive but not statistically significant. Also, the adjustment coefficient of CPI (-0.003129), although negative as expected, is very small in magnitude and statistically insignificant.This means that the first stage pass-through of exchange rate is incomplete, small and slow asshown in figure. This is empirically evidenced in central bank of Nigeria's (CBN) effort at changing the official exchange rate regimes in order to maintain a stable exchange rate and keep inflation rate at a pre-determined target.

4.3 Variance Decomposition

Below is the result of the variance decomposition but as stated earlier; we shall make our inference using the impulse response function. This is because our interest is not looking at the

various contributions of the various variables in the model on the independent variable but looking at the speed of adjustment of the various variables in the model.

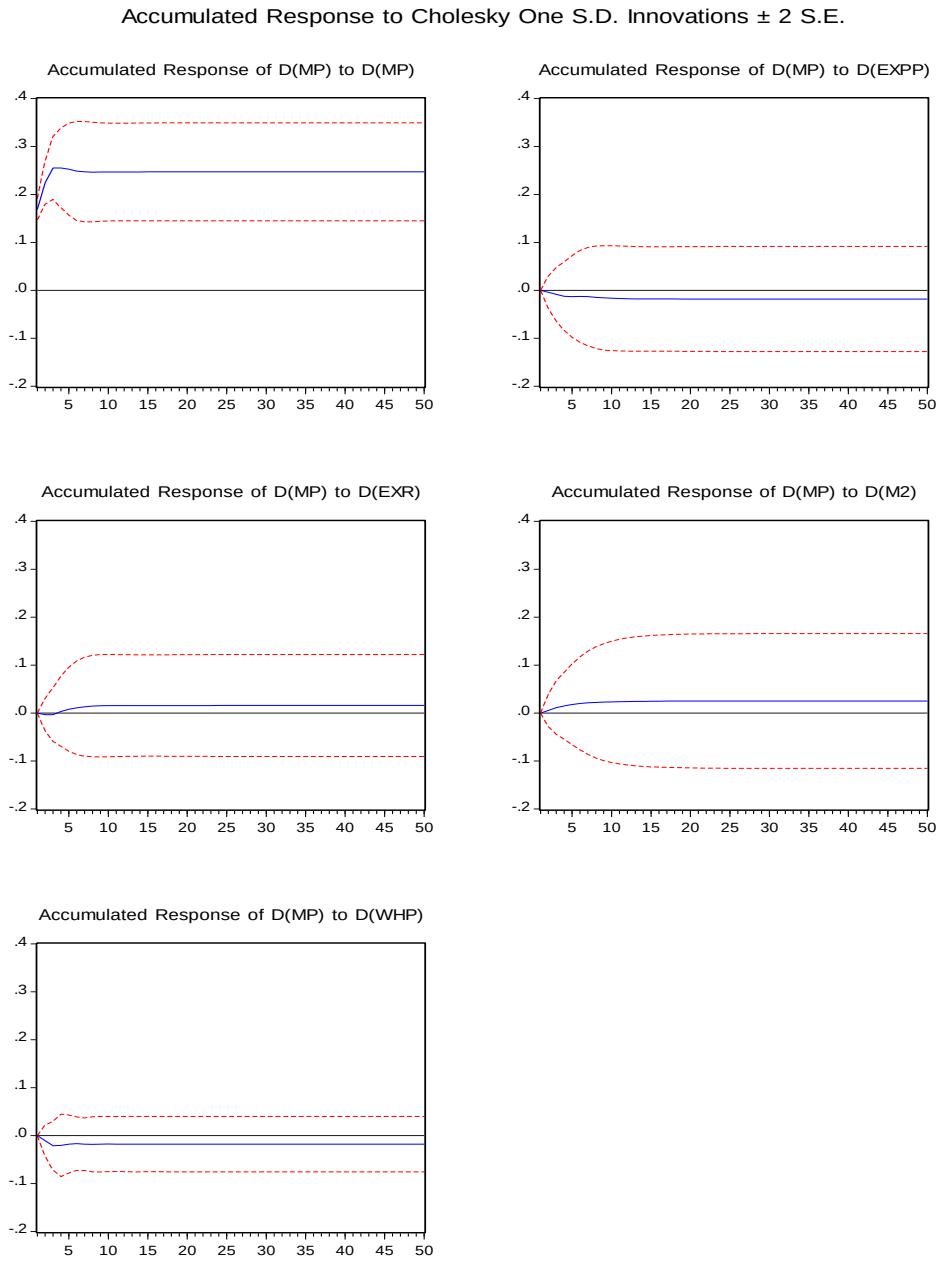
Figure 4.2: Variance Decomposition

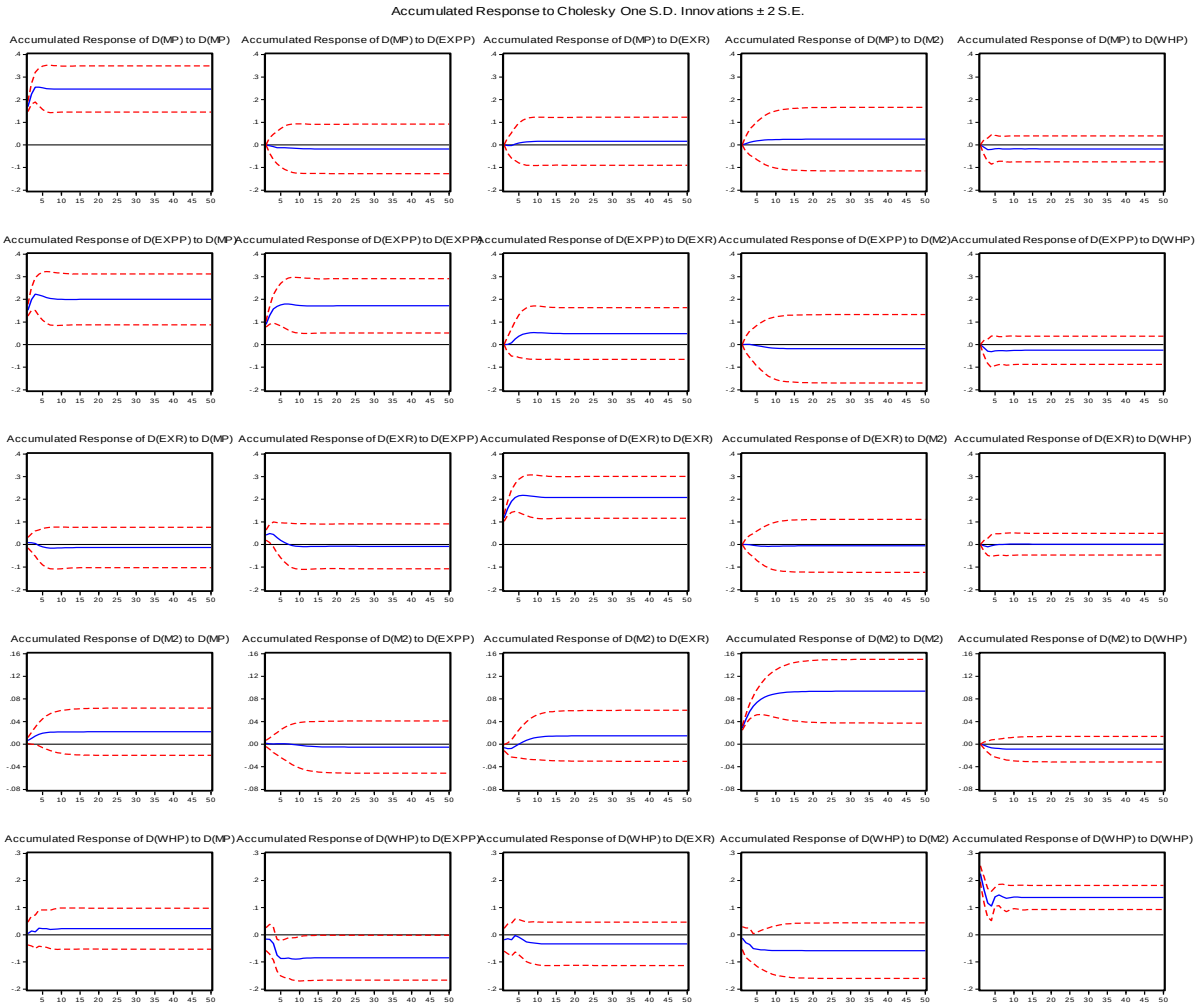


4.4 Impulse Response Function

In order to determine the speed and magnitude of the pass through, we adopted the impulse response function. As can be seen from the MP equation, the import prices response to changes in the exchange rate is positive; suggesting that increase in the exchange rate, or depreciation of the Naira raises import prices. The magnitude is however small and it takes up to seven (7) quarters to reach the maximum impact. This means that the first stage pass-through effect of

exchange rate of exchange rate is incomplete, small and slow. This is similar to other findings in the literature. It is as shown below.





4.5 The Second Stage Pass-Through (The Direct Channel)

Just as in the case of the first stage pass-through, the second stage pass-through describes the transmission of the nominal effective exchange rate to domestic prices with the main aim of establishing the magnitude of the pass-through and how long it persists

The objective was to determine the main channel of ERPT in Nigeria, and to establish the magnitude of the pass-through and how long it persists. Following the same steps as in the case of indirect stage, we tested for Cointegration between import price and the other variables. Given the signs and statistical significance of the coefficients of the variables in the vector, and the adjustment coefficient of the import price equation, we conclude that there is no long-run

Cointegration between CPI, import prices and Exchange rate. We therefore estimated the VAR in first differences of all the variables. The impulse response indicates that the response of domestic prices (CPI) to both import price (second stage pass through) and exchange rate (total or direct pass-through) is positive, incomplete and low in magnitude. In terms of speed, the pass-through effects are both slow. The maximum impact of change in import price takes about 25 quarters, while the response of CPI to exchange rate takes about 17 quarters. This suggests that the pass-through effect of exchange rate in Nigeria is incomplete, low and slow as shown in appendix E. This as stated before is empirically evidenced in central bank of Nigeria's (CBN) effort at changing the official exchange rate regimes in order to maintain a stable exchange rate and keep inflation rate at a pre-determined target.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Summary of Major Findings

Money authorities today are using exchange rate policy as an instrument to stabilize domestic prices as well as affecting the behavior of import prices. However, the difficulty in using this tool has been constrained by authorities to forecast inflation in the presence of high exchange rate pass-through to domestic prices. Furthermore, exchange rate movements in addition to affecting the prices of imported goods and inputs also change the current account position which in turn affects aggregate demand.

In Nigeria, previous studies on ERPT have identified two basic problems: one is, the determination of the actual size and speed of pass-through and the problem of measurement. This study therefore re-examine the dynamics and magnitude of exchange rate pass-through to domestic prices in Nigeria. The theoretical framework for this study gave us the leverage to investigate the pass-through from exchange rate to import prices (first stage pass-through) and the pass through from exchange rates and import prices to domestic prices (second stage pass-through). The Johansen Co-integration method was used to investigate the long-run relationship of the variables andit was discovered that there is no long-run relationship among the variables of interest therefore; the short run dynamics among the variables were investigated using the VAR approach which gave us our findings as below:

i. There is no long run link between exchange rate and import prices, or between exchange rate and domestic prices. This is consistent with the argument that in the long run, all nominal variables don’t matter.

ii. The pass-through effect from exchange rate to import price is incomplete and low. This is consistent with the principle of pricing to market

iii. The pass-through effect of exchange rate on import prices takes about 7 quarters to fully manifest, suggesting a relatively slow pass-through effect.

iv. The second stage pass-through effect, from import price to domestic price is also incomplete, low and slow. It takes even longer time of 17 quarters to fully manifest.

v. The total (or direct) pass-through effect of exchange rate to domestic price is also incomplete, low and slow, taking up to about 17 quarters to fully manifest. This is consistent with the general finding in the literature especially from developing countries. One possible explanation of the predominance of this pricing to market phenomena is that as global firms compete for market in these developing countries, depreciating exchange rate that would otherwise cause import and domestic prices of these goods rise, would rather cause a decline in the profit margin of these firms. There has also been the argument of reduced product specifications/quality to allow firms maintain the domestic price of their goods in these markets when currencies depreciate.

5.1 Conclusion

Considering the first stage pass-through, there is evidence that the pass-through from exchange rates to import prices is low and incomplete. This implies that monetary authorities cannot effectively use exchange rate policy to control import prices and furthermore import prices are responsible for their own price changes. The second pass-through shows that exchange rate is a not potential source of inflation in Nigeria as exchange pass through is also low and incomplete. This is depicted by the impulse response function which is a replica of the variance

decomposition. Thus, there is a direct pass-through from exchange rate to domestic prices though not complete because of the low coefficient. A major implication of this finding is that monetary authorities can use exchange rate as an instrument to stabilize prices though the process of stabilization will be low. Lastly, monetary policy stance has greater influence on import prices than fiscal policy as suggested by results from the first stage pass-through.

5.2 Recommendations

Based on the findings of this study, the following recommendations were made:

i. Though the level of the pass through is low, the results suggest that exchange rate movements still influence domestic prices. While the lower degree of pass-through allows for some flexibility in policy, continued emphasis has to be placed on reducing volatilityand moderating the speed of adjustments.

ii. Government should pursue monetary policy as an instrument to influence import prices in order to attain complete exchange rate pass-through to domestic prices in Nigeria.

iii. There is need for a more predictable exchange rate in order to reduce the uncertainty associated with frequent devaluations of the domestic currency.

vi. The central bank of Nigeria should check the illegal purchase of foreign currencies by banks and individuals so as to give strength to the Naira.

vii. Government should also ban the importation of goods that Nigeria has comparative advantage over other countries in order to boost exports and increase the demand of the Naira.

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APPENDIXES

Appendix A: Unit Root Results

CPI at Levels

ADF Test Statistic	-0.874020	1% Critical Value*	-4.0348
		5% Critical Value	-3.4466
		10% Critical Value	-3.1481

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CPI)
Method: Least Squares
Date: 06/09/13 Time: 05:23
Sample(adjusted): 1981:2 2011:4
Included observations: 123 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI(-1)	-0.009815	0.011230	-0.874020	0.3839
D(CPI(-1))	0.332240	0.092557	3.589572	0.0005
D(CPI(-2))	0.172153	0.097026	1.774291	0.0786
D(CPI(-3))	0.150377	0.097616	1.540490	0.1262
D(CPI(-4))	0.013984	0.095390	0.146603	0.8837
C	0.016762	0.014661	1.143324	0.2553
@TREND(1980:1)	0.000356	0.000586	0.607403	0.5448

R-squared	0.305865	Mean dependent var	0.041517
Adjusted R-squared	0.269961	S.D. dependent var	0.053603
S.E. of regression	0.045800	Akaike info criterion	-3.273856
Sum squared resid	0.243322	Schwarz criterion	-3.113813
Log likelihood	208.3422	F-statistic	8.519077
Durbin-Watson stat	2.001893	Prob(F-statistic)	0.000000

CPI at first Difference

ADF Test Statistic	-3.266286	1% Critical Value*	-4.0355
		5% Critical Value	-3.4469
		10% Critical Value	-3.1482

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CPI,2)
Method: Least Squares
Date: 06/09/13 Time: 05:26
Sample(adjusted): 1981:3 2011:4
Included observations: 122 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CPI(-1))	-0.371327	0.113685	-3.266286	0.0014
D(CPI(-1),2)	-0.300881	0.122810	-2.449981	0.0158
D(CPI(-2),2)	-0.139386	0.121036	-1.151607	0.2519
D(CPI(-3),2)	-0.003215	0.112076	-0.028684	0.9772
D(CPI(-4),2)	-0.012516	0.093117	-0.134413	0.8933
C	0.025289	0.011748	2.152659	0.0334
@TREND(1980:1)	-0.000151	0.000126	-1.197550	0.2336

R-squared	0.320261	Mean dependent var	-0.000122
Adjusted R-squared	0.284796	S.D. dependent var	0.054524
S.E. of regression	0.046111	Akaike info criterion	-3.259862
Sum squared resid	0.244517	Schwarz criterion	-3.098975
Log likelihood	205.8516	F-statistic	9.030410
Durbin-Watson stat	2.000196	Prob(F-statistic)	0.000000

ADF Test Statistic	-1.562005	1% Critical Value*	-4.0348
		5% Critical Value	-3.4466
		10% Critical Value	-3.1481

*MacKinnon critical values for rejection of hypothesis of a unit root.

EXPP at Levels

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXPP)
Method: Least Squares
Date: 06/09/13 Time: 05:27
Sample(adjusted): 1981:2 2011:4
Included observations: 123 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXPP(-1)	-0.044972	0.028791	-1.562005	0.1210
D(EXPP(-1))	0.352846	0.087275	4.042911	0.0001
D(EXPP(-2))	0.123164	0.093274	1.320454	0.1893
D(EXPP(-3))	0.069013	0.093961	0.734483	0.4641
D(EXPP(-4))	-0.290866	0.089864	-3.236735	0.0016
C	0.426338	0.240226	1.774737	0.0786
@TREND(1980:1)	0.002914	0.002007	1.451609	0.1493

R-squared	0.258886	Mean dependent var	0.052542
Adjusted R-squared	0.220552	S.D. dependent var	0.177991
S.E. of regression	0.157142	Akaike info criterion	-0.808107
Sum squared resid	2.864457	Schwarz criterion	-0.648064
Log likelihood	56.69861	F-statistic	6.753511
Durbin-Watson stat	1.886209	Prob(F-statistic)	0.000004

EXPP at first difference

ADF Test Statistic	-4.969379	1% Critical Value*	-4.0355
		5% Critical Value	-3.4469
		10% Critical Value	-3.1482

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXPP,2)
Method: Least Squares
Date: 06/09/13 Time: 05:29
Sample(adjusted): 1981:3 2011:4
Included observations: 122 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXPP(-1))	-0.714252	0.143731	-4.969379	0.0000
D(EXPP(-1),2)	0.102700	0.122107	0.841069	0.4021
D(EXPP(-2),2)	0.198199	0.114092	1.737192	0.0850

D(EXPP(-3),2)	0.223646	0.105518	2.119506	0.0362
D(EXPP(-4),2)	-0.161719	0.091868	-1.760350	0.0810
C	0.051032	0.031541	1.617933	0.1084
@TREND(1980:1)	-0.000193	0.000404	-0.477686	0.6338

R-squared	0.409067	Mean dependent var	0.000835
Adjusted R-squared	0.378236	S.D. dependent var	0.199166
S.E. of regression	0.157046	Akaike info criterion	-0.808885
Sum squared resid	2.836311	Schwarz criterion	-0.647999
Log likelihood	56.34201	F-statistic	13.26794
Durbin-Watson stat	2.003930	Prob(F-statistic)	0.000000

EXR at Levels

ADF Test Statistic	-0.475416	1% Critical Value*	-4.0348
		5% Critical Value	-3.4466
		10% Critical Value	-3.1481

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXR)
Method: Least Squares
Date: 06/09/13 Time: 05:29
Sample(adjusted): 1981:2 2011:4
Included observations: 123 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXR(-1)	-0.009928	0.020883	-0.475416	0.6354
D(EXR(-1))	0.297890	0.089833	3.316059	0.0012
D(EXR(-2))	0.116431	0.093982	1.238865	0.2179
D(EXR(-3))	0.056526	0.094497	0.598183	0.5509
D(EXR(-4))	-0.262271	0.092082	-2.848227	0.0052
C	0.067658	0.029566	2.288378	0.0239
@TREND(1980:1)	-8.25E-05	0.001136	-0.072617	0.9422

R-squared	0.208905	Mean dependent var	0.041770
Adjusted R-squared	0.167986	S.D. dependent var	0.138341
S.E. of regression	0.126188	Akaike info criterion	-1.246868
Sum squared resid	1.847102	Schwarz criterion	-1.086825
Log likelihood	83.68241	F-statistic	5.105353
Durbin-Watson stat	1.945630	Prob(F-statistic)	0.000110

EXR at first difference

ADF Test Statistic	-4.950650	1% Critical Value*	-4.0355
		5% Critical Value	-3.4469
		10% Critical Value	-3.1482

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXR,2)
Method: Least Squares

Date: 06/09/13 Time: 05:32
Sample(adjusted): 1981:3 2011:4
Included observations: 122 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXR(-1))	-0.747447	0.150980	-4.950650	0.0000
D(EXR(-1),2)	0.064955	0.131397	0.494337	0.6220
D(EXR(-2),2)	0.170169	0.121722	1.398013	0.1648
D(EXR(-3),2)	0.208015	0.110525	1.882057	0.0624
D(EXR(-4),2)	-0.093785	0.092668	-1.012054	0.3136
C	0.069104	0.027838	2.482397	0.0145
@TREND(1980:1)	-0.000569	0.000341	-1.670040	0.0976

R-squared	0.398312	Mean dependent var	-0.000325
Adjusted R-squared	0.366920	S.D. dependent var	0.158627
S.E. of regression	0.126214	Akaike info criterion	-1.246011
Sum squared resid	1.831946	Schwarz criterion	-1.085125
Log likelihood	83.00667	F-statistic	12.68817
Durbin-Watson stat	2.003231	Prob(F-statistic)	0.000000

M2 at levels

ADF Test Statistic	-3.211464	1% Critical Value*	-4.0348
		5% Critical Value	-3.4466
		10% Critical Value	-3.1481

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(M2)
Method: Least Squares
Date: 06/09/13 Time: 05:34
Sample(adjusted): 1981:2 2011:4
Included observations: 123 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
M2(-1)	-0.337996	0.105247	-3.211464	0.0017
D(M2(-1))	-0.440414	0.117547	-3.746691	0.0003
D(M2(-2))	-0.270196	0.118675	-2.276768	0.0246
D(M2(-3))	-0.145451	0.111114	-1.309024	0.1931
D(M2(-4))	-0.060089	0.090285	-0.665555	0.5070
C	3.081453	0.927949	3.320714	0.0012
@TREND(1980:1)	0.020333	0.006217	3.270549	0.0014

R-squared	0.380480	Mean dependent var	0.054385
Adjusted R-squared	0.348436	S.D. dependent var	0.310878
S.E. of regression	0.250939	Akaike info criterion	0.128017
Sum squared resid	7.304588	Schwarz criterion	0.288060
Log likelihood	-0.873017	F-statistic	11.87364
Durbin-Watson stat	2.006152	Prob(F-statistic)	0.000000

M2 at first difference

ADF Test Statistic	-7.094274	1% Critical Value*	-4.0355
		5% Critical Value	-3.4469
		10% Critical Value	-3.1482

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(M2,2)
Method: Least Squares
Date: 06/09/13 Time: 05:35
Sample(adjusted): 1981:3 2011:4
Included observations: 122 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(M2(-1))	-2.750838	0.387755	-7.094274	0.0000
D(M2(-1),2)	1.049986	0.339713	3.090803	0.0025
D(M2(-2),2)	0.577577	0.267421	2.159805	0.0329
D(M2(-3),2)	0.274004	0.182268	1.503305	0.1355
D(M2(-4),2)	0.091169	0.092969	0.980640	0.3288
C	0.116627	0.052894	2.204934	0.0294
@TREND(1980:1)	0.000506	0.000679	0.745094	0.4577

R-squared	0.773647	Mean dependent var	-0.000129
Adjusted R-squared	0.761837	S.D. dependent var	0.536507
S.E. of regression	0.261826	Akaike info criterion	0.213393
Sum squared resid	7.883587	Schwarz criterion	0.374280
Log likelihood	-6.016979	F-statistic	65.50920
Durbin-Watson stat	2.004705	Prob(F-statistic)	0.000000

MP at levels

ADF Test Statistic	-0.797949	1% Critical Value*	-4.0348
		5% Critical Value	-3.4466
		10% Critical Value	-3.1481

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(MP)
Method: Least Squares
Date: 06/09/13 Time: 05:39
Sample(adjusted): 1981:2 2011:4
Included observations: 123 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MP(-1)	-0.020716	0.025962	-0.797949	0.4265
D(MP(-1))	0.241882	0.087556	2.762594	0.0067
D(MP(-2))	0.185684	0.092714	2.002770	0.0475
D(MP(-3))	0.019252	0.093668	0.205531	0.8375
D(MP(-4))	-0.377306	0.091642	-4.117157	0.0001
C	0.047590	0.036648	1.298548	0.1967
@TREND(1980:1)	0.001044	0.001696	0.615663	0.5393

R-squared	0.243761	Mean dependent var	0.046491
Adjusted R-squared	0.204646	S.D. dependent var	0.173560
S.E. of regression	0.154785	Akaike info criterion	-0.838329
Sum squared resid	2.779182	Schwarz criterion	-0.678286
Log likelihood	58.55726	F-statistic	6.231791
Durbin-Watson stat	1.836735	Prob(F-statistic)	0.000011

MP at first difference

ADF Test Statistic	-5.507921	1% Critical Value*	-4.0355
		5% Critical Value	-3.4469
		10% Critical Value	-3.1482

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(MP,2)
Method: Least Squares
Date: 06/09/13 Time: 05:40
Sample(adjusted): 1981:3 2011:4
Included observations: 122 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MP(-1))	-0.875082	0.158877	-5.507921	0.0000
D(MP(-1),2)	0.158941	0.129449	1.227823	0.2220
D(MP(-2),2)	0.328907	0.120528	2.728871	0.0074
D(MP(-3),2)	0.318142	0.112685	2.823281	0.0056
D(MP(-4),2)	-0.115202	0.098050	-1.174928	0.2425
C	0.054912	0.031564	1.739709	0.0846
@TREND(1980:1)	-0.000228	0.000400	-0.569597	0.5701

R-squared	0.461809	Mean dependent var	-0.002557
Adjusted R-squared	0.433730	S.D. dependent var	0.205818
S.E. of regression	0.154880	Akaike info criterion	-0.836665
Sum squared resid	2.758605	Schwarz criterion	-0.675778
Log likelihood	58.03656	F-statistic	16.44649
Durbin-Watson stat	1.930934	Prob(F-statistic)	0.000000

TAR at levels

ADF Test Statistic	-2.698443	1% Critical Value*	-3.4843
		5% Critical Value	-2.8849
		10% Critical Value	-2.5791

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(TAR)
Method: Least Squares
Date: 06/09/13 Time: 05:42
Sample(adjusted): 1981:2 2011:4
Included observations: 123 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TAR(-1)	-0.167718	0.062154	-2.698443	0.0080
D(TAR(-1))	-0.000394	0.093442	-0.004216	0.9966
D(TAR(-2))	0.067933	0.093082	0.729816	0.4670
D(TAR(-3))	0.069135	0.092925	0.743993	0.4584
D(TAR(-4))	-0.175661	0.091639	-1.916883	0.0577
C	0.491361	0.186680	2.632096	0.0096

R-squared	0.127416	Mean dependent var	-0.003797
Adjusted R-squared	0.090126	S.D. dependent var	0.352144

S.E. of regression	0.335901	Akaike info criterion	0.703547
Sum squared resid	13.20101	Schwarz criterion	0.840727
Log likelihood	-37.26816	F-statistic	3.416900
Durbin-Watson stat	2.022910	Prob(F-statistic)	0.006435

TAR at first difference

ADF Test Statistic	-6.748698	1% Critical Value*	-3.4847
		5% Critical Value	-2.8851
		10% Critical Value	-2.5792

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(TAR,2)
Method: Least Squares
Date: 06/09/13 Time: 05:44
Sample(adjusted): 1981:3 2011:4
Included observations: 122 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(TAR(-1))	-1.557848	0.230837	-6.748698	0.0000
D(TAR(-1),2)	0.432312	0.195599	2.210200	0.0291
D(TAR(-2),2)	0.410551	0.167650	2.448851	0.0158
D(TAR(-3),2)	0.391154	0.134814	2.901444	0.0044
D(TAR(-4),2)	0.125001	0.092275	1.354663	0.1782
C	-0.006595	0.031253	-0.211006	0.8333

R-squared	0.583095	Mean dependent var	0.000490
Adjusted R-squared	0.565125	S.D. dependent var	0.523108
S.E. of regression	0.344964	Akaike info criterion	0.757176
Sum squared resid	13.80402	Schwarz criterion	0.895079
Log likelihood	-40.18775	F-statistic	32.44817
Durbin-Watson stat	2.028467	Prob(F-statistic)	0.000000

WHP at levels

ADF Test Statistic	-0.681379	1% Critical Value*	-3.4843
		5% Critical Value	-2.8849
		10% Critical Value	-2.5791

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(WHP)
Method: Least Squares
Date: 06/09/13 Time: 05:46
Sample(adjusted): 1981:2 2011:4
Included observations: 123 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
WHP(-1)	-0.018056	0.026499	-0.681379	0.4970
D(WHP(-1))	-0.127031	0.050212	-2.529866	0.0127
D(WHP(-2))	-0.162225	0.050434	-3.216608	0.0017
D(WHP(-3))	-0.027777	0.050610	-0.548841	0.5842

D(WHP(-4))	0.246029	0.050200	4.900941	0.0000
C	0.124655	0.163422	0.762778	0.4471

R-squared	0.306456	Mean dependent var	0.010996
Adjusted R-squared	0.276818	S.D. dependent var	0.143584
S.E. of regression	0.122104	Akaike info criterion	-1.320332
Sum squared resid	1.744407	Schwarz criterion	-1.183152
Log likelihood	87.20041	F-statistic	10.33976
Durbin-Watson stat	2.121095	Prob(F-statistic)	0.000000

WHP at first difference

ADF Test Statistic	-7.658842	1% Critical Value*	-3.4847
		5% Critical Value	-2.8851
		10% Critical Value	-2.5792

*MacKinnon critical values for rejection of hypothesis of a unit root.

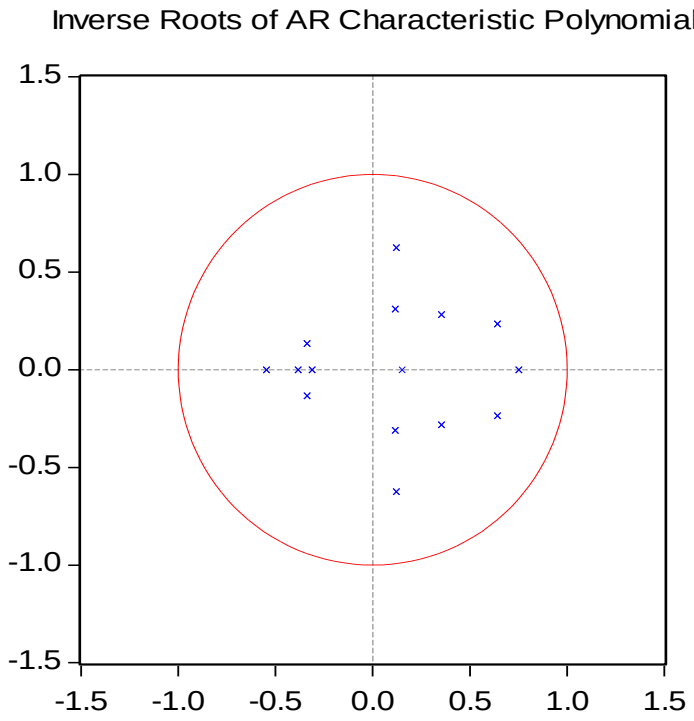
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(WHP,2)
Method: Least Squares
Date: 06/09/13 Time: 05:47
Sample(adjusted): 1981:3 2011:4
Included observations: 122 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(WHP(-1))	-1.215812	0.158746	-7.658842	0.0000
D(WHP(-1),2)	0.010065	0.124810	0.080642	0.9359
D(WHP(-2),2)	-0.168728	0.102105	-1.652499	0.1011
D(WHP(-3),2)	-0.216208	0.079535	-2.718408	0.0076
D(WHP(-4),2)	0.026545	0.054868	0.483793	0.6294
C	0.015510	0.011603	1.336711	0.1839

R-squared	0.701657	Mean dependent var	0.001592
Adjusted R-squared	0.688797	S.D. dependent var	0.218165
S.E. of regression	0.121704	Akaike info criterion	-1.326513
Sum squared resid	1.718188	Schwarz criterion	-1.188610
Log likelihood	86.91728	F-statistic	54.56286
Durbin-Watson stat	2.050505	Prob(F-statistic)	0.000000

df is degrees of freedom for (approximate) chi-square distribution

Appendix B



Appendix C: COINTEGRATION TEST

Lag Order Selection Criteria for the Cointegration Test
Endogenous variables: MP EXPP EXR M2 TAR WHP
Exogenous variables: C
Date: 02/14/14 Time: 08:32
Sample: 1980Q1 2009Q4
Included observations: 112

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-432.9838	NA	0.000102	7.838997	7.984631	7.898085
1	504.8374	1758.415	1.04e-11	-8.264954	-7.245517*	-7.851336
2	576.8879	127.3750	5.48e-12	-8.908713	-7.015473	-8.140565
3	603.5926	44.34877	6.56e-12	-8.742724	-5.975681	-7.620047
4	626.2660	35.22475	8.54e-12	-8.504749	-4.863903	-7.027542
5	734.0543	155.9081	2.47e-12	-9.786684	-5.272034	-7.954947
6	857.7767	165.6997*	5.52e-13*	-11.35316*	-5.964703	-9.166889*
7	874.6158	20.74815	8.53e-13	-11.01100	-4.748741	-8.470200
8	895.9341	23.98304	1.26e-12	-10.74882	-3.612763	-7.853497

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

COINTEGRATION TEST WITH LAG ONE:

Date: 02/14/14 Time: 08:37
Sample (adjusted): 1980Q3 2009Q4
Included observations: 118 after adjustments
Trend assumption: Linear deterministic trend
Series: MP EXPP EXR M2 TAR WHP
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.298941	111.3213	95.75366	0.0028
At most 1	0.208419	69.41211	69.81889	0.0538
At most 2	0.166612	41.83281	47.85613	0.1634
At most 3	0.112775	20.32663	29.79707	0.4009
At most 4	0.049831	6.207077	15.49471	0.6711
At most 5	0.001486	0.175443	3.841466	0.6753

Trace test indicates 1 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.298941	41.90921	40.07757	0.0308
At most 1	0.208419	27.57930	33.87687	0.2336
At most 2	0.166612	21.50618	27.58434	0.2468
At most 3	0.112775	14.11955	21.13162	0.3553
At most 4	0.049831	6.031633	14.26460	0.6091
At most 5	0.001486	0.175443	3.841466	0.6753

Max-eigenvalue test indicates 1 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

MP	EXPP	EXR	M2	TAR	WHP
0.952597	-1.112496	0.329866	-0.567457	-0.146690	3.282348
1.460653	-2.165762	1.059025	-0.246365	-2.385229	-0.841990
-2.299176	3.249755	0.089903	-1.511146	-0.693813	0.544188
1.316736	0.340352	-1.768244	-0.519615	-0.508069	0.661947
2.335387	-1.207793	0.696682	-1.453841	-0.436099	-0.611371
-1.096704	0.294540	-0.449910	1.739825	0.026482	-0.170125

Unrestricted Adjustment Coefficients (alpha):

D(MP)	-0.003285	0.021771	0.005553	-0.045625	-0.012567	-0.000419
D(EXPP)	0.007755	0.009183	-0.020437	-0.049929	-0.006215	-0.001169
D(EXR)	0.009932	0.006585	-0.016817	0.004792	-0.008486	-0.003810
D(M2)	0.003062	0.002951	0.004609	-0.003856	0.004469	-0.000272
D(TAR)	0.053078	0.141007	-0.022338	0.003329	-0.007486	0.003423
D(WHP)	-0.111310	0.024709	-0.021723	-0.001681	0.012945	-0.000520

1 Cointegrating Equation(s): Log likelihood 532.1888

Normalized cointegrating coefficients (standard error in parentheses)

MP	EXPP	EXR	M2	TAR	WHP
1.000000	-1.167857	0.346281	-0.595695	-0.153990	3.445686
	(0.36797)	(0.34025)	(0.41639)	(0.36921)	(0.54441)

Adjustment coefficients (standard error in parentheses)

D(MP)	-0.003129
	(0.01414)
D(EXPP)	0.007387
	(0.01488)
D(EXR)	0.009462
	(0.01057)
D(M2)	0.002917
	(0.00253)
D(TAR)	0.050562
	(0.03068)
D(WHP)	-0.106034
	(0.01780)

2 Cointegrating Equation(s): Log likelihood 545.9784

Normalized cointegrating coefficients (standard error in parentheses)

MP	EXPP	EXR	M2	TAR	WHP
1.000000	0.000000	-1.058484	-2.179500	5.331486	18.36343
		(1.65053)	(1.66311)	(2.07572)	(3.03753)
0.000000	1.000000	-1.202858	-1.356164	4.697046	12.77361

	(1.21085)	(1.22008)	(1.52278)	(2.22837)	

Adjustment coefficients (standard error in parentheses)

D(MP)	0.028671	-0.043496
	(0.02563)	(0.03578)
D(EXPP)	0.020801	-0.028516
	(0.02720)	(0.03798)
D(EXR)	0.019079	-0.025310
	(0.01933)	(0.02698)
D(M2)	0.007228	-0.009798
	(0.00460)	(0.00642)
D(TAR)	0.256525	-0.364438
	(0.05104)	(0.07126)
D(WHP)	-0.069943	0.070319
	(0.03232)	(0.04512)

3 Cointegrating Equation(s): Log likelihood 556.7315

Normalized cointegrating coefficients (standard error in parentheses)

MP	EXPP	EXR	M2	TAR	WHP
1.000000	0.000000	0.000000	-3.609744	2.829384	19.21134
			(0.71949)	(1.91174)	(2.97044)
0.000000	1.000000	0.000000	-2.981488	1.853666	13.73717
			(0.52073)	(1.38362)	(2.14984)
0.000000	0.000000	1.000000	-1.351219	-2.363854	0.801058
			(0.17417)	(0.46279)	(0.71908)

Adjustment coefficients (standard error in parentheses)

D(MP)	0.015903	-0.025450	0.022472
	(0.04238)	(0.05964)	(0.01634)
D(EXPP)	0.067788	-0.094930	0.010446
	(0.04466)	(0.06285)	(0.01722)
D(EXR)	0.057745	-0.079963	0.008738
	(0.03164)	(0.04453)	(0.01220)
D(M2)	-0.003369	0.005180	0.004550
	(0.00750)	(0.01056)	(0.00289)
D(TAR)	0.307883	-0.437030	0.164831
	(0.08423)	(0.11853)	(0.03248)
D(WHP)	-0.019997	-0.000276	-0.012503
	(0.05314)	(0.07478)	(0.02049)

4 Cointegrating Equation(s): Log likelihood 563.7913

Normalized cointegrating coefficients (standard error in parentheses)

MP	EXPP	EXR	M2	TAR	WHP

1.000000	0.000000	0.000000	0.000000	-8.590221	-16.00726
				(2.07629)	(2.48382)
0.000000	1.000000	0.000000	0.000000	-7.578421	-15.35183
				(1.91096)	(2.28604)
0.000000	0.000000	1.000000	0.000000	-6.638502	-12.38216
				(1.53610)	(1.83760)
0.000000	0.000000	0.000000	1.000000	-3.163550	-9.756537
				(1.02894)	(1.23090)

Adjustment coefficients (standard error in parentheses)

D(MP)	-0.044173	-0.040978	0.103147	0.011816
	(0.04449)	(0.05716)	(0.02931)	(0.02404)
D(EXPP)	0.002045	-0.111923	0.098732	0.050163
	(0.04671)	(0.06001)	(0.03077)	(0.02524)
D(EXR)	0.064055	-0.078332	0.000265	0.015665
	(0.03475)	(0.04465)	(0.02289)	(0.01877)
D(M2)	-0.008446	0.003867	0.011368	-0.007426
	(0.00816)	(0.01049)	(0.00538)	(0.00441)
D(TAR)	0.312267	-0.435897	0.158944	-0.032833
	(0.09258)	(0.11894)	(0.06098)	(0.05002)
D(WHP)	-0.022211	-0.000848	-0.009531	0.090777
	(0.05841)	(0.07504)	(0.03847)	(0.03156)

5 Cointegrating Equation(s): Log likelihood 566.8071

Normalized cointegrating coefficients (standard error in parentheses)

MP	EXPP	EXR	M2	TAR	WHP
1.000000	0.000000	0.000000	0.000000	0.000000	-5.638039
					(0.94394)
0.000000	1.000000	0.000000	0.000000	0.000000	-6.203949
					(0.90663)
0.000000	0.000000	1.000000	0.000000	0.000000	-4.368847
					(0.76825)
0.000000	0.000000	0.000000	1.000000	0.000000	-5.937828
					(0.64790)
0.000000	0.000000	0.000000	0.000000	1.000000	1.207096
					(0.24415)

Adjustment coefficients (standard error in parentheses)

D(MP)	-0.073523	-0.025799	0.094392	0.030087	-0.026638
	(0.05505)	(0.05940)	(0.03078)	(0.03141)	(0.03601)
D(EXPP)	-0.012468	-0.104417	0.094402	0.059199	0.019215
	(0.05796)	(0.06254)	(0.03241)	(0.03307)	(0.03792)
D(EXR)	0.044237	-0.068083	-0.005647	0.028002	-0.004228
	(0.04304)	(0.04644)	(0.02406)	(0.02455)	(0.02816)
D(M2)	0.001990	-0.001530	0.014481	-0.013923	-0.010676

	(0.01000)	(0.01079)	(0.00559)	(0.00570)	(0.00654)
D(TAR)	0.294785	-0.426856	0.153729	-0.021950	-0.327050
	(0.11494)	(0.12402)	(0.06427)	(0.06557)	(0.07519)
D(WHP)	0.008022	-0.016483	-0.000512	0.071956	-0.032327
	(0.07237)	(0.07809)	(0.04047)	(0.04129)	(0.04735)

Appendix D: First Stage Pass-through VAR Results

Vector Autoregression Estimates
Date: 02/16/14 Time: 09:50
Sample (adjusted): 1981Q1 2009Q4
Included observations: 116 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D(MP)	D(EXPP)	D(EXR)	D(M2)	D(WHP)
D(MP(-1))	0.361030	-0.107843	0.067357	0.019343	0.112188
	(0.20334)	(0.21174)	(0.15010)	(0.03561)	(0.27248)
	[1.77550]	[-0.50931]	[0.44875]	[0.54315]	[0.41173]
D(MP(-2))	0.098930	-0.022612	0.056416	0.007664	0.159964
	(0.22348)	(0.23272)	(0.16497)	(0.03914)	(0.29947)
	[0.44268]	[-0.09716]	[0.34198]	[0.19580]	[0.53415]
D(MP(-3))	-0.057916	0.032801	0.048396	-0.000353	0.571945
	(0.19756)	(0.20572)	(0.14583)	(0.03460)	(0.26473)
	[-0.29316]	[0.15944]	[0.33187]	[-0.01021]	[2.16047]
D(EXPP(-1))	-0.042244	0.436275	-0.097454	-0.019509	-0.022511
	(0.20130)	(0.20962)	(0.14859)	(0.03526)	(0.26975)
	[-0.20986]	[2.08126]	[-0.65584]	[-0.55335]	[-0.08345]
D(EXPP(-2))	-0.026008	0.087327	-0.077820	-0.003935	-0.178396
	(0.22418)	(0.23345)	(0.16548)	(0.03926)	(0.30041)
	[-0.11601]	[0.37408]	[-0.47026]	[-0.10022]	[-0.59385]
D(EXPP(-3))	-0.034277	-0.119350	-0.093334	0.000234	-0.519673
	(0.19726)	(0.20542)	(0.14561)	(0.03455)	(0.26434)
	[-0.17376]	[-0.58101]	[-0.64097]	[0.00677]	[-1.96593]
D(EXR(-1))	-0.024200	-0.006568	0.363602	0.011775	-0.047242
	(0.14714)	(0.15322)	(0.10861)	(0.02577)	(0.19717)
	[-0.16448]	[-0.04287]	[3.34774]	[0.45693]	[-0.23961]
D(EXR(-2))	0.013246	0.047328	0.117917	0.013397	-0.065635
	(0.15580)	(0.16224)	(0.11501)	(0.02729)	(0.20878)
	[0.08502]	[0.29171]	[1.02529]	[0.49097]	[-0.31437]

D(EXR(-3))	0.059968	0.096480	0.008883	0.026838	0.120499
	(0.14532)	(0.15133)	(0.10727)	(0.02545)	(0.19473)
	[0.41266]	[0.63757]	[0.08281]	[1.05447]	[0.61880]
D(M2(-1))	0.172016	0.007285	-0.015597	0.552341	-0.736198
	(0.59495)	(0.61954)	(0.43918)	(0.10420)	(0.79725)
	[0.28913]	[0.01176]	[-0.03551]	[5.30068]	[-0.92342]
D(M2(-2))	-0.002563	-0.062257	-0.065526	0.164074	-0.108652
	(0.67356)	(0.70141)	(0.49720)	(0.11797)	(0.90260)
	[-0.00380]	[-0.08876]	[-0.13179]	[1.39080]	[-0.12038]
D(M2(-3))	-0.082405	-0.112452	-0.072489	-0.040647	-0.492969
	(0.58835)	(0.61266)	(0.43430)	(0.10304)	(0.78840)
	[-0.14006]	[-0.18355]	[-0.16691]	[-0.39446]	[-0.62528]
D(WHP(-1))	-0.045816	-0.065468	-0.024939	-0.008643	-0.263045
	(0.07147)	(0.07443)	(0.05276)	(0.01252)	(0.09577)
	[-0.64103]	[-0.87964]	[-0.47270]	[-0.69043]	[-2.74651]
D(WHP(-2))	-0.045365	-0.061540	-0.021656	-0.009332	-0.289126
	(0.07062)	(0.07354)	(0.05213)	(0.01237)	(0.09464)
	[-0.64234]	[-0.83678]	[-0.41540]	[-0.75442]	[-3.05506]
D(WHP(-3))	0.000432	-0.006909	0.013869	-0.004458	-0.194802
	(0.07003)	(0.07292)	(0.05169)	(0.01226)	(0.09384)
	[0.00617]	[-0.09474]	[0.26831]	[-0.36350]	[-2.07599]
C	0.030179	0.044195	0.040383	0.016284	0.112590
	(0.03475)	(0.03619)	(0.02565)	(0.00609)	(0.04657)
	[0.86837]	[1.22119]	[1.57414]	[2.67535]	[2.41763]
R-squared	0.135656	0.176556	0.206181	0.463291	0.190381
Adj. R-squared	0.006004	0.053040	0.087108	0.382785	0.068938
Sum sq. resids	2.858786	3.099998	1.557734	0.087694	5.133456
S.E. equation	0.169079	0.176068	0.124809	0.029613	0.226571
F-statistic	1.046311	1.429415	1.731554	5.754722	1.567655
Log likelihood	50.18833	45.49007	85.40391	252.2778	16.23618
Akaike AIC	-0.589454	-0.508450	-1.196619	-4.073755	-0.004072
Schwarz SC	-0.209648	-0.128644	-0.816814	-3.693949	0.375734
Mean dependent	0.050440	0.055231	0.049038	0.056657	0.025561
S.D. dependent	0.169589	0.180932	0.130628	0.037693	0.234809

Determinant resid covariance (dof adj.)	1.27E-10
Determinant resid covariance	6.04E-11
Log likelihood	541.7757

Akaike information criterion	-7.961650
Schwarz criterion	-6.062622

Appendix E: Second Stage Pass-through VAR Results

Vector Autoregression Estimates
Date: 02/16/14 Time: 10:55
Sample (adjusted): 1981Q1 2009Q4
Included observations: 116 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D(CPI)	D(MP)	D(EXPP)	D(EXR)	D(M2)	D(WHP)
D(CPI(-1))	0.631014	0.123412	0.226896	0.012992	0.024133	0.153506
	(0.10754)	(0.70663)	(0.73005)	(0.52238)	(0.12379)	(0.94778)
	[5.86762]	[0.17465]	[0.31079]	[0.02487]	[0.19495]	[0.16196]
D(CPI(-2))	0.196205	0.010474	0.105986	-0.012051	-0.007585	-0.238023
	(0.12578)	(0.82646)	(0.85386)	(0.61097)	(0.14478)	(1.10851)
	[1.55992]	[0.01267]	[0.12413]	[-0.01972]	[-0.05239]	[-0.21472]
D(CPI(-3))	-0.014111	0.138479	0.319117	-0.080549	-0.048809	0.283523
	(0.10694)	(0.70270)	(0.72599)	(0.51947)	(0.12310)	(0.94250)
	[-0.13195]	[0.19707]	[0.43956]	[-0.15506]	[-0.39650]	[0.30082]
D(MP(-1))	-0.004976	0.367362	-0.086572	0.061010	0.015041	0.111583
	(0.03278)	(0.21541)	(0.22255)	(0.15924)	(0.03774)	(0.28892)
	[-0.15177]	[1.70540]	[-0.38900]	[0.38312]	[0.39857]	[0.38620]
D(MP(-2))	0.007990	0.099956	-0.025460	0.055645	0.007104	0.180520
	(0.03577)	(0.23504)	(0.24283)	(0.17376)	(0.04118)	(0.31525)
	[0.22336]	[0.42527]	[-0.10484]	[0.32024]	[0.17253]	[0.57262]
D(MP(-3))	0.013165	-0.079637	-0.017533	0.056504	0.003655	0.544237
	(0.03146)	(0.20672)	(0.21357)	(0.15282)	(0.03621)	(0.27727)
	[0.41846]	[-0.38524]	[-0.08209]	[0.36974]	[0.10091]	[1.96285]
D(EXPP(-1))	-0.000211	-0.060327	0.389742	-0.089658	-0.015382	-0.033380
	(0.03182)	(0.20908)	(0.21601)	(0.15456)	(0.03663)	(0.28043)
	[-0.00663]	[-0.28854]	[1.80429]	[-0.58008]	[-0.41995]	[-0.11903]
D(EXPP(-2))	-0.006558	-0.031399	0.076645	-0.075619	-0.002768	-0.192133
	(0.03491)	(0.22936)	(0.23696)	(0.16955)	(0.04018)	(0.30763)
	[-0.18789]	[-0.13690]	[0.32346]	[-0.44599]	[-0.06889]	[-0.62457]
D(EXPP(-3))	-0.014452	-0.023127	-0.093773	-0.096898	-0.001344	-0.506647
	(0.03063)	(0.20125)	(0.20792)	(0.14878)	(0.03526)	(0.26993)

	[-0.47186]	[-0.11492]	[-0.45100]	[-0.65129]	[-0.03813]	[-1.87693]
D(EXR(-1))	0.001635	-0.014858	0.015917	0.360560	0.010419	-0.039745
	(0.02283)	(0.14998)	(0.15495)	(0.11087)	(0.02627)	(0.20116)
	[0.07163]	[-0.09907]	[0.10273]	[3.25202]	[0.39656]	[-0.19758]
D(EXR(-2))	0.003626	0.017093	0.057210	0.116191	0.012465	-0.063036
	(0.02408)	(0.15822)	(0.16347)	(0.11697)	(0.02772)	(0.21222)
	[0.15059]	[0.10803]	[0.34998]	[0.99337]	[0.44972]	[-0.29704]
D(EXR(-3))	0.011100	0.059674	0.096219	0.008015	0.026109	0.122101
	(0.02249)	(0.14777)	(0.15267)	(0.10924)	(0.02589)	(0.19820)
	[0.49357]	[0.40383]	[0.63026]	[0.07337]	[1.00859]	[0.61606]
D(M2(-1))	0.056721	0.214530	0.102379	-0.024800	0.549826	-0.693523
	(0.09280)	(0.60979)	(0.63000)	(0.45079)	(0.10682)	(0.81789)
	[0.61119]	[0.35181]	[0.16251]	[-0.05501]	[5.14699]	[-0.84794]
D(M2(-2))	0.037260	-0.010594	-0.070255	-0.066449	0.162515	-0.141548
	(0.10508)	(0.69048)	(0.71336)	(0.51044)	(0.12096)	(0.92611)
	[0.35458]	[-0.01534]	[-0.09848]	[-0.13018]	[1.34354]	[-0.15284]
D(M2(-3))	0.070107	-0.123407	-0.211073	-0.067981	-0.041815	-0.495212
	(0.09313)	(0.61192)	(0.63220)	(0.45237)	(0.10720)	(0.82074)
	[0.75281]	[-0.20167]	[-0.33387]	[-0.15028]	[-0.39008]	[-0.60337]
D(WHP(-1))	-0.001771	-0.045824	-0.066102	-0.024674	-0.008438	-0.261862
	(0.01106)	(0.07265)	(0.07506)	(0.05371)	(0.01273)	(0.09744)
	[-0.16017]	[-0.63078]	[-0.88071]	[-0.45944]	[-0.66299]	[-2.68745]
D(WHP(-2))	-0.002614	-0.045998	-0.063086	-0.021156	-0.009004	-0.290583
	(0.01091)	(0.07172)	(0.07410)	(0.05302)	(0.01256)	(0.09619)
	[-0.23944]	[-0.64137]	[-0.85140]	[-0.39903]	[-0.71665]	[-3.02078]
D(WHP(-3))	0.004029	0.000978	-0.005851	0.013831	-0.004428	-0.193971
	(0.01081)	(0.07101)	(0.07336)	(0.05249)	(0.01244)	(0.09524)
	[0.37285]	[0.01378]	[-0.07975]	[0.26347]	[-0.35594]	[-2.03659]
C	-0.001496	0.018797	0.016655	0.044243	0.018059	0.103413
	(0.00616)	(0.04051)	(0.04185)	(0.02994)	(0.00710)	(0.05433)
	[-0.24261]	[0.46406]	[0.39800]	[1.47753]	[2.54503]	[1.90347]
R-squared	0.660719	0.138820	0.192422	0.206749	0.465012	0.191857
Adj. R-squared	0.597759	-0.020987	0.042562	0.059547	0.365736	0.041892
Sum sq. resids	0.065972	2.848322	3.040269	1.556620	0.087413	5.124098
S.E. equation	0.026079	0.171360	0.177039	0.126679	0.030019	0.229839
F-statistic	10.49436	0.868673	1.284013	1.404531	4.684028	1.279344

Log likelihood	268.7861	50.40102	46.61849	85.44541	252.4640	16.34201
Akaike AIC	-4.306657	-0.541397	-0.476181	-1.145610	-4.025242	0.045827
Schwarz SC	-3.855638	-0.090378	-0.025162	-0.694591	-3.574223	0.496847
Mean dependent	0.045861	0.050440	0.055231	0.049038	0.056657	0.025561
S.D. dependent	0.041120	0.169589	0.180932	0.130628	0.037693	0.234809

Determinant resid covariance (dof adj.)	8.35E-14
Determinant resid covariance	2.85E-14
Log likelihood	821.3013
Akaike information criterion	-12.19485
Schwarz criterion	-9.488736

VAR Residual Portmanteau Tests for Autocorrelations
H0: no residual autocorrelations up to lag h
Date: 02/16/14 Time: 09:23
Sample: 1980Q1 2009Q4
Included observations: 118

Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	Df
1	5.980690	NA*	6.031807	NA*	NA*
2	22.91833	0.9555	23.26148	0.9501	36
3	60.62357	0.8281	61.95033	0.7949	72
4	205.8529	0.0000	212.2754	0.0000	108

*The test is valid only for lags larger than the VAR lag order.

Appendix F: Variance Decomposition Results

Variance Decomposition of MP:

Period	S.E.	MP	EXPP	EXR	M2	WHP
1	0.145208	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.232074	98.56137	0.005649	0.000197	0.186545	1.246239
3	0.301617	96.79422	0.004463	0.000712	0.395442	2.805168
4	0.357116	95.72844	0.003240	0.021328	0.598959	3.648032
5	0.374672	94.20969	0.046835	0.309210	0.550683	4.883580
6	0.385182	92.44008	0.091096	1.227716	0.580973	5.660139
7	0.393718	89.63320	0.233369	3.275391	0.802787	6.055252
8	0.404442	85.29505	0.691508	6.591311	1.337406	6.084725
9	0.418185	81.37623	1.212992	10.05371	1.488730	5.868332
10	0.435215	76.79892	2.311189	13.77242	1.493291	5.624179

Variance Decomposition of EXPP:

Period	S.E.	MP	EXPP	EXR	M2	WHP
1	0.159974	78.13084	21.86916	0.000000	0.000000	0.000000
2	0.261167	77.10112	22.30825	0.022581	0.111217	0.456837
3	0.341574	75.67232	23.18550	0.127096	0.235762	0.779321
4	0.404116	74.52170	23.99718	0.350081	0.361786	0.769260
5	0.431895	72.17307	25.10911	1.471143	0.483976	0.762697
6	0.452595	69.31336	25.37000	3.522950	1.065610	0.728074
7	0.469845	65.75409	24.95984	6.534793	2.070405	0.680878
8	0.487687	61.48398	24.04457	10.40785	3.431181	0.632423
9	0.500095	58.98151	23.22971	13.49535	3.691241	0.602190
10	0.511272	56.61495	22.53437	16.58860	3.677546	0.584529

Variance Decomposition of EXR:

Period	S.E.	MP	EXPP	EXR	M2	WHP
1	0.121153	8.61E-05	24.17737	75.82254	0.000000	0.000000
2	0.207263	0.005602	17.65127	82.28784	0.046537	0.008755
3	0.287096	0.007357	13.60780	86.26005	0.101389	0.023406
4	0.361671	0.049722	10.84367	88.91679	0.156177	0.033637
5	0.409465	0.497750	8.977793	90.11227	0.318304	0.093881
6	0.450505	0.891628	7.653626	90.79924	0.449870	0.205641
7	0.484981	1.288471	6.680862	91.23287	0.548003	0.249792
8	0.513144	1.621512	6.012666	91.45493	0.633045	0.277842
9	0.540020	1.577851	5.527921	91.97403	0.630306	0.289890
10	0.563309	1.546668	5.270457	92.26490	0.611342	0.306630

Variance Decomposition of M2:

Period	S.E.	MP	EXPP	EXR	M2	WHP
1	0.023680	1.230495	0.165571	0.493098	98.11084	0.000000
2	0.044828	1.247543	0.181966	0.332948	98.23752	2.52E-05
3	0.066968	1.342389	0.197748	0.187859	98.27124	0.000765
4	0.089738	1.499295	0.197904	0.106929	98.19188	0.003988
5	0.105909	1.671936	0.418521	1.096767	96.79484	0.017940
6	0.120689	1.744549	0.705031	3.402346	94.05949	0.088580
7	0.134538	1.745158	1.179806	6.910863	89.94377	0.220398
8	0.147738	1.704902	1.933873	11.23840	84.71862	0.404212
9	0.160088	1.719809	2.216338	14.15229	81.31362	0.597939
10	0.171848	1.856285	2.845879	16.34924	78.20757	0.741021

Variance Decom

position of WHP:

Period	S.E.	MP	EXPP	EXR	M2	WHP
1	0.117894	0.312227	0.078384	1.987423	0.102221	97.51974
2	0.136123	1.788818	1.549111	1.516700	0.205600	94.93977
3	0.138897	1.884217	2.352751	1.456756	0.788605	93.51767
4	0.141196	2.596914	2.427333	1.416668	1.973174	91.58591
5	0.149193	2.489048	3.073092	2.221776	1.886530	90.32955
6	0.151246	3.012476	3.961551	2.224933	1.872848	88.92819
7	0.152388	3.080334	4.823179	2.254800	2.128871	87.71282
8	0.153378	3.042111	5.590578	2.251674	2.529434	86.58620
9	0.154429	3.006161	5.710902	2.221166	2.960539	86.10123
10	0.155398	3.069192	6.231033	2.224540	3.379387	85.09585

Cholek Orderin: MPEXPP,EXR, M2,WHP

Appendix G: DATA OF EXCHANGE RATE, DOMESTIC PRICES, AND IMPORT PRICES IN NIGERIA

	EXR	CPI	MP
1985	0.893774	555.125	6.262
1986	1.754523	303.104	7.791
1987	4.016037	96.6	16.457
1988	4.536967	97.0935	18.43
1989	7.364735	86.5	37.49
1990	8.038285	79.8186	49.7949
1991	9.909492	69.2424	76.2639
1992	17.29843	57.4406	130.65
1993	22.0654	62.9339	173.661
1994	35.48194	116.628	170.187
1995	65.09269	98.9	482.183
1996	86.89102	121.663	712.423
1997	86.53464	138.685	1019.8
1998	80.42102	157.745	1027.47
1999	92.3381	79.5	727.927
2000	101.6973	80.5	926.964
2001	111.2313	89.4	1785.34
2002	120.5782	89.3018	1954.41
2003	129.2224	86.4643	3097.61
2004	132.888	86.6534	4150.17
2005	131.2743	100	2482.74

Source: CBN Statistical Bulletin