THE IMPACT OF OIL PRICE CHANGES ON INFLATION IN KENYA FOR THE PERIOD 1996-2011

By

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DECLARATION

This Research Paper is my original work and has not been presented for a degree in any other university.

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This Research paper has been submitted for examination with our approval as University supervisors.

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ABSTRACT

This paper analyzed the impact of oil price changes on inflation in Kenya during the period 1996Q1 to 2011Q4, a period characterized by a world economic crunch, increased investment and development activities and a liberalized environment. Oil prices have had an upward trend in the recent past and this has led to the high energy bills which have eaten up of after-tax income of the consumers leading to high cost of living. The paper uses the Johansen Cointegration Analysis and the Vector Error Correction Model to analyze time series quarterly data. The results of the regression showed that the signs of the coefficients of all variables were as expected. Exchange rate, money supply and oil prices were found to be statistically significant while interest rate and GDP were concluded to be statistically insignificant. However in the short-run, GDP lagged once was found to have an effect on inflation, is statistically significant and carries the expected negative sign. Further, interest rate lagged once is also statistically and carries a positive sign unlike in the long-run which could be caused by increase in interest rates by CBK that leads to temporary rise in inflation. Nominal exchange rates both current and lagged have positive coefficient and in agreement with long-run results. Money supply, current and lagged twice and oil prices current and lagged once are positively significant indicating that in the short-run increases in oil prices and money supply would lead to rise in inflation. Several policy implications have been put forward from the findings of the study, which should be adopted in Kenya to mitigate the effects of oil price shocks on inflation.

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LIST OF ACRONYMS

AD- Aggregate demand

ADNOC- Abu Dhabi National Oil Company

BOP – Balance of Payment

CBR- Central Bank Rate

CPI - Consumer Price Index

ERC – Energy Regulatory Commission

FOB- Free On Board

GDP – Gross Domestic Product

KNBS - Kenya National Bureau of Statistics

M2 - Nominal money supply

MENA – Middle East and North Africa

NARC – National Rainbow Coalition

OECD – Organization for Economic Co-operation and Development.

OLS - Ordinary Least Squares

OSP- Official Selling Price

SRAS- Short-run aggregate supply

UK – United Kingdom

US – United States

VAT – Value Added Tax

VECM – Vector Error Correction Model

Q1-Q4 – Quarter 1 to Quarter 4

CHAPTER ONE

1. INTRODUCTION

Inflation has been defined as the persistent increase in the general price levels in an economy. In the recent past, the high international energy and food prices and the global financial crisis have contributed not only to inflationary pressure but also to the slow economic growth of developing economies including Kenya. Inflation has lowered the living standard of the population in many countries oil importing especially the developing countries and this has attracted economists and policy makers to study the major determinants of inflation.

The economic impact of oil price changes is an issue that continues to attract considerable attention, especially at this time, when oil prices have continued to rise globally. High prices of oil directly impact enterprises, households and the governments and this led the Government of Kenya through the ERC to introduce the capping guide for retail prices of diesel, petrol and kerosene citing the need to protect consumers from the petroleum industry cartels in December 2010.

Central banks all over the world implement monetary policies to ensure low and stable prices for sustaining high economic growth rates and economic stability. Low and stable inflation also allows better economic performance by increasing efficiency of the monetary system and by reducing uncertainty about the future. Thus, in the medium and longer term, low inflation facilitates a faster growth of the economy, and therefore higher employment creation and poverty reduction.

With stable prices, business people can easily match their cost of production with output prices more predictably and thus plan effectively, since inflation erode the purchasing power of the population. The public also benefits from low and stable prices as their money maintain value over time. They are therefore able to maintain their preferred levels of consumption of goods and services. Furthermore, low inflation also allow producers and consumers to undertake predictable and consistent decisions that result in better economic performance.

Kenya experienced adverse effects of inflation in early 1990s when interest rates were rising higher and higher with expected higher inflation and increased uncertainty about future inflation. In 2005, the high cost of food, energy and transport pushed inflation from 10.5 per cent to 14.5 per cent in 2006, before declining to 9.8 per cent in 2007. However, during the first five months of 2008, inflation increased to 31.5 per cent in May due post-election violence which disrupted economic activities and saw the country struggle with several monetary policies. In 2011/2012, inflation continued to rise to greater levels due to the high prices of fuel products globally.

Before 2009, inflation in Kenya was computed based on a Laspeyres Weighted CPI index which meant that for a given basket of goods and services, each commodity in the basket is to be accorded an appropriate weight that is informed by household budget survey data; and then changes in price over time estimated. However, this method of measurement became outdated, since the index was based on a fixed basket of goods and services bought in the base year. The economic and social environment in Kenya also experienced a lot of changes witnessing new products into the market and the old ones disappearing. Further, CPI could not take into account changes in consumer tastes and preferences and changes in relative importance of some goods and services.

Currently, KNBS computes inflation using a hybrid Jevons (1865) index, which is based on a weighted geometric mean which is applied at the detailed product level while arithmetic mean is used to aggregate the sub-groups. This reduces inflation by half, on average depending on the volatility of price changes (Sichei and Wambua, 2011).

1.1 History of World Oil Price Shocks

The world oil prices have continued to increase tremendously especially in 2011/2012 causing high inflation all around the world. World Oil Price shocks history dates back to the early 1970s which negatively impacted economies by increasing costs of production and lowering incomes as well as worsening the balance of payments. This period is considered one of the worst oil shocks. The real price of oil rose to a higher level in the

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1973 and 1979. In 1974-1975, the US and global recession was triggered by the tripling of the price of oil following the Yom Kippur war and the oil embargo.

The 1979 oil crisis in the wake of the Iranian Revolution, spread to the U.S and then to the rest of the world, escalating from the protests in Iran at that time and disrupted the domestic oil sector leading to production being curtailed and oil exports being suspended indefinitely. It was much later that the oil exports were resumed under a new regime as the supply was inconsistent and at a lower volume, the prices were pushed up resulting to a widespread panic. The high prices were further accelerated by the decision of the U.S President Jimmy Carter of ordering cessation of Iranian imports to the U.S. (US annual Energy Review, 2006)

In 1980, the production of oil in Iran nearly stopped following the Iraqi invasion of Iran, Iraqi's oil production was also severely cut. After 1980, oil prices began a 20-year decline down to a 60 percent price drop in the 1990s from the 1980's and this led to recession in most economies of the world. Oil price shocks always lead to recession in most economies of the world because the classical argument is that consumer spending is the driver of the economy by 70% hence increases in the prices of petroleum products will lead to a decrease in consumer spending and in turn cause an economic decline. Nevertheless oil exporters such as Mexico, Nigeria, and Venezuela expanded production that enabled the world oil prices stabilize while USSR became the first world producer (Perron, 1989)

Subsequently, most firms made positive strides to increase the share of electricity production from hydroelectric sources and away from oil sources in order to reduce their cost of production. However, most of the countries of the world rely on wood or other biomass for their energy supply and the increased demand for these resources has been environmentally unsustainable because it poses several risks like deforestation, erosion and desertification. According to Legovini (2002), low-income groups demand use of fuel and wood and cannot be reserved without a policy on demonopolization of energy market and subsidization of cleaner and more sustainable energy supply like gas.

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During all these periods the real oil prices peaked at $43 per barrel in 1974, $82 in 1980, relative to $30 in 1990 and to $32 in 2000. The 1990 and 2000 shocks were temporary and lasted about 3 quarters while the oil price shock in early 2003 was moderate in size. However, 2002 shock was quite sharp and persistent lasting about 9 quarters (Ministry of Energy website)

The 2011/2012 developments which led to a steady rise in oil prices in the world are the MENA region crisis with particular concern over supply disruptions from Libya, devastating earthquake in Japan which affected most nuclear power stations thus shifting demand to oil. China's huge demand for oil also pushed prices further. Hence this relatively expensive crude oil as shown in Table 1 fuelled inflationary pressures globally (National Energy policy, 3rd Draft 2012)

Table 1: Murban Crude Oil Prices in US$ per barrel

Month/Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
January	19.70	29.60	31.05	42.10	62.15	54.85	92.25	45.85	77.50	95.55
February	20.15	31.70	30.90	44.00	60.95	58.75	95.10	44.95	74.20	103.60
March	24.00	29.10	3.15	50.95	60.85	62.10	102.20	47.55	78.30	112.55
April	24.05	25.00	33.80	52.55	67.50	67.60	109.35	52.15	84.80	120.70
May	25.75	25.85	37.05	49.80	68.50	68.40	125.75	60.15	77.85	113.60
June	24.90	26.80	35.95	55.45	68.85	69.70	134.00	71.65	74.80	112.15
July	25.65	27.75	37.35	57.10	73.00	73.70	137.35	66.20	73.00	113.95
August	26.10	28.85	41.55	60.95	72.70	71.75	117.50	72.75	74.60	109.05
September	27.70	26.95	41.39	61.05	63.25	78.55	98.05	69.10	75.90	110.90
October	27.35	29.10	42.80	58.00	59.35	76.29	69.25	74.30	81.50	108.95
November	24.40	29.60	39.65	54.95	59.70	91.75	51.40	78.60	85.65	114.35
December	27.15	30.05	38.50	56.90	62.05	90.60	42.10	76.10	91.85	111.80

Source: Ministry of Energy

Table 1 shows the actual monthly average Free on board (FOB) prices (US$) from ADNOC. Kenya imports the Murban crude oil from Abu Dhabi National Oil Company (ADNOC) which constitutes 90% of its crude oil imports and only a balance of 10% of crude oil imports from Saudi Arabia. Every month ADNOC sets an Official Selling Price (OSP) of Murban crude oil and lifted during the previous month and hence the ERC

decision to set the price capping on the 14th of every month in order to factor in changes in the OSP.

Murban crude oil prices have steadily risen from an all time low of US $ 19.70 per barrel in January 2002 to its peak in July 2008. Murban crude oil was selling at US$ 137.35 per barrel in July 2008 translating to US $ 0.86 per liter of crude oil. Kenya has continuously grappled with oil prices and this has witnessed pump prices reaching all time highs of Kshs. 121.30 in May 2012. Despite the drop of world oil prices by 70% in July and December 2008, domestic prices continued to rise steadily in the year 2009 to 2012. The price of Murban crude oil increased drastically from US dollars 85.65 per barrel in November 2010 to US dollars 108.95 per barrel in October 2011 (Ministry of Energy website)

In Kenya however, the observation that the post deregulation of retail prices of petroleum products do not follow changes in the international oil prices is true since the industry players do not adjust prices accordingly. When there is upward adjustment of crude oil prices oil companies are quick to make the changes and are slow to lower prices when oil prices decline. This implied that retail petroleum prices were sticky downwards and was taking long for the companies to pass on cost reduction benefits to consumers when international oil prices were on a downward spiral.

That notwithstanding, the revolutions in North Africa that expanded from a tiny uprising in Tunisia, Libya, Egypt and Sudan to Middle East revolt in 2011, caused another serious oil shortage and high prices in the world. In Kenya the energy sector has been grappling with confusion and there are no clear measures put in place to enable the country escape the continued pressures of oil price changes. The country has experienced continuous shortages despite the international prices easing from the month of May 2011 to $113.60 a barrel from $120.70 per barrel in April 2011. There has been continued increase in prices of oil since December 2010 to of Ksh. 115 for a litre of super petrol never witnessed before in the country (Ministry of Energy publications.)

1.2 Evolution of Inflation in Kenya since Independence

The post-independence economic history in Kenya can be divided into three periods. The first ranges from 1963 the time of independence, to beginning of 1980s which is characterized by strong economic performance and huge gains in social outcomes. The period that followed is from the 1980s to 2002 that is typified by slow or negative growth, mounting macro economic imbalances and significant losses in social welfare, notably rising poverty and falling life expectancy. According to Legovini, (2002) there was also failure to reform and the increased role of politics over policy which was the heart this structural break. Finally the third period from the year, 2003 to 2012 with exception of 2008 that experienced improved economic growth rates, development of infrastructure and intense political activities.

In the 1960s after Kenya's independence in 1963, inflation levels were low and were never a major policy problem. However, after the oil price shocks (1973/74 and 1979) in the 1970s, inflation began to take a centre stage as a policy problem and analysts and policy makers had a greater interest to study effects of inflation at greater depth. In the1980s, inflation began to slow down due to various policy measures to stabilize the balance of payments, and reduce excess liquidity generated by the coffee boom in 1976. In the early 1990s, however, high inflationary pressures was witnessed emanating from expansionary monetary policy, nominal exchange rate depreciation, price decontrols in the face of inadequate supply of essential commodities (Sichei and Wambua 2011)

In 1999/2000, inflation rose mainly due to increases in prices of basic foodstuffs as a result of La Nina drought in 1999/2000. During the same period KRA announced an increase in VAT rate from 15 per cent to 18 percent, a move that increased the prices of foodstuffs affecting the consumers. There was also a depreciation of the Kenya shilling against the US dollar and a rise in prices of petroleum products, partly due to the increase in global crude oil prices (Kenya Monthly Economic review - CBK). Since 2002, Kenya experienced high oil prices, shortages in supply of food stuff due to poor harvests and drought-related shortages in food commodities resulting in inflation.

In 2005-2006 high inflation rates was due to high international oil prices, excessive Government expenditures and drought in 2006. There was also a sharp rise in public transport costs after the introduction of new safety measures (also known as the Michuki rules). The other factors that led to the rise in inflation were credit expansion by the NARC government and depreciation of the Kenya shilling against major international currencies in the second half of 2004. This was worsened by drought that prevailed in late and the first quarter of 2006 and the high international oil prices in the second half of the year (Central Bank of Kenya Annual Reports, 2007)

The year 2008 saw the country hit highest inflation rates, where inflation rose from an average month-on-month rate of 5.7 percent in December 2007 to 19.6 percent by November 2008. In May 2008, inflation hit a record high of 31.5% never seen before in the country. The rise was due to the post-election violence that increased uncertainty and adversely affected food supply chains in the country. The period 2009 saw high inflation rates due to high international oil prices and the credit crunch that hit the United States and slowly spread to the rest of the world. The year 2010 saw the government change the measures of Consumer Price Index and inflation came to lows of one digit (Central Bank Annual Report, 2011).

Inflation was higher in 2011 quarter 2 gradually mounting from 12.19% in April to 12.95% and 14.49% in May and June respectively, on a month-on-month basis. Increase in food prices especially of maize; has seen the Food and non-alcoholic index gradually edge up by 19.14%, 20.12% and 22.52% in the months of April, May and June respectively compared to similar periods in the year 2010 (Daily Nation Newspaper, June 2011).

In the month of June, the Alcoholic beverages, tobacco and narcotics index increased from 8.7% in May 2011 to 11.5% in June 2011. This was in response to the price increases in the budget for the financial year 2011/2012. The housing, water, electricity, gas and other fuels index also rose with the foreign exchange cost adjustment charge on electricity being the main contributor. Global oil prices were on a steady rise in the quarter hitting highs of US dollar 120.70 per barrel in the month of April. Locally,

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average retail pump prices soared to levels of around KES 112.00 and 108.00 per litre for petrol and light diesel, respectively, in April compared to levels of KES 95.00 and 89.00 at the beginning of the year. The price levels jumped further from KES 115.00 to KES 117.00 per litre of petrol in June and August 2011, respectively (Kenya National Bureau of Statistics website)

In a bid to tame inflation, the government instituted critical policy measures that included removal of import duties levied on maize imports. The country has been experiencing a maize shortage and in the year 2011/2012 there was fears of poor harvest of maize and the Kenyans are being urged to resort to alternative food like cassava and potatoes. The Energy Regulatory Commission on several occasions reduced duty on kerosene, mainly used by low income earners for cooking and lighting. Twin food and fuel price shocks fuelled inflation in 2011 continued and this trend has not eased amid fears of rising poverty levels. All said and done, inflation is expected to remain at double digit levels; driven primarily by a weak shilling, rising use of more expensive diesel generated power and higher food prices in Q1 and Q2 of 2012. There has however been a reduction of inflation in July 2012 to 7.84% and a further drop in August 2012 to 6.09% (Kenya monthly economic review, August 2012)

1.3 Problem Statement

High fuel prices have had adverse effects on the Kenya's overall rate of price growth. The need to study the inflation rates and changes in oil prices in Kenya is heightened by the fact that the impact has eroded the purchasing power of Kenyans leading to high cost of living. As the prices of petroleum products increase, the cost of energy bills increase and eat up the share of the after tax income of the consumers, which leads to cutbacks on discretionary areas of spending.

The surging costs of fuel in Kenya has driven up costs like transport and electricity, and sent the inflation rate into double digits. This has put the prices of most basic commodities out of reach of many Kenyans. Inflationary pressure has also led to the widening of the gap between the rich and the poor in the country since most of the poor

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people's disposable income is used to meet the basic daily consumption and little or no money is left for savings and investment.

Kenya government as a net oil-importing country faces a balance of payment constraints as it must secure additional resources to pay for the higher oil import bill. The costs of most development projects have gone higher due to inflationary pressure. This has necessitated the government to reallocate funds from different sources and even borrow in order to bridge the gap increasing the debt burden.

1.4 Objectives of the Study

The main objective of this study is to investigate the impact of oil price changes on the inflation in Kenya.

The specific objectives are:
- To examine empirically the effects of oil price changes on inflation in Kenya.
- To establish and recommend appropriate policy measures to mitigate the inflationary pressure from oil price shocks.

1.5 Justification of the study

Over the years, there has been an increasing trend of petroleum prices, and a close consideration of the demand- and supply-side effects that sparked these price increases shows there is high probability that this trend will continue in the outlook period and beyond. Price capping introduced by the government through the ERC in December 2010 was due to the fact that the oil industry players were quick to pass the high prices to the consumers and not reduce appropriately when international crude oil prices went down.

The uncertainty caused by high inflation will lead to instability in the economy as investors hold back their investments and this will have a negative effect on the economy hence slow economic growth. The paper seeks to analyze the oil prices as one of the main cause of decline in people's welfare; oil price shocks keep up leading to the need to carry out more research to enable the policy makers mitigate its impact on inflation.

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CHAPTER TWO

2.0 LITERATURE REVIEW

2.1. Theoretical literature

The economics literature provides limited consensus regarding a theoretical framework for explaining how changing oil prices affect economic activities. Theoretically, an increase in the price of oil can influence macroeconomic behavior of an economy through several transmissions channels.

2.1.1 Keynesian theory on Cost push inflation

Keynes theory of cost-push inflation attributes the basic cause of inflation to supply side factors. Cost-Push inflation occurs when the price of production increases causing manufacturers to increase prices for their products in order to protect profit margins. The world economy depends on oil as source of energy and therefore changes in the price of oil as a basic input will always impact on the consumers' prices. If there is an increase in the price, then it will lead to higher production cost hence higher consumer prices and vice versa. The oil shocks generally result in severe cost-push inflation, for example the 1973-1974 and 1970-1980 crises (ezinearticles.com)

Hunt et al. (2001) pointed out that increases in the input costs could result in a downward trend of non-oil potential output supplied in the short run given existing capital stock and sticky wages. When inflation levels are high, workers and producers will counter the value deterioration in their real wages and profit margins; this will further put upward pressure on unit labour cost and prices of finished goods and services. Oil is a major input in most sectors of the economy and therefore any changes will lead to automatic changes in a firm's cost of production, upward or downward.

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According to the Real Business Cycle theory developed in the 1980s the supply channel of transmission was reinforced whereby oil shocks act as a supply shock in the economy. Oil shocks therefore are the real shocks to the economy and the primary cause of the business cycle and these can be defined as disturbances to the real side of the economy. Business cycles are always influenced by the oil shocks globally within the real business cycle. The production function, the size of labour force, real government expenditure and the saving and consumption decisions of consumers are affected by these shocks (Abel and Bernanke 1992).

2.1.2 Monetary Theories

An oil price increase or decline can be viewed as an inflationary shock and as a consequence, an oil price increase leads to a rise in the consumer price index (CPI) and vise versa. Central banks authorities always stimulate their efforts to eliminate the extensive impacts of these shocks either through contractionary or expansionary policies. Central bank uses interest rates as a key monetary policy to influence demand and inflation directions in the economy. Currently, the MPC maintained the CBR at 18% with expectation of high inflation rates and oil prices, the rate was however lowered to 16.5% in July 2012 and further dropped to 13.5% in September 2012. When the central bank reduces its interest rate, demand rises, but at the expense of higher inflation, and vice versa (Central bank website)

Many studies done have shown that there is a correlation between oil shocks and economic downturn. Oil shocks by themselves create economic downturn; therefore, tightening monetary policy during or after oil price shocks will rather worsen this situation, creating a deeper economic recession. Oil shocks will always create inflation by increasing the cost of production in many firms which reduces the output of major industries. (Bernanke et al. 1997)

Where inflation is caused by oil shocks with fiscal expansion and demand growth as contributory factors, the solution to the inflationary situation does not require contractionary monetary policy but rather contractionary fiscal policy measures. A reduction in petroleum taxes followed by a reduction in government expenditure may be

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the appropriate measures to adopt. The reduction in taxes will minimize the impact of the oil shock, whilst the reduction in government expenditure will reduce fiscal expansion and the increase in demand growth. Monetary policy tightening such an increase in the interest rate on the other hand will eventually "crowd-out" investment and further reduce output, worsening the initial output-decreasing effect of the oil price shocks (Bernanke et al. 1997)

2.1.3 Phillips curve theory

The Phillips curve analyses the trade off between inflation and output. Modern macroeconomics describes inflation using a Phillips curve that shifts (so the trade-off between inflation and unemployment changes) because of such matters as supply shocks and inflation becoming built into the normal workings of the economy. (Phillips, 1958)

When there is a decrease in the amount of unused productive resources, inflationary pressures are manifested since the overall demand for goods and services grows faster than the supply. The unused resources is measured by the real output gap, that is the difference between actual real output and the economy's potential output. However, the most common measure of the unused resources is the unemployment rate which measures unused resources in the labor market.

Long lasting oil price increase may lead to a change in the production structure and have a deeper impact on unemployment. A rise in oil prices will reduce the return of sectors that are oil-intensive and can incite firms to adopt and construct new production methods that are less intensive in oil inputs, this will enable them curb the high energy costs. This generates capital and labor reallocations across sectors that may affect unemployment. However, the workers and producers may resist declines in their real wages and profit margins hence putting an upward pressure on the unit labour costs and the prices of finished goods and services.

Figure 1 uses the aggregate demand (AD) and short run aggregate supply (SRAS) model to show the appropriate policy response to the oil-price increases, if inflation is the concern, policy makers will most likely opt to maintain the current policies and allow the

self correcting forces in the country to move the economy back to the original price levels. However, if inflation and unemployment are equally important, the authorities will carry out an expansionary policy but will avoid shifting the aggregate demand as far as AD1.

The increase in oil prices shifts the SRAS from SRAS to SRAS1.

Figure 1:   **An increase in Oil Price**
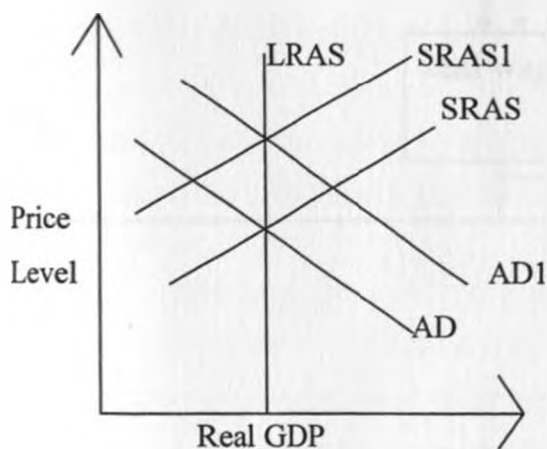
Sichei and Wambua (2011) examined the spiral effect on any changes in aggregate demand and concluded that an upward adjustment in aggregate demand will increase labour demand, reduce the unemployment rate, raise wages and start a wage spiral. The result would be increase in inflation that will cause a real appreciation in the exchange rate that will make the country's exports in the region and internationally uncompetitive. This emanates from the KIPPRA Treasury Macro model as presented in Huizinga et al. (2001) and as shown in Chart 1, where six prices are determined endogenously in the model i.e. price of goods and services, nominal wages, nominal exchange rate, real exchange rate and domestic nominal interest rate.

Total demand is believed to be stabilized through this mechanism whereby, the feedback mechanism may change the composition of demand. When there is an increase in government spending, it will result to a shift from exports as well as investment to government spending causing a government deficit and a deficit in the current account.

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Chart 1: KIPPRA Treasury Macro model

labour supply

unemployment

wages

prices

aggregate supply

capacity utilization

real wages

labour demand

aggregate demand

world prices

real exchange rate

world interest rate

nominal exchange rate

money supply

domestic interest rate

money demand

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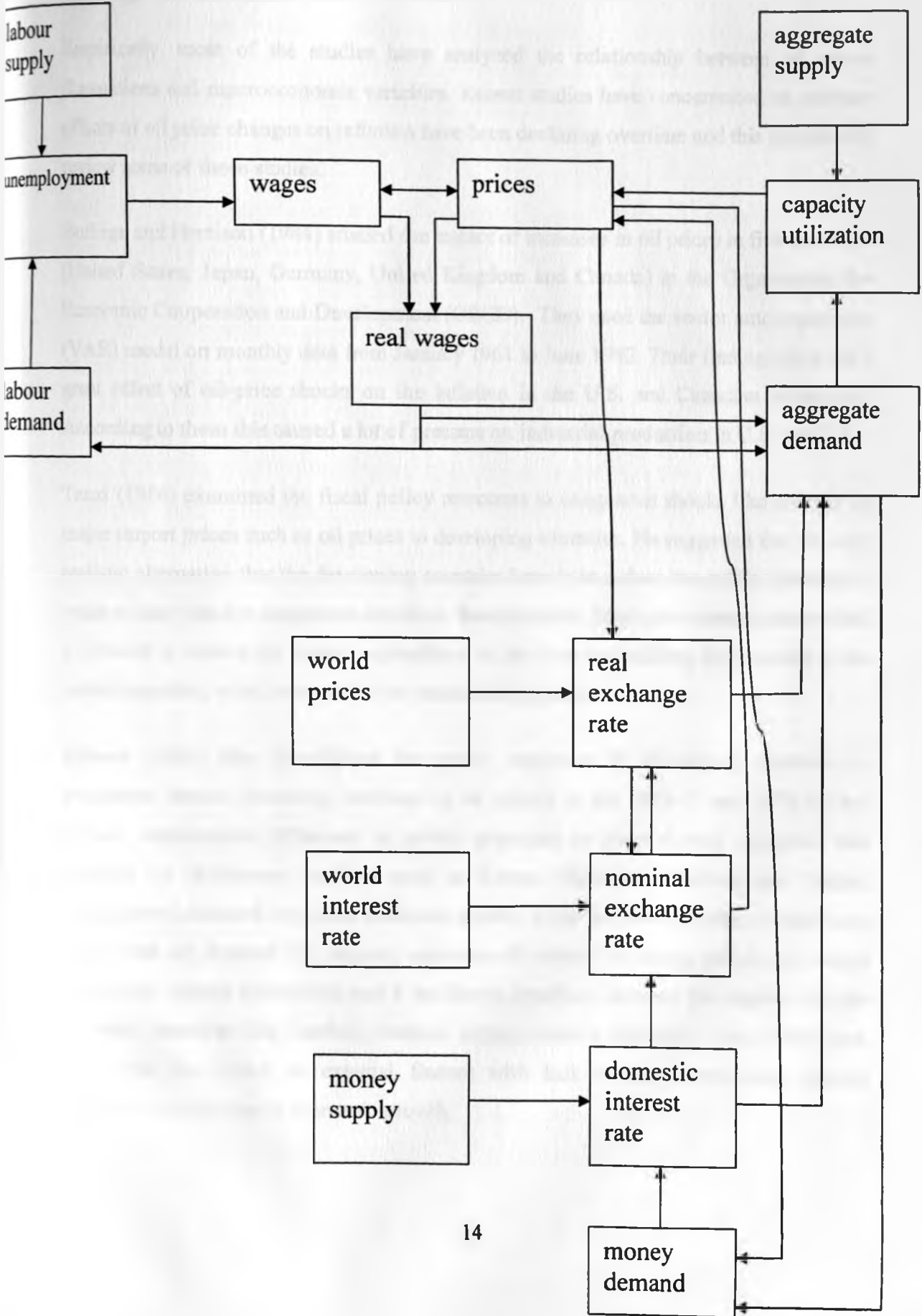
2.2. Empirical Evidence

Empirically, most of the studies have analyzed the relationship between oil prices fluctuations and macroeconomic variables. Recent studies have concentrated on whether effects of oil price changes on inflation have been declining overtime and this section will review some of these studies.

Burbige and Harrison (1984) studied the impact of increases in oil prices in five countries (United States, Japan, Germany, United Kingdom and Canada) in the Organisation for Economic Cooperation and Development (OECD). They used the vector auto-regression (VAR) model on monthly data from January 1961 to June 1982. Their findings revealed a great effect of oil-price shocks on the inflation in the U.S. and Canadian economies. According to them this caused a lot of pressure on industrial production in U.S. and U.K.

Tanzi (1986) examined the fiscal policy responses to exogenous shocks like changes in major import prices such as oil prices in developing countries. He suggested that the only realistic alternative that the developing countries have is to reduce the public spending in order to deal with the exogenous shocks or face recession. Most governments always find it difficult to reduce the current expenditure in the short-run shifting the pressure to the capital spending which turns out to be undesirable adjustment.

Balassa (1986) also investigated the policy responses of developing countries to exogenous shocks (including increases in oil prices) in the 1973-78 and 1978-83 and reveals considerable differences in policy responses to these shocks. Countries that adopted the deflationary policies such as Kenya, Mauritius, Thailand and Tunisia experienced increased long-term economic growth. These policies included a reduction in the growth of demand for imports, adoption of output increasing policies of export promotion, import substitution and a decline in growth of demand for imports. On the contrary, countries like Zambia, Tanzania Egypt, Jamaica, Morocco, Peru, Philippines, and India that relied on external finance with lack of output-increasing policies experienced reduction in economic growth.

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In 1989, Mork studied oil shocks and output correlation taking into account oil price controls that existed during the 1970s in OECD countries. Looking into the possibility of an asymmetric response to oil price increases as well as decreases, he concluded that GNP growth was correlated with the circumstances of the oil market and that statistically the oil price increases were more significant than oil price declines.

Semboja (1994) studied the effects of oil price changes for Kenya. Kenya is a net oil importer and therefore relies on the exchange rate and exports to enable her keep the BOP in check. He employed the method of static computable general equilibrium model to obtain the impact responses. His impact responses suggested that an increase in oil prices lead to an increase in the trade balance, a decrease in output and in the price index, and deterioration of terms of trade.

Using a dynamic model of inflation in Kenya, Ryan and Milne (1994) analyzed inflation determinants and their findings were that the exchange rate movements and changes in oil prices are the most important factors determining inflation, while the contribution from the monetary variables is small.

Brown et al. (1995) analyzed how oil price shocks move through major channels to affect inflation in the U.S economy. They tested such hypothesis using a seven-variable VAR model and their analysis indicated that oil price shocks have permanent effects on inflation and that monetary policy generally accommodated the inflationary pressure of oil price shocks. They also found out that a constant federal funds rate during an oil shock is an accommodative monetary policy stance.

Bernanke et al. (1997) studied systematic monetary policy and the effect of oil price shocks in the U.S economy using the vector autoregression (VAR) model. They suggested that the U.S recessions had been preceded by the increases in oil prices and monetary tightening policy. According to them, oil price shocks generally cause adjustments and therefore most probably the best alternative to monetary policy adjustments to post-war U.S recessions. Furthermore, they also looked into James Tobin's Brookings paper and argued that energy and oil costs were too small, relative to

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the total production costs to account for entire decline in output. Finally they suggested that monetary policy should be kept fixed after an oil shock since the contractionary or expansionary monetary responses destabilize the economy.

Jimenez-Rodriguez and Sanchez (2004) assessed the effects of oil price changes on real economic activity of the main industrialized OECD countries. They used a multivariate VAR analysis with linear and non-linear model specifications and included both net oil importers and exporters in the dataset. The findings revealed that both the net oil importers' and exporters' real GDP differ in response to oil shocks with the exception of U.K which is a net oil exporter and Japan a net importer. The asymmetric specification revealed that oil price declines are significant only in a few countries under study. They also concluded that the oil price shocks and monetary shocks are the largest source of volatility of real output aside from the shocks themselves.

Berument and Tasci (2002) in Turkey investigated the impact of oil prices when wages and other factors of income (profit, interest and rent) were adjusted to the general price level that included oil price increases using the Input-Output analysis under fixed nominal wages. They found out that the inflationary effect of oil prices became significant when the three factors of income – profit, interest and rent were included and therefore indexation could have very severe effects on an economy when oil prices increased or even lead to hyper-inflation in some cases.

The effects of oil price changes on U.S. inflation were studied by Hooker (2002) using a Phillips curve framework. He took into account the asymmetries, non-linearities, structural breaks that had been put forth in the economic literature pertaining to the relationship between oil prices and key macroeconomic variables. He concluded that there is a structural break, where changes in the price of oil contributed significant effects on core inflation before 1980 but weakened since that period. According to him, the oil shocks of the 1970s had a great impact on the U.S economy's general price level until 1980 but the period after this the impact deteriorated.

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LeBlanc and Chinn (2004) estimated the effect of oil price changes on inflation for five countries: the United States, United Kingdom, France, Germany and Japan using the augmented Phillips Curve framework. The findings were in line with most of the studies that there was an effect of oil price changes on inflation although the effects were modest in all the five countries under study in 2004.

Cunado and de Gracia (2004) examined the effects of oil price shocks on economic activity and inflation in OECD countries using Asymmetric Model of inflation. They found out that there is   significance but limited only in the short-run and that if shocks were transformed in terms of local currency of a country under study, then the results would provide more significant evidence on the effects of the shocks. The findings showed that asymmetric relationship was evident in the cases of Malasyia, South Korea, Thailand and Japan with results showing that Asian countries responded differently to oil shocks.

Bouakez et al. (2007) looked into the effect of an increase in the price of oil on the main macro economic variables in the African economies. Using a dynamic stochastic general equilibrium model to determine these effects, he found out that high oil prices would lead to an increase in inflation by a much greater magnitude under managed than under a fixed exchange rate regime than under a flexible exchange regime.

Gregorio et al. (2007) documented a significant reduction in the pass-through of oil price changes to consumer prices in 34 industrialized and emerging countries. They concluded that there is a reduction in the impact of oil price to the general price level over the years due to the reduced oil intensity of economies of the world. The decline is however lower in the emerging countries as compared to the industrialized world.

Killian (2008) used the Structural near VAR model of the real price of crude oil in his study of the G7 countries where he extended his model to treat oil prices as endogenous and disentangled the role of demand and supply shocks in the oil market. His findings showed that the average contribution of an exogenous oil price shock on inflation in G7 countries is quite small and that of the 2002-2003 shock is negligible. He also concluded

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that the reponses of the GDP deflator were more muted and less significant that the corresponding responses of CPI inflation suggesting a very limited indirect impact of oil price shocks.

Blanchard and Gali (2008) also considered G-7 countries excluding Canada in their study which captured the interaction between the oil price and macroeconomic variables using a structural VAR method. They concluded that the inflationary impact of oil price shocks was considerably lower from mid-1980s onwards and that oil prices account for 61% of fluctuations in US inflation. According to them, oil is a factor in production and oil (or energy) goods are part of the households' desired consumption basket and that fluctuations in the prices of oil affect the aggregate demand and supply in an economy. They further proposed that there should be a shift in the degree of real wage rigidity, in monetary policy, and a decline in the share of oil in the economy, as the main factors that may play a role in solving the effects of oil shocks.

Kiptui (2009) looked into the oil price pass-through into inflation in Kenya. The study adopted a Phillips curve approach to estimate the pass-through. He concluded that oil prices have significant effects on inflation with a pass through of 0.05 in the short run and 0 .1 in the long run. Exchange rates have a significant effect on inflation with a pass through of 0.32 in the short run and 0.64 in the long run.

2.3 Literature Overview

In summary, Keynes theory of cost-push inflation attributes the basic cause of inflation to supply side factors and since the world is dependent on oil, this study relies on this theory to explain the consequences of an oil shock. It can be said that empirical evidence varies greatly. Major findings of these studies indicate that the oil price hikes in the 1970s led to average price spiral and adverse macroeconomic consequences but find that oil price volatility, particularly from late 1990s has had insignificant impact on consumer prices. Changes in the structure of the oil markets and in demand patterns have made it difficult to produce reliable empirical outcomes.

Current studies such as those done by Killian (2008) and Blanchard and Gali (2008) seem to indicate lower inflationary impact of oil price shocks in the recent years. Several factors have been attributed to this fact and they include higher energy efficiency of production processes, the importance of globalization in shaping price setting as well as changes in the conduct of monetary policy. There has also been a better understanding of the transmission of supply shocks by central banks and the greater role of price stability in the reaction function of monetary policy has helped to reduce the nominal and real impact of oil price fluctuations.

From the literature review, it is evident that most of the studies done have dwelt on the periods earlier that 2009, this has left a gap of the most current years of 2010 and 2011. This study adopts the most recent years of study 1996-2011 when Kenya changed the measure of inflation and this has seen the inflation levels reduce to one digit. There has also been an oil shock in the recent times that has seen most oil importing countries including Kenya struggle with the import bill. The previous studies have also dwelt on annual data and this study has adopted the use of quarterly data to get reliable results
This has led to the need to study the effects of these oil price changes on inflation in Kenya.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Model Specification

The approach used in determining the impact of oil price changes on inflation in Kenya for the period 1996-2011 is cointegration methodology to guide in model specification and estimation. The period of the study 1996-2011 is a short and current period hence the need for use of quarterly data in order to increase the number of observations (the sample size) leading to reliable results.

The model will be of a generalized form:

$$CPI = AY^{\alpha 1} OILP^{\alpha 2} EXCH^{\alpha 3} i^{\alpha 4} m^{\alpha 5} U^{\bullet} \dots \dots \dots \dots \dots \dots \dots \dots \dots (1)$$

Where;

CPI is the consumer price index

Y is national income (GDP)

OILP is the price of oil in US dollars of a barrel of Murban Crude Oil

EXCH is the nominal exchange rate.

i is the nominal interest rate

m is the nominal money supply (M2)

$U^{\bullet}$ is an error term which captures all the explanatory variables that influence inflation and are not included as independent explanatory variables.

In order to ensure that the linear function in its structural form is less sensitive to extreme observations when the ordinary least squares estimation parameters are applied and ensure normality of the residuals, logarithms are used to transform the function as shown

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below. This helps in reducing heteroscedasticity and multicolinearity in the data which occurs when there is transformation of dependent variable.

We therefore state the regression model derived from equation 1 as:

$$\ln CPI = lnA + \alpha_1 \, lnY + \alpha_2 lnOILP + \alpha_3 lnEXCH + \alpha_4 lni + \alpha_5 lnm +$$
$$lnU^{\cdot} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (2)$$

The constant term α_O represents the prediction of the dependent variable when all independent variables are zero. The parameters α_1 to α_5 represent the elasticity that each of the independent variables have on the dependent variable inflation (CPI). Each of the coefficients will be tested for statistical significance at a predetermined level of significance.

Differencing the variables leads to loss of long-run properties, since the model becomes short-run in nature. To solve this, an error correction model is introduced to reconcile the short-run behavior of the variables with the long-run behavior. The long- run relationship is incorporated by including the lagged vector into the model while the short run dynamics are incorporated by including the variables in their differenced form. Equation 2 is therefore differenced and a VECM equation introduced as follows:

$$\Delta lnCPI = \ln A + \sum_{i=1}^{K} \alpha_{1i} \Delta lnCPI_{t-i} + \sum_{i=0}^{k} \alpha_{2i} \Delta lnY_{t-i} + \sum_{i=0}^{k} \alpha_{3i} \Delta lnOILP_{t-i}$$
$$+ \sum_{i=0}^{k} \alpha_{4i} \Delta lnEXCH_{t-i} + \sum_{i=0}^{k} \alpha_{5i} \Delta lni_{t-i} + \sum_{i=0}^{k} \alpha_{6i} \Delta lnm_{t-i} + \alpha_7 ECT_{t-i}$$
$$+ lnU^{\cdot} \ldots \ldots \ldots \ldots \ldots \ldots (3)$$

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3.2 Descriptive Statistics

The study evaluates the mean, median and standard deviation statistics to check on the normal distribution of the variables. In addition a suitable normality test like Jarque-Bera (JB) test of normality is conducted to ensure that the error term follows the normal distribution.

With the normality assumption, we are able to establish that the OLS estimators of the regression coefficients follow the normal distribution and that for normally distributed variable according to Jarque-Bera, skewness is zero and kurtosis is three. From JB formula,

$$JB = n\left[\frac{s^2}{6} + \frac{(k-3)^2}{24}\right] \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (4)$$

Where n=sample size, s=skewness coefficient and k=kurtosis coefficient

3.3 Unit root test

Before estimation, the study tests for stationarity to avoid getting spurious regression and inconsistent regressions results. An important initial step of the research is to conduct unit root tests on the variables used. Thus the unit root analysis, using the Augmented Dickey Fuller Test is also an important part of this research. The order of integration was established using the Augmented Dickey Fuller (ADF) test which consists of running a regression of the first difference of the series against the series lagged once, lagged difference terms, and optionally, a constant and a time trend.

The Augmented Dickey Fuller test is used to carry out unit root tests to establish the order of integration of the individual series, expressed as xt ~I (d). This study employs the Augmented Dickey Fuller test on each variable in the specified model.

ADF test is based on the estimate of the following regression.

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$$\Delta x_t = \alpha_0 + \alpha_1 t + \beta x_{t-1} + \sum_{j=1}^{\rho} \delta_j \Delta x_{t-j} + U_t$$

.... (5)

Where α_0 is a drift; t represents a time trend; and ρ is a large enough lag length to ensure that U_t is a white noise process. The null hypothesis that the variable x is non-stationary ($H_0 : \beta = 0$) is rejected if β is significantly negative, using the results of Dickey-Fuller (1979).

3.4 Johansen Cointegration Analysis

When the cointegrated variables have been identified the study will proceed to use Johansen-Juselius (1990) multivariate procedure since there might be evidence of more than one cointegration vectors. This procedure better captures the short run dynamics of inflation. When there is residual from two or more nonstationary time series variables, the data becomes stationary; hence there is cointegration between such variables.
This is presented as follows:

$$\Delta X_{t-1} = \mu + \varphi X_{t-1} + \sum_{i=1}^{k=1} \beta \Delta X_{t-1} + U_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(6)$$

where X_t(nx1) vector of I (1) and U_t is Gaussian error term. The model contains information on both short-run and long-run adjustments to changes in X_t via the estimates of φ and β respectively.

3.5 Data Sources and Measures

The model is estimated using time series data from Kenya for the period 1996-2011. The data is obtained from secondary sources including the Kenya National Bureau of Statistic's website and various publications (Economic Surveys and Statistical abstracts), the Central Bank of Kenya annual reports and website as well as the World Bank tables.

CHAPTER FOUR

4.0 DATA ANALYSIS AND RESULTS

4.1 Descriptive statistics

Statistical analysis was carried out using E-views 3.1 software. Table 2 presents the descriptive statistics of the variables used in the study. It is clear from Table 2 that the mean and median are fairly close implying that the data doesn't suffer from outlier problem.

Table 2: Descriptive Statistics

	LNCPI	LNEXCH	LNI	LNM	LNOILP	LNY
Mean	4.164081	4.280433	2.152883	2.464549	3.602587	2.574169
Median	4.111241	4.326297	2.109432	2.549445	3.430919	2.627563
Maximum	4.858804	4.549591	3.287033	3.288402	4.812428	3.414443
Minimum	3.555634	3.991216	0.167589	0.587787	2.451005	1.163151
Std. Dev.	0.361792	0.125381	0.762552	0.629678	0.698660	0.349664
Skewness	0.167240	-0.631489	-0.711445	-0.867995	0.122784	-1.100699
Kurtosis	1.858263	2.782046	3.293054	2.995903	1.699761	6.003833
Jarque-Bera	3.774509	4.380314	5.627986	8.036476	4.669137	36.98444
Probability	0.151487	0.111899	0.059965	0.017985	0.096852	0.000000
Observations	64	64	64	64	64	64

Skewness is a measure of asymmetry of the distribution of the series around its mean. The skewness of a symmetric distribution such as the normal distribution is zero. Positive skewness means that the distribution has a long right tail and negative skewness implies that the distribution has a long left tail. Table 2 shows that the measure of skewness is in most cases close to zero except for national income (Y) at -1.100699 implying that the distribution of this dataset is normal.

Kurtosis measures the peakedness or flatness of the distribution of the series. The kurtosis of the normal distribution is 3. If the kurtosis exceeds 3 the distribution is peaked relative to the normal. If the kurtosis is less than 3, the distribution is flat relative to the normal. From the kurtosis values it is evident that all variables are normally distributed except national income (Y).

Jarque-Bera tests whether the series are normally distributed by measuring the difference between skewness and kurtosis of the series with those from the normal distribution. Under the null hypothesis of a normal distribution, the Jarque-Bera statistic is distributed as chi-squared with 2 degrees of freedom. The results in Table 2 shows all the variables are normally distributed at the 5% level except money supply and national income.

4.2 Correlation analysis

The correlation matrix for both dependent and independent variables is shown in Table 3. Correlation matrix is an important indicator that tests the linear relationship between the explanatory variables. It also helps in determining the strengths of the variables in the model. This also helps to determine which variables to drop from the equation.

Table 3: Correlation Matrix

	Lncpi	Lny	lnoilp	lnexch	Lni	lnm
Lncpi	1.0000					
Lny	0.2708	1.0000				
Lnoilp	0.9477	0.2635	1.0000			
Lnexch	0.6350	0.1162	0.4805	1.0000		
Lni	-0.5867	-0.3589	-0.5359	-0.5699	1.0000	
Lnm	0.4308	0.2214	0.3988	-0.0084	-0.3177	1.0000

From Table 3, it is clear that oil prices are highly correlated with CPI and that exchange rate is also slightly highly correlated with CPI. Further, interest rate is also highly correlated with CPI, oil prices and exchange rate, which brings about multicollinearity. To solve this problem, the variables were differenced once and this eliminated the problem of multicollinearity as shown in Table 4, the differencing was also done to make the all the variables stationary.

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Table 4: Correlation Matrix after Differencing

	dlncpi	dlny	dlnoilP	Dlnexch	dlni	dlnm
dlncpi	1.0000					
dlny	0.0205	1.0000				
dlnoilP	-0.0415	-0.1266	1.0000			
dlnexch	-0.0395	-0.0067	-0.3789	1.0000		
dlni	0.1937	-0.1316	0.0951	-0.1255	1.0000	
dlnm	-0.2087	0.0515	-0.1469	0.0927	-0.1072	1.0000

After first differencing all variables were not highly correlated hence differencing solved the multicollinearity problem that was present before differencing.

4.3 Stationarity Analysis

We tested the time series properties of the variable used in the model using the ADF test. In the analysis four lags is chosen since the data is expressed quarterly. The variable series are also expressed in logarithms. It follows that all the variables have unit roots i.e. I(1) order of integration . The results are presented in Table 5 and 6.

Table 5: Unit Roots Test results (Lag length =4)

Variable	Test statistic	Stationarity
Lncpi	1.247	Non Stationary
Lny	-2.932	Non Stationary at 1% level
Lnoilp	-0.600	Non Stationary
Lnexch	-1.929	Non Stationary
Lni	-2.377	Non Stationary
Lnm	-2.059	Non Stationary

Note: The critical values at 1% significance level is -3.567, 5% significance level is -2.923 while at 10% significance level it is -2.596 on all variables

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Table 6: Unit Roots Test results after differencing (Lag length =4)

Variable	Test statistic	Stationarity
ΔLncpi	-3.670	Stationary
ΔLny	-5.038	Stationary
ΔLnoilp	-4.820	Stationary
ΔLnexch	-3.678	Stationary
ΔLni	-4.391	Stationary
ΔLnm	-4.053	Stationary

Note: The critical values are -3.569,-2.924 and -2.597 for 1%, 5% and 10% significance level respectively.

Since all the variable series have unit roots, it is possible that they are cointegrated thus we move to next stage where we formally test for the possible existence of a cointegrating equation.

4.4 Cointegration Analysis

The test for cointegration used in the study is Johansen's procedure technique in order to identify if there is evidence of more than one co-integrating vectors. We adopt methodology by Johansen (1988) and Johansen and Juselius (1990). We test the null hypothesis of no cointegration (H0: r = 0) against the alternative hypothesis of cointegration (H1: r > 0). If the statistic is bigger than the critical value, the null hypothesis of at most r cointegrating vectors is rejected. The empirical results are presented in Table 7.

Table 7: Johansen Maximum Likelihood Cointegration Test

Hypothesized No. of CE(s)	Eigen value	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value
None *	0.451880	108.4494	94.15	103.18
At most 1 *	0.393833	71.77255	68.52	76.07
At most 2	0.270882	41.23594	47.21	54.46
At most 3	0.196826	21.96484	29.68	35.65
At most 4	0.128717	8.594594	15.41	20.04

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| At most 5 | 0.003102 | 0.189520 | 3.76 | 6.65 |

* denotes rejection of the hypothesis at 5% significance level.

Table 7 shows that the null hypothesis of no cointegration is rejected at the conventional level of 5% and the test concludes there is one cointegrating equation among the proposed variables according to the maximum Eigen value test meaning there is a long term equilibrium relationship among the variables.

Table 8: The Long-Run Error Correction Model

Variables	Coefficients	Standard Error	t-statistics
LNEXCH	0.819905*	0.11004	7.45111
LNI	-0.018415	0.01899	0.96981
LNM	0.076266*	0.01907	3.99948
LNOILP	0.400903*	0.01941	8.6580
LNY	-0.018950	0.03190	0.59403
C(Constant)	-1.066145*	0.50647	-2.10504

*Significant

Table 8 shows the long run dynamics of the study. The long run equation is reported as follows;

$$\ln CPI = -1.07 + 0.82\ln EXCH - 0.02\ln i + 0.08\ln m + 0.4\ln OILP - 0.02\ln Y \quad \ldots\ldots\ldots\ldots\ldots\ldots(7)$$

Nominal exchange rate is positively related to CPI and is a statistically significant determinant of the inflation levels in the country. This indicates that the long-run elasticity of exchange rate to CPI is 0.81. A depreciation in nominal exchange rate in Kenya will result into increase in CPI. On the other hand high inflation causes severe fluctuations in exchange rates which affect trade and the value of money in an economy. Our findings are similar to Ryan and Milne (1994) who found that exchange rate movements and changes in oil prices are the most important factors in determination of inflation.

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The coefficients of interest rates, money supply and oil prices have the predicted signs. Nominal interest rate is negatively related to CPI and its coefficient is not statistically significant determinant of CPI in Kenya. This is explained by the fact that during the period of the study, other factors like food prices, changes oil prices and money supply have had a greater impact on inflation.

The study findings further show that money supply is positively related to CPI and its coefficient is statistically significant. This indicates that the higher the money supply, the higher is the inflation. Money expansion is one of the most fundamental economic variables that determine inflation in a country and therefore the study is in agreement with the expectation. Excess money supply in an economy leads to erosion of the purchasing power of the consumer because of too much money chasing few goods and services. The studies that have similar findings include Ndung'u (1994) and Adam et al. (1996) who found out that money supply determines the level of inflation in Kenya. Killick and Mwega (1989) who concluded that despite many studies using different methodology in Kenya the unanimous conclusion was that monetary expansion is among the most important factors in determining inflation.

The coefficient of oil prices in US dollars is positive and significant determinant of inflation. A 1% rise in the Murban crude oil prices would lead to an increase in inflation rate by 40 % holding other variables constant. The results illustrate the importance of the oil prices in explaining the rate of inflation in the country. Kenya being a net importer of oil, changes in oil prices have a greater and direct effect on the rate of overall inflation in Kenya. Oil prices have affected prices in other sectors of the economy such as transport, energy, food and manufacturing sectors. The high coefficient of oil prices is a clear indication of large magnitude of imported inflation in Kenya and clear intervention policies by the government are required. These findings are in agreement with other reviewed empirical studies. Burbige and Harrison (1984) concluded that there is a great effect of oil price shocks on inflation in USA and Canada, Ryan and Milne (1994) found that exchange rate movements and changes in oil prices are the most important factors in determining inflation in Kenya and Kiptui (2009) concluded that oil prices have significant effects on inflation in Kenya.

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4.5. The Dynamic Error Correction Model

After obtaining the long-run cointegrating equations using the Johansen analysis, we proceeded to estimate the short run dynamic equation within error correction model. Table 9 shows the estimates of the short run error correction equations.

Table 9: The Short-Run Error Correction Model

LAG	0	1	2
DLNCPI		0.101373 (0.75135)	-0.432902* (-3.04237)
DLNEXCH	0.017697* (-2.245907)	0.158556* (2.03443)	0.059105 (0.76564)
DLNI	-0.011779* (1.408816)	0.024344* (2.44573)	-0.001769 (0.18877)
DLNM	0.010734* (-1.569735)	0.005636 (0.80078)	0.000147* (1.42058)
DLNOILP	0.012925* (-1.689372)	0.036542* (1.87431)	-0.009486 (-0.48987)
DLNY	-0.002268 (0.329510)	-0.017151* (1.47156)	0.008958 (0.93981)
ECT(t-1)		-0.005020* (-2.31560)	
CONSTANT	0.024708 (5.24675)		

R-squared	0.305397
Adjusted R-squared	0.113273
Sum squared residual	0.019409
S.E. equation	0.020321
F-statistic	1.589583
Mean dependent	0.020290
S.D. dependent	0.021580

*Significant
Numbers in parenthesis are t-statistics

The short run equation derived from table 9 is expressed as follows;

$$dlnCPI = 0.02 - 0.005ECT_{t-1} - 0.43dlnCPI_{t-2} + 0.02dlnEXCH + 0.16dlnEXCH_{t-1}$$
$$- 0.01dlni + 0.02dlni_{t-1} + 0.01dlnm + 0.0001dlnm_{t-2}$$
$$+ 0.013dlnOILP + 0.04dlnOILP_{t-1}$$
$$- 0.02dlnY_{t-1} \quad \text{..(8)}$$

The empirical findings disclose that the lagged error correction term is statistically significant and the coefficient has the appropriate negative sign as required for dynamic stability. This represents the speed of adjustment to long run equilibrium that affects short run movement in inflation. The negative sign is in agreement with theory indicating a move back to the equilibrium and the coefficient is less than unity in absolute values. The speed of adjustment in this case is slow at 0.005% indicating no adjustment or it may take a long time to return to equilibrium.

GDP lagged once has an effect on inflation in the short run unlike in the long run where results indicated GDP as insignificant. The coefficient is negative as expected. An increase in GDP by one percent would lead to decrease in CPI by 0.017% holding other variables constant. De Gregorio (1993) and Barro (1995,) also found a negative relationship between inflation and economic growth.

Interest rate lagged once is positively related to inflation and its coefficient is statistically significant. This finding contradicts the long-run result which indicates a negative relationship between interest rate and inflation. The positive relationship could be attributed to the fact that when central bank raise their interest rates, the CPI increases as a result and inflation may go up temporarily but the impact may last. The positive relation may also be explained by the fact that an increase in the rate of interest pushes the cost of capital for investors. To some extent, investors may then pass on this higher cost of capital to consumers through higher prices. The positive coefficient lagged interest rate is however partially offset by the negative coefficient of the current interest rate.

Inflation lagged twice also has an effect on the current rates of inflation. Lagged inflation is negatively related to current inflation with a 1% increase in the rate of inflation for the past 2 quarters' rates causes a decrease of 0.43% in the rate of the current inflation.

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Nominal exchange rates coefficients, current and lagged are positive as expected and this is in agreement with the long- run results. Money supply (current and lagged twice) and oil prices (current and lagged once) are also significant determinants of the inflation. The signs on the coefficients of the variables are positive indicating that inflation in the short run increases following a rise in oil prices and money supply. A 1% increase in current money supply and prices of oil is anticipated to increase inflation by 0.01% and 0.013% respectively in the short run.

CHAPTER FIVE

5.0. CONCLUSION AND POLICY IMPLICATIONS

5.1 Conclusion

Kenya has continuously struggled with high inflation and low economic growth rates. Several policy measures have been put in place by the MPC and the government in order to curb the ever increasing inflation yet there is a vicious cycle since the 1970s. Inflation levels took a centre stage then when the world was hit by the first oil price shock and has never been resolved. Kenyan inflation is mostly imported since the country is a major oil importer and in addition does not produce enough food baskets for its fast increasing population hence the need to import food from other countries. The world oil prices have not favored Kenya in the recent past with several increases from ADNOC that produces the Murban crude oil which Kenya imports. The high oil prices have put further pressure on inflation in Kenya leading to escalating cost of living for most citizens. The study conducted an analysis of several factors including the Murban crude oil prices, while others included national income (GDP), nominal exchange rate, nominal interest rate and nominal money supply (M2).

The results of the regression showed that the signs of the coefficients of all variables were as expected. Exchange rate, money supply and oil prices were found to be statistically significant while interest rate and GDP were concluded to be statistically insignificant. However in the short-run, GDP lagged once was found to have an effect on inflation, is statistically significant and carries the expected negative sign. Further, interest rate lagged once is also statistically and carries a positive sign unlike in the long-run which could be caused by increase in interest rates by CBK that leads to temporary rise in inflation. Nominal exchange rates both current and lagged have positive coefficient and in agreement with long-run results. Money supply, current and lagged twice and oil prices current and lagged once are positively significant indicating that in the short-run increases in oil prices and money supply would lead to rise in inflation. This study has limitations especially those emanating from the fact that several factors that have a great impact on inflation have not been considered.

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5.2. Policy Recommendations

The government has put a lot of effort on keeping the inflation low since independence and this is justified because it encourages high economic growth rate in the economy. Looking at the factors that affect inflation in the economy is vital as in this study because it enables the economists and policy makers adopt relevant policy measures to help in curbing inflation. It further broadens the understanding on the effects of inflation and how to deal with inflationary pressures.

Kenya suffers from low supply of food amidst high demand and the need to improve the agricultural sector to solve the problem of lack of agricultural inputs becomes a pressing problem for the government to solve. The new agricultural inputs and machinery should be encouraged and adopted in order for the farmers to improve the supplies. The North Rift of the economy has great potential of improving the food basket of the economy three-folds to make Kenya a self-sufficient economy in terms of feeding the nation (Ministry of Agriculture website). There should be subsidies on food, both imported and domestically produced, not to add agricultural inputs to reduce the end product prices that factor in the cost of importation.

Kenya is an oil importing nation and hence the country suffers a lot when the international crude oil prices sky rocket and hence these prices are immediately felt in the whole economy. Petroleum products are key in the manufacturing and domestic industries and when there is no stability the economy is hit with several disturbances including inflation. The government should be prepared to make tax exemptions especially on the imported crude oil in order to reduce the adverse effect it has on the general public.

Despite the government introducing the price capping mechanism of oil products in 2010, the consumers have not been able to feel the real difference because of the cartels that exist in the oil industry. The industry has several unscrupulous players who have tainted the efforts made by the government. The government needs to further look at the ways to make the price cap work by putting further stringent measures on the players who do not adhere to the rules and regulations set and this will prevent the exploitation of the citizen.

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the efforts made by the government. The government needs to further look at the ways to make the price cap work by putting further stringent measures on the players who do not adhere to the rules and regulations set and this will prevent the exploitation of the citizen. The Monetary Policy Committee of the Central Bank has had several measures to stabilize the shilling exchange rate and increase interest rates in order to reduce inflation levels in the economy. While maintaining a stable exchange rate is important, the MPC strategies must not lead to an overvalued currency since this will be a disincentive to exports. This will make worse problem to the BOP of the country since Kenya import more than it exports and the current account deficit is huge. The measures taken by the government agencies and policy makers must take into account the long run effects of the measures on the economy and not just one sector.

From a policy perspective, the study recommends that further research should be carried out on inflation causes and the way forward especially with respect to agriculture and monetary policies which will enable the country produce enough food, considering the fact that Kenya suffers from high demand and low supply. Malawi as a country adopted several measures especially in regard to food supply and gives most developing country a challenge especially Kenya on how to improve the food basket.

Furthermore, Kenya has had its population increasing at a very fast rate which has caused a lot of strain on its resources leading to the problem of too much demand. The supply side has for a long time been constant while the demand side is increasing at an increasing rate. The planners and policy makers need to come up with swift measures of family planning to enable the population control and this will enable the government plan better for its population in terms of food and other resources.

Kenya has relied more on petroleum products in its production and domestic processes and this has led to high cost of energy amidst high cost of end of products from the industries. Over the years the country has relied on the use of imported petroleum products to propel the energy sector without major innovative measures. Despite the fact that oil has been discovered in the Turkana region this has not made things further easier for the country and before much success can be developed, the country should embark on

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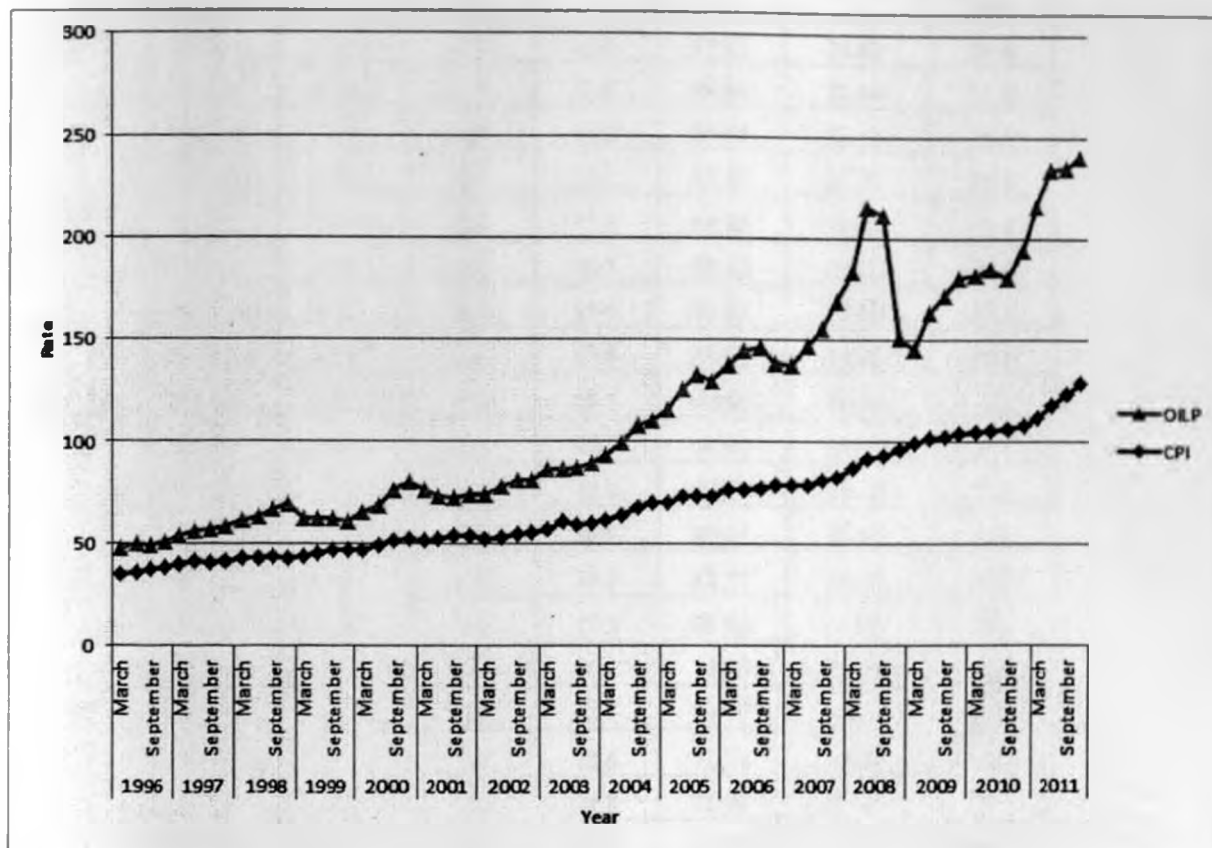US DOE, Energy Information Administration Annual Energy Review.

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APPENDIX

Appendix 1: Graph of oil prices and CPI

Appendix 2: Quarterly data

YEAR	QUARTER	CPI	GDP Growth	OILP	EXCH	INTEREST	M2 Growth rate
1996	March	35.01	4.3	12.8	57.81	24.63	24.8
	June	36.03	2.9	13.9	58.20	22.66	23.6
	September	37.38	3.34	11.6	56.91	22.16	25.8
	December	37.77	5.5	12.7	55.54	22.57	26.8
1997	March	39.56	-2.5	13.8	54.85	21.49	19.1
	June	41.62	2.2	14.7	54.12	20.27	20.2
	September	40.61	-0.1	15.9	62.75	21.44	21.3
	December	40.95	1.3	17.8	63.21	21.45	20.2
1998	March	42.83	1.8	18.7	60.60	26.76	1.8
	June	42.86	2.2	20.5	60.91	26.45	3.5
	September	43.4	4.5	23.8	59.57	26.28	3.4
	December	42.46	4.8	26.8	60.44	23.63	2.8
1999	March	43.4	4.6	19.2	62.77	16.94	5.8
	June	44.94	3.4	17.5	69.36	9.50	7.5
	September	46.32	2.8	16.2	74.40	10.03	6.3
	December	46.8	-1.2	13.7	74.77	15.03	6.5
2000	March	46.73	-6.8	18.6	72.78	18.58	5.6
	June	49	1.5	19.8	75.96	15.47	5.2
	September	51.63	2.5	24.3	77.02	11.38	4.6
	December	52.21	3.4	27.6	78.95	9.84	4.2
2001	March	51.66	-2.1	24.3	78.20	11.57	5.7
	June	52.35	4.98	20.5	78.22	15.01	5.9
	September	53.58	5.58	18.6	78.96	11.83	4.8
	December	53.42	0.63	20.5	78.87	12.70	5.8
2002	March	52.29	4.38	21.28	78.30	11.38	10.4
	June	53.3	-2.47	24.9	78.42	10.54	10.8
	September	54.6	0.44	26.48	78.73	8.80	9.7
	December	54.97	1.86	26.3	79.47	8.19	8.6
2003	March	56.45	-1.05	30.13	77.05	8.25	12.8
	June	60.46	-0.8	25.88	73.66	7.47	11.8
	September	59.53	1.32	27.85	76.20	5.03	11.7
	December	59.8	3.27	29.58	76.84	1.18	10.8

2004	March	61.59	8.31	31.7	76.65	1.25	13.9
	June	64.11	9.31	35.6	78.81	1.58	17.5
	September	68.09	9.18	40.1	80.51	2.33	12.5
	December	70.32	5.53	40.32	80.73	2.24	10.1
2005	March	70.41	7.54	45.68	76.56	5.68	8.9
	June	73.22	3.85	52.6	76.41	8.49	7.9
	September	73.23	7.941	59.7	75.38	8.61	12.7
	December	73.43	6.63	56.62	73.64	8.03	9.9
2006	March	76.35	5.56	61.32	72.35	7.95	20.6
	June	76.39	7.14	68.28	72.44	6.88	19.1
	September	76.8	8.78	69.65	72.97	6.1	12.7
	December	78.27	8.39	60.37	70.46	6.32	15.2
2007	March	78.9	5.35	58.57	69.68	6.18	20.5
	June	78.46	12.88	68.57	67.28	6.65	19.1
	September	80.9	9.21	74.67	67.08	7.06	20.1
	December	82.68	8.2	86.21	64.69	7.55	21.4
2008	March	87.18	-3.39	96.52	67.99	7.05	14.8
	June	92.14	-2.105	123.03	62.95	7.61	17.5
	September	93.75	-0.45	117.63	69.76	8.01	12.7
	December	96.38	-3.19	54.25	78.41	8.24	16.9
2009	March	99.5	20.4	46.12	79.89	7.78	17.8
	June	101.91	7.65	61.32	78.01	7.37	18.5
	September	102.9	2.17	69.35	75.95	7.25	16.7
	December	104.07	1.44	76.33	75.27	7.1	12.8
2010	March	105.01	5.05	76.67	76.70	6.29	21.8
	June	105.65	4.66	79.15	79.64	4.12	24.6
	September	106.32	7.37	74.5	80.66	1.82	22.4
	December	108.07	9.71	86.33	80.84	2.2	20.6
2011	March	112.41	5.76	103.9	82.40	2.6	20.4
	June	118.29	4.31	115.48	86.33	6	19.7
	September	123.88	2.88	111.3	94.59	10.05	19.2
	December	128.87	3.83	111.7	91.52	16.13	18.1