FOOD INFLATION IN MALAWI: IMPLICATIONS FOR THE ECONOMY

BY

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2007/HD02/9120X

A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES IN PARTIAL FULLFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE IN AGRICULTURAL AND APPLIED ECONOMICS OF MAKERERE UNIVERSITY, UGANDA

SEPTEMBER, 2010

DECLARATION

I, Makaiko Gonapanyanja Ularo Khonje hereby declare that the work embodied in this thesis is my own and has never been submitted for any award in any other University. Where other sources of information have been used, they have been rightly acknowledged.

Signature…….

KHONJE MAKAIKO GONAPANYANJA ULARO

Date…….

APPROVAL

This thesis has been submitted with our approval as university supervisors.

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Signed

..... ……

Prof. Adbi K. Edriss (University of Malawi: Bunda College) Date

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DEDICATION

To my Dad

Stocker Gonapanyanja Khonje

My Mum

Selina Chihana

My Brothers

Stephen, Mabvuto, Hope & Vuka

&

My Sisters

Ivy & Irine

"I thank God that you are always there for me and for your moral, social, inspirational and financial support, I love you all."

God should bless you all

ACKNOWLEDGEMENTS

I am grateful to many people for making this work possible. It is difficult to enumerate the names of all of them. Nevertheless, it would be insolent of me if I did not thank some of them by name. Profound thanks and appreciation goes to my supervisors Dr. Barnabas A. Kiiza and Professor Abdi K. Edriss for their untiring support throughout this work. I recognize with gratitude their high intellectual assistance and enormous contribution in shaping and improving the quality of this work. Special thanks to Professor Abdi K. Edriss for his continuous guidance at various stages of my program.

I express my sincere gratitude to the German Academic Exchange Service – Deutscher Akadamischer Austauscdienst Dienst (DAAD) for providing me with a scholarship through African Economic Research Consortium (AERC) to pursue a masters program at Makerere University in Uganda. I am also highly indebted to instructors at Makerere University, for the knowledge they imparted on me and the shared facilities at University of Pretoria. My colleagues pursuing Collaborative Masters of Science in Agricultural and Applied Economics (CMAAE) have been so supportive and indeed wonderful companion, I appreciate their support. Special thanks are due to Departmental staff for making my stay at Makerere campus memorable. My appreciations to Mr. and Mrs. P.C.B. Mkandawire, Ms. Maggie Msukwa and all my friends so numerous to mention, for their support during my studies.

Finally, I thank Almighty GOD for his grace, faithfulness and loving-kindness for giving me the opportunity to study at Makerere University.

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LIST OT ACRONYMS

ADF:	Augmented Dickey- Fuller
AERC:	African Economic Research Consortium
ARCH:	Autogressive Conditional Heteroskedasticity
CMAAE:	Collaborative Masters in Agricultural and Applied Economics
CPI:	Consumer Price Index
DAAD:	Deutscher Akadamischer Austauscdienst Dienst
ECM:	Error Correction Model
EME:	Emerging Market Economies
FAO:	Food and Agriculture Organization of the United Nation
GDP:	Gross Domestic Product
MK:	Malawi Kwacha
MT:	Metric Tonnes
NEC:	National Economic Council
NSO:	National Statistical Office of Malawi
OLS:	Ordinary Least Squares
RBM:	Reserve Bank of Malawi
SFFRFM:	Smallholder Farmers Fertilizer Revolving Fund of Malawi
SPSS:	Statistical Package for Social Scientists
STATA:	Statistical Package for Professionals
UECM:	Unrestricted Error Correction Model
USA:	United States of America
VAR:	Vector Autoregression
VECM:	Vector Error Correction Model
VIF:	Variance Inflation Factor

ABSTRACT

Despite consecutive years of good harvest, Malawi has experienced continuous price escalation of staple food commodities unsolved over the time. The real price of maize in Malawi has increased by 141 percent between 1998 and 2008, and has been rising along with the food prices of many other commodities over this period. This study therefore investigates the determinants of food inflation rate in Malawi and its effect on the economy. Monthly and annual data were collected from National Statistical Office and Reserve Bank of Malawi from 1978 to 2008. Data were analyzed by estimating an error correction model (ECM). The results show that fertilizer prices, crop diversification index, maize prices, diesel prices, real exchange rates and real interest rates significantly and positively influenced the rate of food price inflation in Malawi. In addition, the annual rate of food inflation, exports, imports, real interest rate and real exchange rate significantly influenced real agricultural output (GDP) and national GDP at 1 and 5 percent levels respectively. Furthermore, high food price inflation induced low purchasing power to consumers thereby reducing expenditure on consumable goods. Real national output (GDP) and agricultural GDP were negatively affected by food price inflation. The study recommends that a deliberate policy is needed to promote crop diversification in order to reduce food inflation emanating from monotonic food products. Policy makers also need to review exchange rate policy and move towards flexible exchange rate regime (e.g. crawling peg).

Key words: Food inflation; ECM; Crop diversification; GDP; Economy; Malawi.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

The increase in global food prices has received renewed attention in recent years due to its negative impacts on households welfare (Benson *et al*., 2008a; World Bank, 2008a and 2008b; Wodon and Zaman, 2008; Wodon *et al*., 2008). It is a truism that food inflation is common in this era of globalization and agricultural industrialization especially with occurrence of shocks. Malawi has not been spared from the positive and negative consequences (i.e. increase in farm income by net sellers of food, food insecurity, hunger and poverty) of high commodity food prices. Various governments and development partners have considered robust policy interventions to offset negative impacts of food price inflation[1] on the poor masses (Joseph and Wodon, 2008). The reality of its impacts on immeasurable groups of the society across the world has left many people and interest groups to be interested in understanding dynamics of rising food prices (Weersink *et al.*, 2008).

Food and non-food inflation is measured by rate of change in Consumer Price Index (CPI) for food and non-food components, respectively (NSO, 2008). Food inflation occurs when the aggregate quantity of food demanded is greater than supplied at a particular price and time. However, there are different causes and consequences of demand-pull and supply induced food inflation. Food inflation is explained based on macroeconomic theories of increase in food consumption or investment spending, fiscal policies, monetarist theories, emphasizing the impact of excess money supply in

[1] Inflation is the general increase in price level of different commodities in the economy. It is subdivided into food inflation (escalating food prices) and non-food inflation i.e. rate of change in price of non-food items. However, this paper will concentrate on food price inflation

the economy, the structuralist hypothesis (adverse food supply shocks) and external theories, describing the effects of foreign transmission mechanisms on a small open economy (Diouf, 2008; Abel *et al*., 1998). In economies that hardly raise enough revenue through taxation and borrowing to finance its expenditure, and coupled with political instability, the central bank prints money (seignorage) to finance the budget and this also causes food inflation (Mankiw, 2003; Aisen and Veiga, 2008). Governments especially in developing countries fight to reduce food inflation (disinflation) through restrictive monetary policies, regulation of food prices and wages in order to have good credibility and attain donor confidence. This is critical to many developing countries as their budgets are mainly financed by donor funds (Mankiw, 2003).

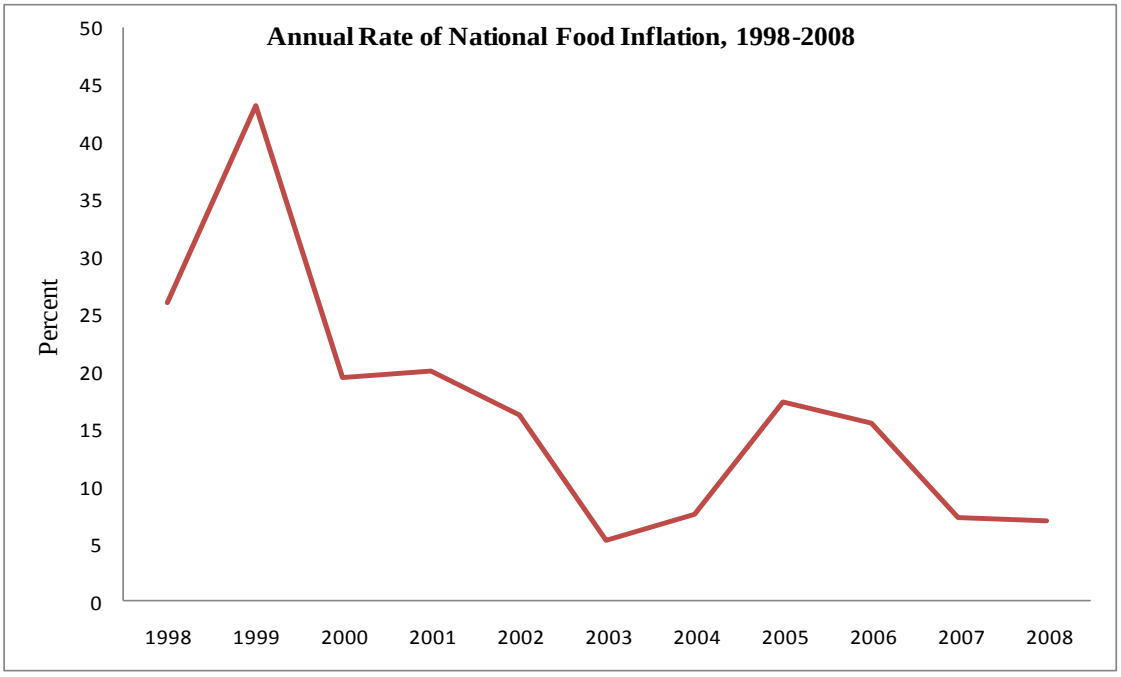
Malawi's inflation is largely triggered by three 'traditional' factors: expansionary policies, oil prices and inter-seasonal price of maize (Kaluwa, 2004). However, Maize stock (food supply shocks) is the probable main determinant of food inflation in the country. This is evident as food prices at the national level accounts 58.1 percent of the total Consumer Price Index[2] (NSO, 2008). Food price bubble reduces individual's purchasing power and it has distribution effects which favour the rich more than the poor (Hyun and Nanak, 2006). According to de Hoyos and Medvedev (2009), skyrocketing food prices have had huge impacts of perpetuating abject poverty because majority of the population do not have access to basic needs of life in the economy, mostly food products.

[2] The cost of living is measured by percentage change in prices of commodity at a particular time [Consumer Price Index (CPI)]. See, Appendix A.

At global level, food prices have risen sharply partly because of using food crops i.e. corn/maize for biofuel production and as a result of other factors such as rapid income growth in developing countries, high fertilizer prices, depreciation of US dollar, low food stocks, high oil prices, domestic policies (i.e. hoarding/speculation, export bans, reductions in import tariff and other restrictions), market structure as well as weather shocks (Africa Research Bulletin, 2008; Von-Braun, 2008; Dewbre *et al.*, 2008; Headey and Fan, 2008; Boadu and Zereyesus, 2009; Torero and Von-Braun, 2008). It is imperative to note that some of the factors that are responsible for global food price inflation do not strongly cause domestic food inflation depending on level of price transmission and the nature of domestic economy.

1.2 Synopsis of Food Inflation Trends in Malawi, 1998-2008

In Malawi, the rate of food inflation has decreased steadily since 1998 as shown in Figure 1.



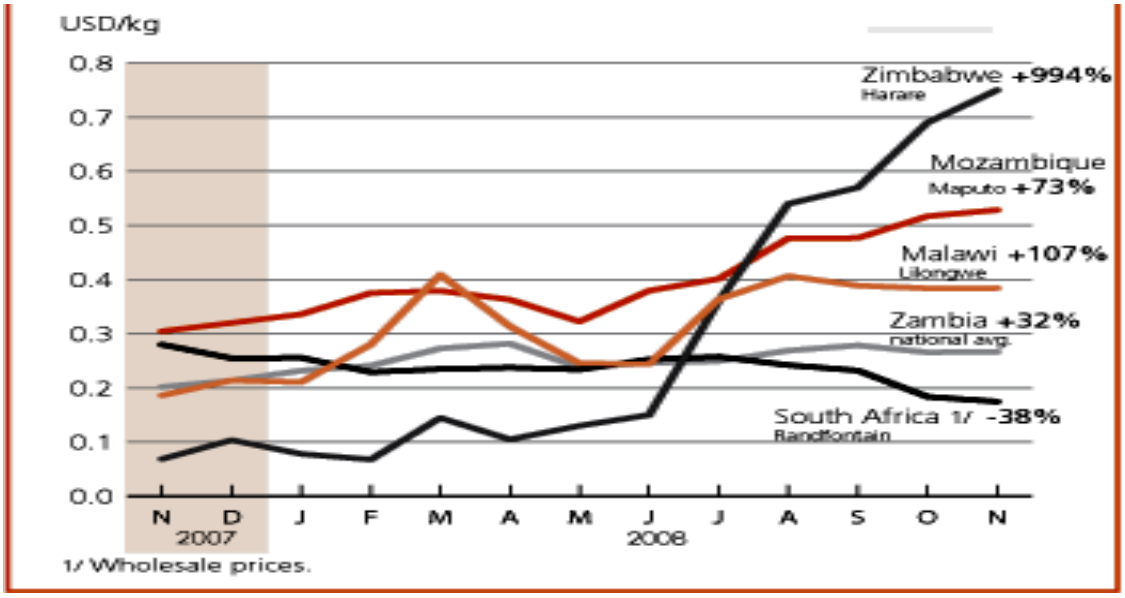
Source: Authors' construction based on study data obtained from RBM (2009).

Figure 1: The Annual Rate of Food Inflation for 1998-2008

However, food price inflation rose markedly reaching an average of 43.2% between the periods of 1998 to 2001. This was attributed to the depreciation of the Malawi Kwacha which resulted in high prices of both imported materials and finished products notably petroleum products and maize. Depreciation[3] has also resulted in increased price of maize in other countries in the southern region of Africa. High food price inflation and underproduction of maize to meet national consumption requirements of 2.4 million metric tonnes also induced increased maize prices. In 2001, average annual food inflation rate was 19.4% and this reduced to 16.2% in the subsequent year due to drought and high fertilizer prices experienced in 2001. However, in 2003 the average annual food inflation reduced to 5.3%, of increased maize production in the 2002/2003 growing season, as well as continued tight monetary policies. Soon after general election in 2004, Malawi experienced high food inflation rates of 15.4% and 17.3% in 2005 and 2006 respectively which is more than double the rate of 7.5% in 2004. Food shortages motivated the government to implement fertilizer subsidy program. The impacts of the program were seen in 2007 and 2008 when the rate of food inflation reduced to 7.2% and 6.9%, respectively.

The price of major food commodities, in particular maize, for the last two years (i.e. 2007 and 2008) has fallen drastically as a result of subsidy program and favourable weather conditions. Nevertheless, prices in the 2008 period still remained 107% higher in Malawi and other countries in Southern Africa as shown in Figure 2 (FAO, 2008; Mason *et al*., 2009). This has subsequently led to hunger and food insecurity in some vicinity of the country, suggesting that food inflation can still occur when the

[3] For example, in South Africa a sharp depreciation of the exchange rate towards the end of 2001 increased the price of maize – one of the key agricultural commodities because of its role as a staple food and as an input in the production of white and red meat and other animal products (Kirsten *et al.*, 2002).



Source: FAO, 2008

Figure 2: White Maize Prices in Selected Southern Africa Markets

nation has attained national food security. During 2007/2008 growing season, Malawi had attained national food security because it produced a surplus of 1.4 million metric tonnes of maize against 2.4 which is national requirement.

1.3 Problem Statement

Malawi has experienced continuous price escalation of staple food commodities in the last decade that has resulted into food insecurity, despite consecutive years of good harvest. The price of maize in Malawi has increased by 141 percent between 1998 and 2008, and has since risen further causing food price inflation. For example, in September 2008 when there was shortage of maize supply in some parts of the country. The development pushed the price of maize and inflation rate in October to 7.2 percent from 7.1 percent in September (Namwaza, 2008 and NSO, 2008). Food inflation has been more pronounced in the last decade and in lean periods every year (NEC, 1999). However, in 2007/2008 growing season, Malawi registered 1.4 million metric tonnes of surplus maize attributed to fertilizer subsidy program and good weather conditions which turned the country from a continental food deficit nation to

an exporter and a donor (Namwaza, 2008). Abundance supply of maize prompted reduction in both food and non-food inflation rate. This shows that domestic food inflation is highly responsive to maize price *via* the law of demand and supply (Mchazime, 2008). Although prices of food basket in Malawi have reduced significantly in the last two years of fertilizer subsidy program, they still remained 107%[4] higher compared to other countries in the region (FAO, 2008). This has been attributed to factors such as weather shocks, high imperfect market information, geographical locations and high intensity of poverty. In addition, many other commodity food prices have risen sharply over the last decade, consequently causing many people to experience hunger in times of plenty. Hence there is need to determine factors responsible for high commodity food price inflation.

High and rising prices of food commodities and products such as maize, rice, irish potatoes, beans, fish and beef have undermined food security (accessibility and affordability), propagated malnutrition, hunger and threatened the livelihood of most vulnerable poor households by eroding their limited purchasing power. In other words, food inflation has had tremendous glum impacts of perpetuating food poverty that triggers household food insecurity and hunger (Arndt *et al*., 2008; Singh, 2009). High food inflation reduces individual's purchasing power of food and it has distribution effect which favours non-poor more than the poor masses in low income countries (Zografakis *et al.*, 2009; Hyun and Nanak, 2006). As such food inflation has huge impacts on perpetuating abject poverty and household food insecurity because majority cannot access basic needs, both food and non-food items. Household food insecurity problems in Malawi are exacerbated widely by food inflation especially

[4] See, Figure 2 and visit FAO website:http//www.fao.org.

after the liberalisation of agricultural commodity market and the removal of price controls on maize (Chirwa *et al*., 2006). As a result, most rural[5] and urban poor households buy few quantities of maize and other food products or commodities from the market due to ever increasing food prices (World Bank, 2003). Not only has food inflation resulted in poor households' reduction of their food consumption levels, but they have shifted consumption to less-balanced diet foods and spend less on other longer-term household needs such as education and health (Zhu, 2008). The fact that people's welfare in Malawi suffer mostly as the food inflation increases for major agricultural commodities and food products, in particular cereals, protein sources and vegetable oils cannot be overemphasized. It is also reported that high commodity food prices have also caused serious problems to various groups such as net producers, poor consumers, net deficit producers, surplus producers and poor net rice seller in Madagascar, Mali, Eastern and Southern Africa (Joseph and Wodon, 2008; Poulton *et al*., 2006; Coady *et al* ., 2009).

The overdependence on maize as main food crop in Malawi in the presence of many other food crops also contributes to food inflationary pressure and the risk of sustaining disinflation (Chirwa and Zakeyo, 2003). This suggests that the quantity demanded for maize is always high compared to other food crops like cassava, sweet and irish potatoes, bananas, rice and yams. According to FAO (2008), the promotion of processing and value-addition to primary agricultural food produce/commodities especially starch and protein based products into final (cooked or roasted) dried products which are ready to eat has not been exploited in Malawi. Consequently, this reduces diversified food products which have high shelf-life and high nutritional

[5] NSO (2005) reported that 45% of rural households were affected badly by the rise in food prices in 2004.

value. These products can easily be manufactured by rural processors through simple processes such as fermentation, roasting, cooking, drying, grinding and mixing. As a result, the ever increasing demand for maize and its related food products in lean periods (when farmers' stock and food supplies are all depleted) pushes the prices of food commodities and products high. Unfortunately, crop or food diversification has not been exploited as a potential means to end high food price inflation in Malawi. Besides, high food price volatility due to higher food expenditures in household budgets, rate of inflation, product heterogeneity and higher market imperfections has been reported in Malawi (González *et al*., 2007; Gopinath *et al*., 2002).

According to Ogbokor (2004), soaring food price inflation provides great challenge to macroeconomic stability and growth of any modern economy. It is even more critical to growth of Malawian economy which is agro-based[6]. Consequently, high food price inflation invariably influences the agricultural output and growth of whole economy. High food price inflation is a major concern and relevant to the poor people in developing countries where majority of consumers spend a higher proportion of their incomes on food (Haszler *et al*., 2009). The fact that majority of poor consumers who are net buyers of food tend to reduce expenditure on food products, agricultural food commodities and other goods and services as a result of escalating food prices, the stability of the economy is at risk (Benson *et al*., 2008a; Shahnoushi *et al*., 2009). The domestic economy shrinks as outputs are hardly absorbed by domestic and export markets which in turn reduce foreign earnings and farm income to producers. Agricultural investment in production and processing is limited and consequently

[9]Agriculture sector remains the backbone of the Malawi's economy as it contributes 39 percent of the gross domestic product (GDP), 85 percent of the labor force and 83 percent of foreign exchange earnings (Chirwa *et al*., 2006).

increasing unemployment rate and instability of the economy. Despite widespread concern about the impacts of high food price inflation on poor people, social stability and economy (World Bank, 2008c), little information is available on real causes of high domestic food price inflation in Malawi and its effects on the economy.

Policy makers often lack sufficient information to gauge the likely effects of food price inflation and to identify, design and implement pro-poor policy actions. Benson *et al*. (2008b) reported that deficiencies in information and analysis have led to policy and market failures in developing countries. Occurrence of high food price inflation despite consecutive years of good harvest validates the need to investigate the forces behind high prices of food commodities and products. The cause of high food price inflation in Malawi beyond the 'traditional' inflation factors such as expansionary policies, oil prices and inter-seasonal price of maize has not been established (Kaluwa, 2004). Most studies have focused on empirically analyzing the determinants of global food price inflation different from Malawi's food inflation. In addition, some of the factors that cause global food inflation such as bio-fuel production, hardly or minimally influences food inflation since it is neither produced nor used in the country. This study therefore provides important insights on crucial determinants of food inflation and its implications on the economy.

1.4 Objectives of the study

The main objective of the study was to analyse the implications of food price inflation on the economy of Malawi in the 1998-2008 periods, with a view to enhancing food security and stability. The specific objectives were to:

(i) examine price trends of major commodities in Malawi in the 1998-2008 periods,

(ii) analyse factors affecting escalating food price inflation rate,

(iii) determine the effect of food price inflation on the economy of Malawi.

1.5 Hypotheses

To achieve the research objectives, the subsequent hypotheses were formulated:

(i) Crop diversification index, maize prices, input (fertilizer i.e. 23:21:0+4S) prices, real wages, oil (diesel) prices, real exchange rates, money supply (M2[7]), real interest rates, lagged monthly rate of change in consumer price index for food and adverse weather conditions (rainfall) do significantly influence monthly rate of change for consumer price index of food.

(ii) High food price inflation negatively affects the real agricultural Gross Domestic Product (GDP) and real national GDP of Malawi.

1.6 Scope and Limitation of the Study

This study provides insights on economic determinants of food price inflation rate and examines causality effects between food inflation rate and its determinants. It also highlights implications of food price inflation on the economy of Malawi and policy responses. Limited numbers of variables were used in the analysis because disaggregated secondary data were costly and difficult to obtain. The other limitation was to find consistent data set because some institutions had no computerized data set and also that they had break up in data collection exercise due to various reasons. In analysing the factors that affect food price inflation, the study used only consumer

[7]M2 is M1 plus quasi money (RBM, 2005).

price index for food as dependent variable compared to non-food consumer price index as the former captures increase in price of all major components or commodities of food basket. Although, the challenge was to get some missing data sets especially in early 1990s.

However, the study still provides useful information concerning dynamics of food inflation in the country because crucial data limitations were thoroughly investigated for consistence by obtaining and checking with other institutions that had same information. The data set used in the analysis covered Malawi only and as such, policy recommendations from the study results are only applicable to Malawi.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview of Global Food Price Inflation and Non-Food Inflation

The global food crisis experienced in 2008 led to escalating price of major agricultural commodities and food products. The global impact of this crisis induced responses from various countries. A wide range of researchers have attempted to identify factors which might have caused the global food prices inflation. Largely, empirical work has reached an agreement that global food price hike was sparked by economic factors such as depreciation of world major currencies, low interest rates, high oil prices, high demand for biofuel production from maize (corn), rapid income growth in densely populated countries, high fertilizer prices, low food stocks, domestic policies i.e. export restrictions and bans, market structure and weather shocks i.e. droughts (Abbott *et al*., 2008; Baltzer *et al*., 2008; Dewbre *et al*., 2008; Helbling *et al*., 2008; Schnep, 2008; Trostle, 2008; Von-Braun, 2008; Yang *et al*., 2008). According to Abbas (2008), food inflationary pressures have been more sensitive to the productivity shocks than the impacts of monetary policy operations. However, some factors do not provide concrete explanation to causality effects. The responses of domestic prices to some causal factors have not been strong enough in the presence of complexity in price transmission and the robust nature of domestic economies.

Tang (2001), estimated inflation models for Malaysia by considering the influence of bank lending using unrestricted error correction model (UECM) due to smallness of sample size. The estimated UECMs revealed that the important factors in the Malaysian inflation process were import price and real income variables. It was further found that concurrent fiscal policies had a major influence on the impact of the

depreciation of the naira on inflation. The UECMs performed well and provided an appropriate framework for forecasting the Malaysian inflation behaviour. Holod (2000) and Leheyda (2005) reported that exchange rate, money demand and supply, wages and real output significantly influenced price level in Ukraine. Ueda (2009) also investigated determinants of households' inflation expectations in Japan and the United States of America by applying a vector autoregression model. It was established that nominal interest rate and the output gap, with energy prices and (fresh) food prices were responsible for realised inflation. Gerlach and Svensson (2003) examined inflation indicators for the euro area by studying the relationship between inflation, output, money and interest rates, using data spanning 1980-2001. The central finding was that both the output gap and the real money gap (the difference between the real money stock and the long-run equilibrium real money stock) contained considerable information regarding future inflation.

In Sub-Sahara Africa and Middle East Asia, a number of authors have empirically attempted to analyzed the determinants of general inflation and a few have concentrated on food inflation. Barnichon and Peiris (2008) explored the sources of inflation in Sub-Saharan Africa by examining the relationship between inflation, the output gap and the real money gap using heterogeneous panel cointegration estimation technique. They found that both gaps were significant in explaining the evolution of inflation, albeit with a larger role played by the money gap. Ocran (2007) applied Johansen cointegration test and an error correction model to find determinants of inflation in Ghana, and identified inflation inertia, changes in money, treasury bill and exchange rates, as determinants of inflation in the short-run. Studies by Rutasitara (2004), Laryea and Sumaila (2001); and Dlamine *et al*. (2001) found that exchange rate, output, monetary factor, foreign price, real wages and lagged inflation influenced

inflation in Tanzania and Swaziland, respectively. Durevall and Ndung'u (2001) also noted that exchange rate, foreign prices and terms of trade had long-run effect on inflation, while money supply and interest rate only had short-run effects in Kenya between 1974 and 1996. In a more recent study by Shahnoushi *et al*. (2009), vector error correction model (VECM) was applied to examine the relationship between food prices and monetary policies in Iran. It was reported that food prices had long-run and short-run granger causality with money supply. In a study by Loening *et al*. (2008), producer prices and supply shocks were found to be crucial determinants of food inflation in Ethiopia. Mohanty and Klau (2002) identified the factors behind the inflation process in fourteen emerging market economies (EMEs). The results showed that the demand side factors dominated supply side factors in influencing inflation. The study illuminated the emerging literature on the new monetary policy framework for targeting inflation.

According to Wang and Tomek (2007), price theory suggests that commodity food prices should be stationary. Yet, tests for unit roots rather frequently imply that these prices are not stationary. This seeming inconsistency is investigated by applying alternative specifications of unit root tests to prices of corn, soybeans, barrows and gilts, and milk (Wang and Tomek, 2007). The predominant evidence suggests that nominal prices do not have unit roots, but the results are sensitive to the specification of the test equation. Thus, accounting for a structural change that shifts the mean appears to be important in unit root tests.

In summary it has been shown that factors such as high oil prices, depreciation of major currencies, low food stocks, high fertilizer prices, maize/corn utilization in

production of bio-fuel, low interest rates, money supply, domestic policies (i.e. export restrictions or ban), rapid income growth in emerging economies and weather shocks are some of the major factors influencing both global food and non-food inflation.

2.2 Economic Determinants of Commodity Food Price Inflation in Malawi

In Malawi, some scholars have comprehensively investigated factors affecting domestic inflation as compared to food inflation. Their empirical work has confirmed that both demand and supply side sectors significantly influence inflation. Zgovu (1994) and Ndaferankhande (2000) found that money wages, transport costs, net credit to commercial banks and price deregulation were significant determinants of inflation. Ndaferankhande and Ndhlovu (2005) applied derived error correction inflation model to investigate the determinants of inflation and reported that lagged inflation, food supply shocks, exchange rate, money supply and growth in real income significantly influenced the dynamics of inflation in Malawi. Kaluwa (2004), used cost-push/demand-pull error correct model to forecast and determine factors affecting inflation. They concluded that exchange rate, wages, money supply growth, lagged inflation and maize prices significantly influenced inflation, and suggested that further research is required to look at food inflation through the maize price dynamics.

Malawi's inflation is mainly influenced by exchange rate, wages, money supply, maize prices, food supply shocks, oil prices and income growth. Prices of food basket have relatively reduced for last two years, though they have remained high by 107 percent (FAO, 2008). There is a need to evaluate the factors that are responsible for high food price beyond 'traditional' inflation factors, and this will be vital contribution to the existing literature and knowledge. Furthermore, a good number of

studies have analyzed factors affecting general inflation and global food inflation as opposed to domestic food inflation. Therefore, this study tends to bridge the information gap by determining factors that affect food price inflation rate in Malawi.

2.3 Effect of Food Price Inflation on the Economy of Malawi

Food inflation is undeniably one of the leading macroeconomic issues that threaten the development of any modern economy (Ogbokor, 2004). Like many developed and developing countries, one of the most fundamental objectives of macroeconomic policies in Malawi is to sustain high economic growth together with low food price inflation. Malawi has had different policy instruments aimed at reducing food inflation such as fertilizer subsidy program with more allocations of budgetary resources. At macro level, exchange rate, trade, fiscal, and monetary policies are affected by high food prices through different ways (FAO, 2008; Kargbo, 2005). Food inflation also affects household welfare that is both consumers and producers in different aspects. For example, it reduces the quantity of food products purchased by consumers and lowers producers' price in the long-run. Hence, food inflation affects the entire economy through different avenues and its impacts are more pronounced in poor economies that are agro-based like Malawi where food expenditure represents more than 60 percent of total consumption expenditure (Haszler *et al*., 2009).

Recent studies by a number of scholars (i.e. Ogbokor, Gokal, Hanif, Khan and Senhadji) have used regression models[8] to investigate relationship between inflation and economic growth. They have reached a consensus that inflation is counter productive to economic growth. Ogbokor (2004) found that inflation was counter

[8] Widely used regression models include: panel, bivariate, multivariate and Ordinary Least Square (OLS) regression models.

productive to growth of Namibian economy. Gokal and Hanif (2004) established that a weak negative correlation existed between inflation and growth in Fiji, while the change in output gap had significant bearing. Khan and Senhadji (2001) also revealed that there was strong existence of a threshold beyond which inflation exerted a negative effect on growth. Inflation levels below the threshold had no effect on growth, while inflation rates above the threshold had a significant negative effect on growth. According to Faria and Carneiro (2001), there was a long-run response of output to a permanent inflation shock in Brazil. Sarel (1995) found that there was a negative relationship between inflation and growth in 26 countries which suggested that retarded growth was associated with high inflation crises. Gross Domestic Product (GDP) or real GDP per capita are used as proxy to measure household economic welfare. Nwachukwu *et al*. (2008) used multiple regression models to assess impacts of Nigeria's exports on economic welfare and found that inflation significantly hampered the Gross Domestic Product (GDP) of Nigeria.

Malawi has seriously been affected by consequences of high food price inflation such as food insecurity and macroeconomic instability. Empirical work highlights that food inflation induces poverty, food insecurity and reduction in expenditure on other important services such as health and education (Capehart and Richardson, 2008; Benson *et al*., 2008a). Arndt *et al.* (2008) showed that urban households and households in the southern region of Mozambique were more vulnerable to food price increase. Ivanic and Martin (2008) found that poverty increases due to higher prices of staple food were much more frequent, and larger, than poverty reductions in low-income countries. Ravallion (2000) observed that poverty increased significantly in rural sectors of India because of higher prices of food. According to de Hoyos and

Medvedev (2009), a 5.5 percent increase in agricultural prices due to rising demand for first-generation biofuels could raise global poverty in 2010 by 0.6 percentage points at the extreme poverty line, with nearly all of the increase in extreme poverty occurring in South Asia and Sub-Saharan Africa. Valero-Gil and Valero (2008) also found that extreme poverty rate increased from 10.58% to 15.95% in Mexico as a result of increase in food prices. The magnitude of impacts for high global food prices on domestic food prices and consequently on household welfare depends on prices transmission and the ability of domestic economy to absorb food price inflation related shocks (Dewbre *et al*., 2008). In addition, vulnerability of households to both negative and positive effects of food inflation varies widely across countries in the world (Headey and Fan, 2008).

Von-Braun (2008), observed that high food price inflation have serious implications for food and nutrition security, macroeconomic and political stability. It was further noted that the financial crunch has also reduced the availability of capital at a time when accelerated investment in agriculture is urgently needed to avert high food prices. Food and financial crises have strong and long-lasting effects on emerging economies and poor people. Farmers in developing countries who took advantage of rising agricultural prices to invest in expanding production now find themselves unable to pay off their debts because of falling output prices. As banks cut lending because of the financial crisis, it is harder for small farmers to make new investments.

The current global recession has made more people, especially farmers to suffer since the demand for agricultural food products is reducing to the maximum thereby lowering incomes to farmers. This is even worse in Malawi where prices of food

baskets have remained high despite the implementation of different policy instruments (FAO, 2008; Kargbo, 2005). Although, food price inflation acted as incentive to produce more by using more expensive inputs i.e. fertilizer, farmers are currently unable to pay back loans, leading to a massive reduction in agricultural investments, with consequent increase in unemployment rate, unsettled debts and social unrest in the agricultural industry (Fuglie, 2008). Incidentally, the agricultural sector supports more people than any other sector in most developing countries like Malawi (Chirwa *et al*., 2006).

This study contributes to the existing literature on food price in many different ways. Firstly, empirical analysis on general inflation has been done in Malawi but there are no known studies on the causes of food price inflation and its effect on the Malawian economy. Secondly, besides 'traditional' inflation factors (i.e. exchange rate, interest rate and money supply), many other variables such as crop diversification are included in the analysis, which has not been found in past studies. Thirdly, the study will empirically analyze the direct link between food price inflation and output. Lastly, the study will analyse the factors that influence the rate of food inflation in Malawi as well as their effects on the economy. This will trigger the development of policies and institutional frameworks aimed at averting high food price inflation in Malawi.

CHAPTER THREE

3.0 METHODOLOGY

3.1 The Study Area

The study was done in Malawi, using monthly and annual data which were collected from different institutions in Central, Eastern and Southern regions of the country.

3.2 Data Sources, Type, Variables and Sampling Period

Data were collected from secondary sources (published and unpublished) in different organisations and institutions and utilized to test the hypotheses of the study. The data collected include: domestic imports and exports, maize prices, annual maize production and hectarage used to compute crop diversification index and oil (diesel) prices from National Statistical Offices (NSO); inflation, food inflation rate, national consumer price index, consumer price index for food, nominal exchange rates, National Gross Domestic Product, agricultural GDP, nominal interest rates, real wages and money supply (M2) were obtained from Reserve Bank of Malawi (RBM) and input (fertilizer i.e. 23:21:0+4S) prices were obtained from Smallholder Farmers Fertilizer Revolving Fund of Malawi (SFFRFM). The Meteorological Department provided monthly rainfall data for Mzimba, Kasungu, Chitedze, Ntaja and Makoka which were averaged to get national monthly rainfall data as a proxy for weather conditions. Monthly data used in analyzing determinants of food inflation were obtained from January 1990 to December 2008 while annual data used in determining effect of food inflation on the economy were obtained from 1978 to 2008.

3.3 Data Preparation and Analysis

Data collected from the different sources were edited, coded, entered into a computer, and cleaned to ensure accuracy, consistency, uniformity and completeness. STATA, SPSS, E-views and Excel computer programs were used to analyze the data to test the study hypotheses.

3.4 Analytical Methods

Firstly, descriptive statistics was used to describe the major variables of interest such as price trends using means, modes and median presented in graphs and Tables. Unit root tests were also performed. Graphs, unit root tests by Augmented Dickey-Fuller (ADF) and Johansen's maximum likelihood procedure were used to show the characteristics of data and to explain why cointegration and error correction models were used (objective 1). Further tests such as Phillips-Perron (PP) tests were also used to test unit root or stationarity, which allow for the serial correlation and heteroskedasticity of error terms so as to increase the power of tests (Sugimoto, 2001). However, the unit root testing results of the ADF tests were treated as reliable, robust, consistent and hence it was reasonable to present ADF tests results compared to Phillips-Perron. The unit root testing procedure used ADF unit root formula which took into account the intercept and the lags to get rid of serial correlation problems. Both tests gave similar results for almost all variables used in the study.

Secondly, in order to determine factors affecting food price inflation rate in Malawi (objective 2); parsimonious derived food inflation error correction model was used

because food inflation and its determinants were cointegrated[9] (Green, 2003). Besides, in cases where data exhibited unit root, short-run relationship can only be captured in an error correction model after establishing existence of cointegration. The model is based on macroeconomic theory of inflation and empirical work on general inflation.

Lastly, to determine the effects of food price inflation on the economy of Malawi (objective 3); an error correction model was run to examine the relationship between food inflation and economy *via* real national Gross Domestic Product (GDP) and real agricultural GDP. In both cases, time series data were used which tend to be nonstationary, and makes ordinary least square (OLS) estimation to be inaccurate and irrelevant to policy makers due to infinite variance and spurious correlations (Gujarati, 2004; Salvatore and Reagle, 2002). Consequently, series of the variables were differenced to eliminate built up of errors in order to attain valid results.

3.4.1 Cointegration Analysis and Development of Error Correction Model

Cointegration analysis tested whether variables were integrated of the same order, a linear combination of the variables could also be integrated of the same order or lower order. The purpose of cointegration analysis was that although macroeconomic variables may tend to trend up and down over time, groups of variables may drift together. This analysis helped to discover if there was the tendency for some linear relationships to hold among a set of variables over long periods of time. A linear combination of two or more nonstationary series may be stationary. If such a stationary, or I (0), linear combination exists, the nonstationary (with a unit root), time

[9] Cointegration means existence of long-run relationship between dependent and its explanatory variable(s). That is if Y_t and X_t are cointegrated, the deviations from the long-run relationship is included as explanatory variable in an error-correction model (Green, 2003; Psaradakis *et al.*, 2004; Salvatore and Reagle, 2002).

series are said to be cointegrated. That is, they were individually nonstationary, integrated of the same order but their linear combination was integrated of a lower order. The stationary linear combination is called the cointegrating equation and interpreted as a long-run equilibrium relationship between the variables. Cointegration test provided a way of partitioning the evolution of time series data into long-run equilibrium characteristics (the cointegrating vector) and short-run disequilibrium dynamics (Psaradakis *et al*., 2004). It also enabled to include a combination of long and short run information in the same model which helped to cover some drawbacks associated with the loss of information from attempts to achieve a stationary series by differencing. After establishing existence of the cointegrating vector by unit root test of residuals via ADF and Johansen procedure or any other test, the deviation from the long-run relationship (residual) was included as explanatory variable in the estimation of an error-correction model. The study used residual-based and Johansen's cointegration tests to establish the existence of cointegrating vectors (long-run relationship amongst study variables). However, the latter is very popular globally because there is a well-documented computer programs than the former (Maddala, 2006). The study reported results for both tests in order to check robustness of results especially if some variables are near-unit roots (Hjalmarsson and Österholm, 2007a; Cavanagh *et al*., 1995; Hjalmarsson and Österholm, 2007b).

3.4.2 Determinants of Food Inflation in Malawi

To investigate factors that affect food inflation (objective 2), an error correction model of food inflation which incorporate both demand and supply factors was derived. Drawing on the standard and dominant theoretical underpinnings for inflation in small open economies, it is assumed that the price level is driven by money demand

and imported food inflation (Ocran, 2007; Mankiw, 2003; Moser, 1995). The economy is divided into two inflation-generating sectors namely: tradable[10] and non-tradable sectors (Mathisen, 2003; Abel *et al*., 1998). The price of non-traded food products responds to disequilibria in the money market and movements in the exchange rates and foreign prices govern the price of traded food commodities. Thus overall food price level (p_t^{fd}) is a weighted average of the prices of tradable food products (p_t^T) and the prices of non-tradable food products (p_t^N) and it may be represented as;

$$P_t^{fd} = \varphi p_t^T + (1-\varphi) p_t^N \qquad 0<\varphi<1 \qquad (3.1)$$

Where φ represents the share of tradable food products in the total expenditure and all variables are in natural logarithm. Since, Malawi is a small open economy, the price of traded food products or commodities is determined exogenously in the world market, and in domestic currency terms, can be represented by foreign prices (p_t^*) and nominal exchange rate (e_t) as; $P_t^T = \varphi(e_t + p_t^*)$ (3.2)

Equation (3.2) implies that both an increase in real exchange rate[11] and foreign prices induce an increase in prices of tradable food products. Determination of the prices of non-tradable food products (p_t^N) is considered by drawing on the monetarist tradition and assuming that prices of non-tradable food products are created in the money market. Prices of non-tradable food products, is viewed as a function of the gap between real money demand and supply in the money market. It is also assumed that the demand for non-tradable food products moves the demand in the economy as a

[10] The tradable sector captures shocks from the foreign sector whereas the non-tradable sector represents disequilibria in the money market.
[11] Real exchange rate (rer) defined in Table 1 was used instead of nominal exchange rate.

whole. Equilibrium in the money market requires that demand for real money balances should be equal to real money supply; $m^d = \frac{m_t^s}{p_t^N}$ (3.3)

Where m^d is the demand for real money balances and m^s is nominal stock of money. Taking natural logarithm of the money market equilibrium in (3.3) and solving for P_t^N yields; $P_t^N = \theta(m_t^s - m_t^d)$ (3.4)

Where θ is the scale factor capturing the relationship between economy-wide demand and non-tradable food products demand. Real money demand (m^d) is assumed to be a function of real income (y_t), real interest rate[12] (rir_t) and expected food inflation (p_t^e). Thus the demand for real money balances can be specified as;

$$m_t^d = \tau_1 y_t - \tau_2 rir_t - \tau_3 p_t^e \quad (3.5)$$

Using adaptive expectation, the expected food inflation may be represented by lagged food inflation (p_{t-1}^{fd}). All the variables are in natural logarithm except for real interest rate. The money demand theory hypothesizes that an increase in stock variable will stimulate money demand whereas increase in the domestic opportunity cost variable lead to demand for money. Substituting equation (3.5) into equation (3.4) yields;

$$P_t^N = \theta(m_t^s - \tau_1 y_t + \tau_2 rir_t + \tau_3 p_t^e) \quad (3.6)$$

Combining equations (3.1), (3.2) and (3.6), the overall food price level is given below as: $P_t^{fd} = \varphi(rer_t + p_t^*) + (1-\varphi)\theta(m_t^s - \tau_1 y_t + \tau_2 rir_t + \tau_3 p_t^e)$ (3.7)

Expanding equation (3.7) and re-writing the resultant equation more compactly yields; $P_t^{fd} = \alpha + \beta_1 rer_t + \beta_2 p_t^* + \beta_3 m_t^s + \beta_4 y_t + \beta_5 rir_t + \beta_6 p_{t-1}^{fd} + \varepsilon_t$ (3.8)

Where ε_t is an independently and normally distributed with mean zero and a common variance (i.e. $\varepsilon_t \sim$ IN $(0, \sigma^2)$) (Maddala, 2006).

[12] See, Table 1 for definition of real interest rate (rir).

Food inflation is also influenced by other factors such as food supply shocks induced by environmental shocks like adverse weather conditions (drought, floods) (w^c), cost-push variables namely transport cost transmitted from oil prices (p^{oil}), real wages (y^w) and other demand-pull variables i.e. prices of maize (p^m). According to Kaluwa (2004); Durevall and Ndung'u (2001), maize prices influenced inflation in Malawi and Kenya, respectively. Input prices for fertilizer, seeds and other input machinery (p^{input}) and crop diversification index (d^c) also influenced food inflation. Equation (3.8) was therefore written to incorporate other additional variables[13] as;

$$P_t^{fd} = \alpha + \beta_1 rer_t + \beta_2 m_t^s + \beta_3 rir_t + \beta_4 p_{t-1}^{fd} + \beta_5 p_t^{oil} + \beta_6 p_t^{input} + \beta_7 p_t^m + \beta_8 w_t^c + \beta_9 d_t^c + \beta_{10} y_t^w + \varepsilon_t \quad (3.9)$$

Reformulating equation (3.9) in first differences for unit root tests and general autoregressive distributed lag form of order *n*, denoted *R (n),* is written as follows;

$$\Delta P_t^{fd} = \alpha + \sum_{i=0}^{n} (\beta_1 \Delta rer_{t-i} + \beta_2 \Delta m_{t-i}^s + \beta_3 \Delta rir_{t-i} + \beta_4 \Delta p_{t-1}^{fd} + \beta_5 \Delta p_{t-i}^{oil} + \beta_6 \Delta p_{t-i}^{input} + \beta_7 \Delta p_{t-i}^m + \beta_8 \Delta w_{t-i}^c + \beta_9 \Delta d_{t-i}^c + \beta_{10} \Delta y^w) + \varepsilon_t \quad (3.10)$$

The problem with equation (3.10) is that it has lost long-run information which might be vital in interpretation of the model due to differencing of variables (Maddala, 2006; Green, 2003). To recover the lost information, equation (3.10) is reparameterized into food inflation error correction model (I) as follows;

$$\Delta P_t^{fd} = \alpha + \sum_{i=0}^{n-1} \beta_{1,i} \Delta rer_{t-i} + \sum_{i=0}^{n-1} \beta_{2,i} \Delta m_{t-i}^s + \sum_{i=0}^{n-1} \beta_{3,i} \Delta rir_{t-i} + \sum_{i=1}^{n-1} \beta_{4,i} \Delta p_{t-i}^{fd} + \sum_{i=0}^{n-1} \beta_{5,i} \Delta p_{t-i}^{oil} + \sum_{i=0}^{n-1} \beta_{6,i} \Delta p_{t-1}^{input} + \sum_{i=0}^{n-1} \beta_{7,i} \Delta p_{t-i}^m + \sum_{i=0}^{n-1} \beta_{8,i} \Delta w_{t-i}^c + \sum_{i=0}^{n-1} \beta_{9,i} \Delta d_{t-i}^c) + \lambda (P^{fd} - \beta_1 rer - \beta_2 m^s - \beta_3 rir - \beta_4 p - \beta_5 p^{oil} - \beta_6 p^{input} - \beta_7 p^m - \beta_8 w^c - \beta_9 d^c - \beta_{10} y^w)_{t-i} + \vartheta D_t + \mu_t \quad (3.11)$$

Where;

[13] Only critical variables to the study were added and real income was captured as average wage rate.

P_t^{fd} = Consumer price index for food.

rer_t = Real exchange rate (Value of Malawi Kwacha equivalent to 1 US$)

m_t^s = Money Supply (M2) in Malawi Kwacha supplied by RBM

rir_t = Real interest rate (%)

P_{t-1}^{fd} = Lagged consumer price index for food

P_t^{oil} = Oil (diesel) price in Malawi Kwacha per litre

P_t^{input} = Input (fertilizer) price in Malawi Kwacha per kilogram

P_t^m = Maize price in Malawi Kwacha per kilogram

w_t^c = Weather conditions (Amount of monthly rainfall in millilitres)

y_t^w = Average real wage rate in Malawi Kwacha

d_t^c = Crop diversification index (proxy for amount of land allocated to maize)

D_t represents a vector of deterministic variables, such as seasonal and impulse dummies, μ_t is random error term and Δ denotes first difference operator. The period of study encompasses a number of policy changes and external shocks that are likely to have affected food inflation. Dummies measured these shocks that could have affected the economy of Malawi. The shocks were properly defined to avoid dummy variable trap. The shocks include liberalization of the economy which started in 1994 onwards (D1), exchange rate crisis of 1998 (D2), drought in 2002 (D3) and new political regime in 2004 (D4). The term in the brackets is the error correction term and it measures the amount of deviations from long-run equilibrium between rate of change for food inflation and its explanatory variables. Definition of the variables, their sources and hypothesized effects on food inflation rate (Model I) in Malawi are shown in Table 1.

Table 1: Definition of Variables, Sources and Hypothesized Effects on Food Inflation Rate (Model I) in Malawi

Variable Name & Hypothesized Effect	Description
Food CPI (1990=100) (P_t^{fd})*	Monthly rate of change in natural logrithm for food CPI as the weighted average of the indices for the lower, middle and upper income groups. The source is Reserve Bank of Malawi (RBM).
Oil (diesel) price (P_t^{oil}) [+][14]	Price in Malawi Kwacha per litre. Source: National Statistical Office (NSO) - Malawi.
Input (fertilizer) price (P_t^{input}) [+]	Price in Malawi Kwacha per kilogram supplied by NSO and SFFRFM.
Maize price (P_t^{m}) [+]	Price in Malawi Kwacha per kilogram obtained from NSO-Malawi
Weather condition (w_t^{c}) [+,-]	Average monthly rainfall in millilitres for five weather stations namely Mzimba, Kasungu, Chitedze, Ntaja and Makoka supplied by metrological department-Blantyre, Malawi used as proxy for weather condition.
Crop diversification index (d_t^{c})[-]	Proxy for hectarage of land allocated to maize. The index was computed as D = (S - 1)/lnAi, D, where A_i = total area planted to the maize and S is the number of crops in the country. A and S were obtained from National Statistical Office- Malawi.
Real exchange rate (rer_t) [+,-]	Price in Malawi Kwacha per US dollar, computed as $\ln(rer)=\ln(e_{nom})+\ln(p) - \ln(p^f)$ where e_{nom} is nominal exchange rate obtained from RBM, p is domestic price captured as CPI supplied by RBM and p^f is foreign prices captured as Producer Price Index{PPI} (1990=100) for all commodities for USA. Source: Bureau of labour statistics. Available at http://www.bls.gov/ppi. The weights were based on Malawi's main trading partners.
Real interest rate (rir_t) [-]	Calculated using *fisher* equation given as [{(1+r) / (1+$\prod$)-1}]*100, where, r is nominal interest rate obtained from RBM and $\prod$ is national inflation rate obtained from NSO and RBM.
Money supply (m_t^{s}) [+]	Malawi Kwacha released by RBM. M2 is M1 plus quasi money. Source is Reserve Bank of Malawi (RBM).
Wage (m_t^{s}) [+]	Average real wage rate in Malawi Kwacha supplied by RBM.

Notes:*Used as dependent variable in model I, while the rest were explanatory variables.

[14] The expected sign of explanatory variable on food inflation rate (hypothesized effect) is given by the sign in square bracket.

Operational Definition of Variables in Model I and Hypothesized Effects

The operational definitions of variables used in model 1(equation 3.11) and their hypotheses are described as follows:

Dependent Variable

The dependent variable was monthly rate of change in natural logarithm for consumer price index of food from 1990 to 2008. It is expected that the relationship between dependent variable and explanatory variables will be either positive or negative depending on the signs of explanatory variables.

Independent Variables

Explanatory variables are operational measurements of the vectors shown on the right hand side of equation (3.11), defined in Table 1 with their respective hypotheses. It was expected that higher oil prices positively affect food price inflation rate, since high oil prices induce high transport costs which in turn translates to high prices of food products and agricultural commodities. According to Headey and Fan, (2008); Arndt *et al.* (2008) and Weersink *et al*. (2008), high oil prices *ceteris paribus* resulted in high global food inflation in USA. This shows that even in developing countries like Malawi, oil prices could result in high food prices.

In Malawi, more land is allocated to maize as opposed to other food crops. This implies that there is little or no crop diversity in the country. Therefore, it was assumed that if more land was allocated to maize, compared to other food crops, this would induce soaring food price inflation. The reason is that lack of crop diversification in Malawi increases demand of monotonic food products or commodities and ultimately contribute to inflationary pressure (Chirwa and Zakeyo, 2003).

Agricultural productivity in Malawi absolutely depends on input use, particularly fertilizer (Jayne *et al*., 2008). Consequently, a positive relationship was hypothesized between input prices especially fertilizer and monthly rate of change in natural logarithm for consumer price index for food. This is so, because high prices limit the quantities of the inputs to be purchased and used which result in low production levels. Increased food demand emanating from low production induces high prices of food products/commodities. Malawi is a landlocked country and use Mozambique as a port to import goods. Sometimes Malawi import Maize from Mozambique in times of deficit supply. This entails that fertilizer and maize price dynamics are closely related in the two countries. Abbott *et al.* (2008) reported that high fertilizer prices in Mozambique *ceteris paribus* resulted in high food price inflation.

It was hypothesized that high maize prices would increase food inflation rate, because high consumer prices of the staple grain directly increase the expenditure of food basket. According to Kaluwa (2004), Durevall and Ndung'u (2001), maize prices significantly influenced inflation of Malawi and Kenya, respectively. Nevertheless, high producer prices would also decrease food prices in the long-run, if producers respond positively to price incentive by increasing production of the high priced commodity or produce which in turn lowers food prices due to overproduction.

Adverse weather conditions i.e. floods and dry spells are responsible for food supply shocks (Ndaferankhande and Ndhlovu, 2005). A negative relationship was hypothesized between food price inflation and occurrence of adverse weather conditions, since weather shocks reduces production levels of food crops and even animals. Ndaferankhande and Ndhlovu (2005) observed that food supply shocks

through adverse weather conditions *ceteris paribus* affected inflation in Malawi. Conversely, good weather condition can boost food production which lowers food prices *via* the law of demand and supply.

Real exchange rate was anticipated to influence food inflation rate in two ways. Firstly, depreciation/devaluation of Malawi Kwacha would result in high prices of both imported materials and finished products notably petroleum products and food products or agricultural food commodities (RBM, 2005). It was observed that depreciation of US dollar resulted in high global food prices in most developed countries (Dewbre *et al*., 2008; Boadu and Zereyesus, 2009; Carranza *et al*., 2009). Conversely, it was hypothesized that appreciation makes domestic tradable food products very expensive on international markets and less competitive which reduces international demand thereby lowering domestic prices. Hence, the sign is ambiguous.

According to Kaluwa (2004), increased money supply increased inflation in Malawi. Therefore, a positive relationship between money supply and food inflation was assumed, as increased supply of money in circulation chases a few food products. Ultimately the growth of money supply in the economy induces food inflation which can be either counter or retro-productive to economic growth and development. Similarly, according to (Abbas, 2009; Price and Nasim, 1999; Shahnoushi *et al*., 2009; Peng *et al*., 2004), money supply and demand *ceteris paribus* had long-run and short-run granger causality with food prices in Pakistan, Iran and China, respectively.

A negative relationship was hypothesized between real interest rates and food inflation rate; because low real interest rate motivates investment in the agricultural

sector which in turn increases agricultural production and lowers food prices. Headey and Fan (2008), observed that lower interest rates were responsible for low food price inflation in most developing countries.

It was hypothesized that real wages positively influence food inflation rate, since increases in real wages induce increases in food price inflation. If real wages increase, sellers of food products virtually increase prices of all major food products. According to Zgovu (1994) and Ndaferankhande (2000), they observed that money wages positively influence inflation in Malawi.

3.4.3 Effect of Food Inflation on the Malawian Economy

Error correction model was run to determine the effect of food inflation on the economy of Malawi (objective 3), *via* economic indicators such as real national Gross Domestic Product (GDP) and real agricultural GDP. Since the model used time-series data which mostly exhibit nonstationarity; variables were differenced to eliminate built up of errors in pursuit of valid results (Gujarati, 2004). Furthermore, in order to ascertain the direction of relationship between food inflation and economic indicators, granger causality test was applied. The long-run or static models were estimated in order to obtain residuals. Johansen procedure was used to establish existence of the cointegrating vectors. Thereafter, an error correction model was estimated between each dependent variable (i.e. real agricultural GDP or real national GDP) and independent variables. The error correction model estimated was specified as:

$$\Delta Y_t = \alpha + \sum_{i=0}^{n-1} \beta_{1,i} \Delta rer_{t-i} + \sum_{i=0}^{n-1} \beta_{2,i} \Delta imp_{t-i} + \sum_{i=0}^{n-1} \beta_{3,i} \Delta rir_{t-i} + \sum_{i=1}^{n-1} \beta_{4,i} \Delta Y_{t-i} + \sum_{i=0}^{n-1} \beta_{5,i} \Delta xp_{t-i}$$

$$+ \sum_{i=0}^{n-1} \beta_{6,i} \Delta p_{t-1}^{fd} + \varsigma (Y - \beta_1 rer - \beta_2 imp - \beta_3 rir - \beta_4 Y - \beta_5 xp - \beta_6 p^{fd})_{t-i} + \rho D_t + \upsilon_t$$

Where; (3.12)

Y_t = Output (Real Gross Domestic Product or Agricultural GDP) in MK

p_t^{fd} = Annual rate of change in consumer price index for food

rir_t = Real interest rate (%)

rer_t = Real exchange rate (Value of Malawi Kwacha equivalent to 1 US$)

imp_t = Domestic imports in Malawi Kwacha

xp_t = Domestic exports in Malawi Kwacha

Y_{t-1} = Lagged real output (GDP or Agricultural GDP) in MK

υ_t is random error term, D_t represents a vector of deterministic variables, such as impulse dummies described earlier and Δ denotes first difference operator. The term in bracket is the error correction term and it measures the amount of deviations from long-run equilibrium between output and the dependent variables.

Operational Definition of Variables in Model II and Hypothesized Effects

Dependent Variables

Dependent variables were real national gross domestic product and real agricultural GDP in Malawi Kwacha. Two separate models were run with the aim of capturing how food inflation rate affected real national GDP and real agricultural output (GDP).

Explanatory Variables

A negative relationship between annual rate of change in consumer price index for food and output (real national GDP and real agricultural GDP) was assumed, as high food prices are counterproductive to growth of the economy. According to Ogbokor (2004) high inflation rate *ceteris paribus* reduced economic growth significantly in Namibia. On the other hand, high food inflation can result in overproduction

especially if producers respond positively to price incentive. Ahmed *et al*. (2007) and Haszler *et al*. (2009) claimed that high food prices act as incentive to boost agricultural output especially by producers who are net sellers of food. As such, there is a certain point when food price inflation can increase the growth of the economy. Consequently, the sign is undefined as it can be either positive or negative.

A negative relationship was hypothesized between real interest rates and output, because low interest rate *ceteris paribus* motivates investment in the agricultural sector which in turn increases agricultural production and lowers food price inflation. Similarly, Headey and Fan (2008) observed that low interest rates were responsible for high food production in most developing countries.

It was assumed that real exchange rate would influence output in two folds. Firstly, depreciation/devaluation of Malawi Kwacha would result in high prices of both imported materials and finished products, remarkably petroleum products and major inputs i.e. inorganic fertilizer. This reduces fertilizer utilization since only few farmers can manage to purchase the input which invariably leads to low agricultural output. It can also stimulate agricultural net exports as they become more competitive on international markets. In the same way, it has been observed that depreciation of the US dollar resulted in low agricultural food production in most emerging economies (Dewbre *et al*., 2008; Boadu and Zereyesus, 2009). Conversely, appreciation makes domestic tradable food products very expensive to be exported and less competitive on international markets, which reduces international demand and lower domestic prices. Thus, the sign of the real exchange rate is indeterminate and can be either positive or negative.

It was asserted that exports especially food products and agricultural commodities or produce positively influence the economic growth of the country, since producers and traders get more foreign earnings that are invested in domestic country. Khan *et al*. (1995) found that there is a two-way long-run relationship between exports and output. On the other hand, net food imports impede economic growth of the country. This is so, because resources which could be invested in the country are instead spent to procure imported food products and even raw materials for the food industry.

3.5 Diagnostic Tests

Since the study used time series data, a number of tests were performed with the objective of evaluating the validity of results and checking necessary statistical properties of the models used. Different diagnostic tests such as normality test (Jarque-Bera chi-square), hettest and Autogressive Conditional Heteroskedasticity (ARCH) for heteroskedasticity test, specification test (Ovtest Ramsey RESET), multi-collinearity test (Variance Inflation Factor-VIF), (Breusch-Godfrey Correlation LM) test for autocorrelation, granger causality test and parameter stability test by cumulative sum of recursive residuals (CUSUM) (Sugimoto, 2001). All tests were performed using STATA and E-views computer programs. Diagnostic tests helped to assess adequacy of estimated error correction and multiple regression models (Gujarati, 2004).

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

This section presents attributes of major variables of interest used in the analysis and main factors that affect food inflation in Malawi as well as its effects on the economy determined by the models. In order to find determinants of food price inflation and the effect of high food price inflation on the economy, error correction models were estimated. For an error correction model to be run, different steps were carried out. Firstly, unit root tests were performed in order to check if each variable was stationary or not. Secondly, residual-based and Johansen's maximum likelihood cointegration tests were performed to examine existence of long-run relationship between food inflation, output and its explanatory variables. Lastly, the parsimonious error correction models were estimated for food inflation and output. This section also presents results from the estimated error correction models on determinants of the food price inflation and its effects on domestic economy.

4.1 Characteristics of Study Variables

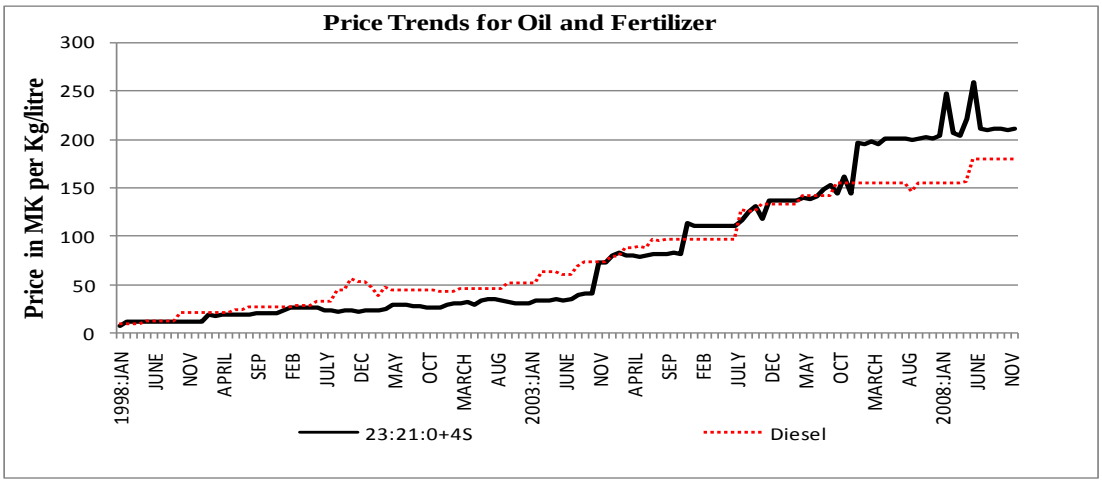
Before discussing determinants of food price inflation and its effect on the economy of Malawi, it is paramount to understand and explain attributes of study variables of interest used in the analysis.

4.1.1 Price Trends for Major Commodities Influencing Food Inflation in Malawi

The price series from January 1998 to December of 2008 for three major commodities, maize, oil (diesel) and fertilizer (23:21:0+4S) trends are presented in Figures 3 and 4. All prices are in Malawi Kwacha (MK) and were deflated by the CPI.

4.1.1.1 Commodity Food Prices and Cost of Production

Key inputs, such as fertilizer, diesel and transport have all gone up tremendously at national level linked to energy prices (Figures 3 and Table 2). The increase in fertilizer prices rose more than four times between 2000 and 2008; the sharpest increase came after 2006. Oil prices concurrently increased significantly from 2002 to mid 2008 (Figure 3) and it has increased by 445% between 1998 and 2008 as shown in Table 2. This partially made the fertilizer prices to increase steadily until the late 2008.



Source: Authors' construction based on study data obtained from various institutions (i.e. NSO and RBM) (2009).

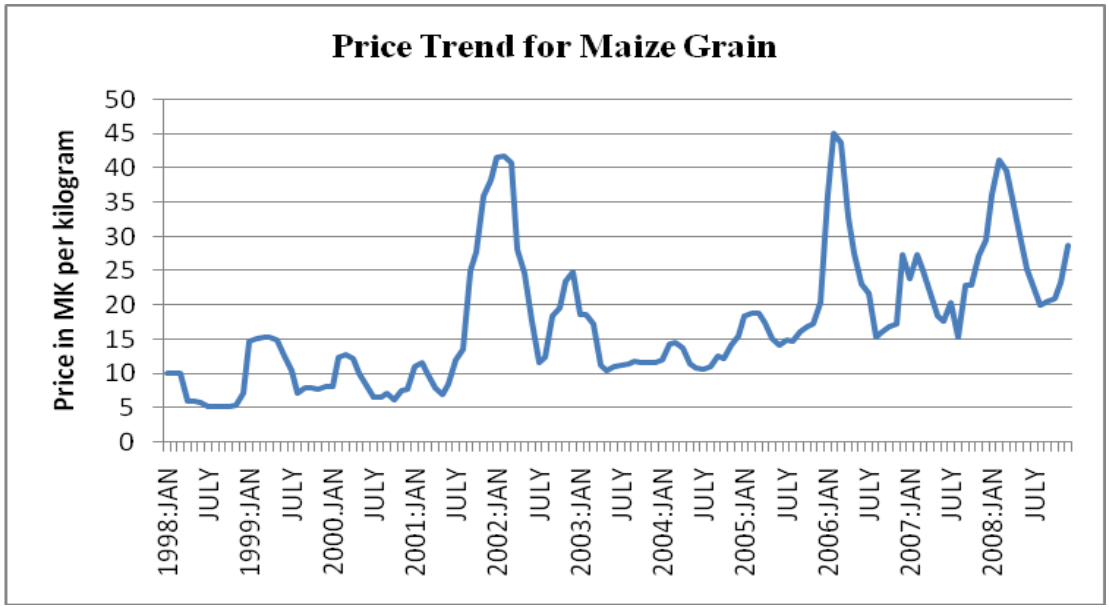
Figure 3: Trends in Real Prices of Oil and Fertilizer: January 1998 to December 2008

Table 2: Percentage Changes in Real Prices for Major Commodities Influencing Malawi's Food Price Inflation between 1998 and 2008

Commodity	Prices in MK per kg/litre		Percentage Change in Prices (1998-2008)
	1998	2008	
Fertilizer	11	211	459%
Oil (Diesel)	11	178	445%
Maize	5.56	28	141%

Note: All commodity prices were deflated by their respective Malawi's CPI so as to be expressed in real constant terms. *Source*: Authors' calculations based on study data obtained from various institutions (i.e. NSO and RBM) (2009).

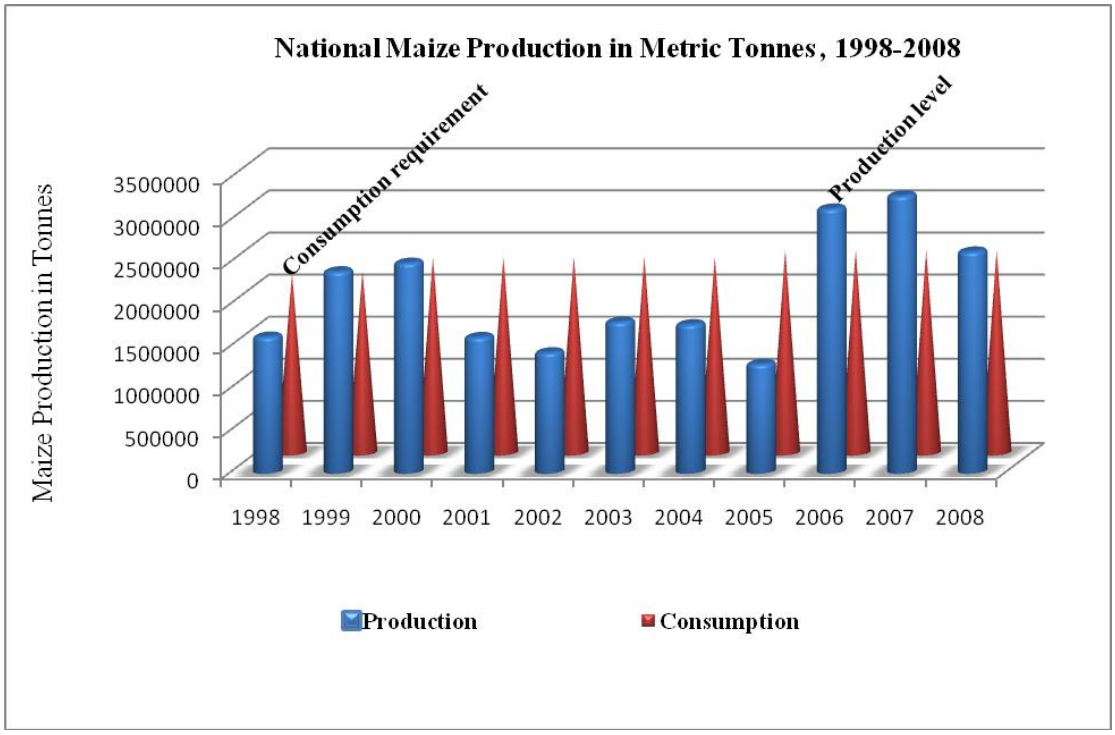
Rising cost of food production is an important factor that influences food inflation. Currently international price of oil and oil products have decreased by 300% from 147 to 48 US$ per barrel due to global economic recession. However, Malawi still has relatively high oil prices in the Southern block of Africa as the government reduced oil prices by 20 percent only. According to Ahmed (2008) and Canova *et al*. (2007), the increase in key input prices is an important structural factor that explains why prices for maize, rice, wheat and other agricultural food commodities have increased so rapidly in the past four years. Prices of maize grain in Malawi have either been increasing or decreasing responding to demand and supply shocks. The price has remained below MK50 per kilogram for the entire period from 1998 to 2008; the sharp rises were in 2002, 2005 and early 2008 due to prolonged dry spells. Although, the general trend has been an increase in the real prices of maize and has increased by 141 percent in the last decade as depicted in Figure 4 and Table 2.



Source: Authors' construction based on study data obtained from various institutions (i.e. NSO and RBM) (2009).

Figure 4: Trend for Real Prices of Maize: January 1998 to December 2008

Malawi on average requires 2.4 million metric tonnes of maize to attain national food security. However, the country has been registering maize deficit against natural requirements from early 2000 to 2005[15] as shown in Figure 5. Currently, Malawi has three years (2006-2009) of consecutive good harvest because of fertilizer subsidy program. Despite this, food price inflation is still in existence (FAO, 2008).



Source: Authors' construction based on study data obtained from various institutions (i.e. NSO and RBM) (2009).

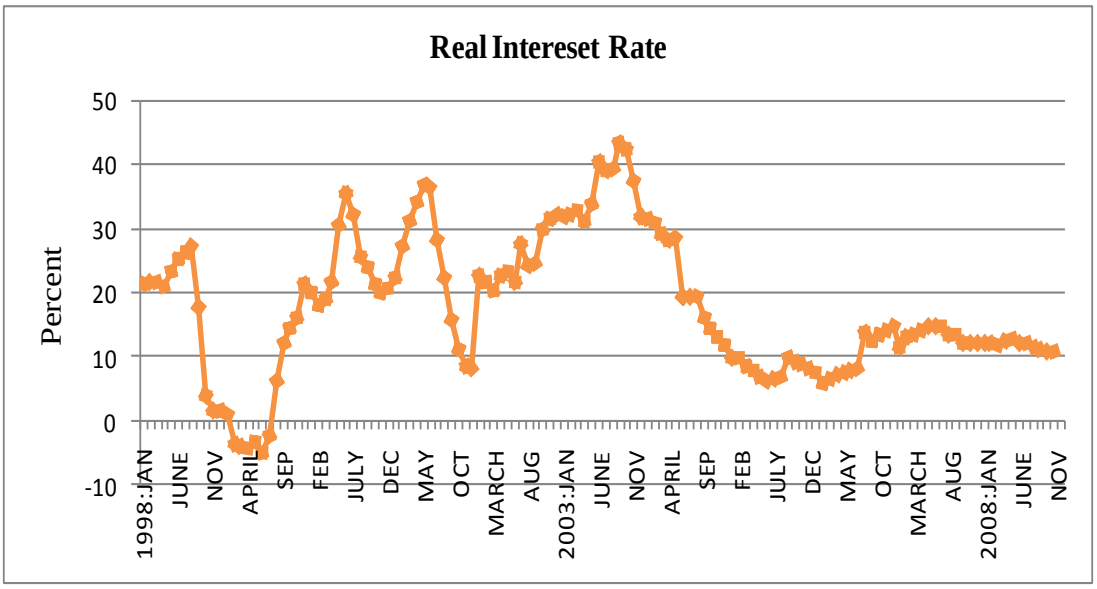
Figure 5: National Maize Production in Metric Tonnes (MT), 1998-2008

4.1.2 Interest Rate and Food Prices

Real interest rate on average remained high from 1998 to 2003 (Figure 6). High interest rates discouraged farmers' borrowings from commercial banks and microfinance institutions. The ultimate result was disinvestment in the agricultural sector, thereby reducing agricultural production and hiking food prices. In 2004, the economy started performing well as a result of prudent management of

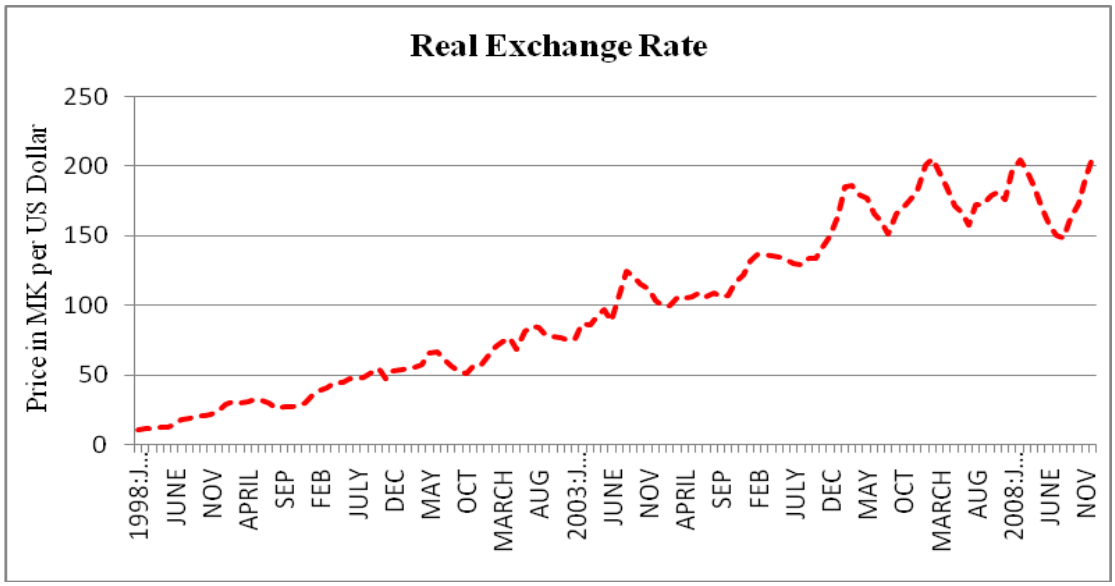
[15] See, Figure 5 for maize production trend against national consumption requirements for other years since 1998.

macroeconomic policies which made the interest rate to decrease slightly to 15% in 2007.



Source: Authors' construction based on study data obtained from various institutions (i.e. NSO and RBM) (2009).

Figure 6: Trend for Real Interest Rate: January 1998 to December 2008



Source: Authors' construction based on study data obtained from various institutions (i.e. NSO and RBM) (2009).

Figure 7: Trend for Real Exchange Rate: January 1998 to December 2008

4.1.3 Exchange Rate and Food Prices

Real exchange rate in Malawi has increased since 1998 and remained constant for the last two years. There was a sharp depreciation in 2000 (when the Kwacha was trading

on average at 62.59 against dollar, from an average of 34.46 in 1998) which increased price of maize. It depreciated to 108.50 in 2004 and depreciated further in 2005. Depreciation or devaluation increased prices of imported oil and oil products, fertilizer and food products. However, for the last three years the real exchange rate has appreciated/overvalued and remained stable as shown in Figure 7. Currently there are fears that Malawi Kwacha has been overvalued for three years and it is being suggested that the government ought to devalue the Kwacha in order to stimulate agricultural exports and redeem the government from shortage of foreign currency (Munthali *et al*., 2008).

The trends for other variables such as money supply, real wages and weather conditions are not presented because they were not significant in explaining the dynamics of food inflation except crop diversification index. In order to further know the attributes of variables of interest, unit root tests were performed in pursuit of obtaining valid results.

4.1.4 Stationary and Nonstationary Series

The concept of stationarity is vital because regression analysis based on time series data implicitly assumes that the underlying time series are stationary. However, in practice nonstationarity is tremendously common in most macroeconomic time series such as food commodity prices. Treating nonstationary series as if they were stationary invalidates the ordinary least squares estimation and eventually results in misleading economic analysis emanating from spurious[16]regressions (Gujarati, 2004). In essence, the presence of spurious or nonsense regression arises when the regression

[16]Spurious or nonsense regression is usually recognized by R-squared close to unity and insignificant test statistics, t and F-statistics look significant and valid instead of being insignificant.

of nonstationary series, which are known to be unrelated, indicates that the series are correlated. Hence, there is often a problem of falsely concluding that a relationship exists between two unrelated nonstationary series. In order to avoid the spurious regression problem, with its related nonstationary pattern of the variables, differencing has become the common method of bringing nonstationary series to stationarity. A variable is said to be integrated of order one/two, or I (1)/I (2), if it is stationary after differencing once or twice. If the variable is stationary without differencing, then it is integrated of order zero, I (0). The value of the mean of a stationary series is independent of time. In contrast, a nonstationary series contains a clear time trend and has infinite variance. If a series is nonstationary, it will display a high degree of persistence i.e. random error never fade away.

4.1.5 Unit Root Tests

Order of integration or (stationarity) of each variable was diagnosed using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests. However, the study reported results for the former, which is more reliable, consistent and robust compared to the latter. ADF test relies on rejecting the hypothesis that the series is a random walk in favour of stationarity. This requires a negative sign and significant test statistic. The tests for integration of order zero I(0) were carried out on the level of the variables and the tests for integration of order I(1) and I(2) were carried out on the first and second differences of the variables, respectively. All variables were expressed in natural logarithm except for real interest rate. The null hypothesis tested is that the series contains a unit root. The number of lags was determined by including six lags and then removing the insignificant ones. The lags were selected by Akaike Information Criterion. The results of the tests and the relevant critical values, as well

as the number of lags to get rid of serial correlation are shown in Tables 3 and 4.

Table 3: Unit Root Test Results for Variables Used in Model I (objective 2)

Variable	Test Statistic		Longest lag	Order of Integration
	ADF_{τ}^{γ}	ADF_{τ}^{κ}		
Change in Food CPI (P_t^{fd})	-1.416	-8.330	4	I(1)
Maize Price (P_t^{m})	-1.701	-9.156	2	I(1)
Fertilizer Price (P_t^{input})	-0.694	-7.229	2	I(1)
Oil Price (Diesel) (P_t^{oil})	-0.741	-5.914	2	I(1)
Money Supply (M2) (m_t^{s})	-0.929	-11.107	1	I(1)
Real Exchange Rate (rer_t)	-1.462	-5.591	3	I(1)
Crop Diversification Index (d_t^{c})	-2.741	-15.000	1	I(1)
Real Interest Rate (rir_t)	-0.757	-6.919	0	I(1)
Real Wage (y_t^{w})	-1.281	-6.590	1	I(1)
Weather Condition (w_t^{c})	-9.807		6	I(0)

Notes: ADF_{τ}^{γ} represents unit root test in its level form whereas ADF_{τ}^{κ} denotes unit root test for differenced variables. The estimation period (n) =228 (1990:1-2008:12). The ADF critical values at 1 and 5% are -3.468 and -2.882, respectively.

The results show that all variables except weather conditions (w_t^{c}) had a unit root in their levels in the presence of structural breaks, thus indicating that the levels were nonstationary. The first differenced series of change in food CPI (P_t^{fd}), crop diversification index (d_t^{c}), money supply (M2) (m_t^{s}), maize price (P_t^{m}), input (fertilizer) price (P_t^{input}), real exchange rate (rer_t), Oil price (P_t^{oil}), real interest rate (rir_t) and real wages (y_t^{w}), clearly rejects unit roots suggesting that the differenced

variables were all stationary. Unit root test results for variables used in model II are shown in Table 4.

Table 4: Unit Root Test Results for Variables Used in Model II (objective 3)

Variables	Test Statistic		Longest lag	Order of Integration
	ADF_{τ}^{o}	ADF_{τ}^{d}		
Real GDP	-1.923	-3.539	0	I(1)
Real Agricultural GDP	-2.202	-3.751	2	I(1)
Real Interest Rate (rir_t)	-1.954	-4.644	1	I(1)
Real Exchange Rate(rer_t)	-2.456	-3.496	0	I(1)
Change in Food CPI(P_t^{fd})	-0.457	-3.138	3	I(2)
Domestic Imports (imp_t)	-2.855	-3.117	2	I(1)
Domestic Exports (xp_t)	-1.781	-4.123	2	I(1)

Notes: ADF^{0} represents unit root test in its level whereas ADF^{d} denotes unit root test for differenced variables. AGRIGDP stands for agricultural GDP. The estimation period (n) =30 (1978-2008).The ADF critical values at 1and 5% are -3.716 and -2.986, respectively.

Results show that the second difference of annual rate of change in consumer price index for food rejects unit root test. The first differenced series of real Gross Domestic Product (GDP), real agricultural GDP, real exchange rate, real interest rate, domestic imports and exports clearly rejects unit roots test, implying that the differenced variables were all stationary.

4.1.6 Cointegration Tests

Johansen's maximum likelihood and residual-based cointegration tests were applied in order to test whether change in consumer price index for food, real GDP and real agricultural GDP can be described by ECM adjustment. The results of cointegration

tests are reported in Table 5. The tests include the Augmented Dickey-Fuller (*ADF*) and Johansen's (1991) maximum likelihood ratio (LR). Residuals have no unit root in their levels, indicating that the levels are stationary. The null hypothesis of no cointegration, i.e. $r = 0$, can be firmly rejected at the 5% significance level on the basis of both tests and this implied that there are at least two cointegrating vectors.

Table 5: Cointegration Tests

Model 1: Determinants of Food Price Inflation in Malawi				
Eigenvalue	0.356	0.238	0.204	0.155
Null hypothesis	$r = 0$	$r \leq 1$	$r \leq 2$	$r \leq 3$
Likelihood Ratio	330.59**	232.63**	172.12**	121.32
5% Critical Value	233.13	192.89	156.00	124.24
ADF_{τ}^{level} for residual	-6.150[2]			
Model II: Effect of Food Price Inflation on Real National GDP				
Eigenvalue	0.871	0.640	0.537	0.418
Null hypothesis	$r = 0$	$r \leq 1$	$r \leq 2$	$r \leq 3$
Likelihood Ratio	135.40**	76.07*	46.43	24.06
5% Critical Value	94.15	68.52	47.21	29.68
ADF_{τ}^{level} for residual	-10.174 [2]			
Model II: Effect of Food Price Inflation on Real Agricultural GDP				
Eigenvalue	0.832	0.615	0.522	0.337
Null hypothesis	$r = 0$	$r \leq 1$	$r \leq 2$	$r \leq 3$
Likelihood Ratio	122.85**	71.14*	43.45	22.08
5% Critical Value	94.15	68.52	47.21	29.68
ADF_{τ}^{level} for residual	-3.965[3]			

Notes: *(**) Significant at the 5 and 1% levels respectively. [] is the number of lags selected by Akaike Information Criteria (AIC).

Cointegration tests results implied that monthly rate of change in natural logarithm for consumer price index for food and each explanatory variable were cointegrated. Therefore, the deviations from long-run relationship were included as explanatory variables in estimation of an error correction model for food inflation. The tests also showed existence of a long-run equilibrium relationship between real output (GDP and agricultural GDP) and explanatory variables. This implied that real output (GDP and agricultural GDP) and each explanatory variable were cointegrated. Therefore, the deviations from long-run relationship were included as explanatory variables in estimation of an error correction models for real national gross domestic product and real agricultural gross domestic product.

4.2 Factors Affecting Food Inflation in Malawi

An error correction model I (ECM) (equation 3.11) was estimated by STATA with the purpose of determining factors that affected food price inflation rate in Malawi (objective 2). The long-run or static model for food inflation was firstly estimated in order to estimate error correction model for food price inflation and results are reported in Table 6.

F-statistics which test the hypothesis that all slope coefficients are simultaneously equal to zero, had F-value of 1081.71 with degrees of freedom of 10 and 217, and probability value of 0.0000, suggesting that the estimated static or long-run model was significant at 1 percent. The model had a goodness of fit measure (R^2) of 0.9781 indicating that the estimated relationship explained 97.81 percent of the total variation in the dependent variable i.e. monthly rate of change in CPI for food.

Table 6: Factors that Influence Food Inflation in Malawi (Long-Run Equation)

Explanatory Variable	Coefficient	t-value
Constant	153.200	3.85***
Input (fertilizer) Price (P_t^{input})	0.008	9.52***
Maize Price (P_t^{m})	1.079	8.11***
Oil (diesel) Price (P_t^{oil})	0.265	5.39***
Crop Diversification Index (d_t^{c}) [-1]	79.704	3.14**
Real Exchange Rate (rer_t) [-1]	17.627	7.69 ***
Weather Condition (w_t^{c}) [-1]	-0.150	1.56
Real Interest Rate (rir_t) [-1]	-0.722	0.55
Money Supply (m_t^{s}) [-2]	1.149	0.70
Lagged Δ CPI for Food (P_{t-1}^{fd}) [-1]	18.287	3.82***
Real Wage (y_t^{w})	3.295	3.07***

Notes: Dependant variable is monthly rate of change in natural logarithm of consumer price index for food. All variables were in natural logarithm except for real interest rate.
Δ denotes first difference operator. ***, ** denotes significance at 1 and 5 % levels, respectively.
The estimation period (n) = 228 (1990:01 - 2008:12), F (10, 217) = 1081.71, R^2 = 0.9781, Root MSE = 11.69, DW = 2.13.

The results suggest that real exchange rate, fertilizer prices, maize prices, crop diversification index, oil prices, real wages and lagged monthly rate of change in natural logarithm of consumer price index for food significantly and positively influenced food price inflation in the long run as shown in Table 6. However, detailed explanation on how each factor affects rate of food inflation is give in subsequent discussion. It is worth noting that real wages had no significant effect in the short-run model. Perhaps this is so because increment in wage rate is usually done after a long

period of time. Consequently, it cannot immediately result in high food price inflation. In this static equation: money supply, real interest rate and weather conditions were not significant in explaining rate of food inflation. Nevertheless, real interest rates had significant effect on rate of food price inflation in the short-run or error correction model.

Short-run model was estimated with the purpose of finding factors that affect the dynamics of food price inflation. For an error correction model to be estimated, all variables are supposed to be captured in first difference form except for an error correction term (residual). As such all variables were captured in difference form excluding error correction term which was entered in its level form. The lagged error correction term, given by the residual from the static cointegration was cointegrating vector. The coefficient of lagged error correction term shows the speed of adjustment to long-run solution that enters to influence short-run movements in food inflation. It should be negative and less than unity in absolute terms, since instantaneous adjustment or 100 percent is not expected.

The negative sign for coefficient of the error correction term[17] is consistent with theory and indicates that if food inflation was above its long-run relationship with each explanatory variable, it would decrease and return to equilibrium. A series of estimations were carried out with varying number of lags on explanatory variables. All impulse and seasonal dummies; exchange rate crisis of 1998 (D2), drought in 2002 (D3) and new political regime in 2004 (D4) were insignificant in explaining food inflation, except market liberalization of the economy in 1994 (D1), and hence

[17] See Table 7.

were excluded from the analysis. Market liberalization meant that price of food products and commodities where free to respond to market forces i.e. demand and supply. This could induce high food price inflation especially if the demand of food products or commodities is higher than supply due to various reasons such as food supply shocks. However, after dropping other wrongly signed and insignificant variables, the final valid results estimated by OLS and Prais-Winsten regression in STATA program for parsimonious food inflation error correction model are presented in Table 7. All variables were in natural logarithm except for D1 and real interest rate. Monthly rate of change in natural logarithm of consumer price index for food is dependent variable. D1 is an impulse dummy for market liberalization of the economy which started in 1994 onwards.

The F-value of 34.24 with degrees of freedom of 12 and 211, and probability value of 0.0000, suggest that the estimated error correction model was significant at 1 percent. The model had a goodness of fit measure (R^2) of 0.6596 indicating that the estimated relationship explained 65.96 percent of the total variation in the dependent variable i.e. monthly rate of change in CPI for food.

The central findings suggest that input (fertilizer) prices, maize prices, oil (diesel) prices, real exchange rate, crop diversification index, real interest rate and lagged monthly rate of change in food CPI were the major factors affecting rate of food inflation in Malawi. All factors were significant at 1 percent level except crop diversification index which was significant at 5 percent level. A unit increase in previous month's monthly rate of change in CPI for food increases current monthly rate of change in food CPI by 19.2 percent. There was no evidence that money

supply[18], weather conditions and real wages affected the dynamics of food inflation in Malawi.

Table 7: Error Correction Model Estimates of Factors that Influence Food Inflation in Malawi (Short-Run Equation)

Explanatory Variable	Coefficient	Standard Error	t-value
Constant	0.0064935	0.0023335	2.78
ΔInput (fertilizer) Price (P_t^{input})	0.1050168	0.0106920	9.82***
ΔMaize Price (P_t^m)	0.0044030	0.0007910	5.60***
ΔOil (diesel) Price (P_t^{oil})	0.0014718	0.0001419	10.37***
ΔCrop Diversification Index (d_t^c) [-1]	0.3692153	0.1610427	2.29**
ΔReal Exchange Rate (rer_t) [-1]	0.1247121	0.0420077	2.97 ***
ΔWeather Condition (w_t^c) [-1]	0.0000339	0.0000348	0.98
Δ Real Interest Rate (rir_t) [-1]	0.0028594	0.0010737	2.66 ***
ΔMoney Supply (m_t^s) [-2]	0 .0019041	0.0031750	0.60
ΔLagged CPI for Food (P_{t-1}^{fd}) [-1]	0.1919656	0.0430111	4.46***
ΔReal Wage (y_t^w)	0.0124291	0.0079401	1.57
D1	0.0409330	0.0122420	3.34***
Error Correction Term [1]	-0.0056881	0.0003528	16.12***

Notes: ***, ** denotes significance at 1 and 5 % levels, respectively.
Δ denotes first difference operator. The number in subscript square bracket [-] shows number of lags.
The estimation period (n) = 224 (1990:05 - 2008:12), F- statistic (12, 211) = 34.24, Prob>F = 0.0000, R^2 = 0.6596, Root MSE = 0.03175, DW=1.78

[18] Similarly, it was also established that rate of increase in money supply was not proportional to increase in agricultural food prices in South Africa (Asfaha and Jooste, 2007).

The positive relationship between input fertilizer price and monthly rate of change in consumer price index for food suggest that a percentage increase in fertilizer price would increase food price inflation by 10.5 percent. Therefore, the hypothesis that input fertilizer prices do not significantly increase food price inflation is rejected. Similar result was obtained by Abbott *et al*. (2008) who reported that high fertilizer prices resulted in high food price in Mozambique. This is crucial to Malawi's agriculture whose productivity absolutely depends on fertilizer usage, and where real fertilizer prices have increased by 459 percent over the last decade (see Table 2). Though, current fertilizer prices have decreased by half due to global recession and reduction in prices of oil, oil products and cost of transportation, prices have remained high to most average farmers in Malawi. This development has made it impossible for the majority of farming population to purchase inorganic fertilizer, thereby reducing fertilizer use and agricultural production of staple food crops like maize. A farmer on average requires 7.5 kilograms of maize to buy a kilogram of fertilizer. Therefore, it is expensive for farmers to purchase fertilizer using income from maize. With such high maize - fertilizer quantity ratio, the idea of buying fertilizer from maize sales in most cases does not materialize.

According to Jayne *et al*. (2008), high maize - fertilizer quantity ratio reduces fertilizer used on maize and other crops; lower maize yields and production, *ceteris paribus*; continued upward pressure on maize prices, even in countries that so far have not experienced major price increases; and a possible shift in area from crops that profits only with heavy fertilization into crops that are profitable even at low or no fertilizer use (i.e., a partial shift into roots, legumes and tubers at the expense of maize in the mixed cassava, beans/maize zones). The impact of low fertilizer use on crop

production and marketed supplies is most discernable in countries that make relatively intensive use of fertilizer such as Malawi. High maize-fertilizer quantity ratio probably validates the reason why the government initiated the subsidy program[19] which has run since 2004. However, the most challenging issues are sustainability, abuse of the program and being a budget drain to the government. In addition, most farmers hardly use pro-poor organic fertilizers i.e. compost, green and farm yard manure which are less expensive compared to inorganic fertilizers.

Maize prices had a positive and significant influence on the rate of food inflation. Maize being the main food crop in the country, its availability absolutely influences both food and non-food inflation. The higher the price of the staple grain as a result of low production emanating from drought, low fertilizer use and other reasons, the higher the cost of food basket. According to Kaluwa (2004), Namwaza (2008), Manson *et al.* (2009) and NSO (2008), maize supply and prices significantly influence Malawi's general inflation. High cost of food sparked by availability of maize for the last two years has been reducing due to high maize production attributed to good weather and fertilizer subsidy program. For example, in the 2007 growing season, Malawi produced 3.3 million metric tonnes of maize with a surplus of 0.9 million metric tonnes against national consumption requirements. Malawi needs on average 2.4 million metric tonnes of maize in order to attain national household food security and thus the national consumption requirement. There has been over production of maize for the last three years (Figure 5) which has kept food inflation rate low. Nevertheless, food inflation has remained high by 107% in Malawi and even in other countries in the Southern block of Africa as earlier shown in Figure 2 (FAO, 2008).

[19] Farmers were able to purchase 50 kg bag of fertilizer at MK950 (6.5 US dollars) instead of actual market price of MK10500 (70 US dollars).

Consequently, some people have experienced hunger in various places of the country. Hence, the study rejected the hypothesis that maize prices do not significantly increase food price inflation.

Results also suggest that oil (diesel) prices significantly and positively influenced food price inflation in the country. Higher oil prices induced high cost of transporting bulky goods especially inorganic fertilizer, agricultural commodities or produce and even increasing the cost of processing food products along the value chain. This cost is frequently transferred to consumers resulting to high food prices. Real price of oil and oil products in Malawi have increased by 445% percent between 1998 and 2008 as shown in Table 2. The results support the findings of Arndt *et al*. (2008) and Weersink *et al*. (2008) that high oil prices resulted in high commodity food prices in Mozambique and Ontario, respectively. Real international price for oil and oil products has reduced by 300% from 147 to 48 US$ per barrel due to global recession. However, Malawi still records high oil prices in the southern block of Africa given that the government reduced oil prices by 20 percent only. According to Dana *et al*. (2006), transport and processing costs still remains high in Malawi and Zambia compared to neighbouring countries in the region.

Crop diversification index was found to be a crucial determinant of food inflation in Malawi. The effect of crop diversification has not been sufficiently examined in previous studies like other 'traditional' inflation variables i.e. interest rate, money supply, real wages and exchange rate in the model. The sign and magnitude of the coefficient for crop diversification is 0.37 which implies that there was little diversification for food crops which induces high commodity food prices. For example, it was established that more land was allocated to maize, compared to other

food crops like bananas, sweet and irish potatoes, yams, sorghum, millet, pumpkins, rice and cassava. Besides, limited promotion of the rural food processing and value addition to agricultural food commodities/products reduces diversified food products thereby risking high food inflation (FAO, 2008). Food processing and value addition enables especially starch and protein based products to be transformed into final cooked dried products which are ready to eat and at the same time enhancing high shelf-life, high quality and high nutritional value of food products. Unfortunately, simple processes like fermentation, roasting, cooking, drying, grinding and mixing that can be used to increase diversified food products from food crops have not been exploited in Malawi. Because one staple food crop (maize) is mainly produced and used as food for majority of the population, this increases demand for maize comparative to other food crops/products and ultimately increasing the cost of food baskets. Chirwa and Zakeyo (2003) observed that lack of crop diversification increases demand of monotonic food products.

Real exchange rate positively influenced food inflation rate. This meant that one percent increase in value for Malawian Kwacha would increase food price inflation by 12.4 percent. Real exchange rate appreciation made domestic tradable food products very expensive to be exported and less competitive on international markets. Currently it is presumed that Malawi Kwacha has been overvalued and ought to be devalued in order to stimulate agricultural net exports and reduce forex shortage (Munthali *et al*., 2008 and Jome, 2009). On the other hand, depreciation can result in high prices of both imported materials and finished products notably petroleum products, fertilizer and food products or agricultural commodities. A number of scholars have examined the relationship between exchange rate and food inflation and

have observed that depreciation of US dollar resulted in high global food prices in emerging market economies (Kirsten *et al.*, 2001; Dewbre *et al*., 2008; Boadu and Zereyesus, 2009; Carranza *et al*., 2009). However, results of this analysis disagree with the findings that depreciation results in high global commodity food prices. This may be attributed to the fact that Malawi is a small country that hardly exports large quantities of food products or produce to developed countries and emerging market economies. Since maize is the staple food crop, the government frequently restricts exportation of agricultural produce through export ban, imposing high tariff rates and tough licensing requirements for maize trade. For this reason, the volume of food products or produce that are exported is highly limited. Consequently, real exchange rate depreciation cannot significantly influence global food price inflation. By and large, the use of food subsidies or export restrictions by the government to stabilize domestic prices also exacerbates food price increases and undermines a rules-based trading system (Lustig, 2009). Hence, the hypothesis that real exchange rates do not significantly influence high commodity food price inflation is rejected.

A unit increase in real interest rates resulted in an increase in food price inflation for countless food products or agricultural food commodities by 0.3 percent. Commercial lending interest rates are still high in Malawi compared to most developing countries (Kaluwa, 2004). High interest rate stimulates savings which reduced investment in agricultural productive assets emanating from high cost of borrowing. High interest rate discourages borrowing culture, reduces investment in agricultural activities and growth of business entities. High interest rate made few entrepreneurs to invest in agricultural activities. This development reduced agricultural production and triggered high food price inflation. Though high food prices acted as incentive to produce more

by using inputs like fertilizer, farmers are currently unable to pay back loans due to high interest rates and current global economic recession. Reduction in agricultural investments accelerated high unemployment rate, unsettled debts and social unrest in the agricultural industry. However, for the last four years government has tried to reduce the cost of borrowing from 45 to 15 percent and this has increased demand for storable commodities, increase stocks, and shift investors from treasury bills to commodity production contracts which in turn lowered food price inflation due to overproduction (NSO, 2008). Similarly, Headey and Fan (2008) and Peng *et al*. (2004), observed that lower interest rates were responsible for low food price inflation in most developed countries and China, respectively.

Although, weather conditions such as occurrence of floods or drought were found to be insignificant in explaining food inflation, it is crucial in explaining the dynamics of domestic food price inflation in some places of the country. Usually, areas which experienced either floods or drought were prone to high food prices due to low production of food crops. This is compounded by the fact that in such areas, people are left with little or no resources i.e. animal stock that can be sold to buy food products or commodities. On the other hand, the distribution and intensity of rainfall for the 2008/2009 growing season was adequately good, coupled with the fertilizer subsidy program and these suggest that maize production levels will certainly remain high against consumption requirements.

4.3 Effect of Food Inflation on the Economy of Malawi

The findings of the effect of food inflation on the economy of Malawi showed existence of at least one cointegrating vector between variables i.e. output and each

independent variable. This implied that an error correction model could be estimated. The results for long-run model of impact of food inflation on real national GDP and real agricultural GDP are presented in Table 8.

Table 8: Impact of Food Inflation on the Economy (Long-Run Equation)

Explanatory Variable	**Real GDP**		**Real AGRICGDP**	
	Coefficient	**t-value**	**Coefficient**	**t-value**
Constant	5.15	(3.85)***	44992.73	(0.25)
Real Interest Rate (rir_t)$_{[-1]}$	-0.06	(0.42)	-48045.74	(3.32)**
ΔFood CPI (P_t^{fd})$_{[-1]}$	-0.006	(4.54)***	-613.80	(3.33)***
Domestic Exports (xp_t)$_{[-1]}$	0.10	(1.96)	28743.82	(3.73)***
Domestic Imports (imp_t)$_{[-1]}$	-0.25	(2.33)**	-27237.84	(2.15)**
Real Exchange Rate (rer_t)$_{[-1]}$	0 .61	(5.02)***	10286.77	(0.60)
Lagged Real GDP	634.23	(5.83)***		
Lagged Real AGRGDP			0.64	(2.74)**
N	30		29	
Adjusted R^2	0.9591		0.8819	
F(6, 23), (6, 22)	114.39		35.86	
Prob > F	0.000		0.000	
DW	1.68		1.99	

Note: AGRICGDP is agricultural Gross Domestic Products. All variables were expressed in natural logarithms with the exception of real interest rate. The number in subscript square bracket $_{[-]}$ shows number of lags.
***, **,* denotes significance at 1%, 5% and 10% levels, respectively.

The results suggest that annual rate of change in CPI for food, exports, imports, lagged real agricultural GDP and real interest rates had major impact on real agricultural GDP while real exchange rate, imports, annual rate of change in consumer price index for food, exports and lagged real Gross Domestic Product were

significant factors that affected real national output (Gross Domestic Product) in the long-run. Food price inflation negatively influenced real agricultural GDP and high food inflation induced low purchasing power to consumers in the long-run. Similarly, high food price inflation was found to be counter productive to the domestic output (GDP) of the economy. In the long-run, high food price inflation results in the reduction in consumption expenditure thereby reducing domestic productivity of the agriculture sector. This becomes critical to economies like Malawi which are agro-based. However a detailed interpretation of the significant variables that affect the economy of Malawi is discussed in the subsequent section.

After estimating residual from long-run equation (Table 8) and establishing existence of unit root in its level form. This implies that an error correction model was estimated, in order to explain the dynamic impact of food inflation on real national GDP and real agricultural GDP and the results are shown in Table 9. Dependant variables are natural logarithm of real GDP and real agriculture GDP (AGRICGDP). All variables were expressed in natural logarithm except for real interest rate.

The F-values of 8.69 and 7.31 with degrees of freedom of 7 and 19, and probability value of 0.0001 for real agricultural GDP and real National GDP show that all slope coefficients are simultaneously equal to zero, suggesting that the estimated models were significant at 1 percent. The models had a goodness of fit measure (R^2) of 0.7621 and 0.7189 for real agricultural GDP and real gross domestic product, indicating that the estimated relationship explained 76.21 and 71.89 percent of the total variation in the dependent variables i.e. real agricultural GDP and real GDP,

respectively. The negative[20] signs for the coefficient of error correction terms for real agricultural GDP and real GDP are consistent with theory and indicate that if output was above its long-run relationship with each explanatory variable, it would decrease and return to equilibrium.

Table 9: Effects of Food Inflation on the Economy of Malawi (Short-Run Equation)

Explanatory Variable	ΔReal AGRICGDP		Δ Real GDP	
	Coefficient	t-value	Coefficient	t-value
Constant	7698.68	(1.31)	237.11	(0.22)
ΔReal Interest Rate (rir_t)	-723.05	(1.32)	812.56	(4.51)***
ΔFood CPI (P_t^{fd})$_{[1]}$	-90.75	(2.04)*	-0.0003	(3.74)***
ΔDomestic Exports (xp_t)	12241.86	(2.11)**	0.00001	(6.11)***
ΔDomestic Imports (imp_t)	-0 .004	(2.05)**	-0.03	(0.23)
ΔReal Exchange Rate (rer_t)$_{[1]}$	-43413.23	(2.12)**	312.59	(1.38)
ΔLagged Real GDP$_{[1]}$			0.50	(2.25)**
ΔLagged Real AGRICGDP$_{[1]}$	0.57	(2.15)**		
Error Correction term$_{[1], [2]}$	-1.02	(2.11)**	-0.27	(2.04)*
N	27		27	
R^2	0.7621		0.7189	
F(7, 19)	8.69		7.31	
Prob > F	0.0001		0.0001	
DW	2.24		1.96	
Root MSE	14375		11746	

Notes: Δ denotes first difference operator. The number in subscript square bracket $_{[-]}$ shows number of lags.
***, **,* denotes significant at 1, 5 and 10% levels, respectively

[20] See Table 9.

Annual rate of change in CPI for food, imports, exports, lagged real agricultural GDP and real exchange rate had major effect on real agricultural GDP while real interest rate, annual rate of change in consumer price index for food, exports and lagged real GDP were only significant factors that affected real national output (GDP) in the short-run. Most factors were significant at 1 and 5 percent levels as shown in Table 8.

Food inflation had negative impact on real agricultural output (GDP). This is an important result since high food price inflation can have two contradicting implications on agricultural output. The study confirms the argument that food price inflation can limit consumers (net buyers) who are also producers in subsistence economies like Malawi to purchase enough food products/agricultural commodities (Haszler *et al*., 2009). Thus, agricultural growth is retarded as food products are not absorbed by the domestic economy. Net buyers of food found themselves in food poverty trap, which perpetuate food insecurity and hunger (de Hoyos and Medvedev, 2009). In Malawi, shortage of food is common during lean periods (November to January every year) when farmers' own stock and food supplies are depleted due to seasonality. This result indicates that food inflation has pronounced effect on people's welfare *via* real agricultural output (GDP) compared to real national output (GDP) as similarly observed by (Zografakis *et al*., 2009). Therefore, the hypothesis that high food price inflation negatively affects real agricultural output of Malawi is rejected. On the other hand, food inflation induces high production of food crops by producers who are net sellers of food and vice versa. Ahmed *et al*. (2007) and Von-Braun (2008), reported that high food price inflation acts as incentive to boost agricultural output especially by producers who are net sellers of food. Kargbo (2005) also noted that

food inflation shocks had significant impact on domestic food production, and were major sources of macroeconomic instability in West African countries.

While food price inflation are currently being perceived as a crisis, higher prices of food basket brought major opportunities to attract new investment in food production and marketing in the country, which partially increased agricultural growth. More people are employed in the agricultural sector through investment in production, processing and packaging. The other reason is that agriculture being a main occupation for majority Malawians, food inflation meant more income to farmers, which in turn improved their livelihood. High prices of food basket also translated to more foreign earnings especially for highly demanded exportable food products and led to stable exchange rate and stabilizing the economy. Though, these benefits are currently being hampered by global economic downturn (recession).The current global economic recession has made more people to suffer (especially farmers and employees in the agriculture industry) since the demand for agricultural food products is reducing and lowering incomes to farmers. It is even worse in countries like Malawi where prices of food baskets have remained high despite countless policy instruments being implemented (FAO, 2008). Consequently, expenditure on consumable goods and investments are reduced.

Results also suggest that food inflation had negative impact on the economy. High food price inflation reduces consumption expenditure, government and investment spending on agricultural food processing thereby increasing unemployment, social unrest and political instability. Domestic food products and produce are rarely absorbed by domestic markets. For example, it reduces quantity of food products

purchased by consumers and lowers producers' price in the long-run. Foreign earnings from exportation of food products are hampered by food inflation. Similarly, at macro level, exchange rate, trade, fiscal, and monetary policies are affected by high food price inflation through different ways (FAO, 2008; Kargbo, 2005). The results support the findings of Ogbokor (2004) that high inflation rate reduced economic growth significantly in Namibia. Hence, the hypothesis that food inflation does not negatively affect GDP is rejected.

There was a positive relationship between real interest rate and national output (GDP), implying that an increase in real interest rate would increase national output especially in the saving sector. Therefore the study rejected the hypothesis that real interest rates do not significantly influence national output. However, for the last four years government of Malawi has tried to reduce cost of borrowing from 45 to 15 percent. This development has made more people to invest their resources in agriculture i.e. most small and large scale farmers are able to get agricultural loans that boost agricultural production which in turn lower food inflation due to overproduction. The only challenge is that interest rates are still high in the country. In the same way, Headey and Fan, (2008) observed that high interest rates were responsible for low food production in developing countries.

Real exchange rate had a negative impact on real agricultural output (GDP). Implying that depreciation/devaluation was disincentive to stimulate agricultural output and vice versa. Depreciation or devaluation result in high prices of both imported materials and finished products notably petroleum products and prices of major inputs like inorganic fertilizers. Malawi's fertilizer stock is imported every year since the

country does not manufacture its own fertilizer. Hence, depreciation and high prices of petroleum products induce high fertilizer price and consequently reduces agricultural output. According to Kirsten *et al*. (2001) ; Dewbre *et al*. (2008); Boadu and Zereyesus (2009); Carranza *et al*. (2009), low agricultural food production are partially caused by depreciation of US dollar in both developing and developed countries notably in USA. Kargbo (2005) and Orden (2002), also noted that exchange rate and monetary policy reforms had significant impacts on food prices, domestic agricultural production and consequently on agricultural trade in West Africa countries and U.S.A, respectively. On the other hand, if Malawi Kwacha is overvalued or appreciated, this makes domestic agricultural products become very expensive to potential buyers and less competitive on the international markets. This invariably reduces the volume of agricultural commodities that can be exported and foreign earnings into the country. Currently, it is presumed that Malawi Kwacha has been overvalued for a long period thereby making agricultural food products less competitive on international markets (Munthali *et al*., 2008 and Jome, 2009). Munthali *et al*. (2008) suggests that the government needs to devalue the Kwacha in order to stimulate agricultural exports and foreign earnings which can increase economic growth. Therefore, the study reject the hypothesis that real exchange rate (appreciation/overvaluation, depreciation/ devaluation) do not radically increase or reduce real agricultural output.

Results also show that there is a positive relationship between exports and output (real agricultural GDP and real national GDP) (Table 8). This meant that an increase in exports would increase both real agricultural and national outputs *ceteris paribus*. Net exports especially food products and agricultural commodities or produce positively

influence the economic growth of the country, since producers and traders get more foreign earnings that are invested in the country. Therefore, the study rejected the hypothesis that exports do not significantly influence real output. Khan *et al*. (1995) and Liwan and Lau (2007) also found that there was a two-way long-run relationship between exports and output and that export had positive impacts on growth in ASEAN countries (Indonesia, Malaysia, and Thailand). However, this study found that imports had a significant negative impact on real agricultural output. This is so because resources which should have been invested in the domestic country are instead spent on procurement of imported food products and even raw materials for the food industry. According to Ng and Aksoy (2008) found that there was a small deterioration in food trade balances of low-income countries especially conflict and small island states due to high food price increase.

Lastly, a unit increase in lagged real gross domestic product increased national output by 50 percent. Lagged real agricultural GDP also positively influenced agricultural GDP. Therefore, in both cases inertia had significant positive impact on real GDP and agricultural GDP.

4.4 Diagnostic Tests Results

A number of tests were performed with the objective of evaluating the validity of results and checking necessary statistical properties of the models used. Table 10 and Appendix B present some diagnostic test statistics results. The tests included: normality test (Jarque-Bera chi-square); hettest and Autogressive Conditional Heteroskedasticity (ARCH) for heteroskedasticity test; specification test (Ovtest Ramsey RESET); multi-collinearity test (Variance Inflation Factor-VIF); (Breusch-

Godfrey Correlation LM) test for autocorrelation; granger causality test and parameter stability test by cumulative sum of recursive residuals (CUSUM) (Sugimoto, 2001). Results show that almost all diagnostic tests statistics cannot be rejected at either 5% or 10% level of significance. This indicates that the models were stable, no multi-collinearity problems, well specified, the error term had constant variance and normally distributed and there was no higher order autocorrelation. In addition, the relationship between monthly rate of change in natural logarithm for Food CPI and each explanatory variable was contemporaneous.

Table 10: Diagnostic Tests for Error Correction Models I and II

Test	**MODEL I**	**MODEL II**	
		GDP	**AGRICGDP**
	Test Statistic	**Test Statistic**	**Test Statistic**
Jarque-Bera	χ^2 =309	χ^2 =3.91	χ^2 =6.64
	[0.000]*	[0.140]	[0.036]
Breusch-Godfrey LM	χ^2 =2.76	χ^2 =2.08	χ^2 =3.38
	[0.096]	[0.083]	[0.066]
Hettest	χ^2 0.16	χ^2 =3.47	χ^2 =3.99
	[0.069]	[0.099]	[0.045]
Ramsey RESET	F = 3.62	F =8.87	F =4.71
	[0.014]	[0.076]	[0.053]
ARCH	F = 0.04	F =0.43	F =0.09
	[0.835]	[0.515]	[0.922]
VIF	1.57	6.68	7.51

[]* the value in square bracket is p-value for test statistic.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary and Conclusions

This study investigated the determinants of food inflation rate in Malawi using an error correction model for estimation of food inflation. Results showed that input fertilizer prices, crop diversification, maize prices, oil (diesel) prices, real exchange rates and real interest rates significantly and positively influenced high food inflation rate which has remained high in Malawi, despite consecutive years of good harvest. Higher input fertilizer prices resulted in skyrocketing food inflation. This is crucial to Malawi's agriculture whose productivity absolutely depends on fertilizer usage. High maize prices increased the cost of food basket. In addition, higher oil prices induced high cost of transporting bulky goods i.e. inorganic fertilizer and other agricultural commodities or produce. This cost is transferred to consumers directly thereby resulting in rising food inflation. Hyperinflation of food also escalated due to sole dependence on maize as food crop. Lack of crop and food diversification is a serious problem as it increases demand of monotonic food commodities or products and ultimately hiking food price inflation. Real exchange rate overvaluation or appreciation made domestic tradable food products very expensive to be exported and less competitive on international markets. On the contrary, devaluation or depreciation can result in high prices of both imported materials and finished products notably petroleum products and fertilizer. High real interest rate also stimulated savings which reduced investment in agricultural productive assets and triggered high food price inflation. Farmers, who took advantage of high food price inflation by increasing agricultural investment through agricultural loans, are now failing to pay

back the loans due to high interest and lower producer's price emanating from global recession.

Food inflation, imports, exports, real interest rate and real exchange rate significantly influenced both real agricultural output (GDP) and GDP, while high food price inflation induced low purchasing power to consumers thereby reducing expenditure on consumable goods. However food inflation had a more pronounced negative effect on both real agricultural output and real national output.

5.2 Recommendations

Results showed that high inorganic fertilizer prices escalated food inflation. This calls for input policy aimed at reducing high prices of inorganic fertilizer. Government and private sector need to invest in fertilizer manufacturing plants or reduce high transport cost of fertilizer through development and utilization of water transport system as opposed to land transport. Besides, pro-poor organic farming practices ought to be initiated and promoted by government and development partners since most farmers are poor and could hardly afford inorganic fertilizer. This would help to increase agricultural production in the era of escalating prices of inorganic fertilizers. On maize price, government should advocate agricultural policies that will boost agricultural production i.e. irrigation farming in order to ensure consistent supply of the grain. Government also needs to regulate maize prices and supply of crucial grain to regions hit by floods, drought and areas with poor infrastructural development. In addition a deliberate policy on crop and food diversification is needed so that Malawians are sensitized by the government and private sector on the need and promotion of crop and food diversification through pro-poor food processing and

value-addition along the value chain. This would help to relax high demand of maize through the utilization of other food crops such as cassava, sweet potatoes, groundnuts, bananas and pumpkins, and even food products thereby reducing the price of maize grain as the main driver of food inflation. High food price inflation spiked by high oil prices requires government to invest in alternative sources of energy i.e. biofuel production which would reduces high demand for petroleum products. Oil prices are also high because most oil transporters use land transport which is expensive compared to water transport. Hence government and development partners need to invest and develop the water transport system. Lastly, the government should regulate low interest rates through prudent management of macroeconomic policies i.e. monetary policies. This would help to promote agricultural production and ultimately reduce food inflation. Devaluation or overvaluation ought to be checked by adopting flexible exchange rate regime (i.e. crawling peg) in order to reduce or avert incidence of high food inflation. This would enhance economic growth, development and social stability in the country.

5.3 Area for Further Research

Further research should focus on detailed analysis on how food diversification influence high food prices compared to crop diversification. More work is needed to unpack why inter and intra food diversification is not common in Malawi and relate to food prices. Besides, there is need to understand why pro-poor food processing, packaging and value-addition along the value chain that result in more diversified food products have not been exploited in the country. This would help to formulate robust policy interventions or strategies on food diversification that could reduce high food prices.

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Appendices

Appendix A

Consumer Price Index (CPI) Weights in Malawi

Commodity	National (2000=100)	All Urban Center	All Rural Centers
Food	58.1	35.2	68.0
Beverage and Tobacco	5.9	8.3	4.8
Clothing & foot wear	8.5	8.6	8.5
Housing	12.1	21.1	8.2
Household goods	4.1	14.9	3.8
Transportation	5.1	11.0	2.5
Miscellaneous*	6.2	10.9	4.2
All items	100	100	100

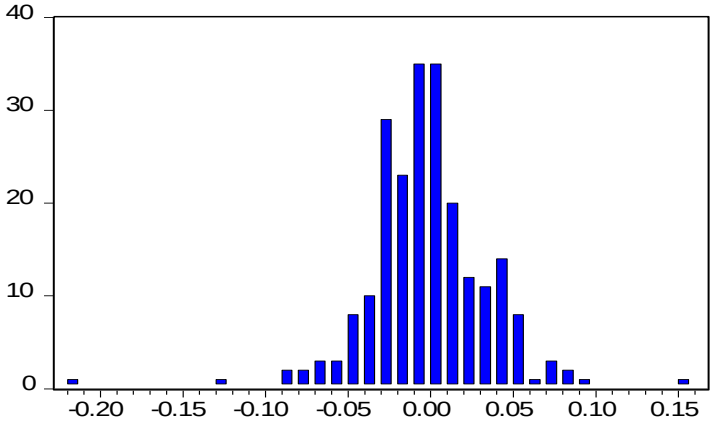
* Miscellaneous goods include fuel and light, health related expenditure, recreation and education, and entertainment.
Source: Malawi Government, National Statistical Office (2008).

Appendix B

1.0 Other Diagnostic Tests Results

1.1 Normality Test: Jarque Bera Chi-square

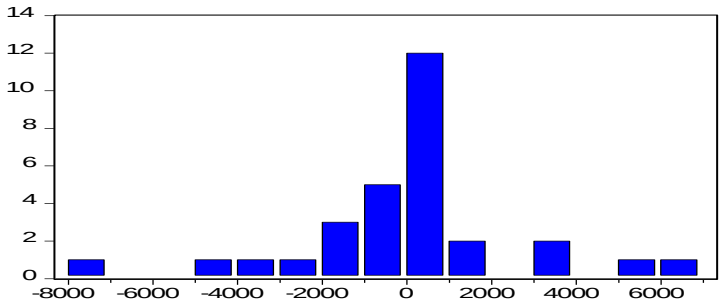
Model I



Series: Residuals	
Sample 1990:04 2008:12	
Observations 225	
Mean	4.18E-18
Median	-0.001473
Maximum	0.158823
Minimum	-0.212205
Std. Dev.	0.037075
Skewness	-0.461082
Kurtosis	8.674832
Jarque-Bera	309.8822
Probability	0.000000

The p-value is very small indicating that the hypothesis that the residual is normally distributed is rejected. However, since the sample sizes were larger enough the central limit theorem was invoked to conduct hypothesis tests of the variables in the model.

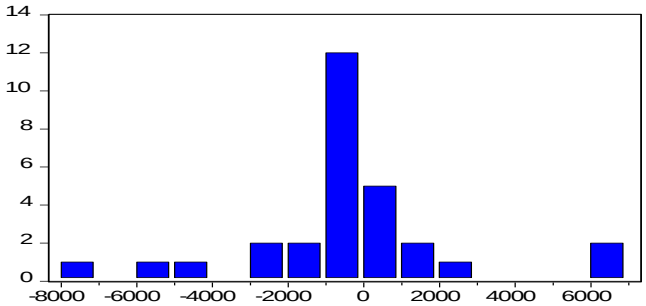
Agricultural GDP model



Series: Residuals	
Sample 1979 2008	
Observations 30	
Mean	-9.09E-13
Median	131.4978
Maximum	6311.052
Minimum	-7946.085
Std. Dev.	2675.123
Skewness	-0.215016
Kurtosis	5.265902
Jarque-Bera	6.649049
Probability	0.035990

The p-value is indicating that the hypothesis cannot be rejected at 5% level of significance meaning that the residual is normally distributed.

Gross Domestic Product Model

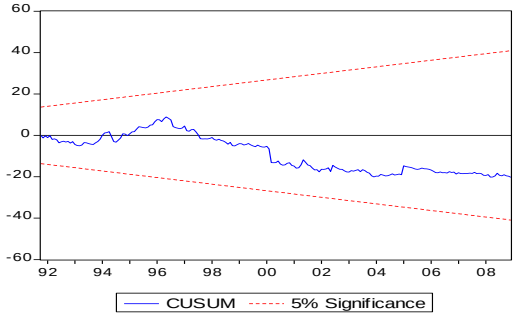


Series: Residuals	
Sample 1980 2008	
Observations 29	
Mean	-325.1332
Median	-308.8758
Maximum	6594.548
Minimum	-7185.357
Std. Dev.	2744.791
Skewness	0.160694
Kurtosis	4.769689
Jarque-Bera	3.909064
Probability	0.141631

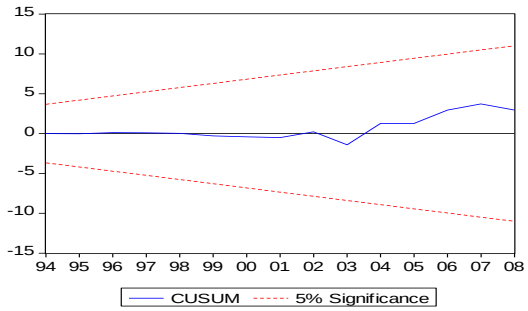
The p-value is indicating that the hypothesis cannot be rejected at 10% level of significance meaning that the residual is normally distributed.

1.2 Parameter Stability Test: CUSUM

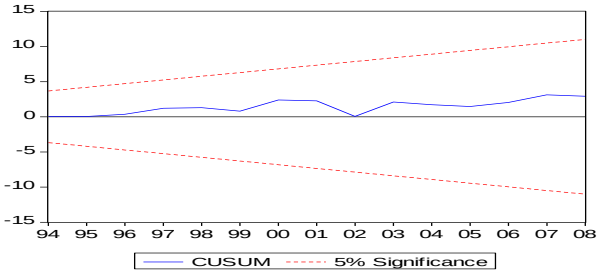
Model I



Agricultural GDP model



GDP Model



Cusum test indicate that, the null hypothesis of no structural change is not rejected at 5% and 10% significance levels.

2.0 Granger Causality Tests

Summary of Two Bilateral Granger Causality Tests: Monthly Rate of Change in Consumer Price Index for Food and Explanatory Variables

dlnmp does not granger cause dlnfdcpi	Dlnmp vs dlnfdcpi (none)	dlnfdcpi vs dlnmp (none)
dlnifp does not granger cause dlnfdcpi	Dlnifp vs dlnfdcpi (none)	dlnfdcpi vs dlnfip (none)
dlnoilpric does not granger cause dlnfdcpi	dlnoilpric vs dlnfdcpi (none)	dlnfdcpi vs dlnoilpric (none)
dlnms does not granger cause dlnfdcpi	Dlnms vs dlnfdcpi (none)	dlnfdcpi vs dlnms (none)
dlnrer does not granger cause dlnfdcpi	dlnrer vs dlnfdcpi (none)	dlnfdcpi vs dlnrer (none)
dlncdi does not granger cause dlnfdcpi	Dlncdi vs dlnfdcpi (none)	dlnfdcpi vs dlncdi (none)
drir does not granger cause dlnfdcpi	drir vs dlnfdcpi (none)	dlnfdcpi vs drir (none)
dlnwr does not granger cause dlnfdcpi	dlnwr vs dlnfdcpi (none)	dlnfdcpi vs dlnwr (none)
dlnwc does not granger cause dlnfdcpi	Dlnwc vs dlnfdcpi (none)	dlnfdcpi vs dlnwc (***)
dlnfdcpi does not granger cause dlngdpa	dlnfdcpi vs dlngdpa (*)	dlngdpa vs dlnfdcpi (*)

***,* significant at 1% level and 10%, respectively

All variables showed that food inflation (fdcpi) was not caused by explanatory variables except a case where fdcpi caused wc. It was also shown that agricultural output caused food inflation and vice versa. Otherwise, the relationships in most cases were just contemporaneous.