THE IMPACT OF OIL PRICE SHOCK ON INFLATION, THE PASS-THROUGH EFFECT IN MALAWI

MASTER OF ARTS (ECONOMICS) THESIS

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UNIVERSITY OF MALAWI

CHANCELLOR COLLEGE

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MASTER OF ARTS (ECONOMICS)

By

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Thesis submitted to the Department of Economics, Faculty of Social Science in partial fulfillment of the requirements for the degree of Master of Arts Economics

UNIVERSITY OF MALAWI
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AUGUST, 2014

DECLARATION

I the undersigned hereby declare that this thesis is my own original work which has not been submitted to any other institution for similar purposes. Where other people's work has been used acknowledgements have been made.

_____

Full Legal Name

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Signature

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Date

CERTIFICATE OF APPROVAL

I declare that this thesis is the student's own work and effort and where he has used other sources, acknowledgement has been duly made. Hence the thesis is submitted with my approval on behalf of the University of Malawi, Chancellor College, Zomba.

Signature: _____

Date: _____

Professor Ben Kaluwa, PhD

Supervisor

DEDICATION

I sincerely thank my wife Irene and kids Leonard, Faith and Yvonne for their love, endless support and spiritual encouragement. Additional gratitude to Total Malawi for all their assistance.

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ABSTRACT

Since 2000 the world has seen a resurgence of increasing oil prices which paralleled the 1978 and 1979 world oil price shock which had global repercussions. Several studies have been conducted so as to understand the magnitude of the impact of oil price fluctuation and the channels through which they affect the economy. This paper investigates the impact of international oil price fluctuation and the magnitude of the pass-through level to inflation, the pricing mechanism and the monetary policy response and its resultant impact on inflation in Malawi using data from 1985 to 2010.The study uses the triangle model of inflation, Phillips curve, to assess the relationship of the variables and estimate the Autoregressive Distributed Lag model (ARDL) so as to get the pass-through effect both in the short run and long run. The results show that money supply, oil price, interest rates and exchange rate variables have significant effects on inflation. However there is an incomplete international oil price changes pass-through to inflation which is even less compared to the exchange rate pass-through to inflation. Therefore inflation in Malawi is largely affected by shocks to the aggregate supply mainly through food prices which forms a large proportion of the consumer price index basket and the exchange rate fluctuation. Interest rates and money supply as instruments of monetary policy have very minimal impacts on inflation.

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LIST OF ACRONYMS AND ABREVIATIONS

ARDL	Autoregressive Distributed Lag Model
CPI	Consumer Price Index
GNP	Gross National Product
GDP	Gross Domestic Product
I	Interest
IMF	International Monetary Fund
M1	Quantity of money in circulation
M2	Broad Money
MERA	Malawi Energy Regulatory Authority
OECD	Organization for Economic Co-operation and Development
OMC	Oil Marketing Companies
PIL	Petroleum Importers Limited
PCC	Petroleum Control Commission
PPI	Production Price index
SDR	Special Drawing Rights
VAR	Vector Autoregressive Scheme
USA (US)	United States of America
IFL	Inflation

CHAPTER 1

INTRODUCTION

1.1 Background

'Oil prices have been volatile since the large price increases of the 1970s and 1980s. The wide price fluctuations in 2007, when daily spot prices for crudes nearly doubled between January and November, by more than US$20 a barrel reinforce the idea that oil prices are volatile. Oil is important in every economy; when its prices are high and volatile, governments feel compelled to intervene. Because there can be large costs associated with such interventions, reserve banks, central planning institutions, and think tanks in industrial countries have been carrying out quantitative analyses of oil price volatility for a number of years'(Bacon and Kojima, 2008: page xiii).

'The oil price levels can affect the balance of payments, gross domestic product (GDP), and where fuel prices are subsidized, oil price level can also affect government budgets, contingent liabilities, or both. At the microeconomic level, higher oil prices lower effective household income in three ways. First, households pay more for petroleum products they consume directly. Seventy percent of Sub-Saharan Africans are not yet connected to electricity; most without access rely on kerosene for lighting. Second, higher oil prices increase the prices of all other goods that have oil as an intermediate input. The most significant among them for the poor in low-income countries is food, on which the poor spend a disproportionately high share of total household expenditures. Food prices increase because of higher transport costs and higher prices of inputs to agriculture such as fertilizers and diesel

to operate tractors and irrigation pumps. For the poor who use transport services, higher transport costs also decrease effective income. Third, to the extent that higher oil prices lower GDP growth, household income is reduced' (Kojima et al., 2010: Page 1).

1.2 Problem Statement

Malawi experienced a recession in 1980 following the major oil price shock in the 1978 and 1979. The economy growth rate drastically reduced and inflation levels increased tremendously .The currency was devalued as a result of the worsening balance of payment precipitated by war in Mozambique coupled with supply constraints in the economy. Similar oil price increases in 1990-91, 1995-96 and 1999-2000 led to the increase in inflation and subsequent stunted GDP growth rate and worsening balance of payment (Ndaferangande, 2000).

Oil is an important source of energy in Malawi for the household sector, industry, transport and service sector. It accounts for 7 percent of Malawi energy requirements (Gamula and Peng, 2012). Malawi imports 97 percent of its refined petroleum products; the balance is contributed by locally produced ethanol which is sold directly to the oil companies for blending with petrol

The internal fuel storage capacity for the country is supposed to be for 30 days but this is not the case on the ground. Consequently the pricing of fuel is heavily influenced by trends on the international market due to insufficient stock days within the country. Because of the pervasive role of oil in the economy, oil prices affect the prices of many goods and services as well as the general price level. Moreover oil

price increases have the potential to increase inflation. The increase in inflation caused by an increase in oil prices is referred to as the pass through of oil to inflation.

Several studies have been conducted focusing on the impact of oil price changes on various macroeconomic aggregates like inflation. Most of these studies have been done in countries outside Africa and few in Sub Saharan Africa. Kiptui (2009) investigated the impact of oil price changes and level of pass-through to inflation in Kenya. The results indicated that oil price had significant effects on inflation.

In Malawi some studies that have been done have focused on either the determinants of inflation (Simwaka et al, 2012) or the level of pass-through of exchange rate to inflation (Jumbo et al., 2014).

This study therefore examined the impact of oil price shocks to inflation and the monetary policy response using an augmented Phillips curve and an ARDL approach to determine both the short run and long run pass-through levels.

1.3 Objectives and Significance of the Study

The purpose of the study is to investigate if International oil prices fluctuations have an impact on the level of inflation in Malawi. The knowledge of the empirical estimates of the degree and speed of oil pass-through and exchange rate pass-through is important for Malawian monetary authorities because of their implication on inflation and fuel pricing policy. Specifically the study will first evaluate time series characteristics of the variables used in the ARDL equation and then parsimoniously specify a model for estimation.

1.4 Hypothesis

The study tests null hypothesis. It is hypothesized that

i) Oil prices do not have any impact on inflation both in the short run and long run.

ii) Output gap does not have any impact on inflation both in the short run and long run.

iii) Exchange rate does not have any impact on inflation both in the short run and long run.

iv) Money supply does not have any impact on inflation both in the short run and long run.

v) Interest rates do not have any impact on inflation both in the short run and long run.

1.5 Outline of the Study

After the presentation of the introduction to the study in this chapter, the rest of the study is organized as follows: Chapter two gives an overview of the Malawi economy. Chapter three provides literature review and chapter four provides research methodology. Chapter five reports and discusses the research findings. Chapter six concludes the study with a summary of policy implications of the estimated results.

CHAPTER 2

BACKGROUND OF THE MALAWI ECONOMY

2.0 Introduction

This chapter provides an overview of the Malawi's economy. It also provides brief information on the performance of the macroeconomic aggregates, policy framework and exogenous factors that influenced the performance between 1980 to 2010.

2.1 Background

Malawi is one of the poorest countries in the world. It was ranked 165th out of 177 countries according to 2005 United Nations Human Development Index. The aggregate real GDP growth is largely determined by climatic condition because of the heavy reliance of the economy on rain fed agriculture. Recent statistics from the National Statistics office indicate that agriculture is on average contributing 31% to GDP (African Economic Outlook, 2011).

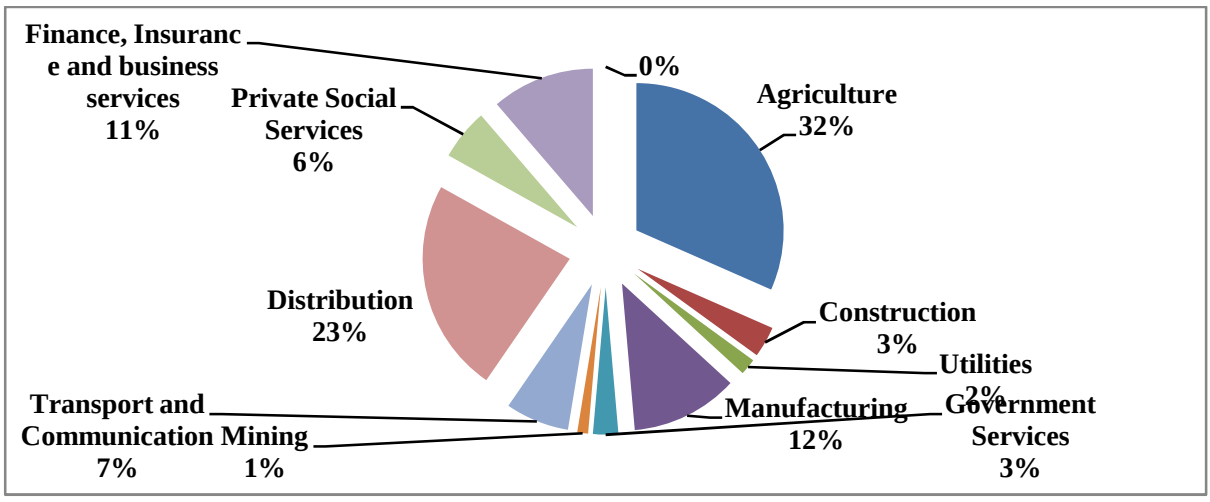


Figure 1: GDP by Sector (percentages)

Source: Authors' Chart based on Africa Economic Outlook figures (2011).

The structure of the economy is gradually changing. The share of agriculture in GDP fell from a peak of 49 percent in 1993 to 31 percent in 2011. Likewise the share of industry declined from as high as 31.5 percent in 1992 to 19 percent .The service sector is now a major contributor with a share of 49.5 percent in 2011.

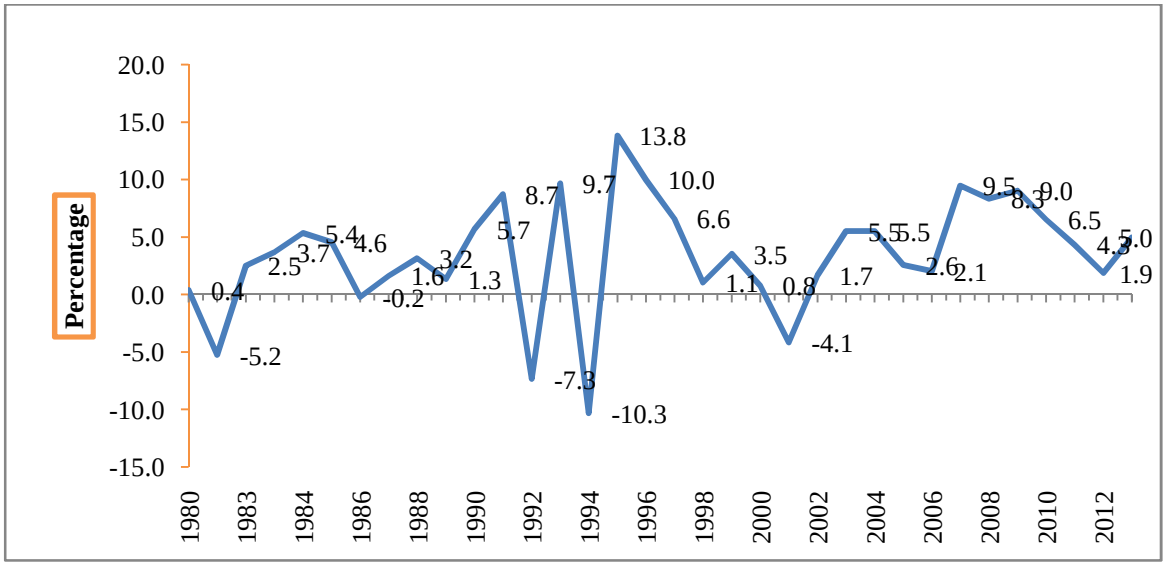


Figure 2: Real GDP growth rate (percentage)

Source: Author's, data from IMF

Malawi GDP growth has been generally weak between 1980 and 1990. GDP grew at an average annual rate of 2.2 percentages. In 1982 in particular GDP registered negative growth. This was mainly due to low levels of foreign aid and deterioration in the transport network due to the war in Mozambique exacerbated by influx of refugees which overstretched government of Malawi budget and the subsequent effects of Oil price shock of the 1978 and 1979 (Ndaferangande, 2000).

During the period between 1990 and 2000 GDP grew by 3.2 percent. However GDP registered negative growth in 1992 and 1994 due to among other factors drought and excessive expenditure due to the preparation and conduct of first multiparty election

in 1994. The growth slowed down in subsequent years when international oil prices increased tremendously before GDP growth picked up from 2002 to 2012.From 2002 the economy begun to recover by registering positive growth. The best growth rates were registered between 2006 and 2010 which were averaging 7.1 percent. The growth was supported by sound macroeconomic management and improvement in small holder agricultural productivity. The debt relief under the Highly Indebted Poor Countries in 2006 boosted confidence in the economy and reduced fiscal pressure on the budget (African Economic Outlook, 2007)..

Real GDP growth in 2012 slowed down following a contraction in the agricultural and manufacturing sectors brought on by drought and foreign exchange shortages and increased international oil price. Growth in 2010 and 2011 was 4.3 percentage and 6.3 percent respectively. The suspension of donor aid in 2011 due to failure by Malawi authorities to adhere to IMF enhanced credit facilities targets disturbed the macroeconomic environment. This was exacerbated by implementation of inappropriate policies which led to growing fiscal deficit, rising inflation and depletion of international foreign reserves in the context of overvalued exchange rate

2.2. The Exchange Rate Trend in Malawi

Various policy measures have been used in the country to achieve faster economic growth and development. On the external sector the exchange rate has been used as a policy instrument to achieve sustainable balance of payment position. The use of exchange rate as an instrument of monetary policy began as early as 1965 when the reserve bank of Malawi became fully operational.

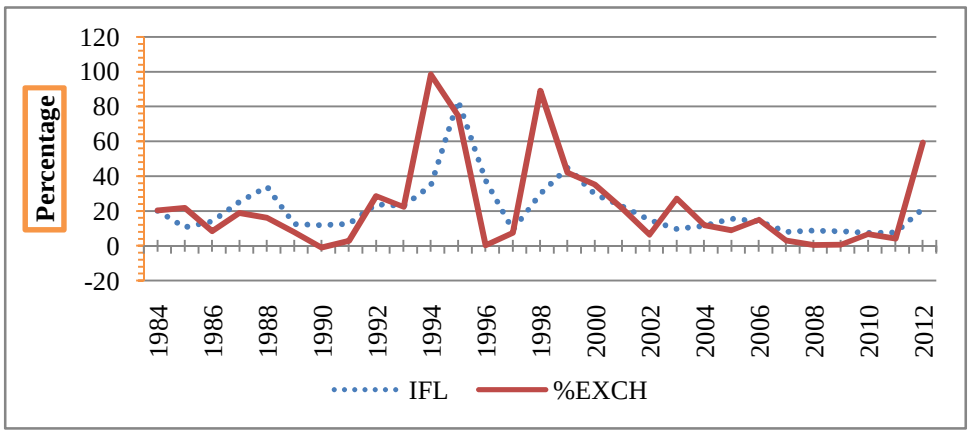


Figure 3: Inflation and Exchange Rate Movement (percentage)

Source: Author's own computation from Consumer Price Index exchange rate movements.

Since 1980 Malawi exchange rate was pegged to the IMFs special drawing rights (SDR), such that when the SDR begun to appreciate in line with the US dollar the kwacha begun to appreciate as well leading to loss of competitiveness on the world stage . Due to worsening terms of balance of trade Malawi decided to de-link the Kwacha from the SDR in 1984 (Munthali, 2010).

The authorities decided to peg the Kwacha to a basket of 7 currencies which were the British Sterling, US Dollar, Japanese Yen, South African Rand, German Mark, French Franc and Dutch Guilder. The currency peg policy failed to bring stability in the exchange rate because the local currency had to be adjusted often to be in line with exchange rates in the basket. The movement of the currencies in the basket tended to interfere with domestic policy objectives (Munthali, 2010).

In February 1994 the kwacha was floated and it lost value by 300 percent, which contributed to increased inflation levels since Malawi heavily depend on imports for

both raw materials for industrial input and for consumption. Later on a decision by monetary authorities was taken to implement a managed float and this resulted in the moderated depreciation of the kwacha. From 2000 the kwacha was fixed. Devaluation was done in an adhoc manner until 2012 when the currency was floated again due to worsening balance of payment deficit which resulted in acute foreign exchange shortage. The trend of inflation as shown in Figure 4 is similar to exchange rate movement. This suggests that exchange rate movement is highly correlated to inflation

2.3. Money Supply Trend

Money supply (M2) movements across the years has been erratic) as shown in the graph Figure 4.

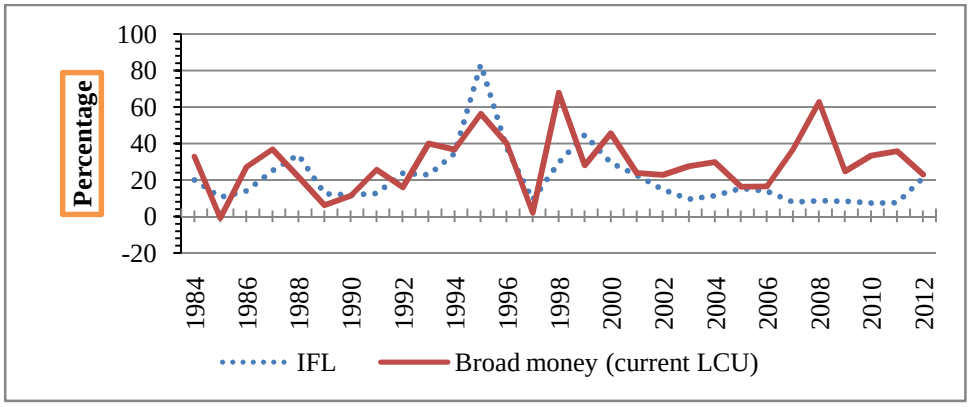


Figure 4: Money Supply and Inflation (percentages)

Source: Author's Own computation from Consumer Price Index and money supply.

M1 refers to the sum of currency in circulation and demand deposits other than those of central government where as M2 is defined as both M1 plus Quasi money. In this paper broad money is going to be used because it is a component that is used for policy analysis.

The trend for money supply since 1984 has been increasing in most of the years except in1985 and 1997 when money supply registered significant negative growth. The highest growth was registered in 1995 of 56 percent and in 1998 when the growth reached 68 percent and also in 2008 which had a growth rate of 63 percent

The devaluation of the Kwacha in 1994 and 1998 led to a general price increase which called for increased cash balances resulting to the increased money supply in 1995 and 1998. Anticipated depreciation of the kwacha in 1997 led to speculation as such people demanded low amounts of kwacha leading to low levels of money supply in that year.

The trend of money supply from 1984 to 2001 as shown in Figure 4 was similar to inflation trend. However from 2002 to 2012 the relationship between money supply and inflation broke down. In subsequent years inflation increased despite decrease in money supply

2.5 Oil Price Movement

Oil prices on the world market have been volatile since the oil price shock of 1978 and 1979. Oil prices went down in 1986 and picked up again the following year and substantially reduced in 1998 before going up in 1989 and 1990 as shown in Figure 5 below.

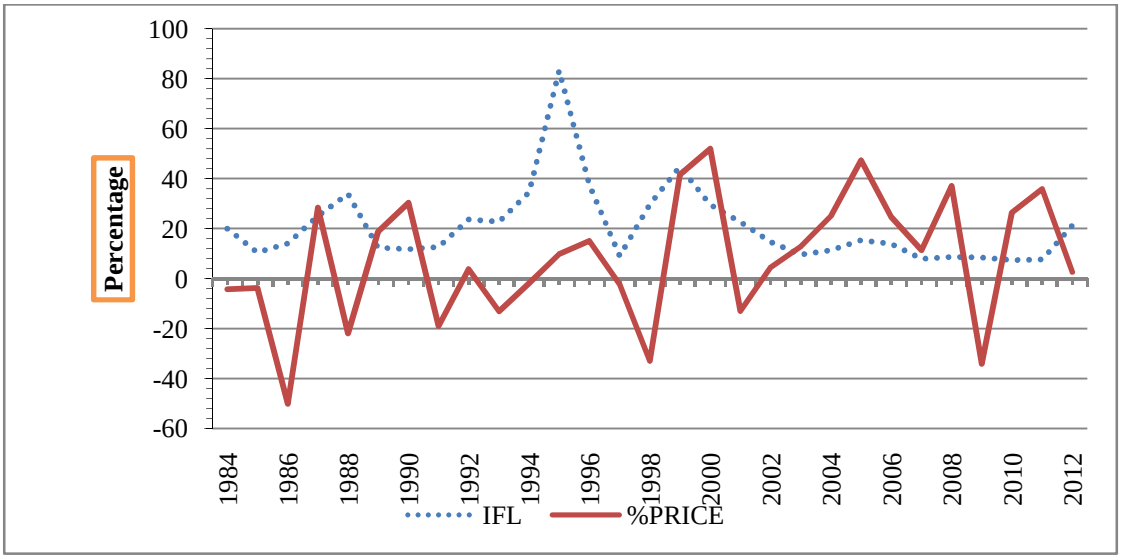


Figure 5: Oil Price Movement and Inflation (percentage)

Source: Author's Own computation from Consumer Price Index and Oil price Movements

The period between 1991 to 1993 the price of oil marginally reduced before increasing again from 1994 to 1996. In 1998 there was a huge reduction in prices to 33 percent before going up with a very big percentage of 42 in 1999 and 2000. There was another sudden reduction in 2001, however, the prices picked up again from 2002 to 2005.A slight reduction occurred in 2007 and rose again in 2008. Another big reduction in prices occurred in 2009 when prices reduced by 34% and picked up in the later years before going down in 2012.The movement in inflation follows a similar trend of oil prices indicating that volatility in international oil prices is correlated to inflation (See Figure 5).

According to Tverberg (2014) the biggest contributor to high prices of oil is stalled oil supply. World oil supply is relatively inelastic. If we compare recent oil production with that in the 1980s and 1990s, we see that about 2005, growth in world oil supply slowed down. The fact that oil production has relatively remain flat since 2005 is one

the reasons why prices have been increasing except for 2008-2009 recession. In recent years the emerging markets India and China have increased demand but world oil output has remained flat. The instability in the Middle East clearly has impact on the supply especially sanctions on Iran (Tverberg, 2014).

2.5.1 Fuel Pricing Mechanism in Malawi

The Price of fuel in Malawi is government controlled. The government through Petroleum Control Commission has been importing fuel and setting up pump prices since the 1990 up to 2003.This setup was changed following a study on energy policy where it was decided that the responsibility of importing fuel and pricing of fuel be separated. This culminated into the establishment of a consortium for oil companies called Petroleum Importers Limited (PIL) owned by oil companies in the private sector with the sole responsibility of sourcing and distributing oil to the oil players. The responsibility of setting prices was transferred to Malawi Energy Regulatory Authority (MERA) which replaced Petroleum Control Commission.

MERA was established with an act of parliament with the responsibility of regulating the energy sector and setting prices for fuel. MERA adopted the automatic fuel pricing mechanism where the requirement is that the pump price should reflect the landed cost of the oil and also provide a decent return to the oil investors.

The price stabilization fund was established to smoothen the price of oil. The pricing structure incorporates a price stabilization fee. The local pump price is adjusted when the oil price stabilization fund is depleted. Every time the landed cost of fuel goes beyond 5% of the pump price MERA makes new oil prices proposal to government

for approval. However the domestic pump price has sometimes been maintained despite the change in economic fundamentals necessitating adjustment of prices. As a result the price stabilization fund has been depleted to the point where the government owed PIL fund for compensation of losses due to fuel being sold below landed cost. Often times the pump price does not reflect the oil price movements because the automatic pricing of fuel is not implemented as and when it triggers need to change prices. It is at government discretion.

2.5.2. Fuel Price Subsidy

In Malawi a large proportion of the international oil price has been absorbed by the price stabilization fund and whenever the account is in deficit the government has subsidized it. It can be argued that the Oil Marketing Companies (OMCs) are also involved in subsidizing the domestic pump price because the margins are set by the government and are not usually adjusted timely as per agreed return on investment of 22 percent (KPMG, 2006) resulting to OMCs reduction in return in investment despite increases in international oil price and general inflation level. See Figure 6 for trend in domestic price and international price. The trend shows that domestic pump prices have moved in opposite direction to international oil price movements except in 2010.

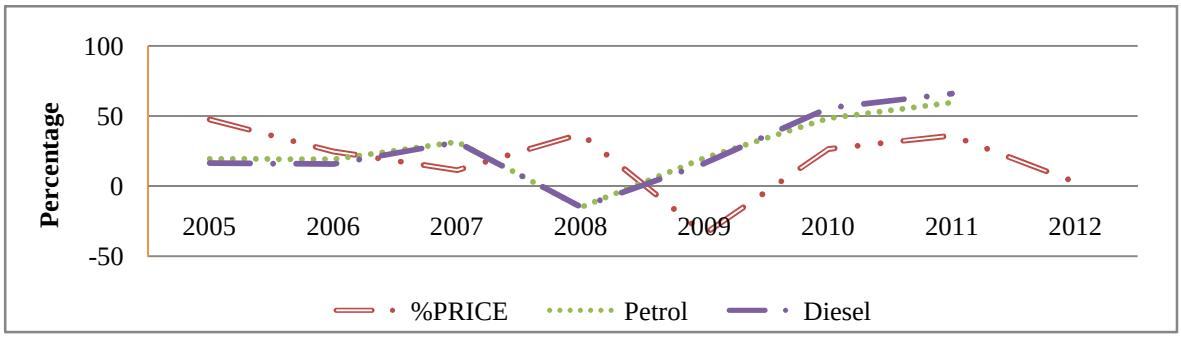


Figure 6: International Oil Price versus Domestic Oil Price (Percentages)
Source: Authors Own computation from MERA oil price build up

Figure 6 shows that domestic prices of fuel have not followed the pattern of international crude oil prices. From 2005 to 2006 the domestic price of fuel was never increased despite that the international price of fuel had been increasing though in a declining fashion. In 2007 the International price of fuel reduced below the domestic price. This decrease in price of fuel internationally was never passed through to domestic prices instead domestic prices of fuel were increased. Whereas in 2008 domestic prices went down yet international prices of oil increased. This pattern of movement is observed even in subsequent years. One of the explanations is that during international oil price decrease government never decreased domestic price of fuel so that the fuel price stabilization fund builds up to cushion times when international oil prices are rising.

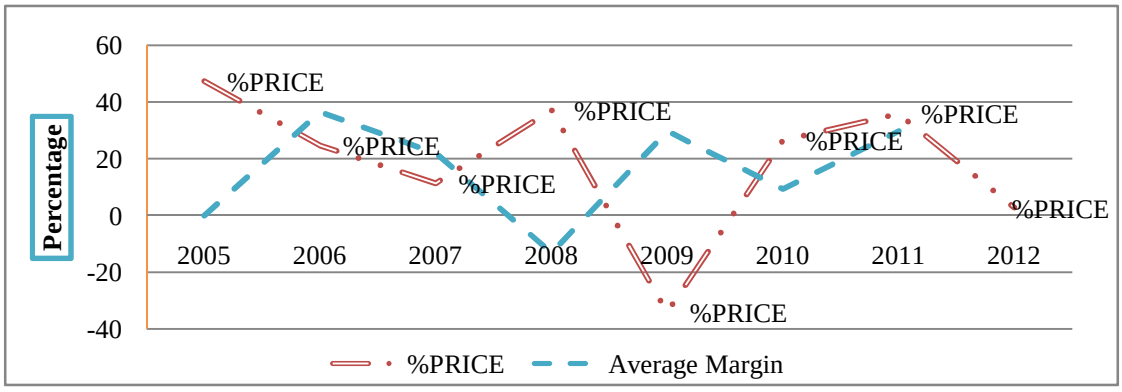


Figure 7: Industry Oil Margins versus International Oil Prices (Percentages)

Source: Author's Own computation from MERA oil price build up.

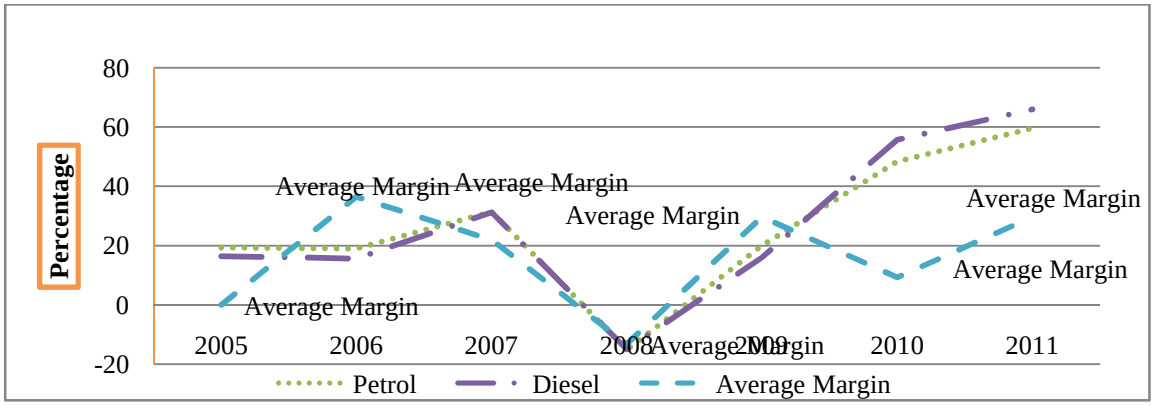


Figure 8: Industry Oil Margins versus Domestic Oil Price (Percentages)

Source: Author's Own computation from MERA oil price build up

From 2006 to 2008 the trend of margins that OMCs make has been declining despite the increase in the domestic pump price in 2007 and international oil price increase in 2008. However the margins were increased in 2009 followed by small percentage increases in subsequent years even though the domestic prices increased by more than 60 percent from 2009 coupled with a moderate increase in international oil prices. (See Figure 7 & 8).

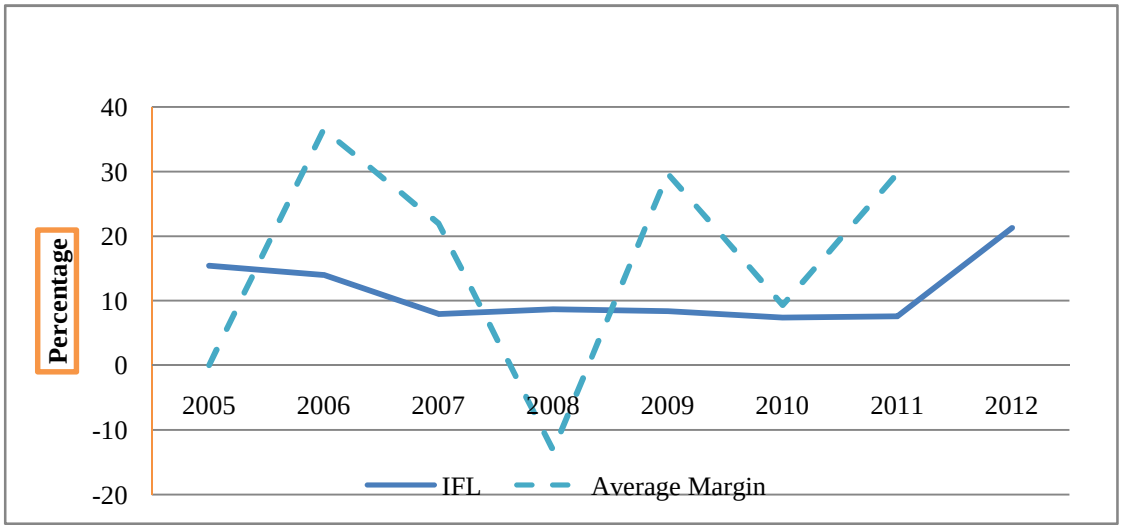


Figure 9: Industry Oil Margins versus Inflation (Percentages)

Source: Author's Own computation from MERA oil price build up.

Figure 9 shows that the margins that oil companies make have not been consistently adjusted with reference to inflation. In 2008 in particular industry oil margins decreased below inflation rate. The OMCs have not been adequately compensated despite the changes in the cost of doing business. Several times the OMCs have had to engage government to consider reviewing the oil margins.

2.6. Concluding Remarks

The chapter has outlined the background of the Malawi economy and movement of macroeconomic aggregates. Real GDP growth rate, inflation rate, oil price movement, money supply, interest rate and exchange rate movement have been analyzed in relation to inflation trends. In addition the chapter has presented the fuel pricing mechanism in Malawi as one of the factors affecting domestic fuel price movement and its subsequent impact on inflation. The next chapter will look at the theoretical and empirical relationship between oil price shock and aggregate economic activity.

CHAPTER 3

LITERATURE REVIEW

3.0. Introduction

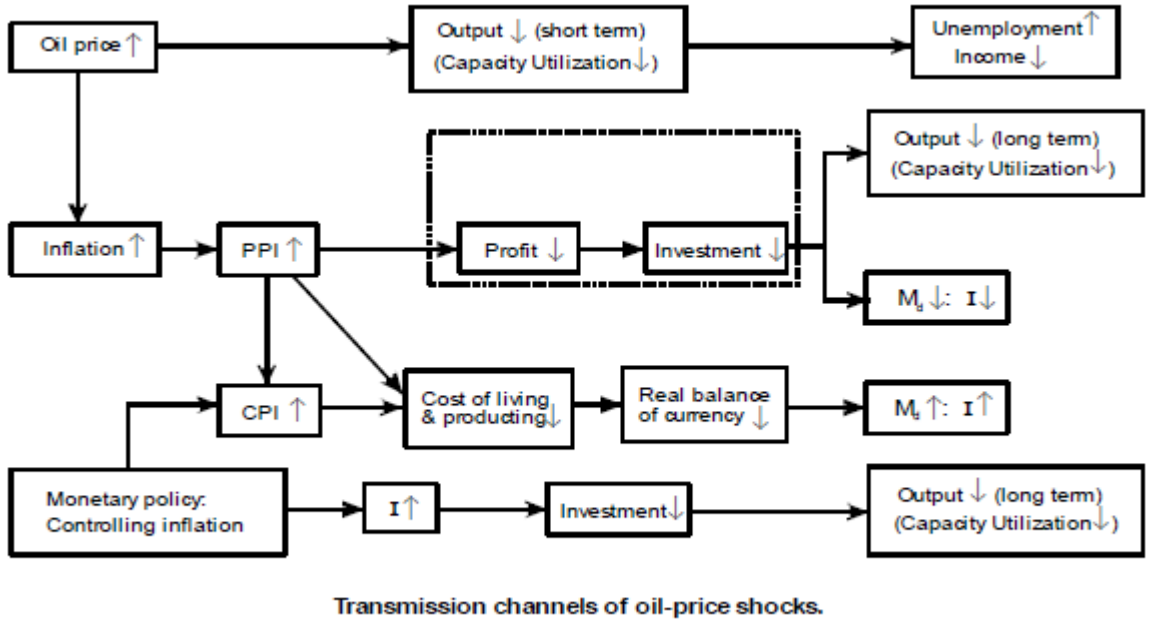
This chapter presents a review of both theoretical and empirical literature on relationship between oil price and aggregate economic activity. The chapter presents some economic theories on which this study is based and some related studies including the possible oil price shock transmission channel in the case of Malawi.

3.1 Oil Prices Changes and Relationship to Macroeconomics Variables

Oil price increases destabilize the macroeconomic environment leading to slow economic growth, reduced productivity and excessive inflation. Oil price shocks affect the macroeconomic activity through various channels. The effect can be asymmetric or symmetric. Symmetric effect according to Chuku et al. (2010) occurs when a positive oil price change impact on macroeconomic activity is a mirror image of the impact on the macroeconomic activity if there is a negative oil price change of the similar magnitude. While asymmetry simply implies that the response of an economic variable to a positive oil price shock will not be proportional to the opposite response of the variable to a negative oil price shock of the same magnitude (Chuku et al., 2010). Chuku et al. (2010) cited in Adenuga et al. (2012) put forth the argument that the asymmetric response to unanticipated decrease or increase in oil price of the macroeconomic variables can be explained by three effects: first the income effect, second the uncertainty effect and third the reallocation effect. They point out that the

Asymmetric effect is as a result of reinforcing factors that tend to amplify positive price shocks and cushion a negative oil price shock effect. Thus explaining why countries have different economic experiences when prices increase compared to when prices decrease.

Several theories have been put forward to account for the symmetric inverse relationship between oil price shocks and aggregate economic activity which examine the different channels through which oil price changes affect macroeconomic environment. (Brown and Yucel, 2002; Jones et al., 2004; Tang et al., 2010). These channels include the supply-side effect, wealth transfer effect, inflation effect, real balance effect, sector adjustment effect and the unexpected effect. The channels are discussed making use of Figure 10.



Transmission channels of oil-price shocks.

Source: Adapted from Tang et al. (2010)

Figure 10: Transmission Channels of Oil Price Shocks

The classical supply side channel postulates that an oil price increase leads to reduction in output as a result of reduction in the level of input used for production

due to the increased price. A firm would be producing at optimum capacity when the marginal cost is equal to the marginal product. The increase in price of oil will result in the marginal cost increase leading to disequilibrium in the optimal level of production as such as part of correcting the imbalance the marginal product will have to decrease. The reduced output causes unemployment to increase. (Brown and Yücel, 2002).

The second mechanism is the transfer of purchasing power from oil importing nations to oil exporting nations referred to as wealth transfer effect. (Fried and Schultze, 1975; Dohner, 1981). The shift leads to increase in demand in the oil exporting nation and contracting of demand in the oil importing nation. The reduced demand increases savings globally as such interest rates will begin to decline. Consequently this will stimulate investment in the oil importing nation which will offset the reduction made by the slump in consumption demand and restore the aggregate demand level due to the increased investment. If prices are down ward sticky then the reduced demand will result in reduced GDP. If the price level cannot fall, consumption spending will fall more than increases in investments leading to a fall of aggregate demand and further slowing economic growth (Brown and Yücel, 2002).

The demand for money in an economy as a result of oil price shocks would occur under two scenarios. On one hand It depends on the perception of the consumer whether the price increase is assumed to be permanent or temporally. This would result in the withdraw of savings or increases in borrowing so as to realign consumption. Consequently Inflation and interest rates rise and demand for real money balances reduces. On the other hand working through the monetary policy

mechanism, companies will reduce investment because of reduced profit and money demand (Chuku et al., 2005). When authorities delay increasing money supply then interest rates will rise leading to stunted growth.

Inflation effect is another transmission channel which establishes a relationship between domestic inflation and oil prices. Inflationary pressure is created by oil price shocks. Every time there is an oil price shock there is an upward pressure on the cost of doing business due to increase in wages and prices for raw materials. According to Tang et al. (2010), when the observed inflation is caused by the oil-price increased cost shock, a contractionary monetary policy can deteriorate the long-term output by increasing interest rate thereby decreasing investment.

The notion that oil price shock effect on macroeconomic aggregates is asymmetric has been challenged by several authors. Brown and Yucel (2002) argue that the asymmetrical spectral adjustment is due to monetary policy being pursued, adjustment costs and petroleum product prices and not the supply side effect. The adjustment cost as pointed out by Brown and Yucel (2002) arise out of the sectors coordination problems or differences in energy to output ratio. The cost and speed of switching the technology of production between sectors is different in the event of an oil price rise. Therefore asymmetry in oil prices will lead to underutilization of resources and increasing unemployment.

Fluctuations of oil prices breed uncertainty in both the consumers and investors such that investment and consumption demand is reduced. This occurs because investors and consumers postpone irreversible investment and consumption decisions

(Bernanke, 1983; Pindyck, 1991). Therefore in the long run as the future prices become increasingly uncertain, the incentive to postpone investment increases thereby affecting prospects for output. (Chuku et al., 2010) .

3.3 Empirical Literature

Several studies have been conducted to empirically investigate the relationship between oil price shocks and macroeconomic aggregates. Some papers have focused on oil price impact on the aggregate world economy and also on economies of different types like oil importing and oil exporting countries or developing and developed countries. While other papers consider the impact of oil on particular economic variables like estimating oil price pass-through into exchange rate, inflation, or unemployment.

Another different approach is where some papers estimate a system of equations using appropriate econometric technique to account for interrelationship between the included variables as well as external (exogenous) ones and do innovation accounting by computing impulse response to oil price shocks, and evaluate its significance, then determine its magnitude, speed of convergence to the long run value as measured by the time it takes for the reaction to disappear.

Adenuga et al. (2012) looked at the impact of oil price shocks on macroeconomic variables in Nigeria. The authors considers the proposition that petroleum prices are not only important in production , and transportation of a wide range of goods and services but also as a harbinger of inflationary pressure which may exceed its importance as a productive input. The authors included other macro economic

variables such as interest rates and exchange rates as a measure of monetary policy. An augmented short run Phillips curve was used to describe the tradeoff between inflation and a measure of economic slack along with other variables that affect price level by changing the cost of producing goods and services. The author opted to use Autoregressive distributed lag model (ARDL) because it yields consistent estimates of the long run coefficient that are asymptotically normal , irrespective of whether the underlying regressors are I(1)or I(0) . The author used a 21 year quarterly time series data (1990Q1 to 2010Q4).

At 1 percent significant level the results obtained indicate that crude oil price and nominal exchange rate lagged two quarters and inflation lagged one quarter were found to have significant effects on inflation. The domestic lending rate and broad money lagged once were found to be significant at 5 percent. From the results the oil price pass-through to inflation in both the short run and long run is minimal. Likewise the pass-through of exchange rate to inflation in both short run and long run is incomplete.

Kiptui (2009) adopted a Phillips curve approach using (ARDL) to estimate oil pass-through to inflation in Kenya. It was found out that oil prices have significant effects on inflation with a relatively higher pass-through in the short run than in the long run. It was also found that exchange rates have a significant influence on inflation with a higher pass-through compared to oil prices both in the short run and long run. In addition inflation was found to be highly influenced by aggregate demand conditions as captured by output gap.

Jumah and Pastuszyn (2007) conducted a study on the effects of oil price shocks and the response of monetary policy in Ghana for the period 1965 to 2004. The objective of the study was to examine the link between aggregate demand in Ghana via interest rate channel and world price of oil by means of cointergration analysis. The study did not identify a direct significant relationship between output and crude oil price changes, however, the study found that the international price of crude oil directly affected the price level which tends to negatively affect real output. The results showed that the monetary policy remained unchanged following an oil price increase in order to lessen any negative growth effects but at the cost of higher inflation. However it was discovered that the output never reverted quickly to its initial position after an oil price shock but declined over an extended period.

Tweneboah and Adam (2008) explored the long run and short run linkages between monetary policy and world crude oil prices for the period 1970 to 2006 in Ghana. They confirmed that there is a long run relationship between GDP, exchange rate, price level and oil price while negatively impacting output. The results revealed that an unexpected oil price shock is followed by an increase in inflation rate and decline in output. Tweneboah and Adam argued that monetary policy was being used as cushion against growth consequences due a rise in oil price at the cost of higher inflation.

De Gregorio et al. (2007) investigate the decline in the pass-through from the price of oil to general price level. The authors first describe correlations between consumer price index and oil prices. They used two estimates, augmented Phillips curve and rolling Vector Autoregressive scheme so as to properly identify the effect of oil shock

on inflation. The augmented Phillips curve was used to test for structural breaks in 34 countries. The results revealed a decline in the average estimated pass-through for industrial economies and to a lesser degree for emerging economies. On the other hand an estimation of rolling vector autoregressive subsample of some countries derived impulse response functions of inflation to oil shocks of which the integrals were interpreted as estimates of pass through. The comparison of the two results obtained using Phillips curve methodology and rolling Vector Autoregressive scheme (VAR) show that United States of America (USA) displayed the same increase in pass-through up to 1980 like was the case with Phillips curve methodology. While Chile and Columbia showed very clear reductions in the pass-through and where as Japan showed small but positive effects of oil shocks on inflation in the most recent VAR.

The results indicate that there had been a recent recovery in the pass-through in some countries like Canada and USA. On the contrary Korea, Japan, Israel, Denmark, Chile seemed to have stabilized the pass-through at low levels.

The VAR methodology showed larger falls in pass-through than the Phillips curve methodology. It was observed that this was due to the possible feedback effects that could dampen the impact in the event of an of oil price rise on inflation. For example the USA pass-through to inflation fell from 7 percent to 3 percent but using VAR method it fell from 60 percent to 6 percent. Likewise Canada registered a large fall using VAR.

The authors find that the effects of oil shocks on inflation have generally weakened in the 12 countries. The decline in the level of pass-through is attributed to a reduction in the oil intensity of economies around the world, a reduction in the exchange rate pass-through, a more favorable inflation environment and also the fact that the current oil price shock is largely the result of strong world demand. This also explains why oil price has had a limited consequence on output.

Van den Noord and Andre (2005) analyze the relationship between core inflation in the face of the oil price shock in the OECD countries of the USA and the Euro area. The authors use an OECD developed analytical framework based on a set of eclectic Phillips curves. The objectives of their study is to explain recent developments in core inflation excluding food and energy prices based on developments in measures of economic slack (the output gap), spillover effects from energy prices into core inflation and lagged response to past inflation via expectation so that policy makers form an informed judgment on inflation risk and the required policy stance.

The results from the estimation indicate that there is less inherent inflation persistence. The change in output gap was not significant in any of the specification estimated. However there is some evidence of positive output gap exerting a stronger impact than a negative output gap on core inflation in both economies. The findings confirm that inflation has become lower and less volatile. However recently this is complicated by the fact that the OECD economies were still grappling with slack in the aftermath of bursting of dotcom bubble unlike in the 1970s. Had the latest oil price shock hit during the upswing in the second half of the 1990s, its inflationary impact would have been heightened rather offset by cyclical forces.

Bernanke et al. (1997) conducted a study on the role of oil shocks on monetary policy in post war US business cycle. Other studies showed that identified shocks to monetary policy explained very little on the overall variation in output and that most of the movement in the instruments of monetary policy is endogenous. From these findings Bernanke et al. (1997) concluded that US business cycles are not primarily caused by erratic and unpredictable fluctuations in monetary policy neither do they rule out the possibility that systematic and predictable monetary policy affect the course of the economy in an important way.

Bernanke et al. (1997) also observed that a VAR system is not the most appropriate way to uncover the effects of monetary policy rules on the economy. They observed that it is difficult to infer the effects of change in policy rule for a standard identified VAR system because it provides little or no structural interpretation of the coefficient that make up the lag structure of the model. Despite the shortfalls of the VAR as alluded to, the authors proceeded to estimate a Structured VAR model by taking steps toward sorting out the effects of systematic monetary policy in the economy. They assumed monetary policy works its effects on the economy through medium term structure of open market interest rates. The expectation theory of the term structure allows them to summarize the effects of alternative expected future monetary policies in terms of their effects on current short and long run interest rate which in turn help determine the evolution of the economy.

Oil price shocks were selected to help analyze the response of monetary policy to economic disturbances. The results indicate that the endogenous monetary policy response account for a very substantial portion of the depressing effects of oil price

shock on the real economy. This is reinforced by a more disaggregated analysis which compares the effects of oil price and monetary policy shocks components of GDP. The author concludes that individual recessionary episodes associated with oil price shocks, both monetary policy and other non oil disturbances play important roles but oil shocks disturbances were per se not a major case of these down turns. In addition their methodology produces reasonable results when applied to the analysis of monetary policy reactions to other types of shocks to output.

Bhattacharya and Batra (2009) undertook an examination of the differential impact of international oil prices and domestic inflation and output growth under two alternative scenarios in India. One scenario is when fuel prices are allowed a formula based automatic alignment with international oil prices and the second is when fuel prices evolve as a consequence of revisions specified periodically by the government. The study was undertaken in VAR frame work using the technique of innovation accounting. The study uses inflation as channel of transmission of international oil price shocks to the demand and supply side of the economy. The objective of the analysis is to attempt to understand the dynamics of the relationships between international oil prices domestic fuel prices and general inflation.

The results show that reaction of domestic petrol prices is much higher if prices are allowed to automatically and fully adjust to changes in international oil prices. But if prices are government regulated, the impact is short lived up to the 4^{th} month before it starts to regress to its original level.

The variance decomposition results indicate that when domestic prices are allowed to reflect changes in international oil prices the contribution to domestic inflation increases after which it declines marginally. It was also observed that the contribution of money supply increases which is a reflection of the counter cyclic role that monetary policy has been used to play in Indian economy to counter external factors and counter rising inflation. The conclusion from this study is that fuel prices if left free to adjust automatically to international prices, variation will impact inflation in a more sustained fashion.

Bhanumurthy et al. (2012) analyzed the impact of transmission of international oil prices and domestic oil prices pass-through policy on major macroeconomic variables in India using a macroeconomic policy simulation model. They investigated the impact of oil price shock on growth, inflation fiscal balances and external balance in the period 2012-13 to 2016.

The model was developed in Tinberg-Goldbern (1955 &1967) tradition. The model simulates different policy options and produces conditional indicators for what would be outcomes under an assumed but realistic set of exogenous conditions. The model consists of 31 equations in the reduced form model with 18 behavioral relationships and 13 identities.

An international oil price shock is expected to result in lower growth and higher inflation via trade channel, fiscal channel and price channel. However the empirical findings is that a shock in international oil price does result in differential impacts on output growth , inflation, current account deficit and these depends on the extend of

the pass through. The results also indicate that when there is no pass-through in the event of a price shock, inflation does not rise as the government absorbs the entire shock but growth declines than in the base case because of rise in current account deficit while fiscal deficit to GDP ratio increases marginally.

3.4 Macroeconomic Transmission Mechanism of International Oil Price: The Malawi Situation

Bhanumurthy et al. (2012) identifies three broad channels through which the international oil price are expected to impact the macro economy and these are Import channel, Price channel and Fiscal channel. These channels are also applicable to Malawi economy. Malawi being a small open economy (Jombo et al., 2014) has limited manufacturing capacity and that it relies heavily on imported manufactured items and fuel for both consumption and intermediate goods.

Secondly the monetary authorities in Malawi have followed a mixed exchange rate policy since the 1980 to 2012. In the early part of 1980 the currency was pegged to a basket of currencies and towards the 1990s the currency exchange rate was fixed. Between 1990 and 1999 the currency exchange rate system was at one time floated and then the policy changed to managed float. From 2000 the exchange rate was fixed only to be floated again in 2012.

Finally interest rates were liberalized during the structural adjustment program. Since then the interest rate has been used as a monetary instrument together with money supply to term inflation.

3.4.1 Import Channel

An increase in the price of oil will translate to higher bill for oil importing countries like Malawi. Assuming low price elasticity of demand for oil, cetrisparibus the trade balance will worsen given a fixed exchange rate regime. The rise in inflation due to oil price increase will result in reduction in real GDP growth. Second order adjustment will occur leading to contraction in aggregate demand and decline in imports. It is therefore expected that the slowdown in economic growth would subsequently reduce demand for imports which in turn would partially mitigate the adverse impact of high international oil prices and trade balance.

3.4.2 Price Channel

The price channel is the route through which movement in international price of oil affects domestic inflation. For a developing country like Malawi an oil price hike in the international market with unhindered pass-through of oil price increase domestically will lead to a jump in the general price level on account of higher prices of oil plus increase in costs of production of final goods using oil as an input.

3.4.3 Fiscal Channel

Another transmission mechanism is the fiscal channel. In the absence of a complete pass-through an international oil price increase will raise the subsidy on oil and therefore the revenue expenditure of the government. For instance in Malawi oil importation is a substantial source of revenue for the government.

3.3. Concluding Remarks

The chapter has presented both theoretical and empirical literature related to the study. The chapter has presented the theory behind the inverse relationship between oil price and aggregate economic activity and the transmission mechanisms and also explained the asymmetrical relationship of oil price shocks to economic variables. In addition the chapter highlighted the possible oil price shock transmission mechanism in Malawi

CHAPTER 4

METHODOLOGY

4.0. Introduction

This chapter presents the methodology employed in order to estimate the oil price shock pass-through level to inflation. The study uses secondary data from Reserve Bank of Malawi to estimate the impact on inflation due to demand and supply shocks and monetary policy response using the augmented Phillips curve. ARDL model was used to estimate the short run and long run level of pass-through to inflation.

4.1The Phillips Curve Analysis of Inflation and Expectation

The Phillips model generally states that wage inflation is determined by excess demand in the labor market whereby the rate of unemployment is explained as an indicator of excess demand. The Phillips curve was modified by Samuelson and Solow in 1960 so that it represents the relationship between rate of unemployment and rate of inflation instead of the rate of change in money wages and unemployment rate.

However Friedman and Phelps argued that the tradeoff between inflation and unemployment is because expectations are adaptive but in the long run no such tradeoff exists. The Phillips curve is vertical. The rational expectation school of thought have criticized the Phillips curve as nonexistent because there is no systematic existence of trade off between inflation and rate of unemployment.

Phillips curve is still relevant in modern economics because of the transformation it has gone through as a result of subjecting it to empirical analysis. Gordon (1982b) coined the term the triangle model of inflation to reflect a new definition of Phillips curve which was a departure from its traditional definition. The triangle model holds that the rate of inflation depends on inertia, demand and supply. This model is slightly different from other versions of Phillips curve by relating inflation directly to the rate of change of detrended output and by excluding wages, unemployment rate, and expectations. The model states that the ultimate source of inflation is output gap and any residual instability of inflation then depends on the severity of supply shocks (Gordon, 2009).

In the modern augmented Phillips curve equation demand is represented by the level of change of output gap while supply enters the equation through one or more exogenous shifts variables to convey the effect of supply disturbances like oil shocks, import prices and price shocks. Finally inertial is formulated as a set of lagged variables of inflation.

'The assumption that excess nominal Gross National Product (GNP) growth (output gap) is exogenously determined imposes a kind of dichotomy on macroeconomic discourse. Under this dichotomy one group of economists tries to understand how excess nominal GNP growth is determined by monetary and fiscal policy through the dynamics of investment, inventory behavior and demand for alternative types of assets and other factors. Then another group of economists is assigned the task of understanding how excess nominal GNP growth is split between inflation and changes in output gap' (Gordon, 2009).

The dichotomy ignores other channels through which inflation influences GNP determination which creates problems in equations where GNP appears as explanatory variable. However the bias due to feedback is likely to be small when other supply shock variables are included.

The triangle model has the following four implications. First to control inflation, the monetary policy needs to set a target of nominal GNP growth when the economy has zero output gaps. Secondly the change in money supply affects inflation if it induces change in nominal GNP. Thirdly in the short run fluctuations in excess nominal GNP growth leads to stagflation. Finally the supply shocks affect the economy in different ways.

4.2 Model Description and Estimation Process

In this study a short run Phillips curve will be used to describe the tradeoff between inflation (the log change in all items consumer price index) and a measure of economic slack along with other variables that affect the price level by changing the cost of producing goods and services. Crude oil prices are included in the Phillips curve to test the proposition that oil prices are important in production as well as a harbinger of inflation pressure. In addition money supply, domestic maximum lending rates and exchange rates are included to establish the effect of monetary policy on inflation.

Autoregressive distributed lag model (ARDL) is one of the preferred methodology in dynamic single equation regression. The ARDL approach produces consistent estimates of the long run coefficient that are asymptotically normal, irrespective of

whether the underlying regressors are I(0) or I(1) (Pesaran and Shin ,1995) . By determining the order of integration of the variables and construct linear combinations of the non stationary data, all variables are transformed equivalently into an Error Correction (EC) model with stationary series only. Furthermore this methodology allows researchers to explore correct dynamic structure in addition to allowing inference on long run estimates which are not possible under alternative cointergration procedures. Pesaran and Shin (1995) demonstrated that ARDL model can accommodate greater number of variables in comparison to other vector autoregressive models (Adenuga et al., 2012).

Time series data is used to test the model. As such the variables are first tested for unit root test. This is done to avoid the possibility of spurious regression. The ARDL model requires that the variables should either be I (0) or I (1) for the bounds test to work.

The bounds test seeks to find out if the variables are cointergrated. It tests the hypothesis that all parameters for the long run variables equal to zero. A rejection of the null hypothesis implies that there is a long run relationship. The F-TEST is used based on the computed F statistic provided by Pesaran et al. (1995). However this test cannot be used in the presence of I (2) variables hence the implementation of unit root test to ensure that none of the variables is integrated of order 2 or above.

Once the F-test is found to be significant then the ARDL form of the equation is estimated where the optimal lag length is chosen according to one of the standard criterion such as the Akaike Information or Schwartz Bayesian. The ARDL model is

estimated using differences of the variables and the lagged long run level variables to determine the speed of adjustment to equilibrium.

Diagnostic tests are performed on the model such as stability test, Breusch-Godfrey Serial Correlation LM test, Breusch-Pagan-Godfrey Heteroskedasticity, Ramesy Reset and Jargue-Bera Normality test.

The Stability test for the short run and long run involves testing coefficients by employing cumulative CUSUMMSQ statistics which are updated recursively and plotted against the break points. If the plots of CUSUM statistics stay within the critical bounds of 5% level of significance the null hypothesis that all coefficients in a given regression are stable cannot be rejected.

4.3 Sources of Data, Scope and Characteristics of Variables

Quarterly series data is used which is computed from monthly series data obtained from Reserve Bank of Malawi and Dubai Quarterly Oil nominal price Data. The data spans from 1980 to 2010.

The macro economic variables considered are Consumer Price Index (CPI), Crude Oil Price, Broad Money Supply, Nominal Exchange Rate, Real Gross Domestic Product, Output Gap and Domestic Maximum Lending Rate. Output gap is the Hodrick-Prescot filtered trend of Quarterly real GDP. The quarterly GDP is interpolated from annual figures using quadratic match where as the other quarterly variables have been interpolated from monthly figures.

4.4 Model Specification

The purpose of this study is to estimate the oil price pass-through to inflation. Several researchers have used a modification of the Phillips curve to determine level of pass-through to inflation. Kiptui (2009) and Adenuga et al. (2012) used the augmented Phillips curve to determine level of oil price pass-through due to international oil price shocks.

This study therefore adopts an empirical augmented Phillips curve estimated by Kiptui (2009) which includes a measure of demand pressure (output gap), CPI, exchange rate with some modification. The model has been modified by adding money supply, interest rates, so as to gauge the monetary policy effect.

The autoregressive distributed lag model is specified below in equation 1.

1. $$\Delta LCPI_t = \alpha + \sum_{i=1}^{i=m} B_{1i} \Delta LCPI_{t-1} + B_{2i} YGAP + \sum_{i=1}^{i=m} \theta_i \Delta LOILP_{t-1} + \sum_{i=1}^{i=m} B_{3i} \Delta LEXCH_{t-1} + \sum_{i=1}^{i=m} B_{4i} \Delta INT_{t-1} + \sum_{i=1}^{i=m} B_{5i} \Delta LMS_{t-1} + \delta_1 LMS_{t-1} + \delta_2 LEXCH_{t-1} + \delta_3 LOILP_{t-1} + \lambda LCPI_{t-1} + \delta_4 YGAP_{t-1}$$

Where

$$\sum_{i=1}^{i=m} \gamma \, (y_{t-i} - \overline{y_{t-\iota})} = YGAP$$

YGAP is Hodrick –Prescott filtered trend of real output

Y is real GDP at 2005 constant prices

$\overline{y_{t-\iota}}$is computed potential output

LOIP is the logarithm of oil Price

LCPI is the logarithm of consumer price index

INT is Domestic maximum lending rates

LMS is logarithm of broad money M2

LEXCH is the logarithm of nominal exchange rate

Δ is the first difference operator

The differenced variables except output gap and domestic lending rates have been transformed by deriving their natural logarithms.

The increase in broad money, international world oil prices, domestic maximum lending rates, output gap and nominal exchange rate is expected to be positively related to consumer price index a priori. Short run pass-through will be given by the estimated coefficient. Whereas the long run inflation pass-through will be given by the following formula Kiptui (2009).

2. $\sum_{i=1}^{i=m} \theta_i \; / \; (1 - \sum_{i=1}^{i=m} B_{1i})$

4.5. Concluding Remarks

The chapter has presented the methodology employed in the study. The chapter has outlined the Phillips curve analysis of Inflation using the triangle model approach. It has also outlined the specification of the ARDL model for determining the oil price shock pass-through to inflation based on an augmented Phillips curve approach.

It has also described all variables including the diagnostic tests used in the study. The next chapter presents and discusses study findings.

CHAPTER 5

EMPRICAL FINDINGS AND ANALYSIS

5.0 Introduction

The chapter presents research results and interpretation. It presents and discusses descriptive statistics, correlation matrix, lag order selection, diagnostic tests and the ARDL model and the impact of oil shocks on aggregate demand and supply and monetary policy on Inflation using the augmented Phillips curve.

5.1 Trend of Variables and Results of Summary Statistics Correlation Matrix and Unit Root Test

5.1.1 Trend of Variables

The first step taken was to investigate how the plots of variables used in this paper behave as shown in figure 9. The variables display a similar trend with slight variation in Output Gap and Domestic Maximum Lending Rates. The trend for log of Consumer Price Index, log of Nominal Exchange Rate and log of Broad Money M2 variables is positive and increasing, while the trend for log of International Oil Price variable is varying but increasing with time. The trend for Domestic Maximum Lending Rate and Output Gap variables is varying across the period.

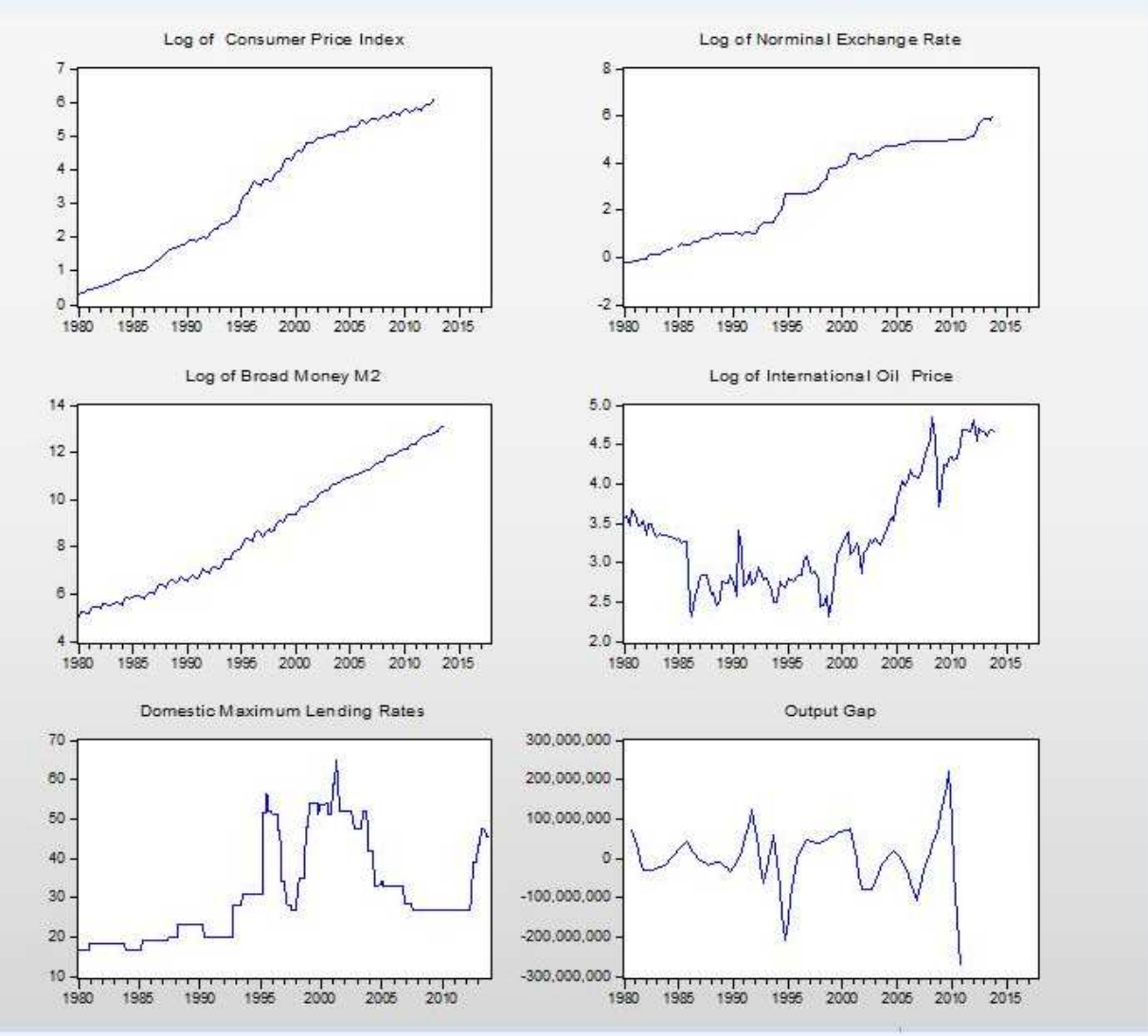


Figure 11: Plot of Variables

Source: Computed by author from data.

The second stage is to investigate the summary statistics and correlation matrix of the variables. The Unit Root Test was conducted to determine the order of integration of each variable in the model

5.1.2 Summary Statistics

The summary statistics of consumer price index (lCPI),international oil price (LPRICE), nominal exchange rate (LEXCH), output gap (OG), domestic lending rate (INT) and broad money supply (LMS) are displayed in Table 1 below

Table 1: Summary Statistics

	Consumer Price Index (LCPI)	Exchange Rate (LEXCH)	Money Supply (LMS)	International Oil price (LPRICE)	Lending Rates (INT)%	Output Gap (OG)
Mean	3.304490	2.792812	8.734882	3.377932	30.96738	0.000113
Median	3.588443	2.730430	8.611404	3.269569	27.00000	-2013395.
Maximum	6.108439	5.983582	13.12726	4.848803	61.66667	2.19E+08
Minimum	0.311399	-0.223685	5.031091	2.314514	16.50000	-2.75E+08
Std. Dev.	1.921108	1.980931	2.503260	0.693752	12.47235	67363806
Skewness	-0.102120	-0.070329	0.177718	0.608877	0.761599	-0.498512
Kurtosis	1.468857	1.436083	1.637020	2.229445	2.298096	5.989172
Jarque-Bera	13.12362	13.86912	11.24294	11.85439	15.93921	50.05976
Probability	0.001413	0.000974	0.003619	0.002666	0.000346	0.000000
Sum	436.1927	377.0296	1187.944	462.7767	4211.564	0.013651
Sum Sq. Dev.	483.4760	525.8279	845.9522	65.45562	21000.54	5.45E+17
Observations	132	135	136	137	136	121

Source: Computed by author from data.

The standard deviations indicate that the variables exhibit significant variation in terms of magnitude suggesting that estimation at levels may introduce some bias in the result.

The probability of Jargue-Bera is not significant hence we reject the null hypothesis that the series are normally distributed.

5.1.3 Correlation Matrix

The correlation matrix of variables is displayed in the table 2below. The results indicate a positive relationship between the dependent variable LCPI and all the other variables However The exchange rate , money supply, International Oil price , Domestic lending rates have an inverse relationship with out gap. Similarly Domestic lending rates have an inverse relationship with International oil prices.

Table 2: Correlation Matrix

	Consumer Price Index (LCPI)	**Exchange Rate (LEXCH)**	**Money Supply (LMS)**	**International Oil price (LPRICE**	**Lending Rates (INT)**	**Output Gap (OG)**
LCPI	1.000000	0.995770	0.989434	0.525678	0.624221	8.72E-05
LEXCH	0.995770	1.000000	0.986788	0.538408	0.633965	-0.024252
LMS	0.989434	0.986788	1.000000	0.614937	0.531573	-0.004788
LPRICE	0.525678	0.538408	0.614937	1.000000	-0.068004	-0.015177
INT	0.624221	0.633965	0.531573	-0.068004	1.000000	-0.048999
OG	8.72E-05	-0.024252	-0.004788	-0.015177	-0.048999	1.000000

Source: Computed by author from data.

5.1.4 Unit Root Test Result

The test for the stationarity of the series which is called Unit Root Test was conducted on the series using Augmented Dickey Fuller (ADF) AND Phillips–Perron (PP) methods. The null hypothesis is that the series variable is non stationary. If the calculated ADF statistic is higher than the Mackinno critical values then the null hypothesis H_0 is not rejected and the series is non stationary. Otherwise rejection of the null hypothesis implies that, the series is stationary. Failure to reject the null hypothesis leads to conducting the test on the difference of the series. Refer to Table 3 (Adenuga et al., 2012).

5.1.5 Phillips-Peron (PP) Specification of Unit Root Test

Phillips and Peron (1988) use a non parametric method to correct for serial correlation in the disturbance. Although the Phillips and Peron tests and the Dickey and Fuller tests provide identical results the power of Augmented Dickey Fuller test is more than the Phillips and Peron tests in the presence of negative moving average components (Adenugu et al, 2012).

The variables tested are LCPI, LEXCH, LMS, LPRICE, INT, and OG. They have been transformed by taking their natural logarithms except LMS and OG.

Table 3: Unit Root Test Results

VARIABLES	ADF			PHILLIPS – PERRON		
	LEVEL	I^{ST} DIFFERECE	REMARKS	LEVEL	I^{ST} DIFFERECE	REMARKS
LCPI	-.6115	-4.3834	I(1)	-.5617	-8.8992	I(1)
LEXCH	-.0668	-8.647	I(1)	-0.2654	-8.7105	I(1)
LMS	1.09	-3.81	I(1)	.822	-12.49295	I(1)
LPRICE	-.3561	-11.19	I(1)	.822	-11.951	I(1)
INT	-2.004	-8.617	I(1)	-1.8673	-8.603	I(1)
OG	-5.00		I(0)	-1.28	-2.724	I(1)

Source: Computed by author from data.

The results in the above Table 3 show that all variables except out gap were found to be non stationary at levels. However they became stationary after first differencing.

5.1.6 Lag Order Selection

The Table 4 shows a combination of various selection criteria using VAR model.

Table 4: Lag Order Selection

VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	194.9450	NA	0.002402	-3.195447	-2.807090	-3.037878
1	196.9040	3.323269	0.002362	-3.212572	-2.799942	-3.045155
2	214.2152	29.05798	0.001766	-3.503842	-3.066941	-3.326577
3	224.5655	17.18901	0.001495	-3.670813	-3.209639	-3.483700
4	252.8103	46.40208	0.000920	-4.157326	-3.671880	-3.960365
5	256.4520	5.917811*	0.000878*	-4.204500*	-3.694782*	-3.997691*
6	256.6473	0.313905	0.000891	-4.190131	-3.656140	-3.973474
7	257.8191	1.862268	0.000889	-4.193198	-3.634935	-3.966693
8	258.5306	1.118087	0.000895	-4.188046	-3.605511	-3.951693

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

The results indicate that six lag lengths was indicated as optimum by LR, FPE, AIC,SC and HQ. Mordi (2007) shows that typically for a given lag length p, the values of these criteria will be ranked as AIC (P_J) ≦ HQ (P_J) ≦SC ((P_J). Schwarz criterion penalizes the most inclusion of extra lags, while Akaike has lower penalty.

Because of this all criterion will be necessary to indicate the same lag length. The ARDL in this study was estimated with a lag of 5. Insignificant variables were removed sequentially while observing the Akaike Information criterion and Schwarz information and the Serial Correlation LM test for the model improvement.

5.2 The Bounds Test

To ensure that there is a long run relationship between the variables, a bounds test was performed on the level variables lagged once. From Table 5, the F –statistic was found to be 2.97.

Table 5 Bounds Test

Wald Test:

Test Statistic	Value	Df	Probability
F-statistic	2.974897	(6, 79)	0.0114
Chi-square	17.84938	6	0.0066

Null Hypothesis: C(18)=C(19)=C(20)=C(21)=C(22)=C(23) =0

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(18)	-0.086297	0.026813
C(19)	0.053475	0.019535
C(20)	0.032338	0.011197
C(21)	-0.000301	0.000471
C(22)	-0.032359	0.016664
C(23)	-2.91E-11	4.67E-11

Restrictions are linear in coefficients.

Source: computed by author from data.

According to Pesaran et al. (2001) asymptotic critical bounds test for F-statistic Table with no intercept and no trend, the F-test statistics for the lower and upper bounds at 10% is 1.81 and 2.93 respectively. Since the value of the computed F-statistics exceeds the upper bounds at 10% significance, it shows that there is evidence of a long run relationship.

5.3 Diagnostic Tests

To ensure the reliability of the results several recommended tests were carried as indicated in Table 6.

Table 6: Diagnostic tests

TESTS	P-VALUES
Jargue-Bera Normality	.090
Breusch-Godfrey Serial Correlation LM(2lags)	.2294
Breusch-Pagan-Godfrey Heteroskedasticity	.0328
Ramsey Reset	.1164

Source: Computed by author from data.

From the results of the diagnostic tests, the Jargue-Bera is insignificant indicating that the residuals of the model are normally distributed. The Breusch-Godfrey Serial Correlation LM (2lags) indicates that there is no serial correlation. However Breusch-Pagan-Godfrey Heteroskedasticity test shows that there is Heteroskedasticity which was resolved by applying a HAC (Newey-West) procedure.

The empirical results also pass the stability tests (CUSUM and CUSUM Squares tests) as shown in Figure 12 and 13.

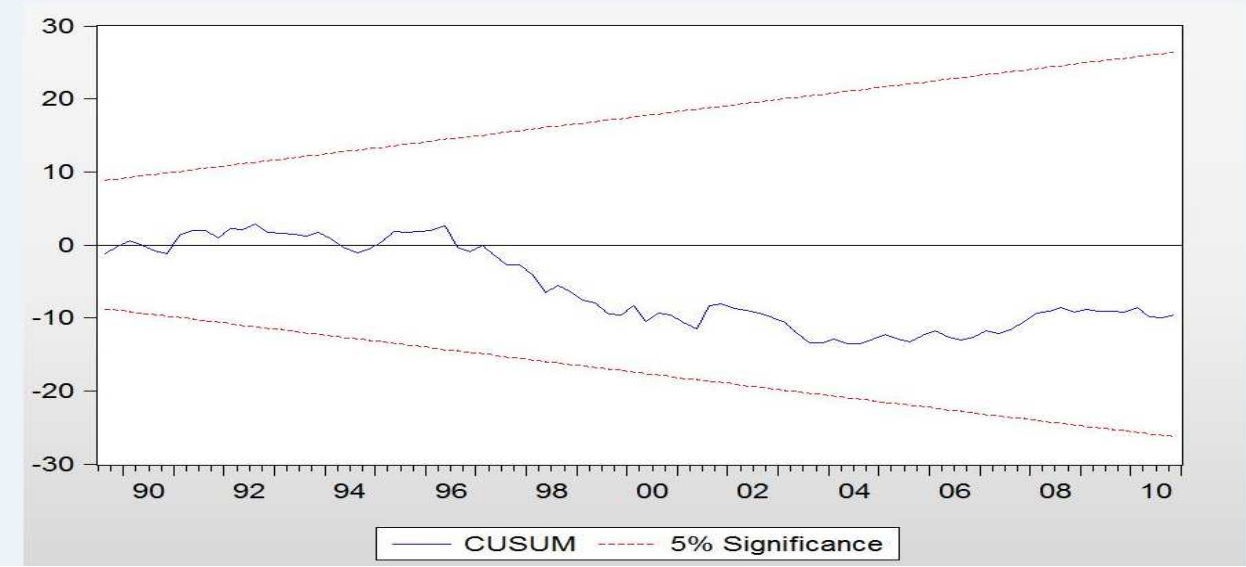


Figure 12: Stability CUSUM Test Results

Source: Computed by author from data.

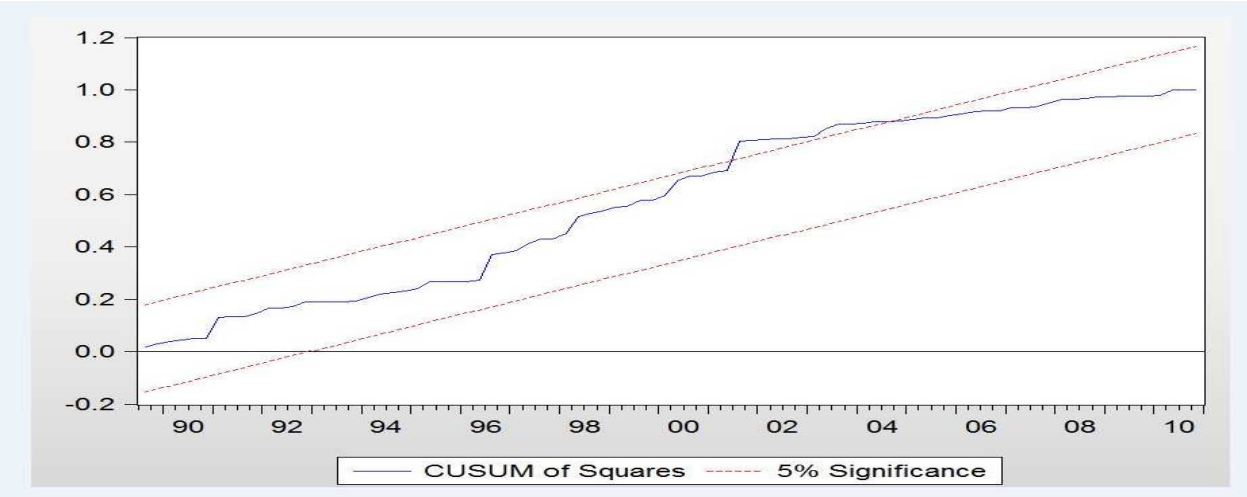


Figure 13: Stability CUSUM Squares Test Results

Source: Computed by author from data.

According to Brooks (2008; pp. 187-188), "the CUSUM statistic is based on a normalized (i.e. scaled) version of the cumulative sums of the residuals. The null hypothesis of perfect parameter stability, the CUSUM statistic is zero; however, many residuals are included in the sum (because the expected value of a disturbance is always zero). The standard error bands are usually plotted around zero and any statistic lying outside the bands is taken as evidence of parameter instability. Similarly, the CUSUMSQ test is based on a normalized version of the cumulative sums of squared residuals. Under its null hypothesis of parameter stability, the CUSUMSQ statistic will start at zero and end the sample with a value of 1. In the same vein, a set of standard error bands is usually plotted around zero and any statistic lying outside these is taken as evidence of instability". Since the line is well within the confidence bands, the conclusion is that the null hypothesis of stability is not rejected (Adenuga et al., 2012 page: 20).

5.4 Validity of the Augmented Phillips curve ARDL Model

From the diagnostic tests indicated in section 5.2 the model can be reliably used to conduct empirical test of the data and interpret the results since it passes the recommended test.

5.5 Empirical Results

The empirical results contained in the Table 6 were estimated using an ARDL model based on the triangle model of Phillips curve which holds that the rate of inflation depends on inertial, demand, supply and monetary policy.

Table 7: Empirical Results

Method: Least Squares

Dependent Variable D(LCPI)

Variable	Coefficient	Std. Error	t-Statistic	Prob.	
D(LCPI(-1))	0.377916	0.095831	3.943574	0.0002	***
D(LCPI(-2))	-0.179465	0.071267	-2.518214	0.0137	**
D(LCPI(-4))	0.621381	0.066443	9.352105	0.0000	***
D(LCPI(-5))	-0.260559	0.089514	-2.910826	0.0046	***
D(LEXCH)	0.218339	0.026635	8.197420	0.0000	***
D(INT)	0.001938	0.001428	1.357083	0.1783	
D(LMS)	-0.085751	0.034865	-2.459547	0.0159	**
D(LMS(-2))	-0.062553	0.044243	-1.413869	0.1611	
D(LPRICE)	-0.031325	0.017175	-1.823887	0.0717	*
D(LPRICE(-2))	0.024969	0.010022	2.491394	0.0147	**
LCPI(-1)	-0.089374	0.028821	-3.101038	0.0026	***
LEXCH(-1)	0.052461	0.020480	2.561585	0.0122	**
LMS(-1)	0.033432	0.012869	2.597919	0.0111	**
LPRICE(-1)	-0.026956	0.012397	-2.174333	0.0325	**
D(LMS(-1))	-0.016001	0.043130	-0.370987	0.7116	
D(LEXCH(-1))	0.021466	0.027715	0.774523	0.4408	

R-squared	0.853453	Mean dependent var	0.046857
Adjusted R-squared	0.825868	S.D. dependent var	0.065604
F-statistic	30.93864	Durbin-Watson stat	1.941910

*Significant at 1% ***, significant at 5%** and significant at 10%**

Source: Computed by author from data.

5.6 Inertia as a Determinant of Inflation

The lagged consumer price indexes are included in the model to test whether previous inflation levels have an impact on the present level of inflation. The results in Table 6 show that consumer price index lagged one quarter and four quarters has a positive impact on the inflation level at 1% level of significant. This indicates that factors that cause inflation do not die away instantly. The consumer price Index lagged two quarters and five quarters is also significant but with a negative sign which shows that lagged inflation has a contemporaneous effect on the level of current inflation levels. The increase in inflation builds up expectation that inflation is going to be persistent but with time the expectation subside. But any other shock within this period is likely to have an opposite effect to inflation.

5.7 Impact of Supply Shocks on Inflation

The volatility of the international oil price is included in the model to test its impact on the levels of inflation. The variable with a lag of zero is found to be significant at 10% with a negative sign contrary to apriori expectation. The price of fuel is government controlled and the pricing mechanism has a built in price stabilization fund as such any movement in international price of oil is not immediately translated into the adjustment of pump prices. In other situations the local pump price has been reduced when the international price oil was rising see figure 7. The international oil price lagged twice was significant and had a positive sign as expected. This can be attributed to increase in local pump prices after the price stabilization is depleted and also persistence of increasing world oil prices which forces government to act.

5.8 Monetary Policy response on Inflation

Exchange rate, Interest rates and Money supply were included in the model to test the impact of monetary policy on inflation. The increase in inflation would tend to decrease real money balances and result in increase for demand for money. The central bank may react by increasing interest rates to reduce the demand for money and reduce pressure on inflation. From the results Interest rates are insignificant but with a positive sign as expected. Indicating that interest rates as an instrument of monetary policy does not have impact on inflation. Whereas Exchange rate with a zero lag was found to be significant at 1% level. The findings are similar to what Jombo et al (2014) found. The exchange rate policy is used as a monetary policy to fight inflation because the country relies heavily on imported materials as input for its industry and imports most goods for consumption.

Money supply with zero lag was found to be significant but with a negative sign. As shown in figure 5 money supply levels were decreasing but inflation was increasing. This is similar to findings by Simwaka et al (year) who argued that the relationship between money supply and inflation had broken-down.

5.9 Short run and Long run Pass-through effect of Oil Price Changes and Exchange Rate

The short run pass-through a coefficient is given by θ_i from equation number 1 and the long run pass- through is calculated using equation 2. From the results the estimated short run pass-through for International oil price is .03 which is the coefficient of lprice (-1).B_{1i}Is the autoregressive coefficient of the consumer price index which is 0.37 .The long run pass-through from an oil price shock to inflation is

computed using equation 1giving 0.05 percent. Hence the oil price pass-through to inflation is 0.03 percent in the short-run, whereas in the long-run pass-through is .05 percent.

This suggests that a 10 per cent increase in crude oil price leads to a .003 percent increase in inflation in the short-run and .005 per cent in the long-run. From Literature Adenuga et al (2012) and Kiptui (2009) found a low and incomplete pass-through to inflation as well due to a number of reasons one of them being a high component of food prices in the CPI basket, controlled prices as well as the volatility of the exchange rate.

The exchange rate was found to be significant. In the short run a 1 percent change in the exchange rate will cause .22 percent change in inflation. This is a similar result found by Jombo et al (2014). The long run pass-through rate is of exchange rate is .35 percent which is higher than oil price changes

5.10. Concluding Remarks

This chapter has presented the study findings. The results from the study were analyzed and interpreted in two forms; descriptive statistics and regression analysis. The results from the ARDL model indicate presence of an incomplete short run and long run pass-through rate of exchange rate and oil price shocks to inflation. The next chapter concludes the study by presenting summary of results, policy implications, and limitations of the study and areas for further research.

CHAPTER 6

CONCLUSION AND POLICY IMPLICATION

6.0 Introduction

This chapter concludes the study by presenting the summary of results in section 6.1, policy recommendations in section 6.2 and limitations of the study and areas for further research.

6.1. Conclusions

The study has examined the pass-through level of international oil prices to inflation in Malawi. The study adopted a Phillips curve for analysis. The Phillips-Lipsey model states that wage inflation is determined by excess demand in the labor market. They establish a negative correlation between the two variables. However the Phillips curve was modified by Samuelson and Solow in 1960 so that it represents the relation between rate of unemployment and rate of inflation instead of the rate of change in money wages and unemployment rate. A more general explanation is provided by Adenugu (2012) where the Phillips curve is described as indicating the tradeoff between inflation and a measure of economic slack along with other variables that affect price level by changing the cost of producing goods and service. The Phillips curve has been advocated as one of the instruments available to policy makers to help them choose an optimal position amongst various combinations of inflation rates and economic slack.

The oil price has been found to be significant and has a long run effect on inflation. However the results show incomplete pass-through to inflation as the percentage is

very small. This is attributed to the presence of fuel pump stabilization fund. Malawi Energy Regulatory Authority newsletter explains that Malawi continued experiencing stabilized petroleum prices despite the global fuel price swings and in times when the price stabilization fund failed to compensate for soaring global oil prices like in 2008, government had forgone its revenue to ensure stable fuel prices.

The study has also found substantial pass-through levels to inflation from exchange rates, money supply and interest rates. This indicates that a combination of the monetary and supply factors have an impact on the level of inflation.

None statistically significant relationship was observed between output gap and consumer price index. This implies that changes in aggregate demand do not play a significant role in changes in consumer prices. This is in line with other studies that have concluded that inflation in Malawi is largely as a result of supply shocks than demand shocks. Whenever there is insufficient supply of staple food inflation increases because the share of food in the consumer price index basket is high compared to other items.

From the policy perspective the results bring to light the effectiveness of domestic anti- inflation policies. The fuel price mechanism is working well as a policy to contain fluctuation of international oil prices from having a significant impact on inflation. Monetary policy that target exchange rate is also a significant tool to control inflation. Most importantly inflation in Malawi is caused by supply shocks like scarcity of food as such the type of polices to be implemented should enhance food production which will lead to growth of gross domestic product

6.2 Limitation of the Study and Areas of further Research

The study uses secondary Monthly data obtained from RBM and Quarterly international oil price sourced from Quandi database .The monthly data was converted to quarterly data for estimation. The transformation of the data has some shortfalls as argued in some literature as it compromises the trend between the periods. However the data had some variables that were significant in determining the level of inflation resulting from demand and oil shocks.

There is need for further research to determine the level of oil price pass-through to inflation in the absence of price controls and investigate the cost of the fuel price controls on the economy. In addition further research is needed on the impact of oil prices fluctuation on non food CPI.

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APPENDIX A DATA USED IN THE ANALYSIS

OBSERVATIONS	LCPI	LEXCH	LMS	LPRICE	INT	HP FILTERED GDP	GDP	OUTPUT GAP
1985Q1	0.931114	0.474431	5.827867	3.304442	17	1519546237	1541896384	22350146.65
1985Q2	0.958967	0.579176	5.894127	3.254886	19	1530441039	1559317260	28876221.37
1985Q3	0.988549	0.557003	5.958339	3.260018	19	1541202681	1576738137	35535456.18
1985Q4	1.02029	0.531804	5.865334	3.282164	19	1551800749	1594159013	42358264.28
1986Q1	1.039216	0.553435	5.803024	2.845878	19	1562227040	1593302940	31075899.29
1986Q2	1.080109	0.59891	5.957391	2.367124	19	1572499825	1592446866	19947040.72
1986Q3	1.1272	0.643475	6.082675	2.400921	19	1582656797	1591590793	8933995.746
1986Q4	1.179475	0.687498	6.05655	2.629488	19	1592748115	1590734719	-2013395.359
1987Q1	1.229933	0.761794	6.013389	2.829284	19	1602829522	1597198030	-5631491.423
1987Q2	1.292808	0.81096	6.263271	2.838103	19	1612955504	1603661341	-9294162.191
1987Q3	1.360464	0.826804	6.426812	2.853593	20	1623177026	1610124653	-13052373.08
1987Q4	1.431746	0.772005	6.368873	2.796265	20	1633539244	1616587964	-16951280.67
1988Q1	1.545219	0.894386	6.261492	2.682162	20	1644079159	1629428891	-14650267.9
1988Q2	1.603152	0.923326	6.443336	2.676445	23	1654823173	1642269818	-12553354.94
1988Q3	1.650132	0.991732	6.586034	2.532373	23	1665788534	1655110745	-10677789.65
1988Q4	1.687571	0.956434	6.507974	2.409944	23	1676984646	1667951672	-9032974.068
1989Q1	1.696533	0.975672	6.495819	2.70805	23	1688414235	1673558865	-14855369.92
1989Q2	1.72562	1.02478	6.601321	2.771547	23	1700074386	1679166059	-20908326.67
1989Q3	1.754231	1.037026	6.709833	2.732201	23	1711952895	1684773253	-27179642.5
1989Q4	1.782607	1.018661	6.596964	2.801338	23	1724024494	1690380446	-33644047.88
1990Q1	1.860923	0.992554	6.526348	2.81441	23	1736246926	1714435805	-21811121.42
1990Q2	1.90806	1.060356	6.70237	2.642622	21	1748556906	1738491163	-10065743.4
1990Q3	1.898619	1.002401	6.784306	3.158418	20	1760877519	1762546521	1669002.447
1990Q4	1.846353	0.959242	6.692456	3.317212	20	1773125556	1786601879	13476323.5
1991Q1	1.90806	0.975151	6.641574	2.787067	20	1785218854	1825595501	40376647.17
1991Q2	1.976855	1.057049	6.8944	2.744061	20	1797083670	1864589122	67505451.81
1991Q3	1.986961	1.067001	7.054191	2.827314	20	1808671500	1903582744	94911243.55
1991Q4	1.956803	1.003508	6.921395	2.866003	20	1819976028	1942576365	122600337.6
1992Q1	2.036447	1.025043	6.84215	2.746202	20	1831050257	1906964190	75913933.29
1992Q2	2.136924	1.22828	7.090271	2.877324	20	1842023818	1871352015	29328197.47
1992Q3	2.225344	1.370741	7.164411	2.901422	20	1853073786	1835739840	-17333945.56
1992Q4	2.251993	1.450258	7.08459	2.844909	28	1864395567	1800127665	-64267901.65

1993Q1	2.320752	1.490448	7.098238	2.762117	28	1876173733	1843744040	-32429693.43
1993Q2	2.367748	1.463792	7.279664	2.771547	28	1888552689	1887360414	-1192275.088
1993Q3	2.376764	1.484475	7.457475	2.667228	31	1901656571	1930976789	29320217.24
1993Q4	2.416211	1.491454	7.454527	2.606387	31	1915608771	1974593163	58984392.6
1994Q1	2.529189	1.742251	7.501303	2.544223	31	1930551003	1924042681	-6508321.72
1994Q2	2.615447	1.953609	7.718389	2.692372	31	1946661849	1873492199	-73169650.45
1994Q3	2.642148	2.045702	7.844123	2.762117	31	1964115824	1822941717	-141174107.2
1994Q4	2.852382	2.688899	7.903818	2.730029	31	1983041709	1772391235	-210650474.7
1995Q1	3.081305	2.726426	7.934609	2.797485	31	2003480054	1846516259	-156963795.3
1995Q2	3.229414	2.728018	8.289473	2.831054	52	2025339751	1920641283	-104698467.7
1995Q3	3.308732	2.726454	8.358674	2.729812	55	2048431589	1994766307	-53665281.57
1995Q4	3.44218	2.726303	8.266601	2.757687	52	2072500922	2068891331	-3609590.389
1996Q1	3.588777	2.72806	8.24057	2.806789	51	2097259562	2106734879	9475316.54
1996Q2	3.665568	2.724134	8.566586	2.848005	51	2122417066	2144578426	22161359.5
1996Q3	3.588109	2.728312	8.71442	2.941276	45	2147688913	2182421973	34733059.88
1996Q4	3.533079	2.7249	8.581169	3.063858	34	2172804432	2220265521	47461088.22
1997Q1	3.657704	2.73043	8.451865	2.961313	31	2197514661	2241315964	43801303.11
1997Q2	3.731314	2.731775	8.641638	2.863438	28	2221600300	2262366408	40766107.54
1997Q3	3.673586	2.846507	8.737752	2.871868	27	2244869426	2283416851	38547424.9
1997Q4	3.663442	2.909397	8.646401	2.88331	27	2267155595	2304467295	37311699.74
1998Q1	3.830887	3.12464	8.698514	2.521988	32	2288316454	2326908506	38592052.4
1998Q2	3.914748	3.226311	8.957146	2.49191	35	2308232970	2349349718	41116747.59
1998Q3	3.929566	3.329583	9.091718	2.518449	36	2326810231	2371790929	44980697.89
1998Q4	4.072484	3.731942	9.062208	2.447839	48	2343979022	2394232140	50253117.92
1999Q1	4.276062	3.778129	9.09576	2.403938	54	2359698242	2412441940	52743697.9
1999Q2	4.339117	3.775784	9.360251	2.725235	54	2373958198	2430651740	56693542.77
1999Q3	4.286836	3.772982	9.392112	2.979942	54	2386782159	2448861540	62079381.19
1999Q4	4.342116	3.817196	9.350244	3.120013	52	2398228832	2467071340	68842508.36
2000Q1	4.537584	3.845	9.339079	3.192355	54	2408395720	2476792082	68396361.06
2000Q2	4.555114	3.926344	9.511686	3.215458	54	2417423356	2486512823	69089467.13
2000Q3	4.535835	4.116357	9.699597	3.318045	52	2425495016	2496233564	70738547.86
2000Q4	4.642766	4.373953	9.701541	3.313085	53	2432837161	2505954305	73117143.63
2001Q1	4.807022	4.379123	9.685678	3.162109	59	2439720463	2474786725	35066261.91
2001Q2	4.783316	4.341425	9.898616	3.222686	62	2446461290	2443619145	-2842145.405
2001Q3	4.783595	4.211166	9.922854	3.17408	52	2453397929	2412451565	-40946364.16
2001Q4	4.862908	4.17083	10.0028	2.903544	52	2460866888	2381283984	-79582903.85
2002Q1	4.958172	4.262668	10.12155	2.996688	52	2469179087	2391404441	-77774645.42
2002Q2	4.929184	4.330075	10.28146	3.189357	52	2478595703	2401524898	-77070804.66

2002Q3	4.923381	4.343372	10.33143	3.241637	51	2489329306	2411645355	-77683951.12
2002Q4	4.977423	4.416629	10.36942	3.219471	48	2501544297	2421765812	-79778485.1
2003Q1	5.057943	4.495318	10.38968	3.351968	48	2515356524	2455065092	-60291431.45
2003Q2	5.016396	4.514479	10.55516	3.194297	49	2530831971	2488364372	-42467599.43
2003Q3	5.009301	4.614146	10.6284	3.277259	52	2547998945	2521663652	-26335293.18
2003Q4	5.069533	4.681545	10.66006	3.3141	47	2566859206	2554962932	-11896274.58
2004Q1	5.155217	4.689756	10.71096	3.37357	42	2587398058	2585952318	-1445739.782
2004Q2	5.123964	4.690369	10.8542	3.495951	39	2609593366	2616941704	7348337.881
2004Q3	5.115596	4.690904	10.88874	3.585931	33	2633422095	2647931090	14508994.85
2004Q4	5.191289	4.690843	10.90875	3.571569	33	2658865801	2678920476	20054674.83
2005Q1	5.289277	4.694035	10.93515	3.724286	34	2685915109	2697939326	12024217.45
2005Q2	5.268373	4.763848	11.02345	3.864767	33	2714573176	2716958176	2385000.114
2005Q3	5.260096	4.81631	11.05888	4.013505	33	2744850677	2735977027	-8873650.875
2005Q4	5.341377	4.817666	11.08567	3.964661	33	2776759776	2754995877	-21763899.85
2006Q1	5.446019	4.866442	11.13281	4.057767	33	2810307092	2769197916	-41109176.3
2006Q2	5.414469	4.924317	11.1956	4.169479	33	2845485639	2783399954	-62085684.9
2006Q3	5.381279	4.930158	11.25017	4.187651	33	2882262742	2797601993	-84660748.28
2006Q4	5.441263	4.928867	11.25434	4.0488	30	2920566918	2811804032	-108762885.5
2007Q1	5.533389	4.937586	11.32011	4.017862	29	2960273774	2878524054	-81749720.24
2007Q2	5.491414	4.943378	11.44851	4.169962	29	3001190939	2945244075	-55946864.24
2007Q3	5.451038	4.943929	11.53145	4.248108	28	3043074950	3011964096	-31110853.24
2007Q4	5.512622	4.94111	11.56905	4.421346	27	3085647374	3078684118	-6963256.174
2008Q1	5.610082	4.944844	11.63157	4.514203	27	3128610337	3142866304	14255966.98
2008Q2	5.570124	4.945204	11.79207	4.759335	27	3171661611	3207048490	35386878.93
2008Q3	5.537859	4.945601	11.88545	4.731525	27	3214507879	3271230676	56722797.07
2008Q4	5.604821	4.945919	11.86025	3.982799	27	3256877940	3335412862	78534921.99
2009Q1	5.703004	4.945943	11.87134	3.796844	27	3298536045	3410758465	112222419.4
2009Q2	5.654476	4.945955	11.94433	4.076331	27	3339295531	3486104068	146808537.1
2009Q3	5.612641	4.945954	12.05132	4.220498	27	3379039870	3561449671	182409800.4
2009Q4	5.675726	4.961895	12.08222	4.323644	27	3417744294	3636795274	219050979.5
2010Q1	5.78133	5.007643	12.12086	4.328831	27	3455498038	3550162081	94664042.72
2010Q2	5.729916	5.015913	12.17239	4.356493	27	3492527245	3463528888	-28998356.98
2010Q3	5.681991	5.015957	12.2611	4.304545	27	3529117222	3376895695	-152221527.4
2010Q4	5.738399	5.015958	12.34122	4.435216	27	3565535154	3290262502	-275272652.4