UNIVERSITY OF CAPE COAST

EFFECT OF EXCHANGE RATE PASS THROUGH ON DOMESTIC PRICE

LEVELS IN GHANA

DOUGLAS ATIAH ANYOKA

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LEVELS IN GHANA

BY

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degree in Finance

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DECLARATION

Candidate's Declaration

I hereby declare that this dissertation is the result of my own original research work

and that no part of it has been presented for another degree in this university or

elsewhere.

Candidate Signature ………………….. Date: …………………………..

Name: ……………………………………………………………………..

Supervisors' Declaration

I hereby declare that the preparation and presentation of the dissertation were

supervised in accordance with the guidelines on supervision of dissertation laid

down by the University of Cape Coast.

Supervisor's Signature ………………….. Date: …………………………..

Name: ……………………………………………………………………..

ABSTRACT

The main purpose of this study was to examine the effect of exchange rate (Cedi to the Dollar) movement on the prices of domestic goods and services in Ghana using time series over the period 2005 to 2015. The quest to conduct this study was to enable an estimation of the rate of any pass-through, and its proportionality to inflation levels in Ghana using exchange rate, interest rates, and monetary policy rate. The study was to establish the effect of exchange rate, interest rates and monetary policy rates on domestic price levels. The study employed a causal research design. The data set for all variables were sourced from World Bank-World Development Indicators Database (Online Edition). Vector Auto Regressive (VAR) model was used in estimating the significant positive effects of the independent variables (exchange rates, interest rate and monetary policy rate) on the dependent variable (inflation rate). The study revealed that there was a statistically significant positive effect of exchange rate, interest rate, and monetary policy rate on domestic price levels. In conclusion, when the cedi depreciates against the dollar, inflation hikes will be experienced. It is recommended that Bank of Ghana ensure a stable exchange rate in order to reduce its potential effect on inflation in Ghana.

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DEDICATION

To my children; Wilson, Newton and Stephanie

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LIST OF ACRONYMS

ADF	Augmented Dickey-Fuller
CPI	Consumer Price Index
ERPT	Exchange Rate Pass-Through
FINSAP	Financial Sector Adjustment Program
GDP	Gross Domestic Product
IMF	International Monetary Fund
LCP	Local Currency Pricing
LCU	Local Currency Units
NEER	Nominal Effective Exchange Rate
OECD	Organisation for Economic Co-operation and Development
PCP	Producer Currency Pricing
PP	Phillip-Perron
PPI	Producer Price Index
PPP	Purchasing Power Parity
PTM	Pricing-To-Market
REER	Real Effective Exchange Rate
SBC	Schwarz Bayesian Criterion
SSA	Sub-Saharan Africa
USD	United States Dollars

CHAPTER ONE

INTRODUCTION

Inflation is a measure of price level changes of a basket of goods and services over a period of time, usually a month. The level of inflation affects the cost of living of the people in an economy. High inflation also increases the opportunity cost of holding money, as the time value of money deteriorates. Again, investors are less motivated as the estimation of real value and yield in investments could be elusive. Thus, high inflation could potentially erode economic gains, and eventually dislocate an economy from its growth path. Several factors influence the level of inflation in an economy. These factors may be demand-pull or cost-push. The effect of exchange rate fluctuation on inflation could be described as a cost-push factor in nominal terms. In that, the changes in exchange rate of a major trading currency is transmitted to the pricing of imported goods and services.

Background of the Study

Ghana's major international trading currency is the US Dollar. Being a hugely import dependent, and a beneficiary of Foreign Aid (FA) and Foreign Direct Investment (FDI), it is not surprising that any fluctuation in the exchange rate of the Dollar against the Cedi would have dire consequences for Ghana's economy. The key question to ask therefore, is what role does changes in your major currency, such as the dollar play in determining the behavior of domestic prices of goods and services. This question has implications for international

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transmission mechanism and, the design of optimal monetary policy in an open economy (Ehsan & Dalia, 2012).

The primary objective of most central banks is to attain and maintain low and stable domestic price inflation. Perhaps that is the reason why there continue to be a growing interest in understanding the mechanisms and the real macro-economic variables that actually affect domestic price inflation. From monetary policy perspective, one such key determinant of price inflation is the exchange rate of a local currency against the currency of a major foreign trading partner. In an open economy such as Ghana, which is also hugely import dependent, the effects of exchange rate changes on domestic prices of consumer goods and services is a major concern for government, the business community and individuals (Berga, 2012).

Since the liberalization of the foreign exchange market in the mid-1980s (as a component of the broad structural adjustment and economic reforms programmes), the rate at which a unit of Ghana's currency (the cedi) exchanges for the US dollar and currencies of her other major trading partners such as the Euro and the UK Pound has seen substantial swings. On the average, the cedi has depreciated against the US dollar since the adoption of managed floating exchange rate regime in 1986 (Mann, 1986). For instance, during the first quarter of 1986, about 0.01 cedi could exchange for a dollar; however, by the end of April 2015, the rate had risen to about 3.84, representing a depreciation of (98.7%) over the period. Inflation rate (consumer prices) in Ghana on the other hand, has generally had a downwards trend since 1967. Inflation; consumer

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prices (annual %) in Ghana was last measured at 17.15 in 2015 (World Bank, 2016).

An important challenge to economic policy makers is how much of exchange rate depreciation is translated into domestic inflation and economic activity. Exchange Rate Pass-Through (ERPT) is the process by which exchange rate depreciation is translated into domestic prices of goods and services. The Central Bank of Ghana has a duty to ensure that the amount of exchange rate changes that is translated onto domestic prices does not lead to distortions in the general price levels. For this reason, where there are occasional misalignments of the nominal exchange rate, there is often a reluctance to allow the exchange rate to adjust for fear that the pass-through could create domestic disruptions and will offset expected international competitiveness gains (Razafimahefa, 2012).

A large price increase of imported goods from exchange rate depreciation can easily spill over to other sectors of the economy, raise the overall domestic production costs, and might lead to an inflationary spiral. In such a situation, the potential for a rise in production costs and ultimately the prices of export products are obvious. The effect of this is to weaken international competitiveness of exported goods and services. It is therefore, essentially important to understand the impact of exchange rate movements and the speed with which such impacts are exerted on domestic prices in order to be able to formulate appropriate policy to counteract the effects of exchange rate movements. When a country's local currency depreciates against a major trading currency, a number of things can happen. The importing firm may manage to

pass on the entire depreciation onto domestic prices of goods and services, or may pass on a portion onto the domestic market, or may not be able to pass on anything at all to the domestic market. Where the importing firm is able to pass on a portion of exchange rate depreciation onto the prices of domestic market, the proportion (degree) of pass-through often depends upon a number of factors, including the level of competition, government monetary policy, the level of development of the economy and elasticity of the good or service among others.

Statement of the Problem

Over the past two decades, a large economic literature on exchange rate pass-through has emerged, all in an attempt to investigate the real factors that determine the levels of exchange rate pass-through onto domestic prices of goods and services (Ca'Zorzi et al, 2007; Choudhri & Hakura, 2012; Gopinath & Itskhoki, 2008; Mihaljek & Klau, 2001; Mihaljek, & Klau, 2008; McCharty, 2006; Gagnon & Ihrig, 2004; Billmeier & Bonato, 2002).

Ca'Zorzi et al. (2007) examined the degree of ERPT to domestic prices in 12 emerging markets in Asia, Latin America, and Central and Eastern Europe and found a significant correlation between ERPT and domestic prices, although the levels of pass-through was said to be generally lower for countries with lower inflation rates than those with higher inflation. Choudhri and Hakura (2012) also examined the pass-through relationship between exchange rate depreciation and inflationary levels among 71 countries using a database from 1979 to 2000 and found strong evidence of positive and significant association between the pass-through rates and the average inflation rate across countries. Choudhri and

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Hakura (2012), Gopinath and Itskhoki (2008), Mihaljek and Klau (2001), McCharty (2006), Gagnon and Ihrig (2004), and Billmeier and Bonato Billmeier (2002) in separate reports all found empirical evidence of a significant positive relationship between exchange rate and inflation.

In some other developments, Mihaljek and Klau (2008) in a paper titled "Exchange rate pass-through in emerging market economies: what has changed and why?" concludes that although the pass-through was significant, it was actually declining. Indicating that the pass-through rate was not proportionate to the levels of fluctuation. They attribute the decline to improvements in macroeconomic performance, intense international and domestic competition, and changes in monetary policy frameworks. Gagnon and Ihrig (2004) also found a similar relationship, but attributed the decline to increased emphasis on inflation stabilization. Siaw and Anokye (2010) examined the effect of exchange rate changes on consumer prices in Ghana between 1990 and 2009 and found an incomplete pass-through. The empirical results also show that the pass-through rate was actually declining, in consonance with the findings of Mihaljek and Klau (2008) and Gagnon and Ihrig (2004) although the reasons for the decline were not articulated.

It does appear therefore that, the level of pass-through is higher for emerging economies than developed ones obviously due to the fact that the inflation levels in developing economies are generally higher than those in developed economies (Dalia, 2012). In Ghana, there have been arguments that exchange rate depreciation is a major source of inflationary spiral. Bawumia and

Abradu-Otoo (2003), Atta-Mensah and Abrodu-Otoo (2000), and Sowa and Kwakye (1993), cited in Sanusi (2012) in separate reports have associated the inability of Ghana to achieve low inflation rates and, the continuous depreciation of the national currency to the adoption of a flexible exchange rate regime, where largely the rate of exchange of the Cedi to the major foreign currencies is determined by demand and supply.

Another school of thought has argued that although statistically significant, exchange rate depreciation is not a major source of inflation in Ghana. Frimpong and Adam (2010) found that pass-through was incomplete and declining. Loloh (2014) also adopted the recursive Vector Autoregressive (VAR) model to estimate the impact of exchange rate movements on domestic prices in Ghana between 1994 and 2012 and found an incomplete pass-through, in consonance with the findings of Sanusi (2012).

The evidence so far from the literature suggests that the rate pass-through in Ghana lacks complete agreement. It is suggested that improvements in macroeconomic performance and increase in trade competition could be abating the levels of exchange rate pass-through. Again, significant changes in monetary policy framework adopted by the Central Bank of Ghana has largely neutralized the negative effects of exchanges rate deterioration on domestic prices. The key question to answer by this paper is whether with the passage of time, and a fairly different macroeconomic situation in Ghana, the pass-through rate will be any different. The paper also looks to address the question of proportionality of the pass-through rate to the levels of inflation. Thus, whether

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the proportion of pass-through is commensurate with changes in inflation in Ghana.

Purpose of the Study

The main purpose of this study is to examine the effect of exchange rate (Cedi to the Dollar) movement on the prices of domestic goods and services in Ghana using time series over the period 2005 to 2015. This will then enable me estimate the rate of any pass-through, and its proportionality to inflation levels in Ghana.

Research Objectives

The specific objectives of the study were to:

1. establish the effect of exchange rate on domestic price levels in Ghana.

2. establish the effect of interest rate on domestic price levels in Ghana.

3. establish the effect of monetary policy rate on domestic price levels in Ghana.

Hypotheses

The study is guided by the following hypothesis based on the stated objectives. The hypothesis, with the null beginning and the alternate following, were tested at 5% significant level.

1. H_0: There is no positive significant relationship between exchange rate and domestic price levels

   H_1: There is a positive significant relationship between exchange rate and domestic price levels.

2. H_0: There is no positive significant relationship between interest rate and domestic price levels

   H_1: There is a positive significant relationship between interest rate and domestic price levels.

3. H_0: There is no positive significant relationship between monetary policy rate and domestic price levels

   H_1: There is a positive significant relationship between monetary policy rate and domestic price levels.

Significance of the Study

A study of exchange rate dynamics and their effect on price levels in Ghana makes important contributions to both academic literature and the conduct of monetary policy. First, exchange rates play a key role in the international transmission mechanism and therefore changes in their dynamics have important consequences for a small open economy like Ghana. Second, changes in exchange rates affect foreign currency denominated assets and liabilities, with dire consequences for the stability of the financial system. For instance, the value of foreign currency denominated debt (usually referred to as Euro bonds) is affected by the rate of exchange at the time of issue.

In a similar fashion, interest payment on euro bonds and eventual repayment of principals are all affected by exchange rate movements. Furthermore, changes in exchange rate dynamics have repercussions on domestic price stability. A knowledge of the precise magnitude of the pass-through effect is therefore important for the conduct of monetary policy under

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inflation targeting regime, as currently pertains in Ghana. The Last but not the least, the study will provide a clear understanding on what kind of relationship exist between Ghana's state of the economy, and the pass-through rate of currency deterioration. This, it is hoped will aid policy prescription in the sense that it will inform the appropriate mix of demand and supply side, and monetary policy for effective management of price levels in the domestic market of Ghana.

Delimitations

The study seeks to assess the effects of exchange rate pass-through on inflation levels in Ghana. The scope of this study covers Ghana, a developing country within the West African Sub-region using annual time series data covering 1985 to 2015. Data on exchange rate, inflation rate and interest rate were obtained from World Bank-World Development Indicators Database (Online Editon). Variables included in the study were interest rates, monetary policy rate and gross domestic product.

Although the main independent variable to be explored was the exchange rate variable on domestic price levels, countless studies have revealed the impact of some other factors such as interest rates, monetary policy, gross domestic product, consumer price index, and unemployment rates as major determinants on the rise an fall of domestic price levels. The study however excluded consumer price index and unemployment rates as explanatory variables. Unemployment rates was excluded because of the relative remoteness of their impact on domestic price levels and determined by some scholars. Also, consumer price index was excluded because of the close relation with the

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variable monetary policy rate and in extension, gross domestic product. Thus, these two variables approximate consumer price index.

Limitations of the Study

One major limitation of this study was the non-availability of daily, weekly, monthly or quarterly data on all variables from the Bank of Ghana and the World Bank. Thus, to produce highly reliable estimates, variables that have their values in quarters much approximating. However, there is no gain in the power of these tests by switching from low frequency to high frequency data and merely increasing the number of observations over a short time period.

Organization of the Study

This entire study is organized into five main chapters. Chapter one presents the background of the study, statement of the problem, research purpose, research objectives, hypotheses testing, delimitations, limitations of the study, significance of the study, and organization of the study. Chapter two focused on the review of relevant literature. Chapter three was devoted to explaining the methodology including model specification and estimation, definition and measurement of variables, validity and relaibility of the instrument and estimation strategy. Chapter four looked at the outturn of the data collected and the discussions there from, whilst Chapter five presented the summary of findings, policy implications, conclusions, and recommendations.

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CHAPTER TWO
LITERATURE REVIEW

Introduction

This chapter shows the review of related literature, theoretical, conceptual and empirical framework. The literature is to provide the theoretical basis for the research. It broadly covers theories of exchange rate and inflation, the evolution of exchange rate and inflation in Ghana, trends of inflation in Ghana, trends in exchange rate in Ghana, impacts of exchange rate on inflation, determinants of exchange rate pass-through, causes of asymmetric pass-through and empirical review of literature.

Theories of Exchange Rate and Inflation

This section presents theories that underpin the current study. These theories have been used by other scholars to study the relationship between exchange rate and inflation which are equally relevant to this study.

Purchasing Power Parity Theory

The common form of Purchasing Power Parity (PPP) asserts that the exchange rate change between two currencies over any period of time is determined by the change in the two countries' relative price levels. The theory suggests that without international trade barriers and transportation cost, the price of an identical good between two countries measured in a common currency should ultimately converge (Madura & Fox, 2011). The general idea behind purchasing power parity is that a unit of currency should be able to buy the same basket of goods in one country as the equivalent amount of foreign

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currency, at the going exchange rate, can buy in a foreign country, so that there is parity in the purchasing power of the unit of currency across the two economies. One very simple way of gauging whether there may be discrepancies from PPP is to compare the prices of similar or identical goods from the basket in the two countries. For example, if the rate of exchange between the US dollar and the Ghana cedi is \$1: GH¢3.5, an item costing GH¢7 in Ghana should cost \$2 in the US for there to be parity. The theory assumes a globalized world's economy where there is free international trade in a perfectly competitive market. Advocates of PPP have generally based their view largely on arguments relating to international goods arbitrage which is in consonance with Law of One Price, which holds that the price of an internationally traded good should be the same anywhere in the world once that price is expressed in a common currency, otherwise people could make a riskless profit by shipping the goods from locations where the price is low to locations where the price is high for sale. If the same goods enter each country's market basket used to construct the aggregate consumer price level, and with the same weight, then the Law of One Price implies that a PPP exchange rate should hold between the countries concerned (Taylor & Taylor, 2004).

According to Balassa (2005), the Purchasing Power Parity doctrine means different things to different people. He discusses two versions of the doctrine which he refers to as the "absolute" and the "relative" versions. Balassa indicates that according to the "absolute" version, Purchasing Power Parity calculated as a ratio of consumer goods prices for any pair of countries would

tend to approximate the rate of exchange. This means that the ratio of price differential for an identical good between two countries should be the same as the ratio of their relative currency exchange rate. On the other hand, the "relative" version asserts that in comparison to a period in which equilibrium prevailed (when parity was established) changes in relative prices of similar goods between countries would reflect adjustments in exchange rate. Cassel (2000), (cited in Balassa, 2005) also formulated the absolute hypothesis by arguing that the rate of exchange between two countries will be determined by the difference between the general price levels prevailing in the two countries. In other words, the real parity between any two countries is the difference in their relative purchasing power of money.

Possible objections to this line of reasoning are not far-fetched. For example, the presence of transactions costs, perhaps arising from transport costs, taxes, tariffs and duties and nontariff barriers would violate the Law of One Price. Moreover, not all goods are traded between all countries, and the weight attached to similar goods in the basket of goods that constitute the consumer price index will differ across countries. In addition, different countries tend to produce goods that are differentiated rather than perfectly substitutable. The Purchasing Power Parity is in line with the international trade theory which assumes that perfect market conditions exist, so that goods and services can flow freely between and among countries. To this extend, consumers are assumed to have identical taste, and impediments to international trade such as transport cost and tariffs are completely absent. Unfortunately, in practice monopoly, price

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discrimination and other forms of imperfect competition are a fact of life (Melvin & Warne, 1973).

International Trade Theory

The International Trade Theory can be traced back to the days of Adams Smith in 1776 (Sen, 2010). In his book the 'Wealth of Nations', Smith advocates for the formulation of free trade based upon the unprecedented success of England in the respective fields of industry and trade. For Smith, the strategy of division of labor, adopted by large-scale industries of his homeland England, provided the base for lowering labor costs, which ensured effective competition across the country. Free trade, as opposed to policies of protection, was championed by Smith as a route to achieve production efficiency at a global level. This saw the birth of the absolute, and later the comparative cost advantage theories of international trade.

The simple idea surrounding the comparative cost theory international trade is that if a country is more efficient in the production of one good relative to another, by means of specialization, the overall world's production will be enhanced if they each concentrated on the production of the good to which they have comparative advantage. It was comparative and not absolute advantage, which was considered both necessary, as well as sufficient, to ensure mutually gainful trade across nations, warranting complete specialization in the specific commodity with a comparative advantage in terms of labor hours used per unit of output.

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The other theories are the imperfect market theory and the product life cycle theory. The imperfect market theory suggests that countries differ in factor endowment. And, imperfect market conditions mean that factors of production are not freely mobile and transferable across countries. Because market for the various factors of production are 'imperfect", firms often capitalize on the relative availability of those resources to increase productivity for export to countries less endowed. In this way, it is argued the overall wealth of all nations then increases. On the other hand, the product life cycle theory states that firms become established in the home market to meet local demand. But as a firm's product market in the domestic economy becomes mature, it finds new market in a foreign country for the product. This is the argument in favour of international trade by the product life cycle theory. It is argued however, that the full benefits of international trade as envisioned by its advocates have not been achieved. Industrialized and powerful nations have used unfair trade terms to crowd out less developed nations. Unfavorable terms of trade and other inequitable conditions of trade result to severe balance of payment difficulties for developing nations.

Price Discrimination Theory

The conventional description of price discrimination is a situation where the same good is sold to different customers at different prices. Stigler (cited in Melvin & Warne, 1973) states that price discrimination is present when two or more similar goods are sold at prices that are in different ratios to marginal costs of production. Stigler's definition recognizes the difference transportation

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and other similar costs could bring about in the prices of goods at different locations. Firms frequently segment customers according to price sensitivity in order to price discriminate and increase profits. In some settings, consumer heterogeneity can be directly observed and a firm can base its pricing upon the unique characteristics of the consumer; in other settings, differences in consumer characteristics is not directly observable, but can be indirectly elicited by offering them with different types of products and prices and allowing consumers to self-select. In both cases, the firm seeks to price its products as a function of each consumer's underlying demand elasticity, extracting more surpluses and increasing sales to elastic customers in the process (Stole, 2003).

Melvin and Warne (1973) argue that for firms to be able to price discriminate, three conditions must be present. First, the firm must have some market power. Second, the firm must have the ability to sort customers. And third, the firm must have the ability to prevent resale. They indicate that price discrimination itself arises naturally from the presence of monopoly and oligopoly. They further emphasize that where a firm has an opportunity to charge a price above the marginal cost, there is an incentive to engage in price discrimination. In that case the firm has a duty to adopt a way of sorting the customers into different categories using an appropriate criterion and, allowing the customers to "self-select". Again, the firm must have a way to prevent customers who purchase at a discount price from reselling to other customers. They state that transportation differential, taxes and tariffs can impose barriers, or the firm may legislate to restrict resale.

Holmes (2005) in a paper titled "The Effects of Third-Degree Price Discrimination in Oligopoly" investigates the pricing behaviour of Restaurants and the rationale for offering discounts to senior citizens, and documents that discrimination between markets is due to two factors: first, the differences in industry-demand elasticity and second, the differences in cross-price elasticity of demand. Holmes posits that industry-demand elasticity measures the tendency of consumers to stay home when prices go beyond a certain level, and cross-price elasticity measures the tendency of consumers to switch to low cost products. It is argued that when the firm involved is a monopolist with market power, the underlying theory of price discrimination is often easier and well understood. On the other hand, when markets are perfectly competitive and firms have neither short-run nor long-run market power, the law of one price applies and price discrimination cannot exist. Stole (2003) however, argues that the economic reality largely lies somewhere in between of the textbook extremes of a perfectly competitive market situation and a monopolistic market, and most economists agree that price discrimination arises in oligopoly settings.

Evolution of Exchange Rate and Inflation in Ghana

As a small open economy with high dependence on the external sector, the Ghanaian economy has over the years remained vulnerable to external shocks, thus making developments in the forex market an important factor for macroeconomic stability. The foreign exchange market in Ghana has undergone myriads of regime changes since independence, with several episodes of controls and liberalization, often linked to the prevailing

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economic conditions over the period. During the period before the economic reforms in 1983, particularly between 1972 and 1982, the economy generally operated a fixed exchange rate system where the exchange rate was held constant, subject to exchange rationing, infrequent devaluations and currency inconvertibility (Harrigan & Oduro, 2000; Aryeetey & Harrigan, 2000).

Following periods of poor economic management and macroeconomic instability, a chain of reforms were implemented between 1983 and 1993. These include Economic Recovery Program, Structural Adjustment Program and Financial Sector Adjustment Program (FINSAP). The core aim of these reforms was to liberalize the economy and transition it towards a market oriented one. These reforms include among other things a gradual transition from a controlled to a liberalized forex market. The series of exchange rate reforms in the post 1983 era, as summarized by Harrigan & Oduro (2000) include "a step-wise devaluation in 1983-1986, introduction of foreign-exchange auction in 1986, legalizing the parallel exchange market through the introduction of foreign exchange bureau in 1988 and the establishment in 1992 of an interbank market". Prior to the reforms, exchange rate was an influential political tool, as adverse developments in the exchange rate had serious political repercussions. Therefore by the early 1990s, after the gradual transition towards a floating exchange rate regime, the degree of politicization of nominal exchange rate changes had reduced (Harrigan & Oduro 2000), even though it still remains an influential factor in the political outcomes of the governments in Ghana.

The performance of the forex market in the post reform era has not been overly impressive. The Ghanaian currency has since the 1990s witnessed consistent depreciation in nominal exchange rate with the US dollar with isolated episodes of appreciation (see figure 1). Annual depreciation in nominal exchange rate (cedi-dollar) averaged (29%) from 1990-99; (17%) from 2000-09 and (10.1%) from 2010-12 (IMF, 2013). A similar trend is recorded for the trade-weighted effective exchange rates which in this case refer to the weighted average of exchange rate between the Cedi and currencies of the major trading partners. Both the nominal effective exchange rate (NEER) and real effective exchange rate (REER) indices show a general trend of depreciation of the cedi as depicted in Figure1.
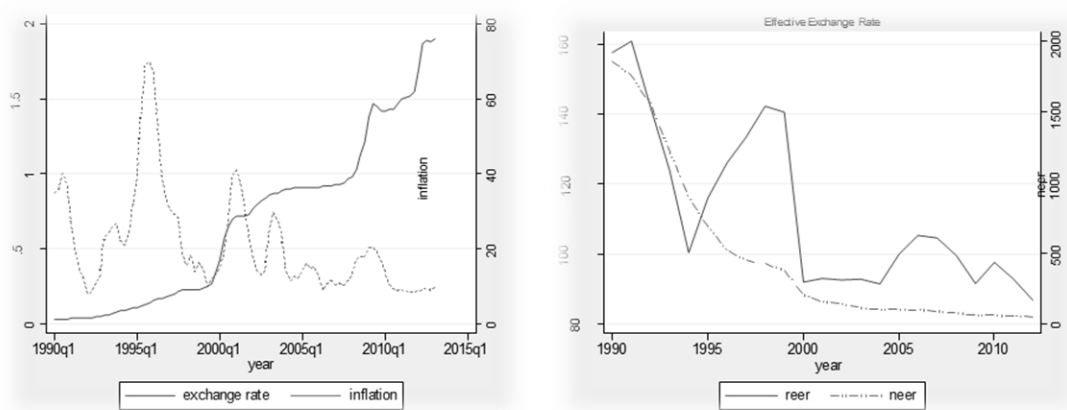
Figure 1: Evolution of exchange rate and inflation in Ghana
Source: World Bank (2016)

However (as seen in Figure 1), unlike the NEER, the REER shows some episode of appreciation after accounting for relative prices. Domestic price levels have also witnessed significant variations over the period, albeit with a

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general decline over the period. As shown in Table 1, average annual inflation reduced from (48.3%) in the period 1990-99 to (18.5%) in the period 2000-09, and further to (9.2%) in 2012. It is interesting to note that performance of the economy in terms of exchange rate and inflation misalignment have strong linkages to national election cycles. These phenomena have been attributed to the fiscal and monetary slippages via ambitious expansionary fiscal and monetary policies during election years, all in a bid to secure political power. In consequence, public debt remains high in most cases exceeding (50%) of GDP. Rising public debt, coupled with declining donor support, falling commodity prices and a surge in demand for imports cumulatively puts pressure on the exchange rate, often resulting in recurrent currency crises in the country such as the recent one in 2013-2014 where the Ghanaian cedi depreciated (nominal) by over (40%). Overall, the growth of the economy in the post reform era has been robust with real GDP growth increasing from an average of (1.6%) in the period 1990-99 to (5.6%) in 2012 (World Bank, 2016).

Table 1: Selected Macroeconomic Indicators

	1970-79	1980-89	1990-99	2000-09	2010	2011	2012
GDP growth % (nominal)	1.4	2.0	4.3	5.4	8.0	15.0	7.9
Real GDP growth (%)	-0.8	-1.0	1.6	2.8	5.5	12.4	5.6
Debt % GDP	18.2	22.5	64.5	62.7	46.3	43.8	50.2
Inflation (%)	38.8	48.3	27.6	18.5	10.7	8.7	9.2

Source: World Bank (2016)

Trends in Inflation Rate in Ghana

Inflation; consumer prices (annual %) in Ghana was last measured at 15.49 in 2014, according to the World Bank (2016). Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used. Generally, inflation rate (consumer prices) in Ghana has had a downwards trend since 1967 as seen Figure 2.
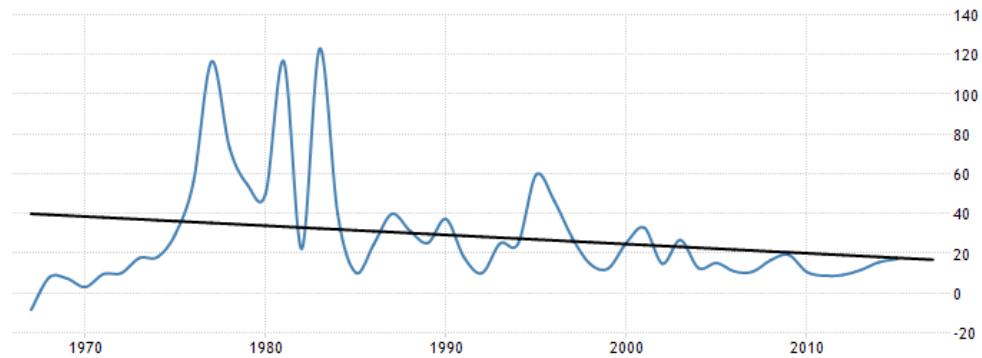
Figure 2: Inflation rate in Ghana (1970-2012)
Source: World Bank (2016)

Trends in Exchange Rate in Ghana (LCU per USD$)

Official exchange rate (LCU per US$; period average) in Ghana was last measured at 1.95 in 2013, according to the World Bank (2016). Official exchange rate refers to the exchange rate determined by national authorities or to the rate determined in the legally sanctioned exchange market. It is calculated as an annual average based on monthly averages (local currency units relative to

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the U.S. dollar). Generally, exchange rate since 2001 has been on the rise as depicted in Figure 3.
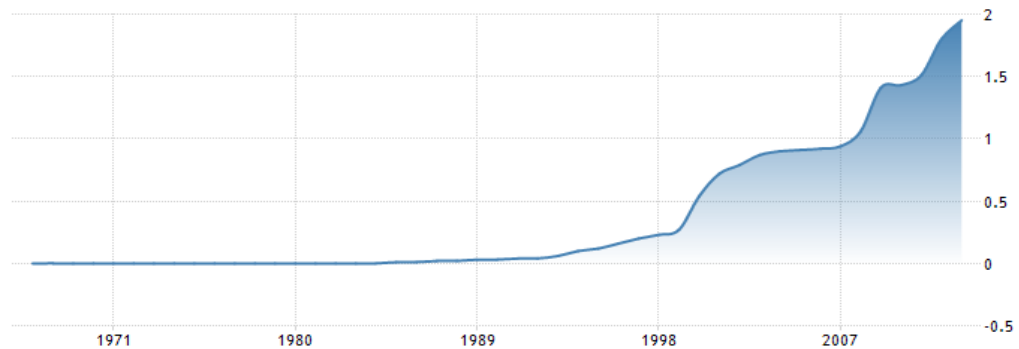
Figure 3: Official exchange rate in Ghana (1971-2007)
Source: World Bank (2016)

Impact of Exchange Rate on Inflation

Exchange rate movements can impact on domestic prices through direct and indirect channels, via their effect on aggregate supply and demand. The direct channel is due to operation of law of one price based on purchasing power parity theory (PPP). It is postulated that exchange rate between two currencies is determined by relative movements in the price levels in the two countries. PPP states that price levels between two countries are equal when expressed in the same currency at any period of time. Therefore, if PPP holds, exchange rate fluctuations translate into proportional movements in the domestic price level; i.e. pass-through is equal to one. In a small open economy (an international price taker), a depreciation of the domestic currency will result in higher import prices (both for finished goods and intermediate inputs), which

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will ultimately be transmitted to higher domestic prices as shown in Figure 4 (Hyder & Shah, 2004).

Exchange rate variations can also affect domestic prices through its indirect effect on aggregate demand. Depreciation of the domestic exchange rate reduces the foreign price of domestic goods and services, and thereby increases foreign demand, resulting to an increase in net exports and hence aggregate demand and real output. The increase in domestic demand and real income may bid up input prices, hence causing workers to agitate for higher wages to maintain a real wage. The nominal wage increase may result to further price increases (Hyder & Shah, 2004). Furthermore, depreciation may increase the domestic price of imported goods and services and thereby lead to expenditure switching in favour of domestic goods and services, which will increase their demands and hence rising domestic prices.
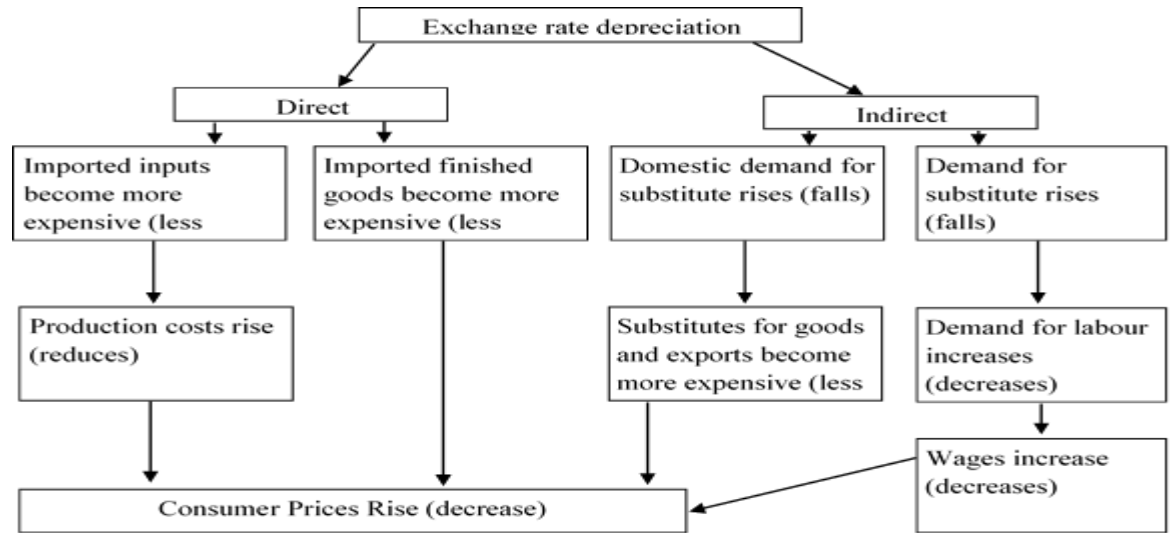
Figure 4: Transmission mechanism of exchange rate pass-through
Source: McFarlane (2006)

Determinants of Exchange Rate Pass-Through

Theoretically, several factors have been proposed as determinants of ERPT. Some of these determinants are micro in nature while others are macroeconomic factors. From the micro perspective, behaviour of exporting firms, which adopt pricing-to-market (PTM) strategies and specific industry and market characteristics, can be mentioned. The theoretical literature developed over the past two decades has provided different explanations on why the ERPT is incomplete. One possible explanation for the incomplete nature of ERPT is the fact that exporters adjust their prices to exchange rate change in order to maintain their completeness in destination market (PTM). PTM is impractical in a perfectly competitive market because in such markets export prices are set to be equal to marginal cost of production. On the other hand, when the exporting firms' margins are positive, PTM can become a sustainable strategy for the

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exporters, in which case the measured pass-through of exchange rate changes to import and other domestic prices, such as producer and consumer prices, will be less than one. Thus, the size of the ERPT will be affected by the ability of exporters to absorb exchange rate shocks within their profit margins (Gaulier, Lahrèche-Révil & Méjean, 2006).

PTM and the resulting optimal mark-up is in turn determined by price elasticity of demand and market share in the destination market. In addition to PTM another important determinant of ERPT is industry specific and market characteristics. Under this, the degree of competition, relative domestic and foreign shares in the market (Dornbusch, 2012) or import penetration, the elasticity of import/export demand and supply, product substitutability and differentiation (Menon, 1995; Yang, 1997), and the perceived reaction of incumbent industry competitors (Dornbusch, 1987) are included. If exporting firms have large domestic and foreign market share for a product, then they are usually willing to absorb a proportion of the exchange rate change so to maintain their market share. This is particularly so if the industry is highly competitive. If the destination market is highly competitive, consumers will be having many substitutes, making them relatively price-sensitive. Thus, exporting firms may try to keep their market share by absorbing exchange rate change in their markups. The willingness to accept lower domestic unit prices (due to low markup) in turn leads to lower ERPT.

For example, exports to certain competitive industries in the US, such as autos and alcoholic beverages, showed relatively high PTM and

corresponding lower ERPT as exporters try to preserve market share (Knetter, 1993). However, if exporters do not face much competition (i.e. the industry is highly differentiated) their prices may be somewhat less responsive to exchange rate changes. In this situation, PTM will be lower and the corresponding pass-through will be higher. Hence, if firms operate in imperfectly competitive industries and have a large share of imports in aggregate domestic sales, the degree of pass through will be high. In related work Dornbusch (2012) and Goldberg and Knetter (1997) show that markets which are not perfectly competitive may experience a range of pricing responses to exchange rate fluctuations resulting in a greater pass-through effects. Also, Daniel (2007) indicated that an exporter with low market share may have less power to absorb exchange rate changes. However, as the exporter's market share and market power increases the incentive to PTM decreases. In such a case the exporter is likely to pass on any increase in costs brought about by depreciation in the importer's currency, and thus, the ERPT is likely to be high. The degree of the substitutability of the imported goods in the domestic market is another factor which determines the degree of pass-through. If the imported good has a domestic substitute, regardless of it being a final or intermediate good, the pass-through is smaller, as firms and consumers are eager to buy the cheaper domestic goods. However, this may not realize if a common factor increases both the international and domestic price simultaneously. Therefore, relative price difference and the degree of substitutability become more important in such cases (Yüncüler, 2009). Concerning this, Yang (1997) shows the existence of

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negative relationship between the size of ERPT and the degree of substitution among different products in the industry. The degree of ERPT into aggregate prices may also be affected by various macroeconomic variables such as the prevailing exchange rate policy or regime adopted by an importing country, inflationary environment, trade openness and the perceived nature of exchange rate change.

Theoretically, if a country adopts a flexible exchange rate regime the more will be the exchange rate volatility and the lesser will be the degree of pass through to import prices. This means when exchange rate is highly volatile the degree of pass through will be low due to menu cost and firm's incentive to maintain their market share. In support of this, Barhoumi (2006) found that countries with fixed exchange rate regimes (low exchange rate volatility) experience a higher long-run pass-through than floating exchange rate regimes (high exchange rate volatility). The trade openness of the importing country is another determinant of ERPT from a theoretical stand point. The more a country is open to trade, the higher will be degree of pass through to import prices due to high competition exporting firms face and low capability to absorb exchange rate changes in their mark-ups. However, the picture becomes more complex once we take into account that inflation could be negatively correlated with openness, as empirically found by Romer (1993). This gives rise to an indirect channel, whereby openness is negatively correlated with inflation and hence with pass-through based on Taylor's hypothesis. The direct and indirect channels go in opposite directions and the overall sign of the correlation between pass-

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through and openness can thus be either positive or negative (Aliyu, Yakub, Sanni & Duke, 2010). Another main macro determinant of ERPT is the prevailing inflation environment in the importing country. Since the late 1980s there has been a general decline in the extent of ERPT in many industrial countries. Following this, Taylor (2000) put forward a hypothesis which states that the observed decline ERPT to aggregate prices is the result of a low inflation environment. Taylor explains the link between inflation and pass-through in terms of a model of firm behaviour based on staggered price setting and monopolistic competition. As firms set prices for several periods in advance, their prices respond more to cost increases (due to exchange rate depreciation or other sources) if cost changes are perceived to be more persistent. Regimes with higher inflation tend to have more persistent costs. He argued that degree of pass-through is endogenous to a nation's monetary policy and monetary stability.

The degree of pass-through is also affected by the duration (persistence) of exchange rate shock. According to Taylor (2000), if the shock displays non-volatile and persistent characteristic, then willingness of firms to reflect such a shock onto their prices increases. Otherwise, if the shocks are perceived to be volatile or temporary, then, firms prefer to make adjustment on their profit margins instead of reflecting them on domestic prices. This is because the high costs of changing prices, as well as the possibility that frequent changes in unit sales prices (in the destination market's currency) can adversely affect a firm's reputation, may prevent firms from passing through temporary fluctuations in exchange rates. When exchange rate changes are large or appear

to be permanent, however, exporting firms are more likely to pass through the changes to avoid a sharp reduction in their profit margins. In general, the greater the persistency and lower the volatility of the external shocks, the higher will be the degree of pass-through. Last but not least the size of the economy could also determine the degree of pass-through. The conventional wisdom had long been that for a large country, the inflationary effect of currency depreciation or import price shock on domestic prices is expected to be lower than that for a small economy. The rationale is that a rise in prices will be counteracted by a fall in world prices through lower world demand, thus, reducing the pass-through effect, whereas a small country would have no effect on international price of the good, which leads to a higher pass-through (McCarthy, 2000). More recent studies, on the other hand, have shown that the evidence on sizable difference in the degree of pass-through between small and large countries is not so clear or less than expected (Yüncüler, 2009).

Causes of Asymmetric Pass-Through

Many empirical studies conducted so far assume asymmetric long-run relationship between the price level and the exchange rate. However, there are various reasons (both micro and macro) why the relationship between prices and exchange rate may be asymmetric. Knetter (1994), Peltzman (2000), Pollard and Coughlin (2003), Wickremasinghe and Silvapulle, (2004) and Delatte and López-Villavicencio (2010) examine how asymmetry might arise in the case of ERPT.

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On the microeconomic side, market share, binding quantity constraint, product switching and menu cost are identified as causes of asymmetric pass through (Pollard & Coughlin, 2003). Knetter (1994) argues that if local and exporting firms that are trying to establish market-share are confronted with trade restrictions, then a currency appreciation of the importing country might cause PTM (in this case, lowering of prices) to be greater than the rise in prices during periods of depreciation. This would imply greater pass-through during episodes of appreciation than depreciation.

The market share model for asymmetric pass-through is also discussed by (Pollard & Coughlin, 2003). If the goal of a firm is to maintain its market share despite fluctuations in the exchange rate, the firm will try to keep its prices constant by adjusting their mark-ups (Pollard & Coughlin, 2003). Thus, an appreciation of the importing country's currency will give foreign firms the opportunity to lower the import prices and thus to rise their market share, while keeping their mark-ups constant. On the contrary, in order to preserve their market share in the case of depreciation, the firms will have to absorb a part of the inflationary impact that will determine a decline in their mark-ups. Given the fact that the foreign firms' actions are restricted by the size of their mark-ups, the pass-through will be higher for appreciation than for depreciation which makes pass-through asymmetric (Marston, 1990).

Another explanation for asymmetric pass-through is production switching. Production switching describes the fact that firms will tend to switch towards inputs produced in their own countries when the exchange rate

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depreciates and switch towards imported inputs when exchange rate appreciates. This is because if the firm's home currency appreciates imported inputs become cheaper and the firm will switch to a production technology that maximizes the use of imported inputs. But, if the home currency depreciates imported inputs become more expensive and the firm will switch to local input intensive production technologies implying zero pass-through (Ware & Winter, 1988). Thus according to the production switching model, ERPT is greater during periods of appreciation than depreciation.

The binding quantity constraints theory of asymmetric ERPT supposes that binding quantity constraints arise when the ability of the exporting firm to increase sales as the importing country's currency appreciates is limited. Quantity constraints faced by firms may arise because of trade restrictions such as quotas that limit imports, or voluntary export restraints. Constraints may also arise because of firm or industry specific factors such as limitations on a firm's ability to expand its production capacity. Under this scenario, when the exchange rate increases, the firm raises its mark-up to maintain its price in the importing country. Therefore, rather than increasing sales the firm may increase its profit margins. However, when the exchange rate decreases, the quantity constraint is not binding. The firm may reduce its markup but still allow its price in the importing country to rise. Pass-through is consequently higher when the importing country's currency depreciates than when it appreciates (Pollard & Coughlin, 2003).

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The menu costs theory of asymmetric pass-through proposes that a firm may respond asymmetrically depending on the size of exchange rate change (i.e. large and small changes in the exchange rate change). According to Pollard and Coughlin (2003) the cost of changing prices enlarges the probability that firms will adjust the invoice price only if the change in the exchange rate is above some threshold and asymmetry in pass-through depends on the currency of invoice. When imports are invoiced in the importer's currency, a small change in the exchange rate which is below a given "threshold" will not affect local prices because the foreign firm will absorb the change in the exchange rate through the price it receives (expressed in its currency) which results in a zero ERPT. But if the change in the exchange rate is significantly above the "threshold", the firm will adjust its price, resulting in partial or complete pass-through depending on the size of the price adjustment. Therefore, with invoicing in the importer's currency, pass-through will be larger when exchange rate changes are large than when they are small. However, when imports are invoiced in exporters' currency, small changes in exchange rate result in large pass through than large change in exchange rate (Pollard & Coughlin, 2003).

On the macroeconomic side, monetary policy and business-cycle might result in asymmetric pass-through in the short run. Monetary policy affects the level of pass-through to the general level of prices and might induce asymmetric ERPT. A monetary policy stance that is sufficiently reactive to inflation can insulate consumer price inflation from the effects of depreciation. More specifically, anti-inflationary monetary policies may imply that countervailing

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measures are implemented more after depreciation than after an appreciation. Under this assumption, depreciation will affect prices less than an appreciation in the short-run (Delatte & López-Villavicencio, 2010). The position in the business-cycle when the exchange rate variation takes place also triggers asymmetric responses. In fact, if the devaluation takes place in the midst of a recession then prices might increase less than they would decrease after an appreciation. The reason is that devaluations often result from a downward adjustment of the domestic aggregate demand. The resulting recession could act to depress domestic prices, hence implying that domestic prices do not respond much to exchange rate depreciation (Delatte & López-Villavicencio, 2010).

Empirical Literature Review

The vast body of literature concerning ERPT can be broadly classified as those done at micro level and those which are conducted at macro level. Studies conducted at micro level focused in examining ERPT into disaggregated import prices of specific domestic industries. On the other hand, those conducted at macro level examined ERPT into aggregate price indices and can be further classified in two categories. The first category examines the degree of pass-through into aggregate import prices while the second one has analyses pass-through into the consumer prices. Among these, some are conducted on country level while others are cross country comparisons. In general previous studies try to analyses the following basic issues concerning ERPT: 1) estimate the degree of pass-through to various price indices 2) try to explain why pass-through is incomplete and why it is declining 3) whether it is a macro or micro phenomenon

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4) why pass-though is lower for domestic prices than import prices and 5) whether pass-through is symmetric or asymmetric.

Against this general background, even if it is impossible to survey the vast literature revolving around ERPT, empirical evidence of a selected industrialized; emerging and developing countries will be briefly discussed in the next section. Numerous empirical studies have estimated the degree of ERPT to import, and consumer prices. There are also few studies which estimate the degree of ERPT to export prices. Menon (1995) made a comprehensive survey of literatures on ERPT. The empirical studies reviewed in his survey were conducted on industrialized economies, in which most of them are on United States (US). Many of these studies concluded that ERPT is incomplete though its extent varies significantly across countries. The main factors that influence the degree of pass-through across countries are the size and openness of the individual economies. Furthermore, the pass-through relationships were found to be largely stable over time. In some studies, the pass-through was asymmetric, which implies that the rate of pass-through is different during exchange rate appreciations and depreciations.

Goldberg and Knetter (1997) find that the response of domestic prices to exchange rate movement is only partial in US. On average only around 60 percent of exchange rate changes are passed on to import prices in the US. However, the response of domestic US price to exchange rate fluctuations vary from sector to sector and a considerable portion of the muted price responses seem to emanate from changes in mark-ups on export prices. Similarly, Yang

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(1997) studies ERPT in US manufacturing industries and its cross-sectional variation. The study shows that pass-through is incomplete (on average 32 percent in the short run and 42 percent in the long run) and varies across industries. In the cross-sectional study ERPT is found to be higher in industries with a higher degree of product differentiation and a lower elasticity of marginal cost. The study also shows a negative relationship between import share and ERPT. Recently, Marazzi & Vigfusson (2005) investigated ERPT to import price in US. They found a sustained decline in ERPT to US import prices, from above 0.5 during the 1980s to somewhere in the neighbourhood of 0.2 during the last decade (1993-2004).

McCarthy (2000) presents a comprehensive study of ERPT on the aggregate level for a number of industrialized countries which include the US, Germany, Japan, France, the United Kingdom, Belgium, Netherlands, Switzerland and Sweden. He estimates a VAR model using import, producer and consumer price data from 1976 up until 1998. The findings of the study show that exchange rates and import prices have a modest effect on domestic price inflation over the post-Bretton Woods era. The pass-through is found to be stronger in countries with a larger import share. The rate of pass-through is, furthermore, shown to be positively correlated with the openness of the country and with the persistence of and exchange rate change, and negatively correlated with the volatility of the exchange rate. An (2006) also analyzed the extent of ERPT at different stages of distribution - import prices, producer prices and consumer prices - for eight major industrial countries: United States, Japan,

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Canada, Italy, UK, Finland, Sweden and Spain. The study found incomplete ERPT in many horizons, though complete pass-through is observed occasionally. The study also revealed that the degree of pass-through declines along the distribution chain. Moreover the time needed for complete pass through becomes longer along the distribution chain. Campa and Goldberg (2002) using quarterly data from 1975 through 1999 of 25 OECD countries, documented the prevalence of producer currency pricing (PCP) and local currency pricing (LCP) in the short-run and long-run pass-through elasticity respectively. At the level of an aggregated import bundle, the evidence across countries is strongly supportive of incomplete exchange rate pass-through in the short run (defined as one quarter). They also reach at similar conclusions about the prevalence of partial pass-through into import prices at a more disaggregated industry level.

Campa, Goldberg and González-Mínguez (2005) estimated short and long-run pass-through elasticities for European countries between the period 1989 and 2004. The results obtained confirm that ERPT is high, although incomplete, in the short-run, and different across industries and countries. Long-run elasticities are higher, although estimated elasticities are still lower than unity, except for the traditionally more inflationary economies and for commodities. In general, the equality of pass-through elasticities among the different industries in each country or for the different countries given an industry was not rejected in the long-run. They have also tested for structural changes in pass-through rates since the introduction of the euro by braking the

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sample period into two (from1989 to 1997 and 1998 to 2004). They found apparent decline in the estimated point elasticities for two-thirds of the industries though it is not statistically significant. Based on this they concluded that there is a statistically significant trend towards lower pass-through rates for manufacturing industries.

For developing economies, Rowland (2003) examines ERPT for Colombia using Vector error correction model (VECM) and found ERPT to be incomplete both to import and domestic prices. He found that import prices respond quickly to an exchange rate change (80 percent within 12 months) while pass-through is modest for producer prices (28 per cent) and very limited for consumer prices (less than 15 per cent). An exchange rate shock does, therefore, only have little impact on consumer price inflation. Ito & Sato (2006) analyzed ERPT in post crisis Asian economies and found that the degree of pass-through to exchange rate shocks varies across the different price indices: the pass-through effect is the largest on the import price index, the second on producer price index (PPI) and the smallest on consumer price index (CPI). The degree of exchange rate pass-through to import prices was quite high in the crisis-hit countries while the pass-through to CPI was generally low, with a notable exception of Indonesia.

Aziz (2009) also measured the proportions of ERPT into import, export and domestic prices for Bangladesh over the period 1973 to 2007. The results indicate that the transmission of exchange rate changes is significant and 'complete' to import, and export prices. However, ERPT to producer and

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consumer prices is found to be only 'partial' implying that degree of pass through declines along the pricing chain. The recursive VAR suggests that response of domestic prices to exchange rate devaluation is positive and larger in the long-run compared to the short-run. The rolling regressions demonstrate that sensitivities of export and import prices to the exchange rate have been consistently around 1 until the early part of this decade. Chew et al (2009) also analyzed ERPT for Singapore and found that ERPT to import prices is complete, with changes in the exchange rate fully reflected in import prices by the fourth quarter of the shock. ERPT to consumer prices is found to be fairly modest were 1 per cent appreciation in the NEER leads to a 0.1 per cent decline in the domestic consumer price in the short run and a 0.4 per cent decline in the long run.

Zorzi, Hahn & Sánchez (2007) estimate the magnitude of ERPT in emerging economies. They found that ERPT is higher for import prices than for consumer prices implying that degree of pass through declines along the pricing chain. Also their analysis partly overturns the conventional wisdom that ERPT is always considerably higher in "emerging" than in "developed" economies. Particularly, they found that in low inflation emerging economies (notably the Asian economies) pass-through to consumer prices is rather low just like advanced countries (such as US and Japan) which are included in their study. In addition, they test Taylors (2000) hypothesis by simple correlation methods and found that positive and statistically significant connections exist between inflation and ERPT.

Bhattacharya et al (2011) analyzed ERPT for India using a monthly dataset from 1997 to 2000. They used a CVAR model involving six variables: output, oil price, import price, domestic price, exchange rate and short-term nominal interest rate. The study found evidence of incomplete ERPT. Their finding also shows that, even if interest rates do not affect aggregate demand implying the absence of inflation-output trade-off, the existence of strong but incomplete pass-through shows the fact that interest rate can impact inflation through the exchange rate channel (that is, the empirical evidence revealed that the policy rate can influence prices through its impact on the exchange rate). Based on this finding they concluded that in India (a country with weak financial development but high trade integration), the most effective mechanism through which monetary policy impacts inflation runs through the exchange rate.

In Africa, Canetti & Greene (1992) shows that apart from monetary expansion, exchange rate movements affect consumer price inflation in Sub-Saharan Africa (SSA). In particular, they find that exchange rates have a significant "Granger causal" impact on prices in Tanzania, Sierra Leone, and the Democratic Republic of Congo, which is linked to the high inflation episodes in these economies. Kiptui et al (2005) found incomplete ERPT for Kenya during the period 1972–2002. Exchange rate shocks account for 46 per cent of the variation in inflation in the first year, peaking at 57 per cent in the third year. Even if an exchange rate shock leads to a sharp increase in CPI inflation, it dies out after four years. Similarly, Choudhri & Hakura (2012) in their cross-country

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study found incomplete pass-through for African countries during the period 1997–2000.

Mwase (2006) examines the effect of exchange rate changes on consumer prices in Tanzania using SVAR model based on quarterly data covering the period between 1990Q1 to 2005Q1. The empirical results indicated that ERPT to consumer prices is low, significant and persistent throughout the review period. The study also analyzed the effect of change in monetary policy regime on ERPT by the dividing the sample into the periods before and after 1995Q4. Sample 1 (1990Q1 to 1995Q3) captures the period characterized by passive monetary policy with high and volatile inflation and nominal exchange rate movements while Sample 2 (1995Q4 to 2005Q1) captures the period characterized by depreciation and declining and stable inflation. The degree of pass-through in the second sample was found to be very low (almost zero) compared to the first sub sample. Aliyu et al. (2010) also studied the degree ERPT to import and consumer prices in Nigeria between 1986 and 2007 on the basis of VECM. Using the impulse response function, they establish the degree of pass-through to import and consumer prices in Nigeria during the period under review to be incomplete (low), persistent and significant. They also found that ERPT is slightly higher in the import than in the consumer prices which suggest that pass through declines along the pricing chain in Nigeria. A one percent shock to exchange rate, for instance, results in 14.3 and 10.5 percent pass-through effect to import and consumer prices four quarters ahead, respectively.

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Frimpong and Adam (2010) analyzed the effect of exchange rate changes on consumer prices in Ghana using VAR models based on monthly data set covering the period 1990–2009. They found positive and insignificant long run relationship between domestic prices and exchange rate; indicating that the long-run exchange rate pass-through in Ghana is zero. However, in the short run they found low but significant pass-through. According to them these findings reflect the impact of increased openness and tighter monetary policy pursuit by the central bank. Several studies analysed ERPT in relation with monetary policy behavior and inflationary environment which was first emphasized by Taylor (2000). A number of recent studies find some empirical support for the relationship but the evidence is not conclusive. Choudhri & Hakura (2012) test Taylor's (2000) hypothesis for 71 countries (where the sample contains set of developed, emerging and developing countries) for the period between 1979 and 2000. In their empirical analysis the long-run inflation rate is used as an indicator of the aggressiveness of monetary policy response to short-run price fluctuations. The use of this proxy is motivated by the plausible assumption that regimes which make a stronger effort in stabilizing the short-run inflation rate are also able to maintain low inflation rates in the long run. They found strong evidence of a positive correlation between ERPT and average inflation for a large sample of developed and emerging market economies. They also explored the influence of other variables, but found that average inflation dominates in explaining differences in observed ERPT.

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Similarly, Devereux & Yetman (2002) estimate simple aggregate pass-through coefficients for 122 countries. In their model, pass-through is determined by the frequency of price changes of importing firms, and this frequency is a function of the monetary policy regime. For countries with very high inflation rates, they found, as in Choudhri & Hakura (2012) that aggregate pass-through is very high, and in many cases statistically indistinguishable from unity. They also show that there is a non-linear relationship between estimated pass-through coefficients and average inflation rates, i.e. as inflation rises, pass-through rises, but at a declining rate. Gagnon et al. (2004) explore the relationship between ERPT, inflation and monetary policy credibility in twenty industrial countries between the period 1971 and 2003. In addition to using a cross-sectional approach, as did Choudhri & Hakura (2012) and, Devereux & Yetman (2002), they also test whether pass-through declined in each country in the sample following a change in the inflation regime. The study shows that countries in which either the level or the standard deviation of inflation declined substantially from the first to the second sub-sample tended to have large declines in estimated rates of pass-through. Finally, they test a more direct connection between monetary policy and pass-through by estimating a Taylor-type monetary policy rules using the forward-looking specification of Clarida et al (1998). In a cross-country regression using the full sample, they find no statistically significant relationship between estimated ERPT and the estimated monetary policy parameters. However, there is a statistically significant relationship between changes in estimated pass-through across the two sub-

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samples and changes in monetary policy parameters. In general the study concluded that the decline ERPT in industrialized countries is attributed to change in monetary policy towards stabilizing inflation.

Using a panel-data set of 11 industrialized countries over the period 1977 to 2001, Bailliu & Fuji (2004) also found evidence to support the hypothesis that ERPT declines with a shift to a low-inflation environment brought about by a change in the monetary policy regime. More specifically, their results suggest that pass-through to import, producer, and consumer price inflation declined following the inflation stabilization that occurred in many industrialized countries in the early 1990s, but not following a similar episode that occurred in the 1980s.

Bouakez & Rebei (2006) used a structural general-equilibrium approach to test the premise that exchange rate pass-through has declined in Canada. They estimate a fully-fledged dynamic general-equilibrium model for Canada over two sub-samples (before and after the Bank of Canada adopt an inflation-targeting regime), and, using impulse response analysis, they investigate whether the implied pass-through has decreased from one sub-sample to the other. Their results show that the shift by the Bank of Canada towards an inflation-targeting regime is largely responsible for the lower degree of pass-through to consumer prices, thus lending support to the Taylor hypothesis. Yelena (2008) also confirms Taylor's hypothesis for 14 Organisation for Economic Co-operation and Development (OECD) countries: Australia, Canada, Denmark, Finland, France, Ireland, Italy, Japan, Netherlands, New

Zealand, Norway, Sweden, the United Kingdom, and the United States. The empirical investigation for these countries confirms the suggestion made by other authors about the decline in the ERPT during the 1990s. Diago (2011) also evaluate the effect of adopting an inflation targeting regime on ERPT in Peru using a SVAR model between the period 1992 and 2011 based on monthly data. To assess time variation in estimated pass through and to see the effect of adopting an inflation targeting regime, the study uses rolling windows of fixed size in estimating the VAR. He founds that the long run pass through effect to import and export prices has declined over the period of analysis in all stages of distribution chain. Based on his finding he concluded that the adoption of inflation targeting regime in Peru has contributed significantly to the reduction of ERPT which consistent with Taylor (2000) hypothesis.

In contrast to these studies, Campa & Goldberg (2002) find that the industry composition of trade is more important than inflation performance in explaining the change in degree of pass-through in OECD countries. According to them although higher inflation and exchange rate volatility are positively associated with higher import price pass-through, microeconomic factors related to the industry composition of trade play a much more important role in determining ERPT. In particular, the move away from energy as a high proportion of the import bundles, to a much higher share for manufactured products, has been the primary driver behind recent pass-through changes into import prices among numerous OECD countries. Similarly, Ghosh & Rajan (2006) highlight the importance of changing product composition as being

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among the main factors in explaining differing rates of ERPT over time in Japan, while Marazzi et al (2005) stress its importance in the case of the US. Moreover, Reginaldo & Leòn-Ledesma (2010) found results which do not support Taylor's hypothesis. They estimate a state-space model of a Phillips curve, allowing for time variation of the ERPT parameter, where ERPT is simultaneously a function of lagged inflation. The study reinforces the view of the previous literature that ERPT has been declining over time. However, Taylor's hypothesis that improved inflation environment should help predict a lower degree of ERPT was not supported by their evidence. Ultimately, they concluded that the evidence presented does not necessarily reject a macroeconomic explanation of the reduction of ERPT into consumer prices. Other parallel developments during this period of increased global market integration may have been driving the positive correlation between both variables, including variables related to structural (microeconomic) changes and macroeconomic stability.

Asymmetric ERPT is analyzed in few studies and these studies have taken three different approaches. One set has looked at whether pass-through differed during general periods of appreciation and depreciation (Mann, 1986). The other set of studies incorporated dummy variables to identify each time exchange rate appreciated or depreciated as well as dummy variables which capture lager and small change in exchange rate (Pollard & Coughlin, 2003). The last set of studies constructed a new series which shows application and depreciation episode and large and small change in exchange rate (Webber, 1999; Wickremasignghe & Silvapulle, 2004).

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ERPT could be asymmetric depending on the direction and size of change in exchange rate. Previous studies of asymmetry have concentrated almost entirely on testing for asymmetry in the direction of change in exchange rate. Early works on this topic are Mann (1986) and Goldberg (1995). Mann (1986) used aggregate trade data and he argued that pass-through into U.S import prices were greater during the period of the dollar's appreciation than during the period of depreciation, although the difference in pass-through estimates was not statistically significant. Similarly, Goldberg (1995) who examined U.S automobile imports from Germany and Japan found asymmetries in consumer prices' reaction to appreciations and depreciations.

Following these studies, Kadiyali (1997), Kanas (1997), Mahdavi (2002) and Olivei (2002) cited in Pollard & Coughlin (2003) analyzed asymmetry of ERPT in which most of them are on US. Kadiyali (1997) focused on a single industry. He examined U.S imports of photographic film from Japan and found that pass-through was higher when the dollar depreciated, consistent with the binding quantity constraint theory. Kanas (1997) also found support for the binding quantity constraint explanation. In a study of eight goods exported from the United Kingdom to the US, he found asymmetric responses in six cases. Four of these six cases were consistent with the existence of quantity constraints. In addition, by using aggregate trade data Webber (1999) found strong support for asymmetric pass-through into import prices in five of seven Asian countries. In contrast to Mann (1986), he found pass-through was higher when the importer's currency depreciated than when it appreciated. This result again

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supports the binding quantity constraint explanation. Mahdavi (2002) examined pass-through in a range of U.S. export industries, while Olivei (2002) did the same for U.S. import industries. Mahdavi found evidence of an asymmetric response in of the 12 industries he studied but with no clear direction in the asymmetry.

In Olivei's analysis, 9 of the 34 industries studied exhibited some degree of asymmetry and most were consistent with the binding quantity constraint explanation. Knetter's (1994) study of German and Japanese exports found relatively more support for the market share theory than the quantity constraint theory. Ohno (1989), Marston (1990) and Wickremasinghe and Silvapullle (2004) study asymmetry of ERPT for Japan. Ohno's (1989) findings support the binding quantity constraint model of ERPT asymmetry, whereas Marston (1990) findings support the market share model as well as the production switching model. Wickremasinghe and Silvapullle (2004) also find that the pass-through coefficients corresponding to appreciation and depreciation of the currency to be 98 per cent and 83 per cent respectively suggesting that pass-through is higher in episodes of appreciation. Similar to Marston the result supports the market share and production switching model of asymmetric pass-through. Pollard Coughlin (2003) analyzed asymmetry of pass-through to US import prices for 30 manufacturing industries. They found evidence of asymmetric pass-through with respect to the direction of change in exchange rate for most of the industries. Also, most of the industries respond asymmetrically to large and small currency changes, with pass-through being greater when the

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change is large. They also examined both direction and size effects simultaneously and found that the size effect was the most dominant. Based on their finding that even after allowing for lagged effects of the ERPT is rarely complete, they concluded that both strategic factors and menu costs play a role in determining pass-through. Kumar (2007) found asymmetry in pass-through between appreciation and depreciation, and between sizes of the exchange rate change for India. It was found that the estimated pass-through coefficients are higher for appreciation than depreciation. Also, the estimated pass-through coefficients are found to be much higher for small than large changes, and do not vary much between the three alternative threshold levels. This result is explained by the fact that much of the imports of India are invoiced in exporter's currency.

Daniel (2007) analyzed exchange rate asymmetry in South African. He estimated monthly data from 1980 to 2005 by using VECM. ERPT is found to be higher in periods of rand depreciation than appreciation which supports the binding quantity constraint theory. He also found some evidence that pass-through is higher in periods of small changes than large changes in the exchange rate, which supports the menu cost theory when invoices are denominated in the exporters' currency. Przystupa & Wróbel (2009) analyzed linearity and asymmetry of ERPT using Polish data. They do not find strong evidence in support of linearity in import prices in reaction to the exchange rate and reject the hypothesis of an asymmetric response to appreciations and depreciations. On the other hand, they found an asymmetry of CPI responses to the output gap,

direction and size of the exchange rate changes and to the magnitude of the exchange rate volatility. The asymmetry is mostly visible after exogenous shocks. They also reject the hypothesis of an asymmetric reaction of prices in a high and low inflation environment.

Delatte and López-Villavicencio (2010) by using quarterly data from 1970:1 to 2009:3 examined asymmetric ERPT for four major developed economies, namely, Japan, Germany, the United Kingdom and the US. Their results show that all the countries under study, depreciations are passed more than an appreciation which suggests weak competition structures and supports the binding constraint theory. Also, the estimated value of the pass-through within the asymmetric model is found to be significant and higher compared to linear estimations.

Low exchange rate pass-through is a common finding for countries that have low inflation environment, stable exchange rate, and small share of imports in their consumption basket (Stulz, 2006; Gagnon & Ihrig, 2001; Devereux & Yetman, 2002; Taylor, 2000). Ghana, however, could not be characterized as having any of these conditions. This study is therefore re-examining this issue by estimating the exchange rate pass-through using Vector Auto-Regressive (VAR) model technique which has so far not been applied to data pertaining to Ghana (2005-2015).

Chapter Summary

From the above review, it is realized that several works have examined the behaviour of inflation rate in both the developed and the developing countries including Ghana, most of these works concentrated on the interrelationship between inflation changes and its determinants without necessarily paying much attention to particular areas such as exchange rate and inflation linkages where most policies and strategies should be geared towards in order to achieve the desired rate of inflation. This in effect has left some gaps in exchange-inflation literature. In the light of this and many others, this study attempts to examine the relationship between exchange rate and inflation in Ghana during the period 2005-2015.

CHAPTER THREE

RESEARCH METHODS

Introduction

This section contains a detailed description of the approach used in the study. It represents the model specification and estimation strategy. It also discusses the nature and source of data employed and analysis for the study. The main purpose of this study is to examine the effect of exchange rate (Cedi to the Dollar) movement on the prices of domestic goods and services (proxied by inflation) in Ghana using time series over the period 2005 to 2015. This will then enable an estimation of the rate of any pass-through, and its proportionality to inflation levels in Ghana.

Research Design

The study used a causal research design which is appropriate for cause-effect relationship and the study also followed the positivist paradigm within the framework of classical and neoclassical economics. The positivist philosophy favors the use of quantitative approach to research. Also, this philosophy is suitable for the development of mathematical models to measure relationship between quantitative measurements. Therefore, quantitative method was used in this study. This calls for a suitable model to be employed to examine the effect of exchange rate on inflation in Ghana.

Model Specification

To assess the effect of exchange rate on inflation in the Ghana, the study used official exchange rate (LCU per US$, period average) as independent

variable and inflation (consumer prices, annual percentage) as dependent variable.

Theoretical Model

Exchange rate

According to World Bank (2016), exchange rate refers to the exchange rate determined by national authorities or to the rate determined in the legally sanctioned exchange market. It is calculated as an annual average based on monthly averages (local currency units relative to the U.S. dollar). The exchange rate (in local currency units) in the study is represented by EXC_t.

Inflation (consumer prices)

According to the World Bank (2016), inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used. The inflation (consumer prices, annual percentage) in the study is represented by INF_t.

Monetary Policy Rate

Monetary policy consists of the process of drafting, announcing, and implementing the plan of actions taken by the central bank, currency board, or other competent monetary authority of a country that controls the quantity of money in an economy and the channels by which new money is supplied. Monetary policy rate is hence, the rate at which central bank lends money to commercial banks. It therefore reflects the interest rates charged to banks from

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their banker (central bank). The monetary policy rate in the study is represented as MPR_t.

Interest Rate

The interest rate is the amount a lender charges for the use of assets expressed as a percentage of the principal. The interest rate is typically noted on an annual basis known as the annual percentage rate (APR). The assets borrowed could include cash, consumer goods, or large assets such as a vehicle or building. For loans, the interest rate is applied to the principal, which is the amount of the loan. The interest rate is the cost of debt for the borrower and the rate of return for the lender. For the study, interest rate was conceptualized to be the lending rates of commercial banks to the general public after consideration of the central bank's monetary policy rates. In aid of model presentation, interest rates is represented as INR_t.

Empirical Model

Model of the study is as follows:

$$INF_t = f (EXC_t + INR_t + MPR_t) \tag{1}$$

Where:

INF_t= Inflation (consumer prices, annual percentage) at time t

EXC_t = Exchange rate (GHC per US$, period average) at time t.

INR_t= Interest rate at time t

MPR_t= Monetary policy rate at time t

Estimation Strategy

This section presents the estimation procedures employed in the assessment of the effect exchange rate dynamics has on inflation in Ghana. Time series data on each of the variables were used. This section explains the various time series techniques used for the analysis.

Unit Root Testing

First of all, the study discusses the Augmented Dickey-Fuller (ADF) test developed by Dickey and Fuller (1981). It checks the unit root problem in the time series. It proposed the following equation with intercept to detect the unit root problem.

$$\Delta Y_t = \alpha + \delta Y_{t-1} + \gamma_1 \Delta Y_{t-1} + \gamma_2 \Delta Y_{t-2} + \dots + \gamma_m \Delta Y_{t-m} + u_t, \tag{2}$$

Where: Δ is a difference operator, and u_t is a residual at time period t. Y_t denotes the time series. $\gamma_1 \Delta Y_{t-1} + \gamma_2 \Delta Y_{t-2} + \dots + \gamma_m \Delta Y_{t-m}$ is used to correct the serial correlation. The equation (2) includes intercept α only and it can also be assumed with both intercept and time-trend T. Then, the test is as follows:

$$\Delta Y_t = \alpha + \lambda T + \delta Y_{t-1} + \gamma_1 \Delta Y_{t-1} + \gamma_2 \Delta Y_{t-2} + \dots + \gamma_m \Delta Y_{t-m} + u_t, \tag{3}$$

ADF test checks the null hypothesis ($\delta = 0$). That means, the time series has unit root problem and rejection of null hypothesis proofs the stationarity of a time series. Phillips and Perron (1988) also proposed the unit root test based on ADF methodology. The difference of Phillip-Perron (PP) test from ADF test is dealing with heteroscedasticity and serial correlation. PP test ignores $\gamma_1 \Delta Y_{t-1} + \gamma_2 \Delta Y_{t-2} + \dots + \gamma_m \Delta Y_{t-m}$ from ADF equation

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(3). It removes the serial correlation by giving ranks to the residuals. Equation of PP test is as follows:

$$\Delta Y_t = \alpha + \lambda T + \delta Y_{t-1} + u_t, \tag{4}$$

PP test uses the modified statistic Z_t and Z_δ which are as follows:

$$Z_t = \sqrt{\frac{\hat{\sigma}^2}{\hat{\lambda}^2}} t_{\hat{\delta}} - \frac{1}{2}\left(\frac{\hat{\lambda}^2 - \hat{\sigma}^2}{\hat{\lambda}^2}\right)\left(\frac{n\left(s.e.(\hat{\delta})\right)}{\hat{\sigma}^2}\right), \tag{5}$$

$$Z_\delta = n\hat{\delta} - \frac{1}{2}\frac{n^2\left(s.e.(\hat{\delta})\right)}{\hat{\sigma}^2}\left(\hat{\lambda}^2 - \hat{\sigma}^2\right), \tag{6}$$

Where, $s.e.(\hat{\delta})$ is the standard error of $(\hat{\delta})$. $t_{\hat{\delta}}$ is the test statistic under the estimates of $\hat{\sigma}^2$ and $\hat{\lambda}^2$, which are given below:

$$\sigma^2 = \lim_{T \leftarrow \infty} T^{-1} \sum_{t=1}^{T} E\left(u_t^2\right), \tag{7}$$

$$\lambda^2 = \lim_{T \rightarrow \infty} \sum_{t=1}^{T} E\left(\frac{1}{T}\sum_{t=1}^{n} s_t^2\right), \tag{8}$$

Where, $S_T = \sum_{t=1}^{T} u_t$ and T is the time-trend. Z_t and Z_δ follow the same distribution as the t-statistic of ADF test under the null hypothesis ($\delta = 0$). PP test has an advantage over ADF test because of its robust heteroscedasticity in the error term (u_t). Secondly, it does not need to specify the lag length for its estimation. Ng and Perron (2001) developed efficient and a modified version of PP test by using generalized least square detrending data. This procedure is also efficient for large negative errors and can do better estimation than PP test. The efficient and modified tests are as follows:

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$$MZ_a^d = (T^{-1}(\gamma_T^d)^2 - f_0)/2k, \qquad\qquad\qquad (9)$$

$$MSB^d = (k/f_0)^{\frac{1}{2}}, \qquad\qquad\qquad (10)$$

$$MZ_t^d = MZ_a^d \times MSB^d, \qquad\qquad\qquad (11)$$

$$MPT_T^d = ((\acute{c})^2 k + (1-\acute{c}) T^{-1})(\gamma_T^d)^2/f_0, \qquad\qquad (12)$$

Where, the statistics MZ_a^d and MZ_t^d are efficient versions of PP test and

$$k = \sum_{t=2}^{T}(\gamma_{t-1}^d)^2/T^2, \acute{c} = -13.5.$$

$$f = \sum_{j=-(T-1)}^{T-1}\Theta(j).k(j/l), \qquad\qquad\qquad (13)$$

Where l is a band width parameter (which acts as a truncation lag in the covariance weighting) and $\theta(j)$ is the j-th sample auto covariance of residuals. Zivot and Andrews (1992) modified the PP and ADF unit root test, which also considers the one-unknown structural break. The ADF test may fail in identifying the true result in the presence of a structural break whether time series is stationary or not. ADF and PP tests do not allow for structural break in data. Zivot-Andrews test uses the sequential ADF test to find the break with the following equations.

Model A: $\Delta Y_t = \mu_1^A + \gamma_1^A t + \mu_2^A DU_t(\lambda) + \alpha^A Y_{t-1} + \sum_{j=1}^{k}\beta_j\Delta Y_{t-j} + \varepsilon_t$............(14)

Model B: $\Delta Y_t = \mu_1^B + \gamma_1^B t + \gamma_2^A DT^*_t(\lambda) + \alpha^B Y_{t-1} + \sum_{j=1}^{k-1}\beta_j\Delta Y_{t-j} + \varepsilon_t$..........(15)

$$Model\ C: \Delta Y_t\, \mu_1^C + \gamma_1^C t + \mu_2^C\, DU_t(\lambda) + \gamma_2^c\, DT_t^*(\lambda) + \alpha^C Y_{t\text{-}1} + \sum_{j=1}^{k-1} \beta_j \Delta Y_{t\text{-}j}$$

$+\varepsilon_t$…….(16)

Where, $DU_t(\lambda)$ is 1 and $DT^*_t(\lambda)=t - T\lambda$ if $t > T\lambda$, 0 otherwise. $\lambda = T_B /$ T, T_B is for a possible break point in the time series. Model A allows for a change in the intercept of the series, Model (B) allows for a change in the trend of a series, while Model (C) allows changes in both intercept and trend.

Cointegration

After testing the unit root problem in the time-series variables, the cointegration test might be applied to find the long-run relationship among the variables. Cointegration states the long-run equilibrium among variables, which may have the shock of disequilibrium in the short-run from long-run, but it will move again in long-run equilibrium (Harris & Sollis 2003). Cointegration, is however maintained, when the stationarity of the variables is detected at two different levels. Thus, stationarity at first difference and stationarity of some variables at second difference. In the absence of cointegration, it is then inferred that there is no long run relationship between the observing variables. In such circumstance, the Vector Auto-Regressive (VAR) model is employed in the model estimation and prediction.

Vector Auto-Regression (VAR) Model

The study used Vector Auto-Regressive (VAR) model testing technique. Vector Autoregression (VAR) is a multivariate forecasting algorithm that is used when two or more time series influence each other. Vector

autoregression (VAR) is a stochastic process model used to capture the linear interdependencies among multiple time series. VAR models generalize the univariate autoregressive model (AR model) by allowing for more than one evolving variable. A VAR model describes the evolution of a set of k variables (called *endogenous variables*) over the same sample period ($t = 1, ..., T$) as a linear function of only their past values. The variables are collected in a k-vector (($k \times 1$)-matrix) y_t, which has as the ith element, $y_{i,t}$, the observation at time t of the ith variable. To estimate the predictive power of exchange rate, interest rate and monetary policy rate on domestic price levels, the VAR model employed was as follows:

$$\Delta INFN_t = \delta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta INFN_{t-i} + \sum_{i=1}^{p} \beta_{1i} \Delta EXC_{t-i} + \sum_{i=1}^{p} \beta_{1i} \Delta MPR_{t-i} + \sum_{i=1}^{p} \beta_{1i} \Delta INR_{t-i} + \varepsilon_t \ldots\ldots\ldots(17)$$

Afterwards, diagnostic tests were used to check the normality, functional form, heteroscedasticity and serial correlation in the model. CUSUM and CUSUMSQ statistics were used to ensure the stability of parameters.

Data Source

The study used annual time series data covering 2005 to 2015. The data set for all variables (inflation rate, exchange rate, monetary policy rate, and interest rates) were all sourced from World Bank-World Development Indicators Database (Online Edition). This composed of annual time series data covering 2005 to 2015.

Validity and Reliability of Instrument

Validity and reliability of the instrument was ensured by retrieving information from recognized and trusted online sources recommended by the supervisor (who happens to be an expert in the research area) for the study. These online data sources included World Development Indicators. According to Lovell and Lawson (1970), validity depends upon judgment of experts who after examining the contents decide what they think it measures. Also, a reliable instrument is the one that consistently produces the expected results (Mulusa, 1990).

Chapter Summary

This chapter presented the methodological framework suitable for conducting the study. The study follows Harris and Sollis (2003) to specify the econometric model for inflation. Annual time-series data on exchange rate, monetary policy rate, interest rate, and rate of inflation from 2005 to 2015 were used for the study. Stationarity test was conducted using Augmented Dickey–Fuller (ADF) and Phillip-Perron (PP). Finally, Vector Auto-Regressive (VAR) econometric model was used to examine the short-run dynamics between the variables.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

This chapter presents the results and discussion to address the hypothesis underpinning the study. The study sought to estimate both the short run and long run effects of exchange rate on the domestic price levels in Ghana (inflation rate) with money policy rate, interest rate, and gross domestic product (GDP) as the control variables. The data obtained was processed with the use of stata and regression analysis, after all preliminary analysis were made, and used in generating the model to address the hypothesis. The results of the descriptive statistics, correlation and unit root have also been presented. Subsequently, the results generated for the main model was generated and presented. Discussions of these results have been made in relation to the hypotheses guiding the conduct of the study.

Descriptive Statistics

To fully appreciate the model obtained, there was a need to present the descriptive statistics of the dependent variable (inflation rate), independent variable (exchange rate) and the other explanatory variables (monetary policy rate, interest rate and gross domestic product). The means, standard deviations, minimum, maximum, skewness, kurtosis, and observation for monthly data from January 2005 to December 2015 were presented in Table 2.

Table 2: Descriptive Statistics of Key Analysis Variables

	inf	exc	inr	mpr	LnGdp
Mean	13.26285	2.466078	17.93264	17.67014	9.762537
Median	12.45000	1.907072	19.00000	17.00000	10.03334
Maximum	20.74000	4.814689	23.50000	26.00000	10.58338
Minimum	8.390000	0.922384	11.00000	12.50000	8.464910
Std. Dev.	3.730830	1.302076	4.271623	4.185771	0.743052
Skewness	0.369956	0.451000	-0.177253	0.670625	-0.432710
Kurtosis	1.750353	1.600415	1.395868	2.413991	1.529428
Jarque-Bera	12.65453	16.63466	16.19348	12.85414	17.46920
Probability	0.001787	0.000244	0.000305	0.001617	0.000161
Sum	1909.850	355.1152	2582.300	2544.500	1405.805
Sum Sq. Dev.	1990.430	242.4424	2609.287	2505.457	78.95415
Observations	144	144	144	144	144

Source: Fieldwork, 2018
Notes: Monetary policy rate (MPR), Exchange rate (EXC), Inflation (INF), Interest rate (INR), Natural logarithm of Gross domestic product (LNGDP).

From Table 2, it could be seen that inflation rate (inf) which was used as a proxy for domestic price levels displayed a relatively low variation with a minimum score of 8.39000 and maximum of 20.7400. The average inflation rate was 13.26285 with volatility measured by the standard deviation of 3.7308. This means that inflation rates between January 2005 and December 2015 was the least at a rate of 8.39% and peaked at a rate of 20.74% with the average inflation rate within those periods being 13.26%. Inflation rate displayed a close distribution with positive skewness values of 0.369956 depicting that inflation

rates was normally distributed during the period under consideration. Inflation rates seemed to be less volatile over the study period.

For the independent variable, it was revealed that exchange rates (exc) recorded a mean of 2.4661, a maximum of 4.8147 and a minimum of 0.9223. This means that from January (2007) to December (2018), the minimum Cedi to dollar exchange rate that occurred in Ghana was GHC0.92 per USD1. Also, the furthest the cedi went in exchange to the dollar was GHC4.81 per USD1 and the average exchange rate within these years period on a monthly basis was GHC2.47 to a USD with a dispersion of 1.3020. Exchange rates displayed a close distribution with positive skewness values of 0.4510 depicting that exchange rates were normally distributed during the period under consideration. Exchange rates seemed to be less volatile over the study period.

For the explanatory variables, monetary policy rate was least at 12.50%, peaked at 26.00% and recorded an average of 17.67% with an accompanying dispersion of 4.19. Additionally, the least interest rate (inr) recorded during the study period was 11.00%, the biggest interest rate record was 23.50% and the average within the 142 observable periods was 17.93% with a recorded standard deviation of 4.27. The last explanatory variable was the Natural Logaritm of Gross Domestic Product (LnGdp). The least LnGdp recorded during the study period was 8.46, the highest being 10.58 and the average being a record of 9.76 with an accompanying deviation of 0.74.

Correlation Analysis

Correlation analysis was examined to know the degree of association and whether there was multicollinearity among the variables. The significant relationship between some predictor variables highlights the importance of checking for potential multicollinearity problem in the regression model. Collinearity makes it difficult to distinguish the effect of one variable from the effect of another in the regression model (Adam & Owusu Junior, 2017). Thus, for a clear prediction to be made in a regression model, there should be no correlation among variables in the model. Hence a reliance on the Pearson product moment correlation analysis on both dependent and independent variables, as well as explanatory (control) variables to test for the existence of multicollinearity. The pairwise correlation among the variables was employed and the results generated are presented in Table 3.

Table 3: Correlation Matrix of Variables

	inf	exc	inr	mpr	lngdp
inf	1				
exc	0.113	1			
inr	0.644^{***}	0.307^{***}	1		
mpr	0.641^{***}	0.749^{***}	0.645^{***}	1	
lngdp	0.219^{**}	0.751^{***}	0.342^{***}	0.600^{***}	1

Source: Fieldwork, 2018
Notes: Monetary policy rate (MPR), Exchange rate (EXC), Inflation (INF), Interest rate (INR), Natural logarithm of Gross domestic product (LNGDP). ***, ** and * indicate 1%, 5% and 10% significance levels respectively.

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From Table 3, the domestic price levels presented by the inflation rates have a positive relationship between the exchange rate, interest rate, monetary policy rate and the natural logarithm of gross domestic product. Between the two dependent and independent variables, although there was found a positive relationship, the correlation coefficient shows a weak correlation at r = .113. This weak correlation found between inflation rate and exchange rates was seen not to be statistically significant. Hence it could be concluded on the two variables that there is no statistically significant relationship between them, hence no issue of multicollinearity between those two variables.

The correlation matrix shown in Table 3 shows that there is a statically significant relationship among all the other remaining control variables as they correlate with themselves and also with both the dependent and independent variables at 0.1% significance level. To fully address whether these statically significant correlation coefficients could mean the existence of multicollinearity among variables, reliance was made on literature in the definition of the term. Kennedy (2008) argues that for the existence of multicollinearity, correlation coefficient must be 0.80 or more. This is further supported by Adam and Owusu Junior (2017) who also argue that when variables exhibit correlation coefficient of 0.80 and above, it is a precursor to multicollinearity. This means that the correlation matrix presented in Table 3 reveals no issue of multicollinearity as no correlation coefficient exceeds 0.80. Thus, because of the relatively low correlations between the independent variables as they do not exhibit correlation

coefficient more than 0.8, there is no any potential multicollinearity among variables that can affect the explained variables in the model.

Unit Root Test

Generally, data must be free from any spurious related issues that may affect the outcome or the results of the findings. It is therefore, important to make some diagnostic test to check the accuracy of every single data used in the study. It is important to perform the unit root test to verify that the variables are not integrated of an order higher than one. The purpose is to ascertain the absence or otherwise of I(2) variables to extricate the results from spurious regression. Stationary series means that the statistical properties of the series are constant over time. The variables were tested for unit roots to verify their stationarity. At levels, a non-statistical test of trend analysis of variables was done and results shown in Figure 5.
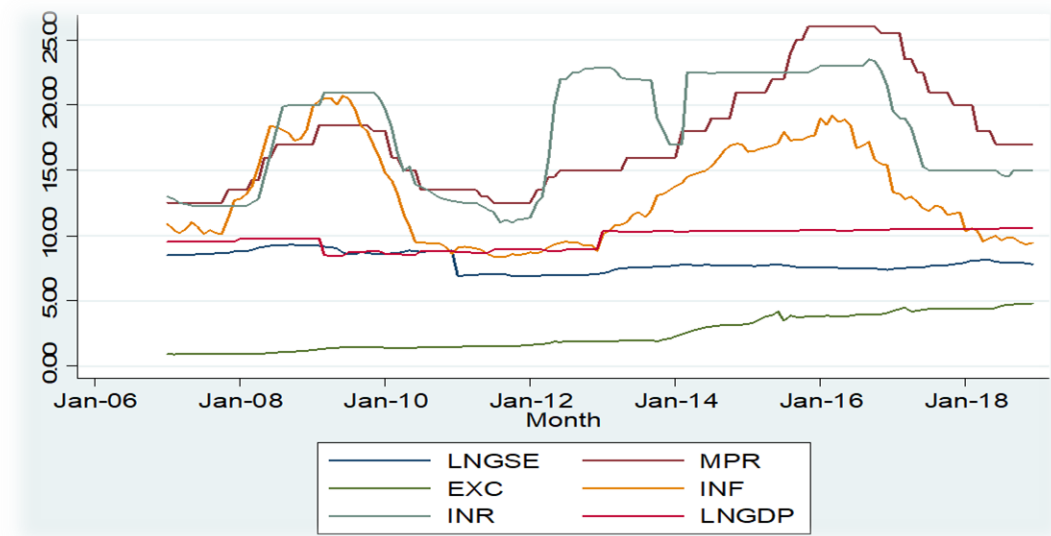

Figure 5: Unit root test results at level showing non stationarity
Source: Fieldwork, 2018

The analysis of the trend of variables as shown in Figure 5 depicts that variables seem to follow the same trend. Most of the series are trending series, which suggest that these series are not stationary. When series tends not to revert around zero but trend, then the observation depicts a non-stationary set of variables. This non-stationarity tends to influence spuriously, the outcome of the regression model. Because this observable trend analysis could be misleading in some situations, reliance is laid on the statistical method of determining stationarity. This was done through the Augmented Dickey-Fuller test (ADF) and Phillips-Peron test (PP) with a truncated lag of 1. The results generated is provided in Table 4.

Table 4: Unit Root Test at Levels

| ADF test		
Variable	Test Statistic	Lags
INF	-1.394[0.8626]	1
EXC	-1.718[0.7430]	1
INR	-2.016[0.5925]	1
MPR	-0.462[0.9848]	1
LNGDP	-2.124[0.5325]	1
PP test		
INF	-1.016[0.9419]	1
EXC	-1.864[0.6732]	1
INR	-1.349[0.8753]	1
MPR	-0.440[0.9856]	1
LNGDP	-2.110[0.5406]	1

Source: Fieldwork, 2018
Notes: Monetary policy rate (MPR), Exchange rate (EXC), Inflation (INF), Interest rate (INR), Natural logarithm of Gross domestic product (LNGDP).

The ADF and PP test were conducted as unit root tests for the variables at levels. The null hypothesis of both ADF and PP tests states that variables are unit roots, thus not stationary. The rejection of the null hypothesis means that the series is stationary. From the unit root test results in Table 5, the null hypothesis of the presence of unit root for all the variables in their levels are not rejected since the P-values of the ADF statistic and PP statistic are not statistically significant at the 5% level of significance. They were considered not to be statistically significant because the t-statistics were all less than the critical values in brackets. Hence, at the various levels of the variables, they were all seen to be non-stationary.

Arriving at non stationarity at levels of the variables, it was deemed important to check the stationarity at the first difference of the variable. The variables were then difference at point 1 and stationarity checked again. This was done in the question to deal with all spurious issues of the variables which could affect the regression model. The graphical approach of observing the trend series in the variables after the first difference was done and the results provided in Figure 6.
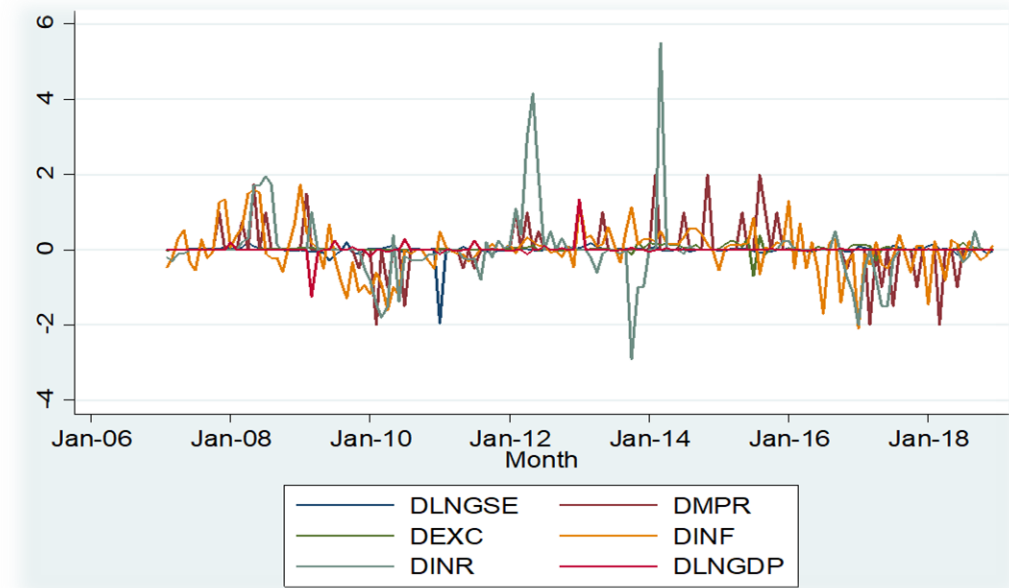
Figure 6: Unit Root Test Results at first difference showing stationarity

Source: Fieldwork, 2018

The analysis of the trend of variables as shown in Figure 2 depicts that variables seem not to follow the same trend. Most of the series are appears to revert around zero, which suggest that these series are stationary. After first difference of all the variables they become stationary as they revert around zero. Because this observable trend analysis could be misleading in some situations, reliance is laid on the statistical method of determining stationarity. This was done through the Augmented Dickey-Fuller test (ADF) and Phillips-Peron test (PP) with a truncated lag of 1. The results generated is provided in Table 5.

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Table 5: Unit root test at First Difference

ADF test			
Variable	Test Statistic	Lags	*I*
DINF	-5.698[0.0000]*	1	I (1)
DEXC	-7.790[0.0000]*	1	I (1)
DINR	-5.530[0.0000]*	1	I (1)
DMPR	-6.561[0.0000]*	1	I (1)
DLNGDP	-8.270[0.0000]*	1	I (1)
PP test			
DINF	-8.091[0.0000]*	1	I (1)
DEXC	-15.484[0.0000]*	1	I (1)
DINR	-7.140[0.0000]*	1	I (1)
DMPR	-11.518[0.0000]*	1	I (1)
DLNGDP	-11.673[0.0000]*	1	I (1)

Source: Fieldwork, 2018

Notes: Monetary policy rate (MPR), Exchange rate (EXC), Inflation (INF), Interest rate (INR), Natural logarithm of Gross domestic product (LNGDP).

The ADF and PP test were conducted as unit root tests for the variables at first difference. At first difference, the variables were all stationary. This is because the null hypothesis of the presence of unit root (non-stationary) is rejected at 5% sig. levels for all the estimates. They were considered to be statistically significant because the t-statistics were all greater than the critical values. Hence, at the first difference of the variables, they were all seen to be stationary. It is therefore clear from the unit root results discussed that all the variables are integrated of order one, I(1). The findings reveal that the variables are first-difference stationary.

Diagnostic Tests

Diagnostic tests were conducted for the variables in relation to serial correlation, functional form, normality and heteroscedasticity. For instance, before you use an estimated equation for statistical inference (e.g. hypothesis tests and forecasting), you should generally examine the residuals for evidence

of serial correlation. These diagnostic tests were conducted and results presented in Table 6.

Table 6: Diagnostic Tests

	LM version	P-value
Serial Correlation (χ^2)	0.244	0.621
Functional Form (χ^2)	0.175	0.678
Normality (χ^2)	3.459	0.116
Heteroscedasticity (χ^2)	2.497	0.177

Source: Computed by Ayonka(2018) using E-views 9.0

For the rejection of the null hypothesis which all state that there is no serial correlation, no functional form, no normality and no heteroscedasticity, the p -value to the LM version statistics should all be less than .05. The results in Table 10 rather shows that all test values have p-values more than .05, this means that the basic diagnostic tests have been met. Thus, there was no issue of serial correlation, the variables were normally distributed, were of functional form, and passed the heteroscedasticity tests.

Vector Auto Regressive Model (VAR)

The stationarity of all variables at first difference or integrated at order 1 explains that there was no cointegration existing among the variables. A decision was then made to use the Vector Auto Regressive Model to estimate the effect of exchange rate on the domestic price changes (inflation) with monetary policy, interest rates and natural lorgarithm of gross domestic product as explanatory or control variables. Prior to the generation of the regression model, varsoc was used to estimate the number of lags that could predict the least error.

It was found that using 2 lags provides a prediction with the least error. Vector Auto Regression model was then run with two lags to estimate the effect of exchange rates on inflation. The results generated is presented in Table 6.

Table 7: Vector Auto Regressive Model

VARIABLES	(1) inf	(2) exc	(3) inr	(4) mpr	(5) LnGdp
L.inf	1.175***	0.00569	0.174	0.216***	-0.00816
	(0.0846)	(0.0143)	(0.113)	(0.0838)	(0.0250)
L2.inf	-0.203**	-0.00268	-0.144	-0.143*	-0.00816
	(0.0877)	(0.0148)	(0.117)	(0.0869)	(0.0259)
L.exc	0.681**	0.707***	0.782	-0.283	-0.0390
	(0.485)	(0.0818)	(0.650)	(0.481)	(0.143)
L2.exc	-0.880*	0.302***	-0.676	0.364	0.0392
	(0.490)	(0.0825)	(0.656)	(0.485)	(0.145)
L.inr	0.0459**	-0.00139	1.319***	0.0859	0.0147
	(0.0540)	(0.00910)	(0.0723)	(0.0535)	(0.0159)
L2.inr	-0.0467	0.00264	-0.372***	-0.0703	-0.00441
	(0.0546)	(0.00920)	(0.0731)	(0.0541)	(0.0161)
L.mpr	0.133**	0.0142	0.496***	0.816***	-0.0243
	(0.0847)	(0.0143)	(0.113)	(0.0838)	(0.0250)
L2.mpr	-0.140*	-0.0196	-0.511***	0.0867	0.0288
	(0.0821)	(0.0138)	(0.110)	(0.0813)	(0.0242)
L.LnGdp	0.138	-0.00685	0.116	0.164	0.934***
	(0.288)	(0.0486)	(0.386)	(0.285)	(0.0850)
L2.LnGdp	0.262	0.0300	-0.229	0.00297	0.0314
	(0.287)	(0.0484)	(0.385)	(0.285)	(0.0848)
Constant	-2.953***	-0.180	1.640	-1.295	0.303
	(0.913)	(0.154)	(1.223)	(0.905)	(0.270)
Observations	142	142	142	142	142

Standard errors in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$
Source: Fieldwork, 2018

From Table 8, it was observed that exchange rates, and two of the explanatory variables, had a positive impact on inflation rates all at the first lag. However, the second lags of these variables were seen to have a negative impact

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on inflation rates. This means that currently, the dependent variable is influenced positively by the independent variable. In the second lags of all variables, an inverse relationship is observed. Overall, emphasis will then be placed on lags one in drawing conclusions.

In details, the results in Table 8 show that lag 1 of exchange rate, the independent variable, had a positive impact on inflation at a significance of 5%, ceteris paribus. This means that when exchange rate increases, inflation rate also increases, and vice versa. Also, lag 1 of interest rate had a positive influence on inflation at a significance level of 5%, ceteris paribus. This means that an increase in interest rates will cause a corresponding increase in inflation rates, and vice versa. In addition, lag 1 of monetary policy rate had a positive influence on inflation rate at a significance level of 5%, ceteris paribus. This shows that inflation rates will increase when monetary policy rates increase and will fall when monetary policy rates fall. The table reveals that lag 1 of natural logarithm of gross domestic product, although had a positive influence on inflation rate, was not statistically significant. It is then said that the first lag of natural logarithm of gross domestic product has no significant influence on inflation rate.

On the second lags, there was found a significant negative impact of all variables, in the exception of natural logarithm of gross domestic product. The results showed that lag 2 inflation rate had a negative influence on inflation at a significance level of 10%, ceteris paribus. In addition, lag 2 exchange rate had a negative influence on inflation rate at a significance level of 10%, ceteris

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paribus. On the same note, lag 2 of monetary policy rate also had a negative influence on inflation at a significance level of 10%. Lag 2 of natural logarithm of gross domestic product, although was found to have a positive impact on inflation rate, was not statistically significant as indicated in the table.

However, among the explanatory variables, it was seen that lag 1 of monetary policy rate has a positive impact on interest rate at 1% significance level, ceteris paribus. Lag 2 of monetary policy rate has a negative impact on interest rate at 1% significance level. Also, lag 1 of inflation has a positive influence at 1% significance level on monetary policy rate and also the lag 2 of inflation has a negative impact on the monetary policy rate at 10% significance level. The remaining explanatory variables were seen not have any statistically significant influence among themselves.

In conclusion, the coefficient of determination (r^2) was used to check the percentage influence exchange rate (independent variable) and the other explanatory variable (monetary policy rate and interest rate) had on the dependent variable, with reliance on the first lag test results. It was revealed from the test that exchange rates account for 46.37% ($r^2 = 0.463761$) change in inflation rates. Thus, a unit increase in exchange rates will cause a 0.4637 increase in inflation rate. For interest rates, because the correlation coefficient was small ($r = 0.0459$), it demonstrated a weak positive impact on inflation rate and was evident in the coefficient of determination. The test showed from the coefficient of determination ($r^2 = .0021$) that interest rates had a 0.21% positive influence on inflation rate. This means that interest rates account for only 0.21%

increase in inflation when interest rates increase. On monetary policy rates, the test showed through the coefficient of determination ($r^2 = 0.0177$) that, the variable explains 1.7% of the change that occurs in inflation rate if a direct change occurs in monetary policy. This means that a unit increase in monetary policy rate will cause a 1.7% marginal increase in inflation rates.

Discussions

Discussions in this chapter were done in accordance with the three-hypothesis undergirding the study. Relevant literatures were used to support findings obtained after the test and implications drawn.

Effect of Exchange Rate on Domestic Price Level (Inflation)

The first hypothesis was to establish whether there is a statistically significant effect of exchange rate on domestic price levels in Ghana. Specifically, the null hypothesis, the testable one was stated as

H_0: *There is no positive significant relationship between exchange rate and domestic price levels.*

The results showed that there was a statistically significant positive effect of exchange rate on domestic price levels, which was proxied by use of inflation rate. This was established with a correlation coefficient of .681 and a coefficient of determination of .4638 at a 5% significant level. Hence the null hypothesis is rejected. This means exchange rate has a 46.38% positive influence on domestic price levels.

The findings of this study fall in line with many studies conducted. For instance, in a study conducted by McCarthy (2000) which also used the VAR

model, found that exchange rates and import prices have a modest effect on domestic price inflation. Also, Aziz (2009), in a study on developing economies found a complete significant positive pass through of exchange rates on domestic price levels. Similarly, the study shares the same light with Canetti and Greene's (1992) study in Sub Saharan Africa which revealed that exchange rate movements significantly affect consumer price inflation in a positive fashion.

In contrast, the finding of the study appears to disagree with Goldberg and Knetter (1997) and Yang (1997) who both respectively found an impartial and incomplete pass through of exchange rates on domestic price levels. In developing countries, the findings of the current study further disagree with Rowland (2003) who used VECM and found an incomplete pass through of exchange rate on domestic price levels. Finally, in Ghana, Frimpong and Adam's (2010) study using similar VAR model found that there is no statistically significant effect of exchange rate on domestic price levels in the short run, which appears to be at variance with the findings of the current study.

Effect of Interest Rate on Domestic Price Levels

The second hypothesis was to check whether interest rate will have an effect on domestic price levels. Specifically, the null hypothesis, the testable one was stated as

H_0: *There is no positive significant relationship between interest rate and domestic price levels.*

The results showed that there was a statistically significant positive effect of interest rate on domestic price levels, which was proxied by use of

inflation rate. This was established with a correlation coefficient of .046 and a coefficient of determination of .0021 at a 5% significant level. Hence the null hypothesis is rejected. This means exchange rate has a .21% positive influence on domestic price levels.

The finding of the test appears to be in agreement with some studies. Choudhri & Hakura (2012) found that higher interest rates cause higher inflation rates. Also, Devereux & Yetman (2002) reported that increased interest rate has an overall positive impact in the escalation of inflation rates in the country. Additionally, Bailliu and Fuji (2004) in a study conducted revealed that in the short run, interest rate has a positive bearing on the inflation rate of country.

Effect of Monetary Policy Rate on Domestic Price Levels

The third hypothesis was to check whether monetary policy rate will have an effect on domestic price levels. Specifically, the null hypothesis, the testable one was stated as

H_0: There is no positive significant relationship between monetary policy rate and domestic price levels.

The results showed that there was a statistically significant positive effect of monetary policy rate on domestic price levels, which was proxied by use of inflation rate. This was established with a correlation coefficient of .133 and a coefficient of determination of .0177 at a 5% significant level. Hence the null hypothesis is rejected. The alternate hypothesis is maintained that monetary policy rate has a 1.77% positive influence on domestic price levels.

The revelations from the current study appears to be in cognizance with studies from other scholars. For instance, it agrees with Mwase (2006) who used the SVAR model to establish that high monetary policy is accompanied with high and volatile inflation. Also, Aliyu et al. (2010), in Nigeria using the VEC model established that monetary policy rate has an overall significant positive impact on domestic price levels. Similarly, Taylor (2000) exposed the positive impact of monetary policy behaviour on domestic price levels.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter summarises the entire study. It highlights the research methods employed, specific objectives guiding the study, key findings arrived at, conclusions drawn from these findings and the appropriate recommendations made. Areas for further studies were also suggested for other users of the study.

Summary

The summary of the study is presented in two parts. The first part is the summary of the research process; and the second part is the summary of the key findings.

Summary of Research Process

The main purpose of this study is to examine the effect of exchange rate (Cedi to the Dollar) movement on the prices of domestic goods and services in Ghana using time series over the period 2005 to 2015. The quest to conduct this study was to enable an estimation of the rate of any pass-through, and its proportionality to inflation levels in Ghana. The study was to establish the effect of exchange rate, interest rates and monetary policy rates on domestic price levels. The following null hypotheses were generated to underpin the study;

1. H_0: There is no positive significant relationship between exchange rate and domestic price levels

2. H_0: There is no positive significant relationship between interest rate and domestic price levels

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3. H_0: There is no positive significant relationship between monetary policy rate and domestic price levels

The study employed a causal research design, based on the positivist paradigm, employing solely quantitative tools of data collection and analysis, to estimate the effect of exchange rates on domestic price levels. The study used annual time series data covering 2005 to 2015. The data set for both exchange rate and inflation were sourced from World Bank-World Development Indicators Database (Online Edition). Vector Auto Regressive (VAR) model was used in estimating the significant positive effects of the independent variable (exchange rates) and the explanatory variables (interest rate and monetary policy rate) on the dependent variable (inflation rate, a proxy for domestic price level)

Summary of Key Findings

The following key findings were obtained after a thorough discussion of the results:

1. There was a statistically significant positive effect of exchange rate on domestic price levels with a positive correlation coefficient of .681 and a coefficient of determination of .4638 at a 5% significant level.

2. There was a statistically significant positive effect of interest rate on domestic price levels with a correlation coefficient of .046 and a coefficient of determination of .0021 at a 5% significant level.

3. There was a statistically significant positive effect of monetary policy rate on domestic price levels with a correlation coefficient of .133 and a coefficient of determination of .0177 at a 5% significant level.

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Conclusions

Having found that exchange rate has a positive influence on domestic price levels means that an increase in inflation rates could be explained by a hike in exchange rates. Implicitly, to curtail the persistence increase in inflation rates, attention should be devoted on measures in reducing exchange rate increase. This means that when the cedi continues to depreciate with respect to the dollar, the country should brace herself for a corresponding increase in the prices of goods and service in the domestic market.

In addition, with a revelation of a positive influence of interest rate on domestic price levels means interest rates should be managed carefully if a country wants to control inflation. The findings suggest that, although a weak relationship exists, when issues concerning interest rates are not subdued and allowed to escalate, a ripple effect of a marginal increase in interest rates are to be expected. This shows that interest rates should be observed and managed keenly if there are attempts by a country to manage one of its micro economic indicators, such as inflation rate.

Finally, a country's monetary policy regime has been found to impact positively on the nation's domestic price levels. This implies that the actions undertaken by a nation's central bank to control money supply to achieve macroeconomic goals that promote sustainable economic growth, when not carefully implemented could lead to high inflation rates. Thus, open market operations, direct lending to banks, bank reserve requirements, unconventional

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emergency lending programs, and managing market expectations should be carefully done to avoid hikes in domestic price levels.

Recommendations

In the lights of the conclusions drawn, it is recommended that

1. Bank of Ghana needs to ensure a stable exchange rate in order to reduce its potential effect on inflation in Ghana.

2. Another policy implication of the study is that the Government of Ghana needs to ensure that low inflationary rate is maintained in Ghana.

3. Also, Bank of Ghana need to tighten monetary policies and interest rate policies to stabilize and check on the inflationary rates in Ghana.

Suggestions for Further Research

After investigating the through put effect of exchange rates on domestic price levels, it is suggested that further research be focused on the following areas:

1. Since exchange rate is a high frequency phenomenon apart from the measurement used in the study, a different measurement can be used by future research to investigate its effects on inflation.

2. Finally, the possible determinants of inflation range from macroeconomic, geographical factors, monetary and fiscal policy factors to others. This therefore means that future researchers could explore the other determinants of inflation other than exchange rate considered in this study.

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