AN EMPIRICAL ANALYSIS OF STAPLE FOOD PRICE VARIABILITY AND AGRICULTURAL SECTOR RESPONSE TO RANDOM OIL PRICE SHOCKS IN NIGERIA (1974-2010)

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Ph.D/SOC. SCIE/08044/2006-2007

BEING A DISSERTATION SUBMITTED TO THE POSTGRADUATE SCHOOL, AHMADU BELLO UNIVERSITY, ZARIA IN PARTIAL FULFILLMENT FOR THE AWARD OF THE DEGREE OF DOCTOR OF PHILOSOPHY (Ph.D) IN ECONOMICS. DEPARTMENT OF ECONOMICS, AHMADU BELLO UNIVERSITY, ZARIA, NIGERIA.

MARCH 2014

DECLARATION

I declare that this dissertation titled **''An empirical analysis of staple food price variability and agricultural sector response to random oil price shocks in Nigeria''** is a product of a research work conducted by me. All the sources used have been acknowledged. I take responsibility for errors or omissions in this dissertation.

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Name of Student	**(Signature)**	**Date**

CERTIFICATION

This is to certify that the dissertation titled "An empirical analysis of staple food price variability and agricultural sector response to random oil price shocks in Nigeria" has been prepared by **Dahiru Suleiman** in accordance with the regulations governing the preparation of dissertation for the award of Doctor of philosophy (phD) degree in the Department of Economics of Ahmadu Bello University, Zaria and is hereby approved for its contribution to scientific knowledge and literary presentation.

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ABSTRACT

The question of variability/instability in staple food prices and the effect of oil price shocks on the export and import of agricultural commodities is topical because it has generated tremendous interest among economists for decades. However, the basic challenge currently confronting Nigerian agricultural sector is therefore related to the problem of variability/instability in staple food prices resulting from the poor performance of the agricultural sector due to oil price shocks. On that basis, the study investigated staple food price variability and agricultural sector response to oil price shocks in Nigeria. Two models were estimated one for agricultural import and the other for agricultural export. For the agricultural import, we estimated for VEC while a VAR analysis is carried out among six key macroeconomic variables: real oil price, real gross domestic product, real exchange rate, crude oil production, money supply and the volume of agricultural import and export. The price data was collected for a period of 216 weeks i.e four years from the six markets of the zone. The study made use of trend analysis, coefficient of variation, Arch/Garch. The results from the various analyses provided empirical evidence of the extent and pattern of the food price variability in the region. The dissertation revealed that (i) the prices of agricultural and a manufactured/industrial foodstuff fluctuate overtime and space and it serves as a threat to food security in the zone (ii) volatility persistence in the markets for agricultural product is more frequent than in the markets for manufactured/industrial foodstuffs; (iii) the response of oil price shock on agricultural import was positive meaning that increase in oil price lead to increase in the importation of agricultural commodities while indicates negative response of oil price shocks on agricultural export. The study concluded that agriculture in the region is at crossroads, that the current high food prices have added impetus for the North-West region in particular and Nigeria as a whole to review its agricultural policies and programmes. It was concluded that frequent variation in the prices of foodstuff is a threat to both the producers and consumers in the North-West zone of Nigeria. The study further concluded that frequent increases in the prices of goods especially food serve as a sources of poverty to consumers, because it reduced their purchasing power and consumption which as a result lead to food insecurity.

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LIST OF ACRONYMS

ADF	Augmented Dickey Fuller
AGE	Agricultural Export
AGI	Agricultural Import
AIC	Akaike Information Criterion
ARCH	Autoregressive Conditional Heteroscedasticity
COP	Crude Oil Production
EXCH	Exchange Rate
FPE	Final Prediction Error
GARCH	Generalise Autoregressive Conditional Heteroscedasticity
GDP	Gross Domestic Product
HQ	Hannan Quin Information Criterion
IRF	Impulse Response Function
MS	Money Supply
ROP	Real Oil Price
SIC	Schwarz Information Criterion
VAR	Vector Autogression
VEC	Vector Error Correction

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

Prior to the oil boom of the 1970s, agriculture was the mainstay of the Nigerian economy. Most of the nation's foreign exchange earnings at that time accrued from the sale of cash crops such as; cocoa, groundnuts, rubber, cotton, palm produce, and solid minerals. The emergence of crude oil production and exports radically changed the structure of the economy. The oil sector took over as the leading sector of the economy and the non-oil sector particularly agricultural production and exports became less competitive. The huge foreign exchange earnings from crude oil exports gave an encouragement to massive importation of goods, including food, to the extent that the terms of trade turned against agriculture (CBN, 2000).

Agricultural price variability plays an important role both at the macro and micro levels. At the macro level, countries likely to be most concerned by macro economic impact of agricultural price variability are the developing or emerging economies that are dependant on agricultural commodities for a large share of their export revenue or whose food imports are significant in balance of payment or fiscal position of government. For exporting countries heavily dependent on agricultural commodities, exceptionally low prices will have immediate balance of payment problem and may curtail investment which can affect capacity utilization and will therefore have significant negative effect on growth. For importing countries faced with exceptionally high prices may experience deterioration in balance of payment and in their public finance. For low-income importing countries, high food prices can result to inflation and high import bills which in turn could worsen the current account balance, as countries have to export more to pay for imports, such deficit may result in the depreciation of the exchange rate.

At the micro level in term of looking at the demand side, higher food prices are disastrous for poor especially in developing countries. This is because at least three-quarters of their total income may be spent on basic foodstuffs while from the supply side, high prices benefit net producers of food commodities and it signals the need for increased production.

Economists distinguish between predictable and unpredictable variability, the latter being characterized by shocks. Shocks to production and consumption transmit into price variability and vice versa. Production can vary either because of variations in area planted or because of yield variations, typically owing to changes in weather and other factors. While consumption may vary because of changes in incomes, changes in prices of substitutes and shifts in tastes. Available literature shows that the most important source of price variability in agriculture is weather shocks. Also, demand shocks, in particular income shocks (Gilbert 2010*a*) and policy shocks (Christiaensen 2009), play an important role in food prices.

Prices play an important role in guiding production, consumption and government policies. Consequently, production decision of farmers and buying decision of consumers are governed by price changes. Many factors such as price support and stabilization measures, export and import of a commodity and others have influenced past and present prices of commodities. The extent to which production and consumption shocks translate into price volatility depends on supply and demand elasticities, which, in turn, reflect the responsiveness of producers and consumers to changes in prices.

Variation of commodity prices among locations and over time is a natural market phenomenon. In fact, price variation is necessary for the existence of a market, as it creates the incentives that attract market actors to engage in trade. Food price fluctuation is considered as a major factor to food insecurity. Rising food prices pose a threat to food security more especially when the household incomes are fixed. However, rising food prices serve as an incentive to increase production and guarantee increased output of food in the long run.

On the other hand, decreases in food prices could lead to food security only in the short run but could engender food insecurity (transitory) in the long run because farmers may be discouraged to produce more due to low prices. In other words both inflation and deflation are undesirable phenomena.

Generally, food price volatility is not socially acceptable because it distorts the consumption budgets. Food prices in Nigeria especially in the North West zone have witnessed unprecedented price fluctuations. The examples are very glaring (e.g gari, yam, sugar, beef, etc). The cause may be that wages have increased.

At the global level, food price increase was very high in 2007. It was almost a World phenomenon because social and political unrest had occurred in 61 countries (Wikipedia, 2008). These price increases had social, economic and political dimensions in that year. Large amount of food production in the world does not ensure any country's food security. This was due to unfair distribution of resources, variation in production function, and low productivity. Even when production increased through time; food insecurity, malnutrition and hunger remained a serious problem in the world (Barrett 2002).

Hunger, has remained a pervasive problem in developing countries, and much of the development agenda that focused on scarce resources emphasized providing food to people in need to enable them feed themselves.

Price variability or fluctuation of staple food has assumed critical importance today in the context of agricultural trade liberalization. One of the major arguments advanced against agricultural trade liberalization is that it would lead to transmission of international price volatility into domestic markets. This will have serious implication for food security of the poor in a country where access to food is the biggest challenge (IFPRI, 2002).

Extreme variability in commodity prices, particularly of food commodities affect small holder farmers in countries like Nigeria with low propensity to save because of poor access to efficient saving instrument. If price is inelastic, lower price translates into lower farm incomes, which adversely affect the food security status of household. Therefore, the revenue from their production will also be volatile and as such households become vulnerable to food insecurity because they can't cope with this fluctuation. There is considerable literature of the adverse effects of the oil shocks on the agricultural sector in Nigeria.

International evidence suggests that resource-rich countries are characterized by slow or stagnating growth de-industrialization, low savings, lagging human and physical capital accumulation, and stagnating or declining productivity. This is premised on the fact that managing oil wealth has proven to be a difficult challenge for many countries across the world, example Ecuador, Mexico, Nigeria and Venezuela.

Fluctuation in oil price is a development in the global economy, which is posing a great challenge to researchers and policy makers studying the stochastic nature of macro economic dynamics. And as one of the oil exporters, Nigeria has benefited both from exporting more crude oil in terms of volume and also from its improvement in its terms of trade due to the rise in oil price. This is of course, evidenced in an upward surge of government revenue from oil sector rising from 26% in 1970 to about 86% in 2005.

1.2 Statement of Research Problem

The performance of agriculture since the discovery of crude oil in Nigeria has been dismal. This has led to food shortages which in turn has caused food insecurity. Before the discovery of oil in the 1970's, the Nigerian economy held the promise of a vibrant agricultural sector. As soon as oil was discovered, the problem of food shortage became pertinent due to the neglect of agriculture. This unfortunate neglect scuttled the production foundation of the Nigerian agricultural sector.

A shock in oil prices is a concern to the Nigerian agricultural sector. Agricultural sector in Nigeria is seriously affected by the shocks in oil prices. Thus, creating a demand gap for staples and increasing the export supply of tradables. Positive price shocks affects agricultural productivity in Nigeria because it raises the import demand of staples as domestic production could not meet domestic demand which have negative effect on employment that ought to have been created by the sector.

The mechanism through which oil price shocks effect food prices in Nigeria is, when oil price increased, it lead to the expansion of import of staple and thereby increasing the domestic prices such goods while reduction in oil prices reduces imports and expand export. This therefore reduces the domestic prices of the staples as surpluses is been produced.

A related cause of concern is the apparent disparity between the low rate of food production and the high demand for food in Nigeria. This has caused a demend-supply gap between food availability and total requirement; consequently, causing national food insecurity.

The Nigerian food crisis has been on for three decades and price volatility has been an important component of it. Staple food price movements have important effect on the transitory food security. The majority of these staple food consumers are poor people whose consumption pattern is more price-responsive. With their low incomes, they have no savings to fall back on or other assets to buffer the fluctuation in seasonal or inter-annual prices of food.

The shortage of food means escalating food prices and for the majority of low income families, this is a threat to food security in Nigeria. Excessive volatility of staple food prices destabilizes and jeopardizes household incomes and investment among the poor people, particularly among rural dwellers.

Food insecurity is a major challenge confronting the nation currently. Many households are net buyers or consumers of staple food in Nigeria. Consequently, staple food price variability distorts the consumption pattern of most households and this leads to serious implication of food insecurity in the zone.

The volatility of oil price has some repercussions on the agricultural production in the sense that it raises the cost of production and leads to a rise in the price of staple food.

1.3 Research Questions

From the above discussion, the following research questions arise:

a) What are the pattern and causes of staple food price volatility in the North-West zone of Nigeria?

b) How persistent is the volatility of staple food prices in the study area?

c) What is the response of food imports to oil price volatility?

d) What is the response of commodity exports to oil price volatility?

The above questions have been investigated in the context of the objectives of the study which are presented below:

1.4 Objectives of the Study

The main objective of the study is to empirically analyze staple food price volatility/variability in the North-Western zone of Nigeria as well as the agricultural sector response to oil price shocks in Nigeria. The specific objectives are:

a) To assess the pattern and causes of staple food price volatility in the North-West zone of Nigeria.

b) To analyze how persistent the staple food price volatility is in the study area.

c) To investigate the response of food imports to oil price volatility.

d) To examine the response of commodity exports to oil price volatility.

e) To make policy recommendations.

1.5 Research Hypotheses

The following hypotheses were tested:

1. Ho**:** Staple food prices are not volatile.

   HA**:** Staple food prices are volatile.

2. Ho: There is no volatility persistence of Staple food prices.

   HA: There is volatility persistence of Staple food prices.

3. Ho: Oil price volatility does not response to the food imports in Nigeria.

   HA: Oil price volatily response to commodity imports in Nigeria.

4. Ho**:** There is no response of commodity exports to oil price volatility in in Nigeria.

   HA: There is the response of commodity exports to oil price volatility in Nigeria.

1.6 Rationale for the Study

Agricultural sector crisis have been quite recurrent in Nigeria in recent decades, with no concrete measures taken to redress the problem. Price volatility is an important component of the problem and therefore it is very important to study price variability at micro and macro levels. The difference between the variability in the prices among commodities are important for decision making especially rural dwellers, private investment decisions in farming and farm product marketing.

The price data is fundamental to estimates of inflation and market analysis. The data set generated over a period of four years would therefore be very useful for research and policy design. This is because reliable information on food prices is a pre-requisite for accurate and effective design, monitoring and evaluation of agricultural development project. The insight generated from the analysis would also add considerable value to understanding the behavior of prices of commodities for both agricultural and manufactured/industrial products and to the analysis of the economic life and welfare of the households in the zone.

Price movements have important impact on households, especially as measured in terms of transitory food security. This is especially the case for poor households whose consumption is more price-responsive and who are less able to draw upon savings and other assets to buffer the fluctuation in seasonal and inter-annual prices.

Therefore, this study is expected to contribute to knowledge by showing not only the magnitude and trends of food price volatility in the North West zone but also, how has been the response of agriculture to oil shock in Nigeria from 1974 - 2010. The dissertation will also assist the government, the general public, donor organizations and other interested parties who want to intervene in one way or the other in seeking solutions to the problems of food price variability in the zone and in revamping the Nigerian agricultural sector so as to be providing the economy with huge earning from foreign exchange.

1.7 Scope and Limitations

The micro study covers six markets in Kaduna and Katsina States in North-West of Nigeria. Because of the limited budget and time constraint, three markets were selected from each State. The markets selected covered both urban and rural areas. There are three senatorial zones in each of the state. Those that supply the food crops are those farmer's surrounding the senatorial zone. One market was selected from each of the senatorial zones of the states. The macro study covers the period 1974 to 2010.

1.8 Organization of Work

This dissertation is organized into five chapters. The first chapter is the introduction containing background to the study, Statement of the research problems, research questions, and objectives of the research, scope and limitations of the research. Chapter two contains the review of literature which consists of definitions of key terms, theoretical, empirical and theoretical framework of the research. Chapter three contains the methodology, which includes the method of data collection, model specification and technique of analysis. The presentation and discussion of the data collected is in chapter four. The last chapter, which is chapter five, presents the summary, conclusion, and recommendations of the study.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview of Related Concepts

a) Agriculture

Agriculture is the production of food, feed, fiber and other goods by the systemic growing and harvesting of plants and animals. It is the science of making use of the land to raise plants and animals. It is the simplification of nature's food webs and the rechanneling of energy for human planting and animal consumption. Until the exploitation of oil reserves began in the 1980s, Nigeria's economy was largely dependent on agriculture before oil emerged on large scale in 1970s. Although only a tiny proportion of the population benefits from the oil boom, investment in agriculture has declined to the extent that its productivity lags behind even some of the poorest countries in the region. Nigeria's wide range of climate variations allows it to produce a variety of food and cash crops. The staple food crops include cassava, yams, corn, coco-yams, cow-peas, beans, sweet potatoes, millet, plantains, bananas, rice, sorghum, and a variety of fruits and vegetables and even animals such as cows, goats, sheeps, camels etc (Spedding C.R.W.' 1979).

b) Staple Food

A staple food is a food that is "eaten regularly and in such quantities as to constitute the dominant part of the diet and supply a major proportion of energy and nutrient needs". Staple foods vary from place to place, but are typically inexpensive or readily available foods that supply one or more of the three macronutrients needed for survival and health: carbohydrate, protein, and fat, such as grains, tubers, legumes, or seeds. The staple food of a society may be eaten as often as every day, or every meal. Early civilizations valued staple foods because, in addition to providing necessary nutrition, they can usually be stored for a long period of time without decay (Wikipedia, 2012).

Most staple foods derive either from cereals such as wheat, maize, rice, or starchy root vegetables such as potatoes, yams, and cassava. Other staple foods include pulses (dried legumes), and fruits such as breadfruit and plantains. Staple foods may also contain, depending on the region, olive oil, coconut oil and sugar.

c) Inflation

Inflation is defined as a persistent increase in the average price level in the economy, usually measured through the calculation of consumer price index. The word "persistent" is of great importance in understanding the concept. A single increase in prices is not called inflation. When inflation occurs, there is a sustained increase in the price level. Prices of individual goods and services are determined in many ways. In competitive markets, the interaction of many buyers and sellers. In imperfectly competitive markets, prices are determined by producer's decisions. In any economy, prices are continuously changing as markets adjust to changing conditions. Lack of rain may dry up corn and wheat fields, reducing supply and pushing up the price of agricultural product. Also, excessive rainfall may also damage crops thereby reducing supply and pushing up the prices of food crops. When prices of some goods are rising and others are falling, these are relative price changes (Friedman, 1963).

d) Deflation

Krugman (1998) defined inflation as a persistent fall in the average level of prices in the economy. There are two broad explanations for a fall in the price level, and economists have used these to categorise " good deflation" and "bad deflation". The first type of deflation, "good" deflation comes about from improvements in the supply side of the economy and /or increased productivity. A simple aggregate demand/aggregate supply diagram will illustrate that an increase in the long-run aggregate supply curve can result in an increase in real output and a fall in the price level. If the level of real output increases, then we can assume that there is a lower level of unemployment as more workers will be needed to produce the higher level of output. The second type of deflation, "bad" deflation, finds its source in the demand side of the economy. Another simple aggregate demand/aggregate supply diagram will illustrate that a fall in aggregate demand will result in a decrease in the price level and a decrease in real output. If real output decreases, then it is assumed that the level of unemployment will rise, as firms will need fewer workers if there is less demand.

Both causes of deflation result in a fall in the price level, but we might say that the first is positive because it results in an increase in real output and a fall in unemployment, while the second is negative because it results in a fall in real output and rise in unemployment.

e) Market Structure and Prices

This refers to different markets in an economy. Examples are perfect competition, monopoly, duopoly, oligopoly and bilateral monopoly. There are equilibrium quantities and prices in these markets.

An outward shift in demand from the market equilibrium would raise the price P* as demand moves to the right along the Supply curve. Similarly, an outward shift in supply from the market equilibrium would lead to lower price P* as Supply moves to the right along the demand curve. Both of these hypothetical price changes would only be short-term. In the long-run, producers would alter their planting decisions in light of the new price expectations (Dixit and Stiglitz, 1977)

f) Price Volatility

According to Loy and Weaver (1998) Price volatility refers to the variation, instability or fluctuation in prices.

There are two types of price volatility or variability and there is need to distinguish between price variation across different locations (spatial variation) and price variation over time (temporal variation). Although the process of arbitrage is similar in both cases, the causes of price variation differ.

2.1.1 Spatial Variation in Staple food prices

Rashid and Minot (2009) were of the opinion that the patterns of spatial variation in food prices in a country depended partly on whether or not the commodity was internationally traded. According to them:

- For non- tradable food commodities, areas producing large surpluses of the commodity (those with good agricultural potential relative to the size of the population) tend to have the lowest prices. In contrast, cities and other deficit areas have higher food prices in order to cover the cost of shipping food from surplus zones.
- For tradable commodities, prices generally depend on distance from the point of entry or exit. Imported food will be least expensive near the port of entry or along the main transport routes. For example, in Sub-Sahara Africa, rice and wheat are generally least expensive at the port city or in places with good market access.

Spatial arbitrage refers to the process in which traders buy in low-price locations and sell in higher-priced locations. In competitive markets, spatial arbitrage has three implications:

- Since transport costs are a major factor in trade. Spatial arbitrage ensures that the price difference between two markets will be, in the long-run, no greater than the transport cost, defined as the full cost of shipping the commodity from one market to another including profit and compensation for risk, if the difference between the price in market A(P_A^a) and in market B(P_B^a) is greater than the full cost of transportation between the two markets (C), including taxes, risk premium and normal profit, then trade will be profitable. Divergence in prices occurs because the good are not competitive. In other words, if

$$P_B^a - P_A^A > C \text{ – – – – – – – – – – – – – – – – – – – } 2.1$$

then it will be profitable to ship the commodity from market A to market B. Trade will reduce the supply and raise the price in the exporting market (market A) and increase the supply and reduce price in the importing market (market B), thus causing the price in the two markets (P_A *and* P_B) to move toward each other. Equilibrium is reached when:

$$P_B - P_A \text{ – } 2.2$$

Where

$$P_B \leq P_B^a \text{ and } P_A \geq P_A^a \text{ – – – – – – – – – – – – – – – – – – } 2.3$$

In this situation, any small change in price in one market would be reflected in an equivalent change in the price in the other market. On the other hand, if the difference between the price in market A and in market B is less than the full cost of transportation, then it is not profitable to trade between the two markets, it means there is price convergence due to competitive nature of the commodity in the markets. Trade will remain unprofitable if prices remain in the following ranges:

$$P_A + C > P_B > P_A - C \text{ – – – – – – – – – – – – – } 2.4$$

This implies that:

$$P_B + C > P_A > P_B + C \text{ – – – – – – – – – – – – – } 2.5$$

* Second, spatial arbitrage implies that there is a flow between two markets the price difference will be approximately equal to the transport cost. To keep the flow going, the price difference must be larger enough to cover the cost of trading.

- And finally, spatial arbitrage implies that, if the price difference between two markets is less than transport costs, there will be no private trade of the commodity between the two markets.

2.1.2 Temporal Variation in Staple food prices

Minot (2009) explained that the variation in food prices over time (temporal variation) also depends on whether or not the commodity is internationally traded:

- For tradable food commodities, the variation in prices over time is largely determined by world prices, trade policy, and the exchange rate. If trade policy and the exchange rate remain unchanged, the domestic price of a tradable commodity will generally track the international price of the commodity.
- For non-tradable food commodities, the variation in prices over time is primarily caused by the seasonal harvest calendar and by weather-related differences in production from year to year. Seasonal prices are lowest during the harvest and rise throughout the post-harvest period in order to cover the cost of storage. Similarly, year-to-year variation in staple food prices is inversely related to the harvest. Because farmers and consumers can switch between staple foods in response to prices, the prices of different staple foods often move together over time.

Temporal arbitrage refers to the process of storing a commodity when the price is low in order to sell it when the price is high. The implications of temporal arbitrage are quite similar to those of spatial arbitrage:

- First, temporal arbitrage ensures that the expected price increase between two time periods will be, in general, no greater than the full cost of storage, including profit and compensation for risk. If the expected price increase were temporarily greater than the storage cost, traders would have an incentive to buy and store more of the commodity, thus raising the current price (when the commodity is less scarce) and lowering the expected later price(when it is more scarce). This reduces food price variability over time.

- Second, temporal arbitrage implies that, if there is storage between two time periods, the expected price increase will be approximately equal to the storage cost. To maintain the incentive to store, the monthly price increase must be enough to cover the monthly cost of storage.
- And finally, temporal arbitrage implies that, if the expected price increase from one time period to another is less than storage costs, there will be no storage undertaken by private traders because storage would not be profitable.

According to Cochrane (1958), there are two types of price volatility or variability: seasonal and cyclical price variation. The seasonal price fluctuation or instability is a regular pattern of fluctuations that occur within a year, because of heavy dependence of agricultural production on climate. There are periods of high and low production for different commodities. Seasonal crops record low price during harvest or peak production periods. The activities of speculative middlemen do influence seasonal price variability in that they buy agricultural commodities at harvest time when they are cheap, store them and release them to the market when prices rise. Their activity often results in artificial scarcity, which forces food price up.

Per capita aggregate production, a factor affecting food security status of households, is expected to influence the food security status of households through the price effect. The fall in food prices in local markets following an increase in per capital aggregate production is expected to influence the incomes of households whose income is dependent on the sale of food crops. The effect of this on the food security status of households is dependent on the price elasticity of demand (Foster, 1992). If price is inelastic, lower price translates into lower farm incomes, which adversely affect the food security status of households.

2.2 Theoretical Literature

The incidences of staple food price hike and poverty are particularly devastating in the World particularly in developing countries and a lot of resources are being channeled towards programmes aimed at stabilizing food price variability by various international organizations and government of the developing nations. In terms of food insecurity, 852 million people worldwide are still chronically food insecure. In Africa, an estimated 200 million or 27.4 percent of the people in the continent are food insecure due to the fact that food price increase is one of the major cause of food insecurity (IFPRI, 2002: FAO, 2003)

There are several factors which influence the pricing behaviour of different market participants at a given marketing level such as trader’s access to and assimilation of market information, structural differences and diversity at each marketing level, and the nature of the product (Kinnucan et al., 1987; Ward, 1982). This information provides the description of grain market structure at three levels; producer market, wholesale market and retail market and how these structures relate to the grain pricing behaviour of different market participants.

Many studies shows that changes in fuel prices have an influence on food prices (Arndt et al., 2008; Rosegrant et al., 2008; Tyner and Taheripour, 2008; Yang et al., 2008). Tyner and Taheriour (2008) emphasized that rise in oil prices have an influence on the increasing corn prices. Rosegrant et al. (2008) states that allocation of land for food crops resulted in a volatility spillover between food and oil prices.

Baffes (2007) found the effect of oil price on agricultural commodity prices as 17%. According to Mitchell (2008) production cost of agricultural commodities are affected by both energy costs and transport costs and the effect is between 15-20%. Braun et al. (2008) indicates that increased transportation costs are attributed to the increased energy prices which also have an influence on the increased fertilizer prices, pesticide prices. Thus, agricultural production costs have increased. With the increasing energy prices, the transportation cost also increases owing to the fuel usage. Since the food commodities are transferred from manufacturing areas to consuming areas, transportation cost directly affects the price of the commodities. Thus, the commodity prices increase with the increasing energy prices. As a result, increasing energy prices not only affects the fuel and oil prices but also influences the food prices. Since the energy and food have a strong influence on humans' wealth, with the raising prices and decreasing purchasing power of citizens', there becomes a motive to find alternatives for fuel which is biofuel and ethanol. So, the tendency in energy prices is a motive to produce biofuels. This creates a tendency for the production of biofuels which simultaneously creates a new demand for food commodities.

IFPRI (2008) mentioned the possible effect of commodity speculation on the increasing agricultural prices. Cooke and Robles (2009) highlight impact of the futures market developments on food price spikes between 2006 and 2008.

The structure and conduct of market participants have a direct implication for the nature of grain and price relationships between different marketing levels and the direction of causality. The term market structure refers to the composition of buyers and sellers, their size distribution, the degree of product differentiation, and the ease of entry of new firms into an industry (Branson and Norvell, 1983). Based on the nature of grain price transmission through the vertical marketing system inference can be made about the efficiency of grain marketing and the competitiveness of grain marketing at different marketing stages.

A school of thought believes that public policy on food and agriculture is itself at the root of Nigerian food security problems. According to this school, food policy has been characterized by inappropriate role of government in food and agriculture, which manifest in badly formulated and poor executed food policies and the perennial emergence of the unintended consequences and beneficiaries of the food and Agricultural policies.

Shepherd (1972) argued that agricultural price variations were caused by different forces according to length of time involved. Long-term movements are caused by changes in population, in the technology of production, in real income per capita. Long-term movements are caused by changes in supply and demand like any other price movements. The short-term movements are caused by annual variations in weather, war, booms and depression.

Bordo (1980) argues that agricultural commodities tend to be more standardized and exhibit lower transaction cost than manufactured goods so that agricultural prices are characterized by short-term contracts and respond more quickly to monetary changes than the prices of other goods.

According to Olukosi and Isito (1990), prices are lowest at harvest time and highest before the harvesting period. The fluctuation in prices could also be due to other factors, such as demand and supply, number of producers producing a particular crop, the level of transformation the crops undergoes before it gets to the market, the cost of storage, transportation system, number of middle men involved in the marketing of the crop before it get to the retailers and also government intervention in fixing the price.

The World Bank (1991) noted that, Food demand and supply trends were known to have influenced prices as well as the composition of their diets and other factors related to food security. Although food insecurity is usually associated with rural households and urban poor who are more vulnerable to high food price and limited access to food as a result of low income, there are differences between household food security within the urban and rural areas. While real wage and employment are the main determinants of food security in the urban areas, the level of domestic food production dictated by the extent and ease of access to production inputs and services is a primary determinant of food security in rural areas.

Kwanashie et al (1998) pointed out that in the past, increased food output had solely been achieved through an expansionary effort of farmers by bringing new farm-land into cultivation. The authors emphasized probable exceptions to rice and cowpeas: but revealed that there had been no significant increases in area cultivated in the 1960s and 1970s. Similarly, that agricultural yield stagnated and output performance was unimpressive with only few exceptions. The report by Olayemi et al (1986) cited in Kwanashie et al, 1998; for the period 1985-2000 show huge national food deficits for all staple commodities (cereals, root and tubers and legumes), with self-sufficiency ratios falling below 80 percent in most cases. Both crop and livestock productions remain below potentials.

Roy and Darbha (2000) argued that the structuralism perspective describes adequately the situation in developing countries, where price and output mechanism are different across sectors. Moreover, the existence of structural bottleneck e.g. low supply elasticity for agricultural products, foreign exchange constraints, and high price and indexation in the industrial sector greatly influence the origin and persistence of inflation.

The second argument for the food price increase lies in the monetarist view. The monetarists argued that price increases are due to autonomous increase in money supply, and not just a reaction to accommodate real shocks in the economy (Kargbo, 2005). Since

Schuh (1974) first pointed out the importance of macroeconomic and financial factors in determining agricultural commodity prices, Frankel (1986) was the first to demonstrate that monetary changes can have short-run real effect on agricultural prices. The result of the study by Frankel (1986) shows that monetary changes can cause agricultural prices to overshoot their long-run equilibrium, i.e. monetary changes can have real short-run effect on agricultural prices. He also argued that the relatively slow speed of adjustment of industrial prices to monetary changes add to overshooting in agricultural prices.

So many theoretical explanations have been given for instantaneous changes in agricultural food prices. It is usually assumed that agriculture is a sector in which prices are more flexible than in non-agricultural sectors (Robertson and Orden, 1990).

Sarris (2000) addresses whether cereal price variability had changed more directly. His first step is to determine if the price series are trend or difference stationary. The argument for this is that if the series is trend stationary, then any shock has a temporary effect and if the series is difference stationary, then any shock will have permanent effects. The usual method to determine whether a series is trend or difference stationary is to perform unit root tests. Unfortunately these tests are of low statistical power especially when it comes to series that contain structural breaks or when the number of observations is small. Sarris (2000) uses a rather short time series: yearly data from 1970-1996. Further, the year of the first oil shock and the collapse of Bretton Woods were identified by Dehn (2000) as a structural break. Sarris (2000) does not first- difference the series. Instead he divides the nominal prices by the Consumer Price Index (CPI) and detrends the real maize, wheat and rice prices. He finds very little inter-year variability for wheat, maize and rice. Sarris (2000) also constructs an index of intra-year variability by dividing the unconditional standard deviation of price for the July-June crop year with the average annual price (calculated using monthly price data). This index is then regressed on a constant and linear time trend which turns out to be insignificant. This leads to conclude that there are no trends in the intra-year variability of prices.

According to Moledina, Roe and Shane (2003) it is "reasonable to expect that producers can distinguish regular features in a price process such as seasonal fluctuations and the ex-ante knowledge of the conditional distribution of commodity prices. On the basis of this information, producers generate probabilistic assessment of predictable and unpredictable elements in price process". Moledina et al. (2003) proposed that the predictable and seasonal components of the price process should not be considered part of price volatility. Once the predictable components have been removed, only the stochastic or unpredictable component remains. According to Moledina et al. (2003) the stochastic or unpredictable component of the price process is the appropriate measure of volatility. Empirical evidence presented by Just and Pope (2002) questions the assumption that volatility is deterministic. Campbell et al. (1997), quoted in Just and Pope (2002), state that "however, it is both logically inconsistent and statistically inefficient to use volatility measures that are based on the assumption of constant volatility over some period when the resulting series move through time". Thus, it is important that the techniques used to quantify volatility account for both the predictable and unpredictable components of the price process and that they allow for changes in volatility over time.

The late 1960s and 1970s saw many African countries including Nigeria changing their agricultural policies in favour of industrialization and in most of these countries, government agricultural policies, tended to focus more on cash crops rather than on food crops that are consumed locally (Club of Rome, 1989). This implies that less of their budgets were set aside for the promotion of agricultural food crops despite its potential huge contributions to their national economies. The consequence is that agricultural production, particularly food crop production was on the decline in the 1970s. African countries adopted some policies and which were not suitable to their own environment and this contributed to food insecurity. An example was the Green Revolution in Nigeria that could not succeed as it did in South Asia due to the lack of proper institutions and infrastructure. The outcome of its failure was the liberalization of the agricultural sector thereby abolishing the provision of chemical inputs, subsidies and financial assistance to farmers (IFPRI. 2001).

Food price volatility arises from shocks that can come from a number of sources, with the impact being felt differently in each separate commodity market. On some occasions, these shocks will be correlated. Often, this will be the case if common factors simultaneously affect a range of different markets, perhaps including non-agricultural markets. This appears to have been the case in 2007–2008 when most agricultural prices and many non-agricultural prices (energy, metals and freight rates) rose simultaneously. It was also the case in the 1973–1974 food price spike. In such cases, it appears likely that there are common causal factors. There is less agreement in the identity of these causal factors but demand growth, high oil prices perhaps generating demand for grains as biofuel feedstock's, dollar depreciation and futures market speculation are all candidates in this regard (Cooper & Lawrence 1975; Baffes 2007; Abbot *et al*. 2008; Mitchell 2008; Gilbert 2010*b*).

Food insecurity was generally accounted for within fluctuation in household own-food production and food prices. Siamwalla A, and Valdes A, 1994. Also, Idachaba F.S (1989) indicated that food price inflation constituted the greatest threat to the low living standard in Nigeria.

Son et al (2006) argue that people differ in terms of needs and that prices play an important role in individual consumption pattern, Changes in prices of goods affect purchasing power of the poor, notably in less developed countries where most of the poor live and where prices dispersion can be large. Generally, price change has been emphasized as an important factor that influences the level of undernourishment in the world, and particularly in Sub-Saharan Africa, South Asia, and China where there are four out of five under-nourished people in the developing world. They also revealed that, out of the 900 million people in Africa, about 315 million of them are currently living on less than $1 a day (UNDP, 2008).

IFPRI (2008, p.6) noted "higher food prices lead poor people to limit their food consumption and shift to even less-balanced diets, with harmful effect on their nutritional status and health in the short and long run".

Williams et al (2008) also argued that different groups will be affected by rising food prices. The next effect of price increases on poverty would be negative. There is a clear and present danger that rising food prices will push large numbers of households back below the poverty line. Higher prices will put upward pressure on the cost of living and thus lower the overall standard of living. If food prices increased and people's nominal expenditure had not changed, then the number of people of poor would increase, Increases in prices would reduce people's real expenditure and thus increase the number of poor.

A school of thought believes that public policy on food and agriculture is itself at the root of Nigerian food security problems. According to this school, food policy has been characterized by inappropriate role of government in food and agriculture, which manifest in badly formulated and poor executed food policies and the perennial emergence of the unintended consequences and beneficiaries of the food and Agricultural policies.

Gilbert and Morgan (2010) argue that food price volatility is determined by the interaction of production (harvest) and consumption shocks with supply and demand elasticities. Increased weather variability may therefore translate into higher food price volatility. Agriculture is central to rural development. Farming has high potential to create jobs, to increase returns to the assets that the poor possess-their labor and in some cases their land-and to push price of food staples, which is crucial when so many of the poor are net buyers of food.

The combination of oil price shocks that occurred in the 1970's, the persistent droughts in some parts of Africa leading to reduction in global food supplies; as well as inflationary pressures triggered adjustment in the agricultural and food prices across the globe (Cleaver and Donovan; 1995; Oden, 2003). Extensive research has been devoted to understanding the factors underlying the short and long-run price volatility (Hathway, 1974; Belongia and King, 1983; Barnett, Bessler and Thompson, 1983; Kargbo, 2000). Explanations for the rising food prices generally fall into two broad categories. First is the Structuralist view which argues that structural shocks in certain sectors of the economy raise the prices of food and other commodities. Eventually, these price increases are either accommodated or validated by an increase in money supply, thereby, keeping upward pressure on prices of other goods.

Hamilton (2001) argued that a regulatory environment acted to filter out many of the economically endogenous influences on petroleum demand and supply with the result that the particular timing of changes in nominal crude oil prices reflects largely exogenous developments specific to the petroleum industry. In essence, Hamilton claimed that the factors, some of which were enumerated above bear little resemblance to the usual enumeration of key business cycle developments and that in particular, it seem difficult to claim economic endogenously for specific events such as t000he 1973-74 OPEC embargo; the 1979 Ayolallah Phenamena, the USA 1980 Iran-Iraq war and of recent the 1991 Iraq and allied forces war.

2.2.1 Theoretical Framework

We adopted the cobweb theory for the purpose of this dissertation.

Cobweb Theory

The Cobweb theory forms the basis of this research because it assumes that the commodity markets are not always in equilibrium. Agricultural markets are thought to be suitable for the application of Cobweb theory, since there is a lag between planting and harvesting. Suppose that as a result of unexpectedly bad weather, farmers go to market with unusually small crops. This shortage is equivalent to a leftward shift in the market's supply curve, results in high prices. If farmers expect these high conditions to continue, then in the following year, they may produce more than what is demanded and prices will fall. But, if they expect low prices to continue, they will decrease their production for the next year, resulting in high prices again. The cobweb model is a special case of fluctuation in agricultural prices. Therefore, the decision by producers to produce is based essentially on the current market price, rather than the expected price when the commodity reaches the market. The model is therefore based on the following assumptions: 1) Producers base production plan on previous year's prices. 2) Consumers base their purchase on current prices. 3) There is no artificial effort to influence price or output and 4) Producers do learn hard from their mistakes regarding unfulfilled price expectations. The nature of the model is illustrated below.

Price

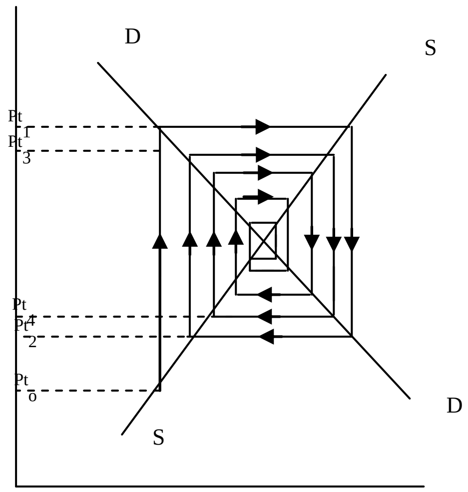


Fig. 2.1: Cobweb **Quantity**

We started by assuming that the producers sell their agricultural commodities at the low price 0Pto at period to. Since they believe that this low price will continue into period t1, they curtail supply. The result is that in t1, the price rises to opt1. Again, producers believe that price opt1 will prevail in the next period. So, they expand production, in action which brings down the price to opt2. Expecting the price opt2 to prevail in the next season, producers reduce supply, as a result of which the price goes up in opt3. As they base production on opt3, the producers expand output and cause the price to fall to opt4. In the diagram the price elasticities of demand and supply of agricultural product, are assumed equal. This is why we have the price moving towards the equilibrium at which it converges.

The model postulates a situation in which there is an immediate response to a change in price on the demand side but a delayed, or lagged, response on the supply side. This is a reasonable assumption since demand decisions are less concerned with immediate physical problems, whereas supply decisions are more likely to involve having the goods available in the market. We may state the situation in the mathematical form as follows:

$$D_t = f(P_t) - 2.6$$

$$D_t = f(P_t) - 2.6$$

Where Dt represent the quantity demanded and St the quantity supplied. Both are functions of price, but the quantity demanded is determined by the current price, whereas the quantity supplied depends on the price in the preceding period. Price in period t is determined by market clearance when D = S.

If we stipulate linear functions, we have

$$D_t = \alpha + \alpha P_t - 2.8$$

$$S_t = \beta + bP_{t-1} - 2.9$$

When the market is functioning efficiently, the equilibrium price is p, but if, because of imperfect information or other reasons, this price is not achieved, the difference between the actual and equilibrium price is given by:

$$P_t = P_t - P ------------------------ 2.10$$

Similarly, the equilibrium quantity is Q, and the difference, in non-equilibrium situations, is:

$$q_t = Q_t - Q ------------------------ 2.11$$

For any commodity which takes some time to produce, the decisions about the quantity to be supplied at any time t must have been based on knowledge of prices at time t-1 and mere guesses about prices at time t. Agricultural production provides one of the best examples of supply function of this form, that is

$$Q_t = f(P_{t-1}) ------------------------ 2.12$$

Once the element of time is introduced, there is no assurance that any equilibrium price and quantity will exist in the market.

2.2.2 Production Behaviour of Small Scale Farmers

Food and cash crop production in Nigeria has for a long time depended largely on the output of small-scale farmers. It is estimated that more than 90 per cent of the total cultivated land in the country is still in the hands of small-scale farmers (Agricultural Policy for Nigeria, 1996). They constitute the bulk of agricultural producers and provide close to 95 per cent of the food supply in the country, and 87 per cent of crop exports. Their land ownership pattern is governed by a communal land tenure system of small holdings. The production input of these farmers consists mainly of land and family labour: capital investment is negligible, modern biological inputs such as fertilizers and chemicals are seldom used, and the level of production technology is low. The rural environment (with little or no basic amenities) and the cultural background (norms and beliefs) in which they live and operate do very little to facilitate effective communication and diffusion of agricultural information, and the adoption of new technologies. In addition, opportunities and access to information is limited, while the average distance from home to the farm ranges from 5 to 10 kilometers. Small-scale farmers mainly practice subsistence farming, although some allowance is also made for marketable surplus (Olayemi, 1980; Ojo, 1991).

Given this setting and the importance of small-scale farming in Nigeria, the government, over the years, has tried several strategies in order to boost food production; increase the level, grade and varieties of export crops, produce adequate food for the ever-growing populace and furnish raw materials for the growing agro-allied industries etc. A number of policies have been introduced, including an Agricultural Credit Guarantee Scheme, Operation Feed the Nation, Green Revolution, River Basin Development Authorities, National Accelerated Food Production Programme, Guarantee Minimum Price Scheme, Marketing Board System, etc. Furthermore, the conversion of all enclave agricultural development projects (ADPs) in the country, to statewide ADPs, is an attempt to investigate the problems and increase the production of these small-scale farmers. Yet, Nigerian agricultural exports continue to decline and production has not been able to meet the food needs of the country- food production per capita has been declining annually (see Food and Agricultural Organization (FAO) *Production Year Book*,1993). The FAO, in another Publication, *The Food Security Index* 1997, classified Nigeria among countries with low levels of food security.

2.2.3 The Effect of Oil Price Shocks on the Nigerian Agricultural Sector

Agricultural production was the mainstay of the Nigerian economy. It was the mainstay source of food for most of the population (Okumadewa, 1997). The agricultural sector performed well in the 1950s and 1960s. However, in recent years, the sector has witnessed a tremendous decline in its contribution to national development. For example, the contribution of agriculture to GDP was 64.1% in 1960, 47.6% in 1970, 39% in 1990 and 28.4% in 2002. The near eclipse of the sector since the era of the oil boom (1972-1980) has been one of the most important factors that rocked the boat of food security in Nigeria. Domestic food production has not been able to meet national food demand. This has led to the increased importation of food to meet the shortfall in domestic production. Nigeria still depends on food imports to fill the gap in domestic food supply and this has had some negative effects on the living standard and agricultural sector performance. Imports affect household food consumption and demand patterns by the taste for foreign foods. They also affect household food consumption and demand patterns by heightening the taste for foreign food. According to Olayiwola et al (2008), this situation is strategically risky. Food supply has also been unstable due to the increase in world prices of food stuff. The price of food produced in Nigeria had been on the increase which is an indication of the inadequacy in supply. This could be attributed to the high post harvest losses, poor harvesting practices, inefficient storage and processing technique. Accessibility to food is also limited due to the incidence of poverty, unemployment and underemployment. Food intake and nutrition of many households are of relative low quality as a result their poor economic status because nutritious foods are sometimes expensive.

According to Ajani (2008), protein energy malnutrition (PEM) account for almost sixty percent of deaths among children in Nigeria. Another reason attributed to the poor performance of the agricultural sector is low public investment in this sector.

2.2.4 Agricultural Pricing Policies and Nigerian Food Insecurity

Since independence, agricultural policy in Nigeria has been characterized by instability and inconsistence. Frequently, changing governments tried to make their mark by adopting entirely new policies and programmes so that many initiatives were formulated and scrapped in rapid succession. There was generally a lack of focus on effective implementation, with the result that many policies were undermined. Moreover, inadequate institutional arrangement for policy and program coordination often led to duplication of effort and inefficiency. Four distinct phases of agricultural policy making can be distinguished (Manyong et al. 2003, World Bank 2006a, Daramola et al. 2007). During the 1960s, government continued to pursue on export-oriented strategy for agriculture. Public policy remained largely confined to agricultural research, extension and export crop marketing.

There are five basic objectives of Nigeria’s agricultural pricing policy: that farmers obtain remunerative prices for their products; that the prices and income should be stabilized for farmers; that the prices of Nigeria’s agricultural commodities be competitive in the international market in order to expand agricultural exports; that agricultural imports do not enjoy undesirable comparative price advantages over local commodities; and finally, that agricultural commodity prices be in parity with those of non-agricultural commodities in Nigeria (FMANR,1987).

Several instruments were deployed in pursuit of the stated objectives. First, government intended to use exchange rate policy to achieve a ‘realistic exchange rate for the naira’ so that favourable price regimes would exist for Nigeria’s agricultural products in the international market. Second, prices of agricultural inputs were subsidized to make inputs easily accessible to small-scale farmers and, in the process, encourage farmers to adopt improved production practices and new technologies. Third, government applied the minimum price guarantee scheme to assure farmers of floor prices and the purchase of their products in case the open market failed to absorb the quantities of products offered for sale.

Nigeria's agricultural pricing policy, however, failed to achieve the stated objectives. In the first place, the naira remained very strong until the currency was depreciated during the period of SAP. Before then, farmers received relatively low prices for scheduled commodities, especially cocoa.

Secondly, the minimum guaranteed prices were fixed at a level which did not adequately provide incentives to the farmers, so the strategy failed to serve as an incentive for increased production. Thirdly, the benefits of the subsidy scheme did not fully accrue to the small-scale farmers because of malpractices perpetrated by distributing agencies especially government functionaries who diverted large quantities of subsidized inputs, especially fertilizers and other agro-chemicals, to underground markets where farmers had to buy at prices much higher than the subsidized rates. Moreover, these inputs were never available in sufficient quantities or at easily accessible locations to the farmers.

As a result of these factors, the agricultural pricing policy made minimal impact. Neither the prices of inputs nor that of output have remained moderate or stable. Price inflation fuelled by macroeconomic policies, especially during SAP era, affected the prices of farm inputs and output so that both farmers and consumers faced escalating prices in the input and output markets.

The budgeted funds available for agriculture have fluctuated considerably overtime, both in terms of absolute outlays and budget shares (Garba, 2000). During the late 1970s and early 1980s, the federal government significantly increased its spending, such that the share of agriculture in the total budget exceeded 10 percent by 1983. During the SAP period, the budget share fell back to an average of about 3.5 percent.

Nigeria embarked on economic and trade reform in the mid 1980s in the context of a Structural Adjustment Programme (SAP). Similarly, the country is committed to the World Trade Organisation (WTO) agreement that became effective in 1995. These agricultural trade reforms have an adverse impact on the food security status of the country. This is because the primary objective of the reforms (economic and trade) were not geared toward addressing the Nigerian food security. These impacts definitely vary according to policies introduced and the structure of the economy. The reason being that all diversified agricultural economy is likely to adjust to reforms more readily than a monocultural economy (Oyejide and Ogunkola, 2008). Therefore, three levels of analysis are involved in the assessment of the reforms on food security in Nigeria. Level one is the components of the reforms; secondly, the immediate impacts of the reforms and thirdly, the impacts of the reforms on food security.

The main categories of reforms of the agricultural sector comprise of trade liberalization and other macroeconomic reforms on one hand, and on the other hand, is the institutional and agricultural sector-specific reform covering fiscal, credit, trade and the exchange rates reforms.

Import duties on agricultural products, especially food items such as grains and oils were raised to between 50% and 100% during the 1978-1982, then followed by the placing of most agricultural imports under license. The situation of the agricultural trade liberalization prior to SAP was that between 1982-1985, about 200 commodities were subjected to quantitative import restrictions and all food items were placed under ban.

The SAP period was a period of trade liberalization including the agricultural components which started with tariff reduction as well as reduction in the number of items on the prohibition list in 1986. There was also the abolition of import and export licensing scheme. Institutions were continuously being established and restructured from the early 1980s to the extent that so many agricultural institutions were involved in the production and the supply of inputs; River Basin Development Authority, RBDA (1977) was established to facilitate irrigation agriculture as an attempt to expand farmland. These included the Agricultural Development Projects, ADPs (1976), National Centre for Agricultural Mechanization, Green Revolution Programme, (GR) (1979), Nigerian Agricultural Cooperatives and Rural Development Bank, NACRDB (2000) and the Agricultural Credit Guarantee Scheme, ACGS(1977).

The policy reforms began in 1986, and led to the creation of new institutions. For example, the Directorate of Food, Roads and Rural Infrastructure, DFRRI was established in 1986 with the responsibility of constructing roads, initiating pilot food production project and providing rural water and electricity supply. Similarly, the Fertilizer Procurement and Distribution Department (FPDD) of the Federal Ministry of Agriculture were recognized in 1989 in preparation for the privatization and commercialization of fertilizer trade.

According to Ihimodu (2004), empirical records of many of these programmes and projects were not impressive enough to bring about the expected transformation of the sector. The food self-sufficiency ratio has fallen from 98% in early 1960s to less than 54 in 1986. In 1990, 18% of the population (14.4 million) was estimated to be critically food insecure and this has increased to 36% (32.7 million) in 1992 and further increased to 40.7% in 1996. According to Idachaba (2004), over 40% of Nigerian's estimated population of 133 million people was food insecured adding that to be able to provide needed food for the rising Nigerian population; the government adopted the "fire brigade" approach of food importation. The idea of importing food to meet the food shortage was later dropped because food import bills grew substantially and was taking a larger share of the GDP.

The decision by the public sector to disengage from direct output and input supply was seen as a result of the establishment of the National Agricultural and Land Development Authority (NALDA) in 1991 and the mager of DFRRI and Ministry of Agriculture in 1993. The ADPs were increasingly ineffective as a result of under funding because the World Bank had withdrawn its financial support. The disengagement of the public sector from certain agricultural activities was the result of the reforms. The transition from public sector involvement to private sector has not been smooth. The abolition of the commodity board for example exposed farmers to sharp fluctuations in World commodity prices and exchange rate risk. There was also in addition, sharp deterioration in produce quality affected the export sales of cocoa.

The commercialization of fertilizer procurement and distribution and also the decision to reduce fertilizer subsidies came into being as a result of the implementation of the Structural Adjustment Programme (SAP) in 1986. The annual average quantity of fertilizer procured and distributed by the public agencies during the reform period (1.371 million metric tones)1986-1993 was much larger than the annual average during 1980-1985 (765,000 metric tones). Therefore, the subsidy rate declined from an annual average of about 75% during 1980-1985 to 60% in 1986-1993 and 64% in 1994-2000 (Oyejide and Ogunkola, 2008). Prices of staples increased more during the reform relative to other periods and post reform prices change were lower than the pre-reform prices change. This is attributed to the effect of increase in supplies, especially from domestic resources.

The pre-reform growth rates were superior to the reform rates. While the direction of changes in prices was definite increase in incentive for all commodities, the direction of changes in output was mixed. More importantly, changes in output were generally lower than changes in prices.

The reform has not changed the pattern of agricultural practice in the country. However, the impact of the reform on the sector has been marginal. This explains the relatively unchanging yield, as farming activities remains predominantly the activity of the aged with little or no knowledge of modern farming practice, which is also constrained by limited access to improved seeds and seedlings.

2.2.5 Impacts of the Agricultural Sector Reforms on Food Security

Before the implementation of the reforms, Nigeria maintained absolute self-sufficiency in root crops and tubers, and the country produced almost all the maize, millet and sorghum consumed. On the other hand, only about 5 percent of wheat consumed was domestically sourced, and import dependency was almost complete in the case of soyabeans oil. In spite of the restrictive policies which were in place at the time, local consumption of some major foods such as wheat, rice, sugar and soybean oil relied substantially on imports.

Since the SAP started, the country has maintained a high level of self-sufficiency with respect to major cereals. However, imports dependency on wheat remained extremely high while self-sufficiency increased with respect to rice. Ironically, roots and tubers that were dependent on domestic production joined the list of items imported into the country.

Since SAP started, there were increases in self-sufficiency for many of the cereals. Import dependency declined from 96 percent in 1986-88 to 43 percent in 1998-2000. Significantly most food items are met through domestic food production. While the population is estimated to have increased between 1980-2001, the rural component which was 73 percent in 1980 declined to about 56 percent in 2001. The proportion of urban dwellers rose steadily from about 27 percent to 44 percent over the same period. The share of consumption of own production was however between 21 and 26 percent for the period. This depicted an upward trend between 1980 and 1985 which was maintained in the reform period. Rural household's dependence on consumption of owns production is obviously much greater than that of urban households.

Oyejide and ogunkola (2008) argued that the distribution of household expenditure over food and other consumption items showed several trends. First, the proportion of household expenditure on food increased in the reform period and fell in the post-reform period to the level attained in the pre-reforms period. In the case of rural households, food expenditure was 75% of total spending in the pre-reform period, this rose to 80% in the reform period but fell in the reform period to 68%. The corresponding proportions for the average urban household were 65%, 75% and 61% respectively. Second, the average rural household devoted a higher proportion of its expenditure to food during each of the three periods than the typical urban household. Third, the average rural household's food expenditure constitute a higher proportion of consumption of own production. In the pre-reform period, consumption of own production was 52% of total food expenditure, but fell to 42.5% during the reform period and further to 41% in the post reform. Fourth, consumption of own production was more important for the rural household than their urban counterparts. An indication of increasing commercialization in production and greater reliance on the market for the purchase of food by rural population was witnessed when there was a decline in the proportions of consumption of own production in the total food expenditure of the rural households.

2.2.6 Agricultural Sector Policies

In order to provide enabling environment for the agricultural sector to supply more food, the federal government, from time to time, introduced various policy initiatives which are summarized in table 2.1. All the below tabulated agricultural and rural development initiatives have affected agricultural production level in Nigeria.

After the political independence in 1960, Nigeria's development priorities were broadened and include agricultural development. Agricultural policies were a priority through food and export crop production. While priority was rural employment and the creation of right environment for private agents participation in agricultural activities, these policies were firmly knitted in national development plans, annual budgets, and credit guidelines and in other policy documents. Most agricultural plans were aimed at improving the living standards of people, and were to be achieved through the growth of agriculture and industries; they were however less specific on food production but more on export. Thus the commitment of the government towards agriculture was weak and less effective; for instance programs such as NAFP, ADPS, National Agricultural Cooperative Management Centre (NACMC), RB&RDA, and others were introduced and implemented to achieve this purpose. However, this goes to explain that pre-SAP policies were hanged on 'non-price' incentive support programs as well as government preferences (see, Garba, 2000). The evolution of such agricultural development strategy that is oriented towards non-price incentive and preference policies by government became pronounce in the administrations that later followed, such that structural change or leadership instability result in changes in thrust of agricultural policies (see, Akinboye,2008). This is because policies introduced were not tied to genuine political or economic reasons. A s a result several agricultural programs were rolled out from 1960-to date. Programs introduce include; Farm Settlement Scheme (1960s), NAFPP (1972), ADPS (1974), OFN (1976), ACGSF (1977), Land Use Act (1978), GR (1980), NALDA (1986), DFRRI (1987), NAFDP (1992), NACRDB (2000), NSPFS (2002), RTEF (2003), NEEDS (2004) and NFRA (2007).

TABLE 2.1: AGRICULTURAL SECTOR POLICIES AND PROGRAMMES

NO	DATE	HEAD OF GOVERNMENT	TYPE	PROGRAMME/POLICIES	SPECIFIC OBJECTIVE	BROAD OBJECTIVE
1	Early 1960s	Regional Government	Regional	Farm Settlement Scheme	To make settled farmers serve as models in good farming systems for farmers residing in nearby villages to emulate.	To settle young school leavers in a specified area of land, making farming their career thereby preventing them from moving to the urban areas in search of white collar jobs.
2	1972	General Yakubu Gowon	Military	National Accelerated Food Production Programme (NAFPP)	To bring about a significant increase in the production of maize, cassava, rice and wheat in the Northern states through subsistent production within a short period of time.	To provide agricultural extension services
3	1974	General Yakubu Gowon	Military	Agricultural Development Projects (ADP_S)	To bring about solution to the decrease found in agricultural productivity by sustaining domestic food supply.	To provide extension services, technical support and rural infrastructure.
4	21st May 1976	General Olusegun Obasanjo	Military	Operation Feed the Nation	To bring about increased food production in the entire nation through the active involvement and participation of every body in every discipline.	To mobilise the nation toward self-suficiency and self-reliance in food. To address the problem of rising food crisis, rural-urban migration and escalating food import bills.
5	1976	General Olusegun Obasanjo	Military	River Basin Development Authorities ($RBDA_S$)	To generate hydroelectric power and domestic water supply and production and rural infrastructural development.	To boost economic potentials of the existing water bodies particularly irrigation and fishery.
6	1977	General Olusegun Obasanjo	Military	Agricultural Credit Guarantee Scheme Fund (ACGSF)	To mobilize funds from the banking sector for rural development to guarantee loans by the commercial banks for investment in agriculture.	To minimize the risk involved in financing the agricultural sector.
7	1978	General Olusegun Obasanjo	Military	Land Use Act	To facilitate an effective utilization and exploitation of the land resources for agricultural purposes.	To bring the existing land tenure system under one common law.
8	April 1980	Alh. Shehu Shagari	Civilian	Green Revolution (GR)	To boost production of livestock and fish in order to meet home and export needs and to expand and diversify the nations foreign exchange earnings through production and processing of export crops.	To increase production of food and raw materials in order to ensure food security and self-sufficiency in basic staples.
9	1986	General Ibrahim Babangida	Military	National Agricultural Land Development Authority (NALDA)	To moderate the problem of low utilization abundant farmland, thereby increasing food production level of farmers through expansion of farmers farmland.	To encourage farmers to plant above what they can consume, so that the surpluses can be sold at the local markets or exported to other countries for foreign exchange earning.

10	1987	General Ibrahim Babangida	Military	Directorate of Food, Road and Rural Infrastructure (DFRRI)	-To harness all the resources in the rural areas. - To ensure adequate assistance was given to the rural dwellers in the provision of infrastructure. -To ensure that the production of export crops was encouraged through the construction of feeder roads in the rural areas.	To improve the quality of life (improvement in nutrition, housing, health, employment, road, water, industrialisation etc) and standard/level of living of the rural dwellers.
11	1992	General Ibrahim Babangida	Military	National Fadama Development Project (NAFDP)	To promote simple low-cost improved irrigation technology under World Bank financing.	To sustainably increase the incomes of the Fadama users through expansion of farm and non farm activities with high value-added output.
12	2000	Olusegun Obasanjo	Civilian	Nigerian Agricultural, Cooperative and Rural Development Bank (NACRDB)	To enhance access to credit by the beneficiary farmers, rural dwellers and small scale entrepreneurs.	To improve the quantum of loanable funds to the agricultural sector through recapitalization.
13	Jan. 2002	Olusegun Obasanjo	Civilian	National Special Programme on Food Security (NSPFS)	To assist farmers in increasing their output, productivity and income, strengthening the effectiveness of research and extension service training and educating farmers on farm management for effective utilization of resources.	To increase food production and eliminate rural poverty.
14	16th April 2003	Olusegun Obasanjo	Civilian	Root and Tuber Expansion Programme (RTEP)	To achieve economic growth, improve access of the poor to social services and carry out intervention measures to protect poor and vulnerable groups. And also to achieve food security and stimulate demand for cheaper staple foods.	To address the problem of food production and rural poverty.
15	2004	Olusegun Obasanjo	Civilian	National Economic Empowerment and Development Strategy (NEEDS)	Too achieve a minimum target annual growth of 6 percent in agricultural GDP of US $3 billion per year on agricultural exports and 95 percent self-sufficiency in food, and to also increase cultivable land by 10 percent per annum and foster implementation of private sector participation through incentives schemes to achieve agricultural production sustainability.	Poverty eradication, employment generation, wealth creation and value re-orientation.
16	2007	Umar Musa Yar'adua	Civilian	National Food Reserve Agency (NFRA)	Raising agricultural productivity by shifting from traditional subsistence farming to commercialised agriculture.	T oversee Nigerias Food Security Strategy/Agenda

All the above tabulated agricultural and rural development initiatives have affected agricultural production level in Nigeria.

2.3 Empirical Literature

Several studies of spatial market integration have been carried out in Ghana and Benin. An early study of grain markets in Ghana used both the Ravallion model and cointegration methods to examine the relationships between maize, sorghum, and millet prices in three markets (Alderman, 1992). The study used monthly wholesale prices over a period 1970-1990 in two markets: Techiman, a maize zone in the center, and Bolgatanga, a millet zone in the north. The author found that maize markets were relatively well integrated and that there were links between the markets for maize, sorghum, and millet.

Saghaian (2010) investigated the link between corn, soybean, wheat, ethanol and crude oil prices. In this study, correlations are found between soybean and wheat (83%), corn and soybean (88%), and corn and wheat (90%). Results also showed wheat market is influenced by the corn and soybean markets. Moreover, it is stated that "innovations in corn and soybeans price series affect residuals in each other, but they are not connected by directed paths."

There are a group of studies that focus on transmission between various food-related markets. Rezitis (2003) underlines that both farm and retail prices in Greece have significant effects on each other. Volatility spillover effects are also present between producer and consumer prices. Retail and farm prices arrange themselves according to one another. In another study that deals solely with food prices, Christian and Rashad (2008) examine the increased food prices between 1950 and 2005 and report a decrease in farm value of retail prices.

Vavra and Goodwin (2005) examine the relation between retail prices and consumer prices of food and discover presence of asymmetric affects of price changes in

U.S. They find that with decreasing retail prices, consumer prices tumble as well. Furthermore, the links between retail and farm prices is not contemporaneous but with a time lag. The reaction of the other market is influenced by the size and the speed of the transmission. In an earlier study, Minten and Kyle (2000) emphasize that the increase in the wholesale prices is significantly transmitted to the retail prices within the same week of the price change in wholesale level. Aksoy and Isik-Dikmelik (2008) document that a change in the commodity prices is more significant in countries in which people consume more staples rather than various kinds of foods to extend that consumption of staple food crops affects the household income. Because both the producers (net food sellers) and consumers (net food buyers) in rural areas are affected from the changing prices of crops that are produced or consumed in that area considering the variety of food in urban areas. So, the main staples used in rural are mostly the ones that are produced there. Generally, those aforementioned crops consist of wheat, rice, and maize, proportion of which is of great importance in overall food consumption. Consequently, it is inferential that the increase in the staple food crop prices has a significant influence on the household welfare. So, price change in that commodity will have a greater effect. Since volatility in prices has an influence in the market uncertainty and market risk, it has an effect on both consumers and producers. Thus, accurate forecasting becomes more difficult that accordingly affects the welfare of consumers and producers (Apergis & Rezitis, 2003). Apergis and Rezitis (2003) used GARCH model to examine the link between agricultural input prices, agricultural output prices, and retail food prices.

Badiane and Shively (1998) examined the speed of adjustment in Ghanian maize prices. The study uses monthly wholesale maize prices data over the period 1980-1993 for three markets: Techiman, a surplus zone in the center, Accra, a deficit market in the south, and Bolangtanga, a maize-deficit market in the extreme north of the country. The analysis is carried out with an autoregressive model in price levels, as well as a model of price variability. They found that maize prices in both deficit markets are relatively well integrated with maize prices in Techiman, the surplus market. However, the relationship is closer between Techiman and Accra than between Techiman and Bolangtanga, presumably due to the shorter distance between them. Furthermore, they find that the economic reforms introduced in 1983, including agricultural market liberalization, reduced the level and volatility in maize prices in wholesale markets, although the degree of seasonality is still high.

Abdulai (2000) used a threshold cointegration model to examine the relationships among maize prices in the same three markets in Ghana. The study used monthly wholesale maize data over 1980-1997 for Accra, Techiman, and Bolgatanga and found that prices in Accra responded more quickly to changes in Techiman than do prices in Bolgatanga, reflecting the fact that Accra is closer and a more active market. Half of the full adjustment in prices back to the long-run relationship occurs in 4-7 weeeks. In addition, the results indicate that an increase in maize price in Techiman is more quickly transmitted to the two deficit markets than a decrease: in other words, the marketing margin was more when it is compressed than when it expands. Overall the study found that maize prices in different markets were relatively well integrated.

Lutz et al (1994) examined the impact of agricultural market liberalization on maize price behaviour in seven markets in Benin. The data consisted of maize prices from the seven markets at 4- and 7-days intervals over the periods 1987-1989 and 1998-2001. The seven markets included three urban centers (Cotonou, Parakou, and Bohicon) and four rural centers (Ketou, Glazoue, and Azove). The Johansen rank test was used to identify the number of common trends found among the seven markets. In the first period, all seven markets were cointegrated with each other, indicating that they followed a common trend.

In the second period, only six of the seven markets followed a common trend, the prices in Ketou not having a long-run relationship with prices in the other markets. In addition, the study compared at the speed of adjustment to the long-run equilibrium in the two periods. It found that there was no consistent pattern: the adjustment seems to be more rapid in the second period for some of the markets, but prices in Cotonou, Parakou, and Azove adjusted more slowly in the second period. Overall, the study concluded that most of the markets in Benin were integrated in the sense that they follow ed a common trend, but there was no evidence of improvement in the degree of integration or speed of adjustment to shocks.

Kuiper et al (2003) focused on the issue of price leadership between retail and wholesale prices in Benin in order to test the assumption that retail prices follow the wholesale prices in the same market. They used retail and wholesale price data from periodic markets operating every four day in five markets. The tests for cointegration indicate that retail and wholesale prices were strongly co-integrated. The coefficient on the long-run relationship implies that retail prices are 2-18% above the wholesale price in the same city. They then examined whether wholesalers or retailers are "price leaders" using the Granger causality test. They found that in three of the four markets, the wholesale price in each period was significantly affected by the retail price in the previous period, but not the other way round. These markets include the two large urban areas: In only two markets did wholesalers play a price leader role. The authors interpreted this to mean that wholesalers could only influence prices when they carry out inter-city trade and thus have alternatives of selling to retailers.

Lach and Tsiddon (2007), used monthly store-level transaction price data for wine and meat products, sampled at Israeli wine and grocery stores, respectively. These were the same data used by the Israeli Central Bureau of statistics for constructing the monthly consumer price index. Lach and Tsiddon (2007) used these data to address one of the central questions on menu costs: They found that if the cost of price change is a "small fixed" amount as the menu cost usually envisions, and then we should not see small price changes. In addition to the earlier studies 0f (Lach and Tsiddon, (1992, 1996), which they found small price changes have been documented, for example, by Carlton (1986) for intermediate good price data, and more recently by Levy, et al. (2005) for retail prices of food products and by Ray, et al (2006) for whole sale prices of food products.

Van Campenhout (2007) analyzed the relationship between maize prices in seven markets in Tanzania using weekly price data over the period 1989-2000. He uses a threshold auto-regressive (TAR) model which allows pairs of prices to be linked only when the difference between them exceeds a threshold. The study finds that the implied marketing cost is 2-11% of the mean of the two prices, depending on the market pair being analyzed. Generally, the markets that are close to each other, such as Iringa and Mbeya, have a small threshold, while those that are farther, such as Iringa and Dar es Salam, have a larger threshold. The study measures the half-life of the adjustment process, that is, the number of weeks it takes for half of the full adjustment to take place. Across the six pairs of markets analyzed, the half of adjustment was between 4 and 12 weeks. The analysis also shows that the speed of adjustment has decreased over the 11-year period, the decline being statistically significant in four of the six market pairs. In addition, the threshold decreased 8-55%, implying a reduction in marketing costs between markets and a closer link between maize prices in different cities.

Lach and Tsiddon (1992) argued that there was no contradiction between the presence of small price changes on one hand, and menu costs on the other, as long as many different products were sold by the same firm and the firm is subject to price adjustment. They argued that in such an environment the optimal change in the price of a single product may indeed be small as long as the average price change of different products by the same firm is large. Lach and Tsiddon (1996) finding are consistent, for example, Lach and Tsiddon (1996) found that the smaller a price change of a given product in a market, the larger the average price change of the remaining product sold by the firm.

Blandford (1983) used the unconditional standard deviation of price as a measure of volatility. Using price data for wheat and coarse grains, and computing the standard deviation of changes in price (from the trend) for two ten-year intervals, he concluded that volatility was high. Using the standard deviation as a measure of volatility, he concluded that from 1971-1981, within one standard deviation, 27 percent of wheat prices fluctuated while 17.6 percent of grain prices fluctuated.

Negassa (1998) used various methods, including Granger causality analysis, to examine the relationship of teff, maize, and wheat prices across numerous markets in Ethiopia. He tested for causality in 28 commodity-market-pair combinations and in only one case was there no causation, In 14 cases, there was two-way causation between the market price in Addis Ababa and the other market. And in the remainder there was one-way causation. Overall, the study concluded that there were "strong causal relationships" between the cereal wholesale prices in Addis Ababa and those in other selected markets.

Ngassa and Meyers (2007) examined Ethiopian price data using an extended version of the parity bounds method (PBM). It is extended to allow the probability of each type of regime to gradual change in response to changes in policy. The model is tested on monthly data on wheat and maize prices in Ethiopia during a period when the Ethiopian Grain Trading Enterprise was relieved of its responsibility to stabilize prices and made to operate as a commercial enterprise. The policy change causes a statistically significant shift in the PBM parameters in only a few of the market pairs tested. Maize was characterized by price differences below marketing costs even though flows were observed, suggesting trading losses. In contrast, wheat price differences often exceeded transfer costs, implying excess profits.

Heifner and Kinoshita (1994) used time series data to measure variability in grains prices. They used standard deviation as a measure of variability of the rate of change in real prices of grain. They found that most grains and soybeans exhibited price variability below 10 percent between the 1950's and sixties, but rose to the 20 percent range during the eighties and nineties.

Muller and Ray (2007) used weekly product-level price data of Dominick's supermarket price for both the retail as well as the wholesale price for 30 commonly used food products in six categories in order to explore asymmetric price adjustment. This is a follow-up of Peltzman's (2000) study in which he used the same data set to explore the asymmetry. The difference between the two studies was that while Peltzman used the data at a monthly frequency, Muller and Ray used the data at a weekly frequency. Their findings indicated that there was a limited asymmetry in the price behaviour of some individual product, but they did not find any evidence of chain-wide asymmetric price strategy.

In a study of market integration in Uganda, Rashid (2004) examined the effect of market liberalization on maize price movement. His study compared the behaviour of maize prices before and after market liberalization which occurred in the mid-1990s. His analysis was based on weekly maize price data for eight districts over 1993-94 and 1999-2001. The study examined how many of the markets were co-integrated (that is, follow a common trend) in the two periods, as well as the direction of causality in pairs of markets. The results indicated that market integration had improved markedly between the early 1990s and the end of the decade. In 1993-94, only four of the eight markets were cointegrated, meaning that they followed a common trend. In contrast, seven of the eight markets were following a common trend in 1999-2001 periods. At the same time, the maize markets in the northern districts of Gulu and Arua remained relatively disconnected from the other maize market in the country. This is explained by the insurgency in the north which made trade with the rest of the country both risky and costly. In addition, there was cross-border trade between the northern district of Uganda and southern Sudan, so that prices in the north reflected, to some degree, market conditions over the border.

Jeleta and Gebremedhin (2009) considered the relationship among wheat and teff prices in six market towns in Tigray region in northeast Ethiopia. The analysis is carried out using semi-monthly prices from May 2006 to October 2008. The authors tested the cointegration of wheat and teff prices for each of the 15 pairs of markets. Wheat prices are cointegrated in 13 of the 15 market pairs, indicating that they followed common trends. Similarly, teff prices are cointegrated in 12 of the 15 market pairs.

Weber and Anders (2007) study the scope of market power in German retail market using mean analysis and structural conjectural variation analysis. The extensive mean prices analysis of the data shows that the hypothesis of competitive behaviour in the German retail food market can be rejected because their data items at varying and temporarily rigid prices across different types of retail store. Weber and Anders (2007) found significant difference in the pricing behaviour across store types between 2004-2006 with discount stores featuring the highest degrees of price rigidities for beef and porks product. Weber and Anders (2007) employed a structural conjectural variation approach to parameterize the retail industry-level and they found significant deviations from perfectly competitive behaviour. Thus, both approaches suggest that retail market of food in Germany have some market power.

Meyers (2008) provided a more recent study of maize markets in Malawi. The analysis used weekly maize prices from ten markets over the period 2001-2008, focusing on the difference in price within nine pairs of markets. The price spreads were quite volatile and often turn negative, suggesting that the trade flows are not steady and that there may even be trade reversals. The study finds strong evidence of a long-run relationship in six of the ten market pairs tested. Half of the full adjustment is more rapid than estimated by earlier studies of Malawi maize markets by Goletti and Babu (1994) and Chirwa (2000), suggesting an improvement in market efficiency over time. It is also comparable to the speed of adjustment of maize and soyabean markets in the United States, estimated to range between 0.2 and 3 weeks (Godwin and Piggot, 2001). The estimated threshold above which price transmission occurs ranged from 0.5 malawi to 6.4 across the nine market pairs studied, which is equivalent to US$5 to 61 per ton as at December 2004 exchange rates.

Ratfai (2007) who investigated some fact about price adjustment patterns at the level of individual price using high frequency panel set of retail prices of 14 processed meat products collected in a district stores in Hungary during the 1993-1996, when they were experiencing moderate and stable inflation rates. He noted the finding from moderate inflation regime interesting because other related studies have focused on data from either low or high inflation countries. Ratfai (2007) finds that stores typically change their prices in large discrete and infrequent jumps. He also finds price heterogeneity across both, stores and products which are more prevalent in the frequency of price change.

Bahadir-Lust et al (2007) studied the nature of price distribution for 10 food products across 131 retail stores in Germany when the aggregate inflation rate was relatively low. They used various model of sales and weekly transaction price data, they investigated whether the cross-sectional price distribution is persistent or perhaps it changes over time.

Both of them reported prices vary considerably across stores. Store heterogeneity, accounted for roughly 30 % of this price changes. Their regression analysis also suggests that the degree of price changes varies across products, regions, as well as the type of stores.

Goletti and Babu (1994) used cointegration methods to examine the behaviour of maize prices in Malawi before and after market liberalizations. They used monthly retail data for eight markets over a period 1984-1991. They tested the cointegration of each pair. Before liberalization, 18 of the 48 market pairs were co-integrated, but after market liberalization 34 pairs were co-integrated. This indicates that the market liberalization in 1987 improved the transmission of price changes from one market to another. On the other hand, they find that the transmission is only partial and can be slow. The average adjustment to an initial shock took 5.7 months. Finally the study examines the symmetry of adjustment. They find little evidence that price increases and price decreases are transmitted any differently in Malawi.

Agbola et al (2003) examine cross-sectional data from the South African Integrated Household Survey (SAIHS) analyzing household consumption of food and estimating price and expenditure elasticity of demand for the food. The result provided an insight into the impact of price increase on low-income households. The result of the study indicates that during the six months period of the survey, the price of maize meal rose by between 25% and 35%, the sugar price increased by about 20% and the price of meat by between 25% and 65%, while the average spending on all the items increased by 28%.

The increasing spate of fluctuation in food prices, global crisis and food insecurity have been issues of concern to policy makers the world over. Most countries with widespread food security problems are assessed based on three indicators; low average calorie consumption, large fluctuations in and low level of food consumption, and large numbers of absolute poor. Food insecurity often results in human suffering, substantial productivity losses and a misallocation of scarce resources due to diminished work performance, lower cognitive ability and school performance, and ineffective income earning decisions (Braun et al. 1992)

An important way of gauging governance according to FAO (2005) is to consider how well government investment in agriculture and agricultural research promotes sectoral development of the national economy and well being. FAO found that in the countries with the highest level of hunger, where an average of about 70 percent of the population depend on agriculture, the share of public budget expenditure invested in agriculture in proportion to the importance of agriculture to the national economy fell far below the scale of investment in countries where the incidence of hunger was lower.

Tostao and Brorsen (2005) examined market integration in Mozambique using monthly retail prices of maize over 1994-2001 and estimates of transfer costs. They used the parity bounds method (PBM) which distinguishes among three regimes: competitive trade (when the difference is equal to the transfer cost), non-trading markets (when the price differences is smaller than the transfer cost), and disequilibrium (when the price difference exceed transfer cost). A measure of the level of the integration of a market pair is the proportion of the time they are in the first two regimes. The results suggest that markets within southern Mozambique are efficient (by this definition) 55% of the time, while those in central Mozambique are efficient 84% of the time. Southern and Central Mozambique are relatively well integrated, but the transfer cost between northern Mozambique and the rest of the country are too high to justify maize trade. A vector-autoregression (VAR) analysis confirmed that prices in each of the six main markets were linked to prices in one or two of the other markets.

Moser, Barrati, and Minten (2009) examined rice markets in Madagacar using four quarters of data on prices and transportation cost for almost 1400 communes. They applied the parity bounds model which distinguished among the three trading regimes, as described above. At the Sub-regional level, 69% of the communes appear to be in competitive trading markets, 21% are in non-trading (or segmented) markets, and 10% are in disequilibrium. At the regional and national levels, markets were found to be either segmented (due to high transportation costs) or in disequilibrium, possibly indicating imperfect competition.

Son and Kakwani (2006a) developed a methodology to measure the impact of price changes on poverty in Brazil covering the period 1999-2006. The impact was measured by an entire class of additive separable poverty measures which captured impact of price changes on poverty by means of price elasticity of poverty, total effect of changes in prices on poverty was explained in terms of two components. The first component was the income effect of the changes in price and the second was the distribution effect which was captured by price changes. It is the distribution effect which determines whether the price changes benefit the poor proportionally more or less than the non-poor. The authors also derived a new price index for the poor (PIP). While this index can be captured for any poverty, empirical analysis by the authors was applied to Brazil and it was based on three poverty measures, the headcount ratio, the poverty gap ratio and the severity of poverty. Hyun H.S. and N. Kakwani (2006a) found that price changes in Brazil during the 1999 to 2006 period have occurred in a way that favours the non-poor proportionally more than the poor. Nevertheless, during the last 2-3 years, the price changes have favoured the poor relative to the non-poor. The methodology for the study was based on consumer demand theory.

Bussolo et al (2006) carried out an impact analysis of commodity price changes on rural households in Uganda with particular emphasis on the case of Coffee. Using data from three household surveys covering the 1990s, these authors confirmed a strong correlation between changes in coffee prices in a liberalized market and poverty reduction. This was clearly highlighted by comparing the performance of different households grouped according to their dependence on coffee farming. Regression analysis based on pooled data from three surveys of consumption expenditure on coffee-related variables, other controls and time fixed effects, corroborates that correlation between price changes and poverty is not spurious, They also found that while both poor and rich farmers entered the coffee sector, the price boom benefited relatively more the poorer households, whereas the liberalization seemed to have created more opportunities for richer farmers. Notwithstanding the importance of the coffee price boom, the agricultural policy framework and the thorough structural reforms in which the coffee market liberalization was embedded certainly played a major role in triggering overall agricultural growth in Uganda.

Chapoto and Jayne (2009) examined the effect of trade policy and market intervention on maize price instability in eastern and southern Africa. The study applied an econometric model to estimate both the level and variability of monthly food prices for eight countries over a period from January 1994 to December 2008. The result of the study indicates that maize price volatility had declined greatly in Kenya since its adoption of the maize-without-border policy of the East African Community in January 2005. Also, the result show that, in well functioning markets, there was a regular seasonal price pattern in which prices were lowest directly after the harvest and rose gradually over the season reflecting the costs of storage until they reached their peak in the months prior to the next harvest.

Kilima et al (2008) studied changes in the variability of maize prices using monthly maize wholesale price data from seven region of Tanzania over the period 1983 to 1998. They found that market liberalization increased both the level and the variability in maize prices. In addition, they found that maize price volatility was significantly lower in ‘’developed areas (defined as larger towns and cities), near national borders and in maize deficit zones presumably had lower price volatility because they were supplied by multiple production zones, thus muting the effects of supply fluctuation in any one of them. Maize volatility in border areas may be lower because of the opportunity for cross-border trade to absorb surplus.

Aminu et al (2010) analyzed the integration of selected markets using some complementary commodities using time series price data from 1990-1998 using correlation coefficient (r) and coefficient of multiple determinations (r2). The result revealed that there was the existence of price variation and trade relationship among the selected commodities and the markets.

Ahmed and Bernard (1989) also calculated correlation coefficients between district prices of Aman and Aus rice during 1976-82. In case of Aus rice only 48 out of 190 pairs of correlation were statistically insignificant; all remaining coefficients were highly significant. Of the 48 insignificant coefficients 18 relate Chittagong to other districts in the northern and southern parts of Bangladesh. In case of Aman rice, 63 out of 190 pairs were statistically insignificant.

Using Nigeria data for the period 1974 to 1979 and applying VAR technique of estimation. Sanni (1988) found that unexpected oil price increase had negative effect on the agricultural sector. The period was very short and monthly data had to be used for crude petroleum prices and crude oil production.

Z.Zhnag et al. (2010) used vector error correction model, Granger causality test, and variance decomposition in order to investigate the long-run and shot-run relationship between fuels which are ethanol, gasoline, and oil and agricultural commodities which are corn, rice, soybean, sugar, and wheat. Rezitis (2003) used GARCH model to examine the relation between lamb, beef, pork and poultry producer and consumer prices. Saghaian (2010) utilized cointegration test, vector error correction model, and Granger causality test to examine the link between corn prices, soybean prices, wheat prices, crude oil prices and ethanol prices. Kargbo (2000) utilized cointegration test, vector error correction model to examine the relation between food prices, indices of domestic food production, income, money supply, real exchange rates and African governments' trade policies. Minot (2010) used vector error correction model to examine the link between maize, rice, and wheat prices of the world and nine Sub -Saharan African countries.

As Askari and Krichene (2008) state even if the oil prices rise tremendously, change in the demand for commodities or for oil will be relatively small if the elasticity is low. That is, increasing oil price will not have a significant influence on demand for food commodities.

Barlect and Gounder (2007) examined oil price shocks and economic growth in Venezuela using Vector Autoregressive (VAR) methodology based on quarterly data. Three oil price measures were considered, following the various theoretical implications that oil price shocks have no economic growth. The authors analysed the short-run impact of oil price shocks in a multivariate framework which traced the direct economic impact of oil price shocks on economic growth as well as indirect linkages. Furthermore, the models employed the linear oil price and two leading non-Linear oil price transformations to examine various short-run impacts. A wald and likelihood ratio tests of Granger causality, was utilized and the result indicated that linear price change, the asymmetric price increase and the net oil price variables was significant for the system as a whole, whereas the asymmetric price variables was not. Following the causality analysis of oil price rexus, the generalized impulse responses and error variance decompositions the authors reaffirmed the direct link between the net oil price shock and growth, as well as the indirect linkages. They concluded that since oil consumption continued to increase in New Zealand, there is a need for policy-makers to consider oil price shocks as a major source of volatility for many variables in the economy.

Akpan (2009) analyses the dynamic relationship between oil price shocks and major macroeconomic variables in Nigeria by applying VAR approach. The study pointed out the asymmetric effect of oil price shocks; for instance, positive as well as negative oil price shocks significantly increase inflation and also directly increases real national income through higher export earnings. The findings of the study showed a strong positive relationship between oil price changes and real government expenditures.

Barnanke, Gertler and Watson (1997) study the role of monetary policy as the central issue rather than a factor contributing to discontinuity in the oil Price – GDP relationship. Evidences from their impulse response function shows that had the federation maintained that funds rate at the pre-shock level, most of the GDP response to oil price over the 1973, 1979-80 and 1990 episodes would have been avoided. Hamilton and Herrera (2001) re-examine Bernanke, Gertter and Watson (1997), and arrive at a diametrically opposite conclusions about the relative contributions of monetary policy and oil price shocks to the recessions following the 1973, 1979-80, and 1990 oil price shocks. From their analysis of the impulse response functions, they discover that the potential of monetary policy to avert the contractionary consequences of an oil price shocks is not as great as suggested by the analysis of Bernanke, Gertter, and Watson. Rather, oil shocks appear to have a bigger effect on the economy than suggested by their VAR, and we are unpersuaded of the feasibility of implementing the monetary policy needed to offset even their small shocks.

Semboja (1994) studied the effect of oil price changes for Kenya, which is a net importer of oil. For this purpose, he calibrates a static computable general equilibrium model to obtain the impact responses, rather than estimating a VAR process to generate the dynamic responses. The impact response suggest that an increase in oil prices lead to an increase of the trade balance, a decrease of output and of the price index and also deterioration of the terms of trade.

For instance, while Mark (1989) further confirmed Hamilton's result as to a negative correlation between output growth and oil price increases, Papepetrou (2001), examining the case of Greece and using a Vector Autoregressive (VAR) model, also reports a negative impact of real oil price changes on the Industrial Production and employment.

Bassam, (2007) in his work the drivers of oil prices; discuss three main approaches for analyzing oil prices: non-structional models, the supply-demand framework and the informal approach. Each of these approaches emphasizes a certain set of drivers of oil prices. While non-structural models rely on the theory of exhaustible resources as the basis for understanding the oil market, the supply-demand framework uses behavioural equations that link oil demand and supply to its various determinants such as GDP growth, prices and oil reserves. The informal approach, on the other hand, analyses oil price movements within specific contents and episodes of oil markets history. He uses the later approach to identify the main factors that have affected oil price movements in recent years, analyzing whether these drivers reflect structural changes in the oil market.

Sanni (1988) studied the impact of random oil price shocks on agricultural aggregates such as the total value of agricultural exports and imports using Nigerian data, for the period 1974-1979. He used vector autoregressive model with 4-lags specification. He found out that the portion of total value of agricultural exports and imports forecast error variance attributable to changes in the triangularized real oil price (ROP) innovations becomes progressively larger. The result therefore confirmed the effect of oil-price shocks were generally negative on the agricultural sector.

The VAR model was used by Sanni (1998) with six variables namely: exchange rate (EXCH), money supply (M1&M2), real oil price (ROP) crude oil production (COP), volume of agricultural export (AGE), and volume of agricultural import (AGI), we therefore included another variable real gross domestic product (GDP) because it is a measure of total output within the limits of country. But in terms of the data sourcing Sanni (1998) used monthly data from 1974-1979. This dissertation used annual data from 1974-2010. This was based on the fact that the annual data super cede and is more reliable than the monthly data. Sanni (1988) had six equations; each equation expresses the current Value of one of the variables in the system as a function of lagged values of all variables in the system plus an error term. The compact representation is as in equation 2.13.

VAR MODEL --- (2.13)

$$\begin{Bmatrix} q_t \\ v_t \\ w_t \\ x_t \\ y_t \\ z_t \end{Bmatrix} = \begin{Bmatrix} a_{11}(L) & a_{12}(L) & a_{13}(L) & a_{14}(L) & a_{15}(L) & a_{16}(L) \\ a_{21}(L) & a_{22}(L) & a_{23}(L) & a_{24}(L) & a_{25}(L) & a_{26}(L) \\ a_{31}(L) & a_{32}(L) & a_{33}(L) & a_{34}(L) & a_{35}(L) & a_{36}(L) \\ a_{41}(L) & a_{42}(L) & a_{43}(L) & a_{44}(L) & a_{45}(L) & a_{46}(L) \\ a_{51}(L) & a_{52}(L) & a_{53}(L) & a_{54}(L) & a_{55}(L) & a_{56}(L) \\ a_{61}(L) & a_{62}(L) & a_{63}(L) & a_{64}(L) & a_{65}(L) & a_{66}(L) \end{Bmatrix} \begin{Bmatrix} q_t \\ v_t \\ w_t \\ x_t \\ y_t \\ z_t \end{Bmatrix} = \begin{Bmatrix} q_t^* \\ v_t^* \\ w_t^* \\ x_t^* \\ y_t^* \\ z_t^* \end{Bmatrix}$$

$$a_{ij}(L) = \sum_{i=1}^{M_{ij}} a_{ij}1L^{1}, \textit{ and}$$

Where

$q_t^-, v_t^-, w_t^- X_t^-, y_t^-$ *and* z_t^- and zero$^-$ mean white noise innovations with constant covariance matrix.

Where

$$\frac{E(q_{t,}^* V_{t,}^* W_t^* Z_{t,}^*)}{q_{t,}^* V_{t,}^* W_{t,}^* X_{t,}^* Z_{t,}^*} = d_{t,s} M - - - - - - \; - - - - - - - - - - - \; - - (2.14)$$

Equation (2.14) was estimated by ordinary least square (OLS).

Meanwhile Burbidge and Harrison (1984) tested the effect of increases in oil prices using a seven-variable vector auto regression (VAR) model for five countries (U.A, Japan, Germany, U.K. and Canada) using monthly data from January 1961 to June 1982. They found out that substantial effects of oil-price shocks on price level were evident on the U.S. and Canadian economies and with great pressure on industrial production on U.S. and U.K. They also ported out that the oil shock in 1973 only worsened the incoming recession of that period. Following the collapse of oil prices in 1986, it was argued that oil price-macro economy relationship has weakened. In addition, an asymmetric oil price-macro economy relationship was established (Mork, 1989).

Aliyu (2007) assesses empirically the effects of oil price shocks on the real macroeconomic activity in Nigeria. Granger casualty tests and Multivriate VAR analysis has used with both Linear and non-linear specifications. The author used monthly data from January 1980 to December 2007. The paper finds evidence of both linear and non linear impact of oil price shocks on real GDP. In particular, asymmetric oil price increases in both the non-linear models are found to have positive impact on real GDP growth of a larger magnitude than asymmetric oil price decreases adversely affect real GDP.

Aliyu (2009) assessed the impact of oil price shock and real exchange rate volatility on the real gross domestic product in Nigeria using quarterly data that span the period 1986-2007. He used the Johansen VAR-based cointegration technique to examine the sensitivity of real GDP to change in oil prices and real exchange rate volatility in the long-run while the vector error correction model was used in the short-run. The result of the long-run analysis indicated that a 10.0 per cent permanent increase in crude oil prices increases the real GDP by 7.72 per cent, similarly a 10.0 per cent appreciation in exchange rate increases GDP by 0.35 per cent. The short-run dynamics was found to be influenced by the long-run equilibrium condition. He recommended the diversification of the economy and infrastructural diversification.

Valadkhani et al. (2001) assess the impact of oil price changes on consumer goods and services during the year 1996-97 in Australia. The major impact of oil price rise was borne by transport sector and agricultural sub-sector. Further, study shows that the impact of rise in oil prices on Australian economy in the year 1996-97 was more than what was observed in 1970s.Valadkhaniet al. (2001) also show that the poor spend a higher proportion of their total consumption expenditure on basic necessities than that of rich and vice versa. In this way they rank the items of consumption expenditures according to their priorities of expenses in terms of weights. The poor household spends more on diesel fuel, kerosene, heating oil, lubricants, other oils, meat, dairy products, food products, LPG and other gas fuels. The increase in oil prices increase cost of production of these items. It can be easily concluded that increase in price of petroleum affects both the consumers and producers. Technically speaking, it can be tentatively concluded that impact of price rises are regressive in nature.

Jiménez-Rodríguez and Sánchez (2005) study the effects of oil price shocks on the real economic activity of Japan (among other OECD countries) employing quarterly data from 1972:I to 2001:IV. They find a negative association between oil prices and Japanese real GDP growth using a second-order vector auto-regression model. Cuñado and Pérez de Gracia (2005) use quarterly data from 1975:I to 2002:II to show that there are no co-integrating long-run relationships between oil prices and industrial production and between oil prices and CPI, with the impact of oil shocks on these variables thus being limited to the short run. Moreover, they find that oil price shocks Granger-cause both output growth rates and inflation rates.

Gounder and Bartleet (2007) used a multivariate framework to measure the shortrun impact of oil price shocks on economic growth, inflation, real wages and exchange rate. Short-run impacts were examined using linear and non-linear oil price transmission. The likelihood ratios tests of Granger non-causality result indicated thet linear price change, asymmetric price increase and the net oil price variables impacted significantly on the economy unlike the asymmetric price decrease. The generalized impulse responses and error variance decomposition results confirm the direct link between net oil price shock and growth and its indirect linkages through inflation and real exchange rate. The paper, thus, concluded that oil prices exhibit substantial effects on inflation and exchange rate in New Zealand.

Lippi and Nobili (2008) maintain that the source of oil shocks may affect economic performance differently: oil price increases due to higher oil demand shocks affect output differently than oil price increases due to lower World oil supply shocks. They argued that positive oil supply shocks decrease domestic production. In order to assess the effects of oil supply shocks, they employ the sing-restrictions approach pioneered by Canova and Nicolo (2002) and Uhlig (2005). They set up a three-variable VAR model that includes World crude oil production, twelve real price changes, and domestic growth rates. Following Lippi and Nobili (2008), they defined positive oil supply price shocks such that oil production decreases but oil prices increase at the contemporaneous period where no additional restrictions are put on for additional periods as well as for their effect on output.

Jin (2008) employed a vector autoregressive model VAR to compare the effects of oil price and real effective exchange rate on the real economic activity in Russia, Japan and

China. He first applied a Lag Augmented VAR (LA-VAR) approach causality test to investigate whether the oil price shock and exchange rate volatility granger-cause the economic growth in Russia, Japan and China. In addition, cointegration technique was used to examine how the real GDP of Russia, Japan and China are affected by changes in oil prices and exchange rate in the long-run. To get the short-run of the model, a vector error correction model (VECM) was employed to analyze the short-run dynamics of the real GDP for the three countries. His findings indicated that oil price increases impact negatively on economic growth of Russia. Specifically, a 10 per cent permanent increase in international oil prices is associated with a 1.67 per cent growth in Russian GDP and a similar decline in Japanese GDP. On the one hand, an appreciation of the real exchange rate leads to a positive GDP growth in Russia and a negative GDP growth in Japan and China.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Introduction

When food markets are characterized by competition and good information, they work well in redistributing food from low-price markets to higher-price markets and from low-price periods to higher-price periods. In doing so, they tend to reduce spatial variation in food prices, as well as reducing price variability over time. Indeed, the elimination of price variation would cost more than the social benefits, as well destroying the incentives necessary to attract private agents to engage in trade.

However, food markets may be inefficient due to monopolistic behaviour, imperfect competition, policy inconsistency and /or high transportation costs. Furthermore, even when food markets work well, they can not be expected to address all food security problems, such as delivering food to households whose livelihoods and purchasing power have been destroyed by natural disasters.

The framework, consisting of equations 3.1-3.6, which were developed to answer the questions on the extent and trend of staple food price movements. The trend analysis is based on three key issues: a) Observation of the graph of the series, b) measurement of the stochastic properties of the series (mean, standard deviation and co-efficient of variation) and c) comparison of the behaviour of the price series across the markets under study. The pattern of price movements can be analyzed using time series analysis. Consequently, in the empirical framework, we identify how we intend to collect data and analyze the data collected.

There are six sample markets- Samaru, Giwa, Kafanchan (Kaduna State), Funtua, Mai-aduwa and Katsina (Katsina State).

Let the markets be represented as follows:

Samaru = 1

Kafanchan = 2

Giwa = 3

Kastina = 4

Funtua = 5

Mai-adua = 6

The price of commodity n in the market at time t is given by:

$$P_{njt} = f(D_{njt}, S_{njt}, P_{nit}) - - - - - - - - - - - - - - - - \quad 3.1$$

Where,

P_{njt} = price of n commodity in market j at time t.

S_{njt} = supply of n commodity in market j at time t.

P_{nit} = price of n commodity in market i at time t.

D_{njt} = Demand for commodity n in market j at time t.

J=1,2,3,4,5,6 and i=1,2,3,4,5 if j=6j, i=2,3,4,5,6 if j=1 and i=1,3,4,5,6 when j=2.

From equation (3.1), it is obvious that Snjt would be seasonal if n is agricultural product and stable if n is manufactured product. Therefore,

a) In the period of declining supply of agricultural products, the impact of change in demand on price would be stronger than when supply is rising.

b) Other things being equal (e.g holding cost constant), the impact of changes in demand on price of manufactured commodities would be strong.

c) The seasonality of agricultural commodity prices could depend on both demand and supply, while that of manufactured goods would depend more strongly on demand shift.

$$D_{njt} = f(P_{njt}, p_{njt}, Z_t) - - - - - - - - - - - - - - - - \quad 3.2$$

Zt = disturbances such as payment of salary for urban markets.

$$S_{njt} = f(P_{njt}, p_{njt}, k_{nt}) - - - - - - - - - - - - - - - \quad 3.3$$

Where,

Knt is the seasonal effect on supply.

The reduced form of equation (3.1) and (3.3) for agricultural commodities and manufactured goods are:

$$P_{njt} = f(P_{njt-1}, P_{njt}, Z_t, K_{nt}) - - - - - - - - - - - - - - - \quad 3.4$$

and

$$P_{njt} = f(P_{njt-1}, P_{njt}, Z_t) - - - - - - - - - - - - - - - - - - \quad 3.5$$

If the markets are competitive, it is expected that the difference in prices between any two markets would not exceed transport costs, i.e.

$$P_{n1t} - P_{n2t} = \Delta P_{n12t} \leq T_{12} - - - - - - - - - - - - - - - - - - - \quad 3.6$$

Where, T_{12} is the transport cost between any two markets

But given the reduced form equation in (3.5), the agricultural products equation can be:

$$P_{njt} = f(P_{njt-1}, P_{njt}, K_{nt}, U_t) - - - - - - - - - - - - - - - \quad 3.7$$

Where,

Ut is random disturbance which is assumed to be white noise.

Assuming a linear functional form, eq (3.7) can be written as:

$$P_{njt} = \alpha_1 + \alpha_2 P_{njt-1} + \alpha_3 P_{njt} + \alpha_4 K_{nt} + U_t) - - - - - - - - - - \quad 3.8$$

Where,

$\alpha_1 > 0$j $\alpha_2 < 0$

α3>0 implies competition

<0 implies that market j follows markets i

$\alpha_4 < 0$ K_{nt} - weather

$K_{nt} = 1 \rightarrow$ harvest period

$K_{nt} = 0 \rightarrow$ off - harvest period

While the industrial products equation is:

$$P_{njt} = P_1 + \beta_1 P_{njt-1} + \beta_2 P_{njt} + \varepsilon_t - - - - - - - - - - \quad 3.9$$

Where,

$\beta_1 > 0$

$\beta_2 < 0$

$\beta_3 > 0$ competitive market

< j is follower and i is leader

3.2 Model Specification

To model the food price volatility ARCH/GARCH model was used. It is to be noted that Moledino et al. (2003) and Just and Pope (2002) made use of the model to measure staple food price volatility. The rationale for using ARCH / GARCH model is the high frequency nature of the data for the staple price volatility that were collected on daily basis.

The specification of the ARCH/GARCH models is as follows:

$$Y_t = \alpha_o + \sum_p^{p\max} \eta P_{it-1} + \sum \eta D_t - - - - - - - - - - \quad 3.10$$

In simple terms, an ARIMA (p,d,q) process indicates that the coefficient needs to be lagged p times, the series is to be differenced d times to yield a stationary series, and the error term to be lagged q times to generate the desired result. The rejection of null hypothesis of no ARCH effect indicates the fact that the series vary over time and suggests that the GARCH approach should be used instead. The presence of ARCH effect (whether or not volatility varies over time) has to be tested in the conditional variance of:

$$h^2 = Var\left(\frac{\mu_t}{\Omega_{t-1}}\right) -3.11$$

$$h^2 = P_o = P_1 U^2{}_{t-1} + P^2 P^2{}_{t-2} + - - - + P_q U^2{}_{t-q} - - - - - - - 3.12$$

Where U_t^2 is the square residual in period t. whenever the probability values are lower than 0.05, it indicates that the null hypothesis is rejected at 5 percent level of significance, indicating that the volatility varies over time.

The rejection of the hypothesis of no ARCH effect will lead the application of the GARCH approach. The GARCH model is presented as:

$$Y_{it} = a_o b_1 Y_{it-1} + b_2 Y_{it-2} \varepsilon_i , t = 1,2,- -T - - - - - - - - - - - - - - 3.13$$

$$\delta^2{}_{it} = cons\tan t + \alpha_1 \sum\nolimits^2{}_{it} + \beta_i \delta^2{}_{it-1} - - - - - - - - - - - - - - - 3.14$$

Where Yit is the price index in time t of commodity I, σt2 is the variance of εt conditional up to period t-1. The sum of αi + βi gives the degree of persistence of volatility in the series. The closer the sum to 1, the greater is the tendency of volatility to persist for longer time. If the sum exceeds 1, it is indicative of an explosive series with a tendency to meander away from mean value. The GARCH estimates will be used to identify periods of high volatility and volatility clustering in this study.

As a relative measure, the co-efficient of variations is also useful in comparing price variability among the foodstuffs for the four years period in the six markets. This is based on the fact that, so many people have used the model. For example, Blandford (1983) used it to measure grain price instability in world grain market and found a very high volatility in the markets studied. Also, Heifner and Kinoshita (1994) used same model to measure grains prices and concluded that most grains exhibited high price variability. It is also useful when comparing two or more sets of data which are measured in the same units. It is expressed as:

$$CV = \frac{S}{\overline{X}} \quad - - \; - - - - - - - \; - - - - \; - - - - - - - \; 3.15$$

Where:

CV= Coefficient of Variation

S= Standard deviation of a set of data

$\overline{X}$ *= Mean of a set of data*

Since this dissertation has confirms that all the series are non-stationary in their level, but stationary in their first difference, it became obvious bearing in mind the need to accommodate the interdependence of relationships between most economic variables, allowing for the possibility of Co-integration among the variables in order to achieve objective two.

While the third measure used to determine the degree of the agricultural sector response to oil price shock is Vector Auto regression (VAR) model so as to estimate the response of the sector to oil price shock from 1974-2010. This was done in order to capture the behaviour of the variables used. Impulse response functions were examined to trace out the response of the dependent variables in the VAR model to shocks in the oil price and output. Variance decomposition technique was used to evaluate the relative importance of oil price shock on the response of agricultural export and import in Nigeria.

We choose export and import as a measure of the agricultural sector output because it is assumed that when oil shock affect agricultural output, such effect will manifest in higher import of agricultural commodities as local production fails to meet local demand, and lower export as domestic output fails to produce surplus for export.

The VAR model is adopted from the work of Sanni (1998) with six variables namely: exchange rate (EXCH), money supply (M1&M2), real oil price (ROP) crude oil production (COP), volume of agricultural export (AGE), and volume of agricultural import (AGI). The research recognized the need to include another variable real gross domestic product (GDP) because it is a measure of total output within the limits of country. In the area of the data sourcing Sanni (1998) used monthly data from 1974-1979 whereas this dissertation used annual data from 1974-2010. This is based on the fact that the annual data is better justified and more reliable and is more reliable than the monthly data and also there is the non availability of the monthly data.

The choice of how many, and which variables to include in a VAR could be extremely controversial because of some consideration such as degree of freedom, data availability and economic considerations. The paper assumes the following ordering of the six variables used in the VAR: real oil price, crude oil production, exchange rate, money supply and real Agricultural Import in the first model, while for the second model the ordering is as follows: real oil price, money supply, exchange rate, crude oil production and real agricultural Export.

The primary interest here is to empirically investigate the effects of real oil price (ROP) on volume of agricultural export (AGE) and volume of agricultural import (AGI); crude oil price (COP) is added so as to capture supply influence that might affect crude oil prices. So, the remaining variables: MS1 (and alternatively, MS2) and exchange rate (EXCH) were added to permit random oil-price shocks to operate indirectly on AGE and AGI through the domestic monetary sector and exchange rate effect. Real price was of primary interest since most theoretical models of oil price shocks have focused on the analysis of the effect of relative oil prices,

[See Bruno (1984) Bruno and Sachs (1982), and Harkness (1982)].

Vector Autoregressive (VAR) model

To capture the response of agricultural sector to oil price shocks in Nigeria, we employed the VAR model pioneered by Sims (1980). Here, the focus is on the joint behaviour through time of a vector of stated variables. The model is specified thus:

$$Y_t = C + \sum_{i=1}^{k} \Phi_i Y_{t-1} + \Sigma_t - - - - - - - - - - - - - - 3.16$$

Where yt = (yit - - - , Yct), Φi are (K×K) coefficient matrices and Ut = (Uit, - - - Ukt). This is K – dimension white noise with zero means that is E(Ut) = 0 and contemporaneous covariance matrix

E(U, U') = Σu Σu is a diagonal matrix where diagonal elements are the variance of the structural disturbances and off-diagonal elements one zero (structural error terms are assumed to be mutually uncorrelated).

For Estimation purposes, however, because the variables in equation (3.16) have to be either stationary or cointegrated, the next step is to investigate the integration order of each of the variables using the Augmented Dickey Fuller (ADF) test. Where the variables are found to be integrated of order I(1(1)), then unless they are cointegrated, the VAR should be estimated in first Difference of all the variables involved. However, where the variables are found to be cointegrated, then a Vector Error Correction model is appropriate.

From the above discussion, two separate VAR models are implied:

1. Model of the response of agricultural import: all these variables except agricultural export are assumed to determine agricultural import; including real oil price and crude oil production i.e.

   Xt1 = (rop, cop, exch, ms, y) -- 3.17

2. Model of the response of agricultural exports in which all the variables except agricultural export are assumed to determine it.

   Xt2 = (rop, ms, exch, cop) -- 3.18

3.3 Dickey-Fuller and Augmented Dickey Fuller Test for Stationarity (ADF)

It is necessary to test whether the sample data for the price analysis is stationary or non-stationary. The test shows whether the series are stationary or not as well as their order of integration (Johnston and Dinardo, 1997). The ADF test was applied to test for the presence of unit root (Dickey and Fuller, 1981) and to determine the number of times the series needs to be differenced to make it stationary. Once the presence of unit root was confirmed the data was differenced twice to make it stationary.

There are two principal methods of detecting non-stationarity. The first method is by subjective judgment applied to time series graph of the series and to its correlogram. It is not easy to judge one series to be stationary and the other non-stationary on the basis of visual inspection of the series alone.

To find out if a time series pt is non-stationary, we ran the regression of the following equation:

$$P_t = \alpha + \beta p_{t-1} + \varepsilon_t - - - - - - - - - - - - - - - - - - 3.19$$

where,

α = Intercept

β = Coefficient

pt = Current price

pt-1 = Previous price

et = Disturbance term, assumed to be an independent normal variable w ith zero mean and constant variance. The time series pt will converge to a stationary one, as /t→00/. If / β/‹1 and it's autocorrelation declines exponentially from one to zero with the increase in lag length. Therefore, such a series shows a downward slopping curve.

Hence, the series is non-stationary and is sometimes called a random walk with drift (see also Fama, 1970; Dickey and Fuller, 1979; Johnston and Dinardo, 1997). Though such a series can be transformed to induce stationary by differencing, if finally, / β/>1, the time series is also non-stationary and in fact exhibits an explosive character. The solution of such an explosive series will not be attempted in this study.

The computed t-statistic, whose critical values have been tabulated by Dickey and Fuller (1979), will be based on Monte Carlo simulation. The test will allow us to know for each data set whether the data sets are stationary, and if they are, at what level, (at zero level, first difference or at second difference). The ADF test statistic will show if the series is stationary, and for a series to be stationary the test statistic must be greater than the critical value in absolute term.

3.4 A Priori Expectation

In estimating the GARCH effect of price volatility, it is expected by a priori that the degree of persistence of price volatility for the markets under study when summing the conditional variance ($\alpha i+\beta i$) would be closer to one. It is also expected that there would be high degree of volatility persistent in the urban markets than the rural markets. The closer the value of the conditional variance to one, the higher the degree of volatility persistent of the prices. It is expected also that higher prices of staple will mean less purchasing power and reduction in consumption pattern of households in the study area while lower prices will be an indication of higher purchasing power and an increase in consumption pattern.

While it is expected that from the result of the VAR estimation, it would suggest that real oil price (ROP) and crude oil production (COP) contribute very little in the movement of both export and import.

3.5 Sampling Frame and Sample Size

The sampling frame used in this dissertation was the purposeful sampling. This is based on the fact that the primary interest of the micro component of the study is to investigate staple food price volatility. It therefore, became imperative for the purposeful choice of the markets so that we could draw our sample from some selected markets within the study area for the purpose of collecting data.

Kaduna State has 23 Local Government Areas (LGAs) while Katsina State has 34 LGAs. The local governments areas of each state are divided into three (3) Senatorial zones. The Southern, the Central and the Northern Senatorial zones.

The first stage involved a purposeful selection of six local government areas i.e three from each state. This is followed by the selection of two urban and one rural market from each of the two states, making a sample of six markets in the zone.

The second stage is that in Kaduna state one urban market each was selected from both Southern and the Northern senatorial zones (Sabon-Gari market from the north and Kafanchan markets from the south) and one rural market from the Central senatorial zone (Giwa market) while in Katsina state also, one urban market each was selected from Central (Katsina market) and Southern (Funtua) senatorial zones, and a rural market from the Northern senatorial zone was selected-that is, Mai'adua.

3.6 Sources of Data

The study made used of both primary and secondary sources of data. The primary data were collected through market survey record sheet on the price movement of ten (10) staple foods for a period of two hundred and seventeenth weeks (217) i.e four years. The price data for Maize, Millet, Guinea Corn, Local rice, Soya beans, Beans, Fresh Meat, Peak milk, Sugar and Flour were collected in the urban markets while in the rural markets, price data for six agricultural commodities were collected (Maize, Millet, Guinea Corn, Local rice, Soya beans and Beans). The justification for collecting only agricultural commodities in the rural markets is the fact that they are basically weekly grains markets.

This price data provides a unique opportunity to assess the relationship among market prices of different commodities. It also demonstrates the usefulness of such price data in understanding the operation and performance of marketing system and providing an insight into the formulation of effective marketing and pricing policies.

While in estimating the VAR model, data were collected from the central Bank of Nigeria statistical bulletin from 1974-2010 on some key macroeconomic variables: volume of agricultural export (AGE) and import (AGI), Real Gross Domestic product (GDP), money supply (M1), money supply (M2), exchange rate (EXCH), Real oil price (ROP) and Crude oil production (ROP).

3.7 Tools of Analysis

The study made use of both descriptive and econometric mode of analysis. The descriptive analysis involves the use of trend analysis in order to measure the movement pattern of prices of selected food stuff (agricultural and industrial) from the six selected markets. The main measures adopted are the Arch/Garch model adopted from the work of Moledino et al (2003) and Just and Pope (2002). The coefficient of variation was used to measure grain price instability in world grain market. A VAR model was also used to estimate the response of agriculture to oil price shocks in Nigeria 1970-2010.

3.8 The Study Areas

Kaduna state lies between latitude 09 03' N 11 32' N and between longitude 960 15' E and 080 60' E 060, with land mass of 45,567 square kilometers. It was ranked 3rd position with estimated population of 6,066,562 in 2006 census.

Agriculture and Forest resources are enormous. On the gentle rolling high plains, the tropical ferruginous soils have been intensively used for cereal and cotton cultivation. In the North of latitude 100 the soil produce large quantities of cotton lint and seed for which Soba, Makarfi, Ikara, Kauru and Lere LGAs are known. Yam and maize have been successfully produced in Igabi, Giwa and Birnin-Gwari LGAs. In the well watered

Southern part of the state, the rich darker soils are used for cultivating cereals, yam, cassava, rice and famous Southern Kaduna ginger ("Chitta"- Hausa).

The state has about 23 Local Government Areas namely: **Giwa, Chikun, Birnin-Gwari, Igabi, Jaba, Jema'a, Kachia, Kaduna South, Kaduna North, Kagarko, Kajuru, Kauru, Lere, Kubau, Makarfi, Sanga, Sabon-Gari, Zaria, Zangon Kataf, Kubau, Soba, Ikara and Kudan.**

Katsina state covering an area 23,938 square km is located between latitude 110 08'N and 130 22'N and longitude 60 52' E and 90 20' E. The state is bounded by Niger Republic to the North, Jigawa and Kano states to the east, Kaduna state to the South and Zamfara State to the West.

Agriculture remains the backbone of the state's economy as 75 per cent of its people are farmers. Katsina state is blessed with aboundant agricultural land and a wide range of crops are grown. These include: guine corn, millet, maize, cowpea, cotton, and groundnut, etc. In addition, the state possesses a large livestock population mainly made up of cattle, goats and sheep.

Katsina state has about 34 Local Government Areas namely: **Katsina, Batagarawa, Daura, Danmusa, Funtua, Dandume, Kafur, Danja, Kankara, Zango, Mashi, Dutsinma, Kankia, Matazu, Sandamu, Baure, Charanchi, Mani, Musawa, Ingawa, Faskari, Maiaduwa, Malumfashi, Dabai, Jibia, Bakori, Batsari, Kurfi, Sabuwa, Kaita, Dutsi and Safana.**

The figure below shows the map of Nigeria indicating Kaduna and Katsina states- the study areas (See fig 2 and 3 below)

Figure 2: Showing the Map of Nigeria indicating the two states

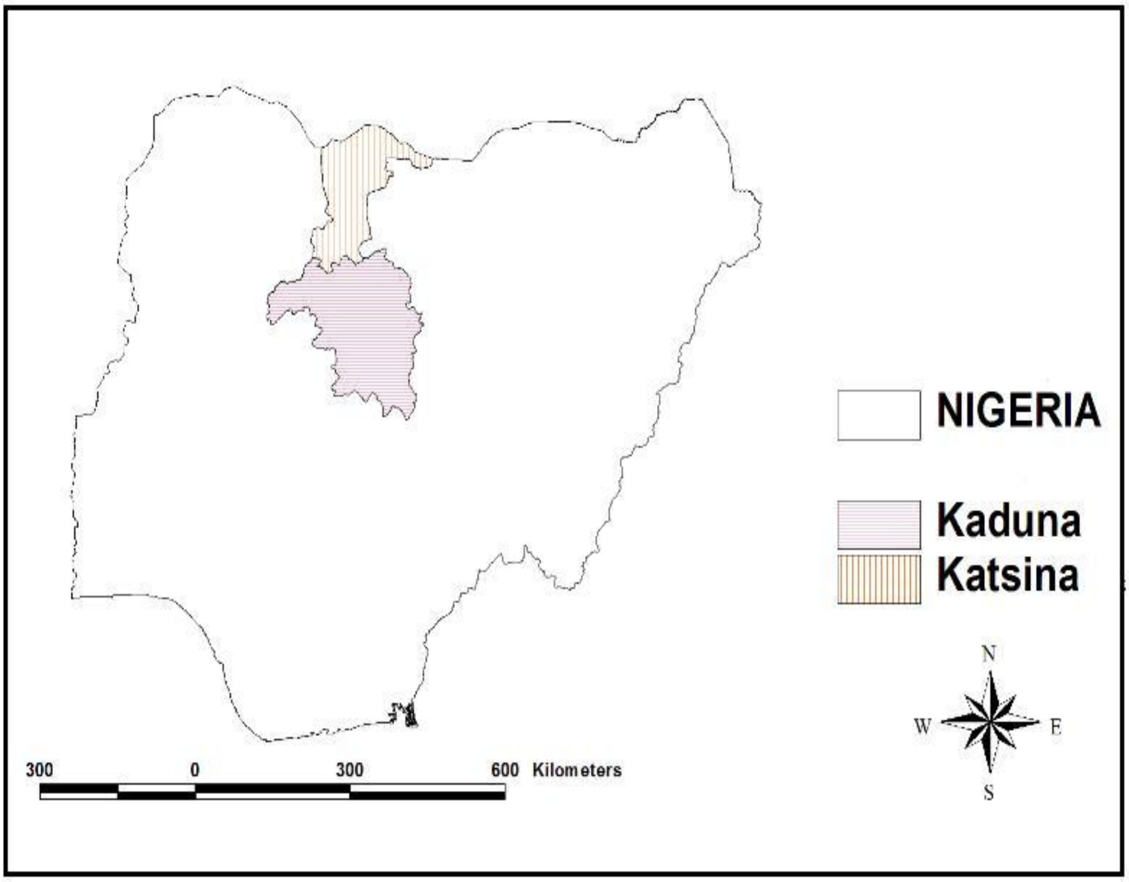
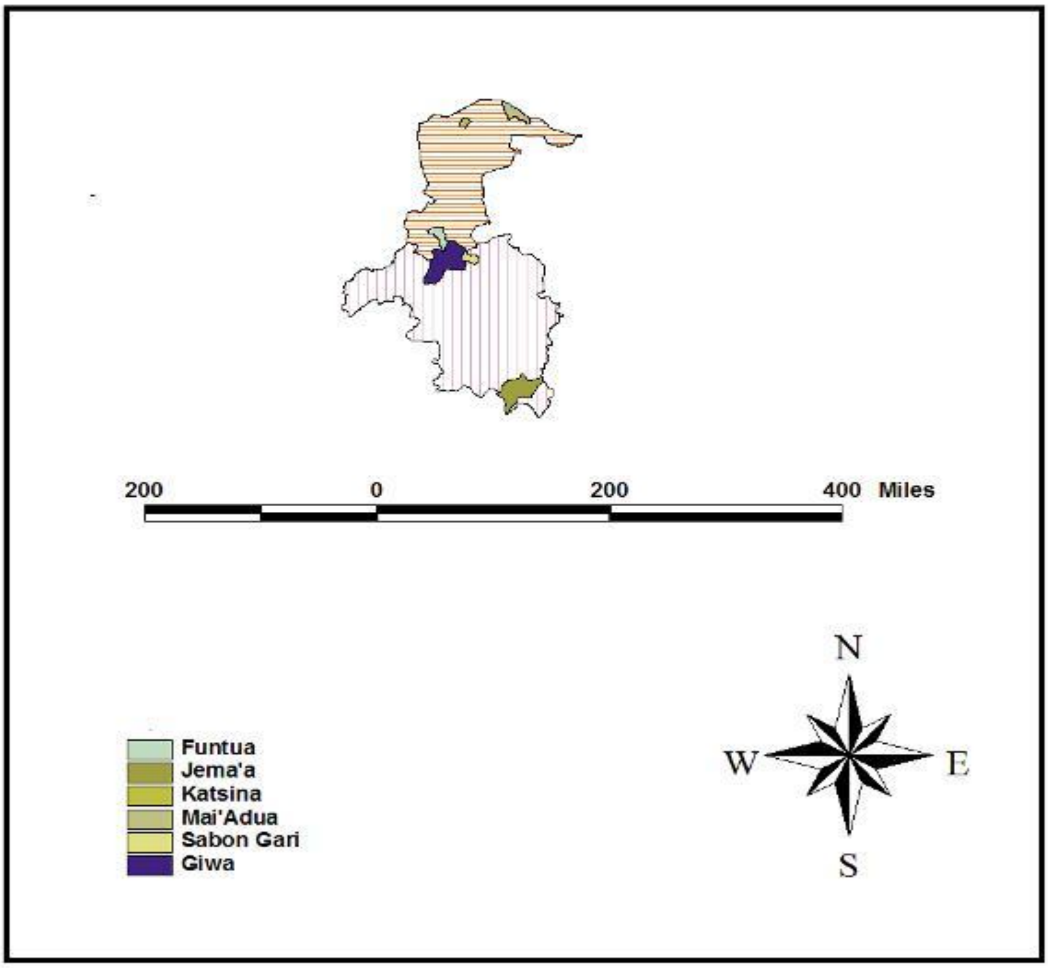


Figure 3: Showing the Map of Kaduna and Katsina State indicating the study areas.



CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Introduction

The presentation and discussion of the collected data is divided into sections: Section one consists of the trend in the variability of staple food prices in the region, the second section contains the presentation and discussion of the results on staple food prices volatility. We used trend analysis, coefficient of variation and ARCH/GARCH analysis so as to see whether it has effect on the consumption pattern of households in the study area. The data used for the analysis were collected on daily basis using market survey record sheet for a period of four years (2007-2011). However, ten commodities comprised of both agricultural and manufactured foodstuffs were selected in the urban markets while five agricultural food crops were selected in the rural markets. This is because; the rural markets were purely market for agricultural food crops. The second section which is on the effect of oil price shocks on the agricultural sector (1994-2010) was used. VAR estimation analysed the effect on both agricultural import and export.

4.2 Trend Analysis of the Variability in the Prices of Selected Foodstuff in the Markets Studied

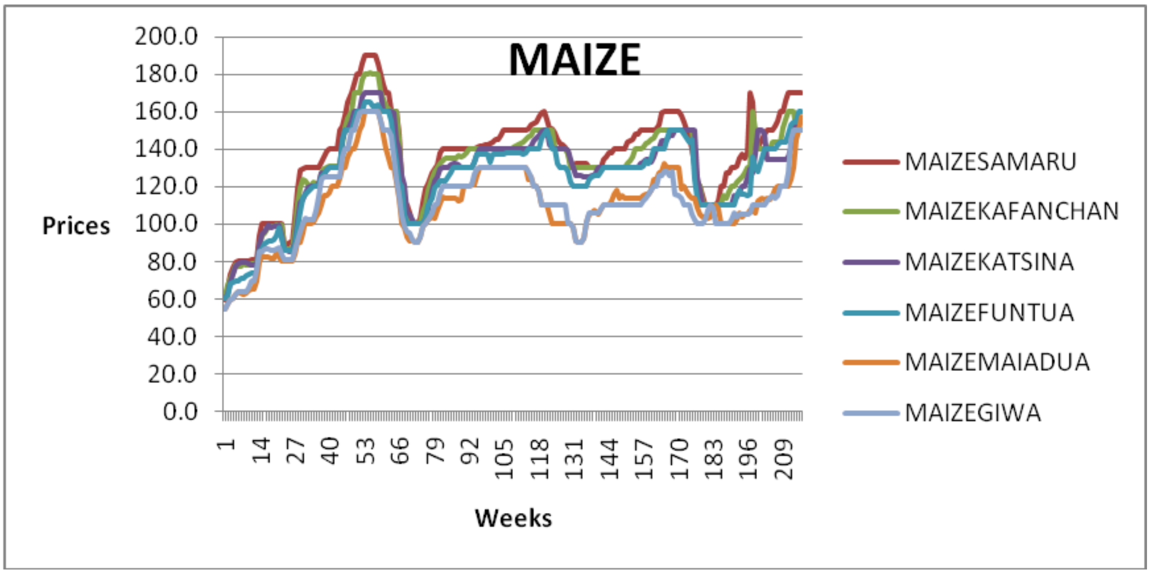
The trend analysis shows the pattern of price variability of both the agricultural and manufactured/industrial goods in the six selected markets of the region. One important thing to note is that their pattern of price variability is seasonal in nature. This is clearly shown from figures 4 to 13 which indicate three periods of price variability namely: the pre-harvest usually called the hunger period, the harvest and the post-harvest period. The following figures below depict the nature and patterns of the price variability of the selected foodstuff in the six markets studied over the specified period of four years.

From the various figures, it is evidence that period of higher prices of the staple is an indication of periods that the households became vulnerable to food insecurity and a period when there was a drastic reduction in their consumption pattern. This is because their purchasing power has reduced while periods of relatively low price is an indication of periods when households are food secured due to increase in their purchasing power.

MAIZE

Figure 4 presents the pattern of maize price variability in the North-West zone of Nigeria. It is cleared that there are three phases in the price movement of the commodity. The period of low price (harvest), period of relatively high price and the period of high price of the commodity (Scarcity or hunger). It was also observed from that maize price was highest in the Urban markets of the zone than in the rural markets. The reason for this high price was the seasonality in the demand of the commodity which is a function of the presence of staff and students. Between week 197 and week200, the price series of the crop skyrocket as a result of scarcity of maize occasioned by the April, 2011 post-election violence that occurred in the region. The lower price in the rural markets of the zone was attributed to the fact that the crop has been produced in the rural areas of the region and as such supply is always greater than demand. The harvest period of the crop makes it possible for the price to be very low because of excess supply as indicated by the following weeks: 20-25, 26-65, 125-140 and 165-185 while the post-harvest period makes the price to increase due to excess demand as can be seen from the following weeks: 26-50, 75-110, 150-170 and 180-216.

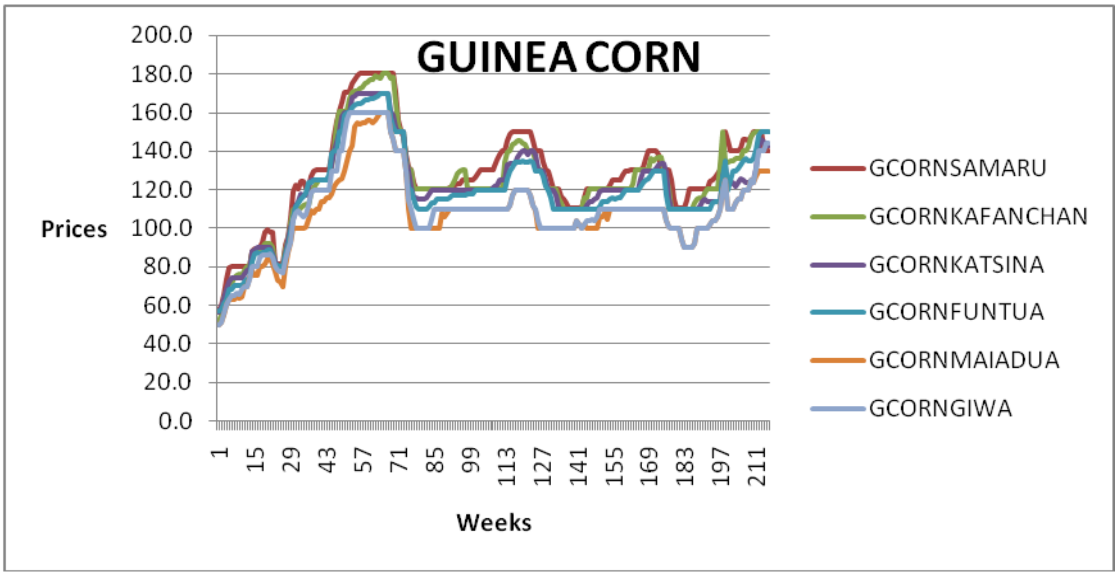
Figure 4: Trend in the Price of Maize



GUINEA CORN

The trend in the price of Guinea corn as shown by the figure 5 indicates that the price of guinea corn in the selected markets of the region varies overtime due to the seasonality of the crop. The price is always highest in the urban markets of the region while the price is lowest in the rural markets. This can be attributed to the fact that it is the rural markets that send price signal to the urban markets of the region. It is also noted that price is highest during the off-harvest (scarcity) and lowest during the harvest period. This is indicated in the figure by the upward movement of the price series. The highest price during the off-harvest is an indication that most households in the region would become vulnerable to food insecurity while the lowest price during harvest is an indication that most households become food secured as they can purchase as many goods as possible. It was also observed that the price of guinea corn skyrocket during the post-election period as indicated by the figure between week 197-200. This is possible because of the imposition of curfew which drastically reduced business activities in the region.

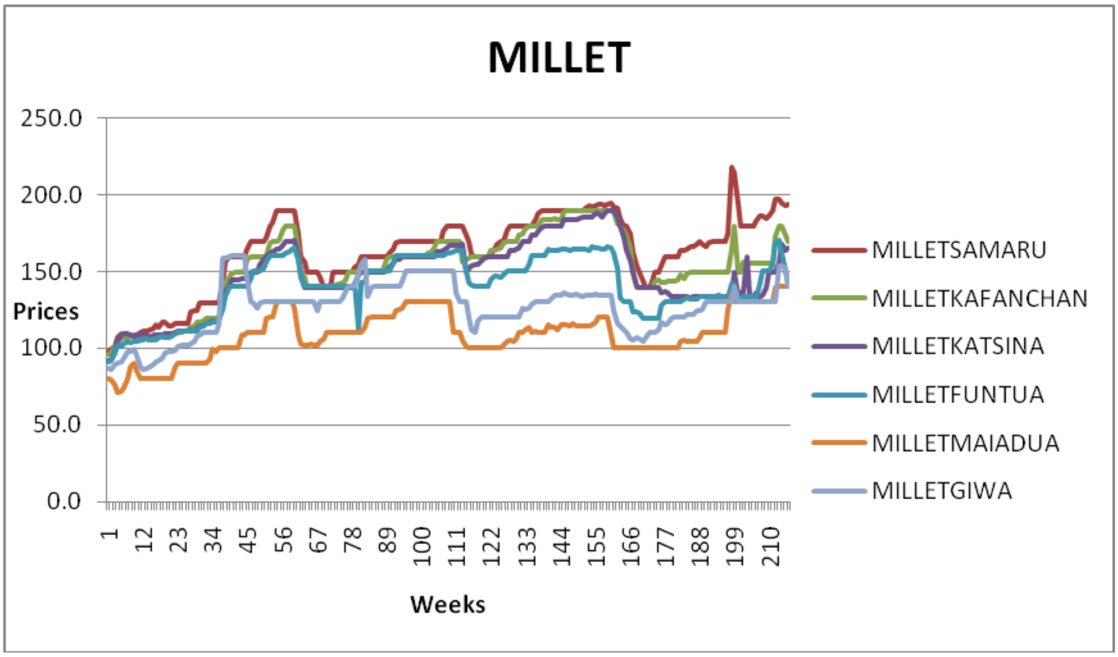
Figure 5: Trend in the Price of Guinea Corn



MILLET

The price of Millet in the North-West region of the country is variable as observed from the figure 6. This can be attributed to the fact that the crop has so many uses. The price is highest during the off-harvest and lowest during the harvest period. Also, the period of festivity makes the price of millet to be very high. The lowest price of Millet occurred in a market where it is close to where the product has been produced in abundance like Mai'adua. The post-election violence of 2011 sharply increased the price of Millet in the region as can be seen by the rise in price from N180 to N230 from week 197-200. The price of the commodity as can be observed from figure 6 is always high especially during fasting period as a result of excessive demand by consumers in the region. This is assumed to be the period when suppliers/marketers make high profit. Millet is one of the staple food that almost every household used in one way or the other and so changes in the price of the good greatly affected almost every household in the region.

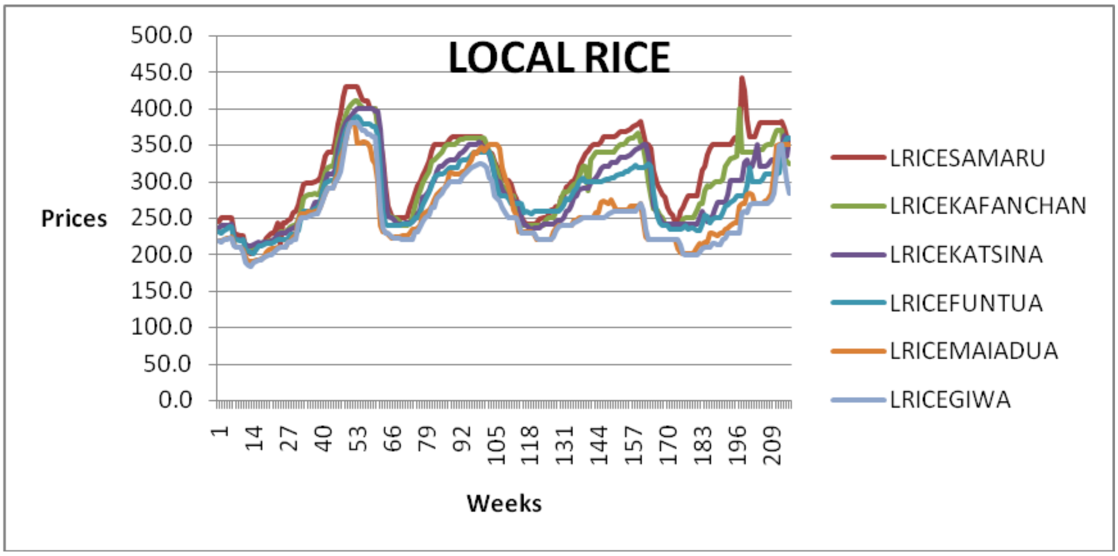
Figure 6: Trend in the Price of Millet



LOCAL RICE

Price of Local rice shows a trend pattern that the crop experienced two periods of extremely high price. The period of extremely high price which is occasioned by the 2008 World global economic meltdown in which the prices of grains including rice increased so fast as indicated by week 45-65. This increase caused riots in some countries of the World. The second phase of the increase in local rice price was the 2011 election violence. The lowest price as can be seen was during harvest period when the crop becomes so available. The price is lowest in area where the production of the crop is highest, like Giwa**.** The harvest period of the crop makes it possible for the price to be very low because of excess supply as indicated by the following weeks: 10-20, 60-75, 105-125 and 160-175 while the post-harvest period makes the price to increase due to excess demand as can be seen by following weeks: 25-50, 76-100, 130-155 and 180-216.

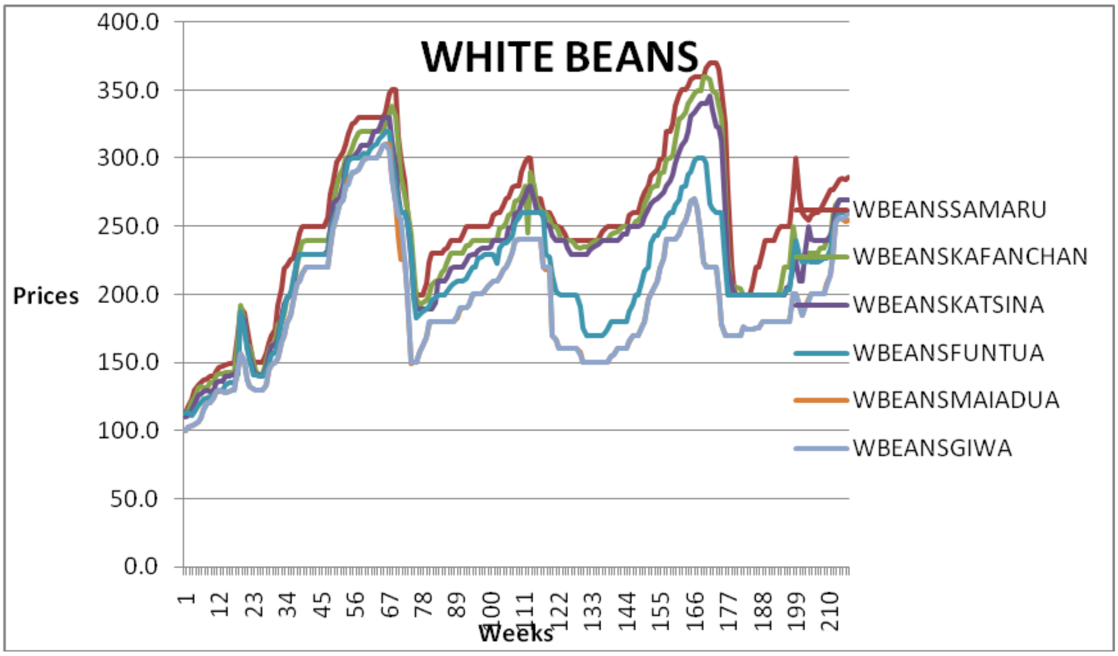
Figure 7: Trend in the Price of Local Rice



WHITE BEANS

The price of white beans also varies among the selected markets of the North-West region of Nigeria as can be seen from figure 8. White beans are considered as a daily food by most households in the region. The frequent variation in the demand for white beans makes its price to also vary overtime. The high price of the commodity as can be seen from the figure indicates that there are three periods in which the price of the good changes. These are the harvest, the post-harvest and the planting periods. The high price of white beans was during the post-harvest, planting period and when students and staff are on campus or salary is paid. This is noticed in the urban markets where the demand of white beans is always very high. The harvest period of the crop makes it possible for the price to be very low because of excess supply as indicated by the following weeks: 20-25, 75-85, 115-140 and 175-195 while the post-harvest period makes the price to increase due to excess demand as can be seen by following weeks: 1-20, 26-70, 95-120 and 180-216. The reason for the high demand that result to higher price is the fact that the markets were surrounded by Government parastatals, Institutions of higher learning etc and since the commodity is protenous it became necessary to purchase the good for those that can afford it because of its nutritious importance.

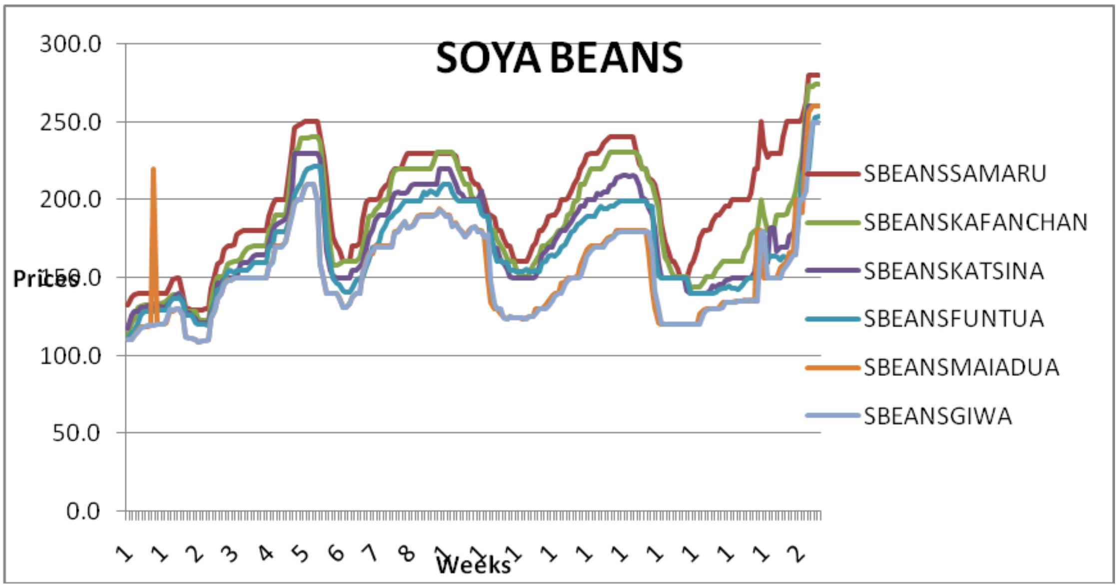
Figure 8: Trend in the Price of White Beans



SOYA BEANS

The variation in the price series of Soya beans as can be seen from figure 9 shows that the price of the commodity varies over a period of time in the markets of the region. There is the period of relative low price and period of high price. The price of Soya beans is always highest in the urban markets of the region while it is lowest in the rural markets. The reason for the high price in the urban markets was the high demand of Soya beans while the reason for the low price in the rural markets was the high supply of the crop. The harvest period of the crop makes it possible for the price to be very low because of excess supply as indicated by the following weeks: 15-30. 65-80, 115-130 and 165-180 while the post-harvest period makes the price to increase due to excess demand as can be seen by the following weeks: 30-50, 90-110, 130-160 and 190-216.

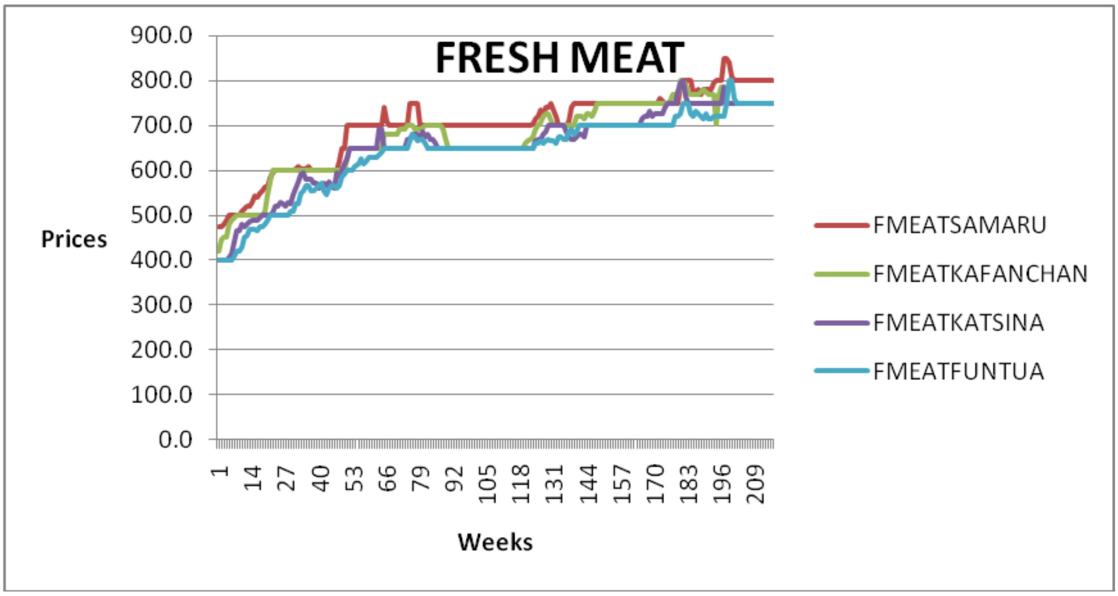
Figure 9: Trend in the Price of Soya Beans



FRESH MEAT

Figure 4.7 shows that the price of fresh meat varies over time, but the variation in the price of fresh meat is not occasioned by season of the year but as a result of festivity e.g Sallah and Christmas. The price of fresh meat keep on increasing as festivity is approaching. As seen, the figure only presents the urban markets for fresh meat while neglecting the rural markets. The justification for that was, it was only in the urban market that fresh meat was sold per kilogram and so the unit of measurement in the rural markets was not known. It can be observed that the price of fresh meat in the urban markets of the region keeps on increasing. The continuous increase in the price of the good was due to demand factor as those markets were surrounded by institutions of higher learning comprising of students and staff and other government parastatals/agencies in the region, especially in Kaduna state. This continous rise in the price of the commodity is an indication that most households are deprived of consuming fresh meat, and the resulting effect of this, is that most households in the study area become vulnerable to malnourishment.

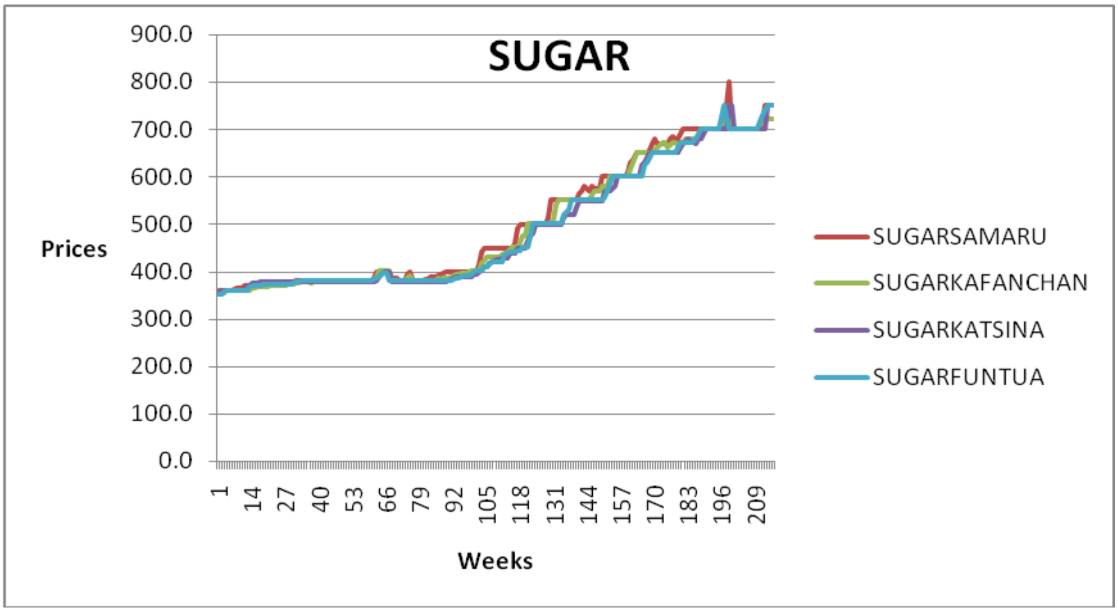
Figure 10: Trend in the Price of Fresh Meat



SUGAR

The trend in the price of sugar in the selected markets of the North-West region of Nigeria as can be seen in figure 11 which shows that the price of sugar increased over the specified period of time. The unit of measurement was not known in the rural markets and therefore, the market price per measure was not known. This makes the researcher to concentrate only on the urban markets of the region. From the figure, it can be seen that the price was relatively stable from week 1-65 but started increasing up to week 197-200 when the price overshoot because of the scarcity of the commodity caused by April, 2011 post-election violence in the region. The price of sugar kept on increasing throughout the period because it is not a seasonal product.

Figure 11: Trend in the Price of Sugar



PEAK MILK

Peak milk, unlike the prices of sugar, is an industrial product which price fluctuates/varies over time. It can be observed from figure 12 that the price of peak milk also kept on increasing in the markets in North West region. This is because of the nature of the product as it is consumed most often in the urban canters. Therefore, the price trend of peak milk kept on increasing.

Figure 12: Trend in the Price of Peak Milk

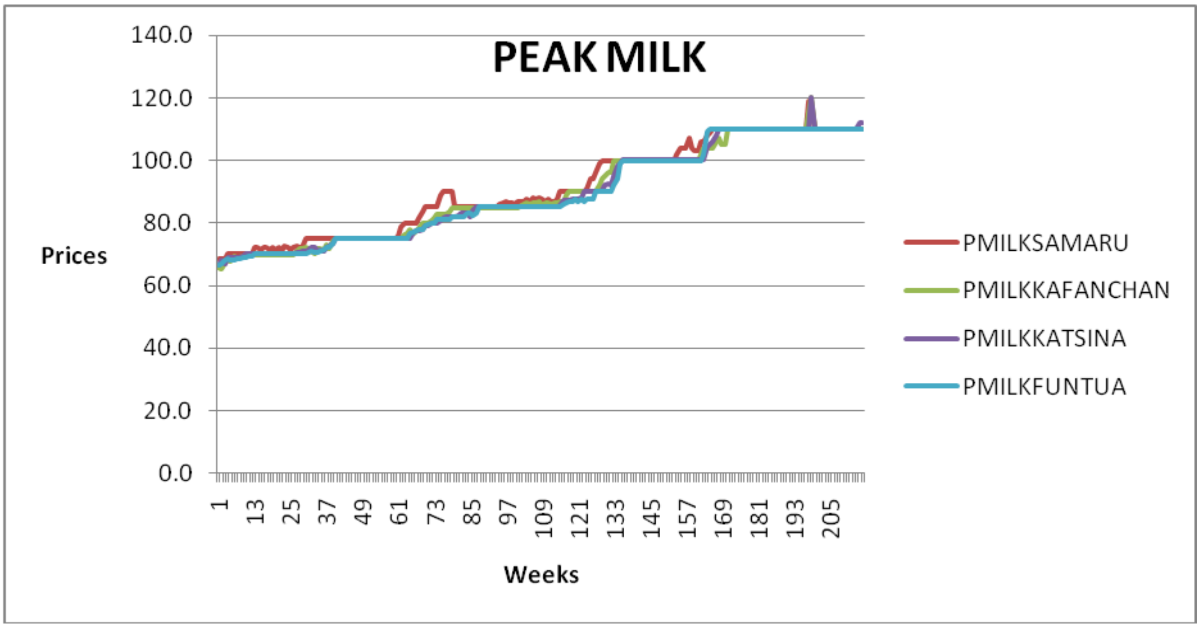


Figure 13: Trends in the Price of Flour

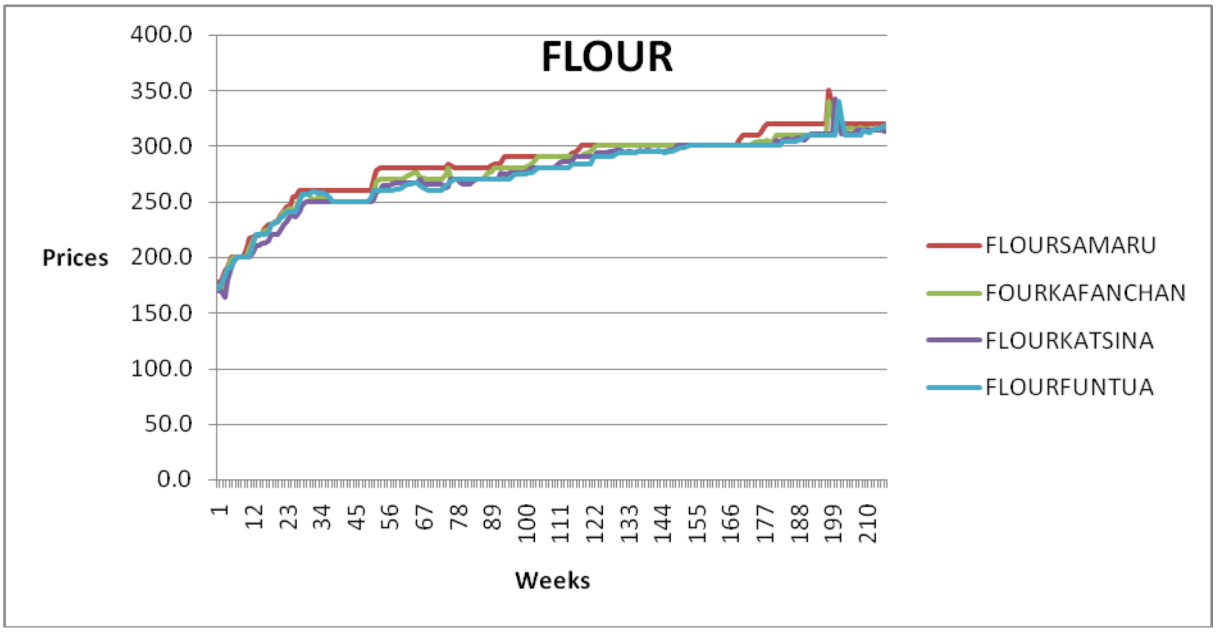


Figure 13 shows the pattern of price movement for flour in the four urban market. As can be observed, the price is relatively stable over time and then changes. Among the four markets, the highest price occurred in Samaru market of Kaduna State followed by Kafanchan, Katsina and Funtua. This highest price in Kaduna State is as a result of the presence of staff and students brought about by the establishment of many government parastatals and institutions of learning. This is possible because when staffs are paid salaries and students are on campus, the price tends to be higher unlike when students are on holiday and workers are not paid salaries, price tends to be moderately low.

4.2.1 Implication of Food Price Variability in the Region

Figures 4 to 13 show the patterns of price variability of both the agricultural and manufactured/industrial goods in the six selected markets of the North-West zone of Nigeria. One important thing to note in terms of agricultural foodstuff is that their pattern of price movement is seasonal in nature. This is clearly shown from the figures which indicate three periods of price variability namely: the pre-harvest usually called the hunger period, the harvest and the post-harvest period.

They also indicate that the prices of both agricultural and industrial/manufactured foodstuff are highest in urban markets than the rural markets of the zone due to excess demend. The frequent changes in the prices of especially agricultural products are the causes of seasonality in both the demand and supply. This is due to the fact that the urban markets are surrounded by institutions of learning and government parastatals, and once students are on session and staffs are paid their salaries, prices of such goods rise up and vice-versa. It is obvious that all the urban markets in the zone have the highest prices of agricultural goods. Changes in the prices of goods overtime is translated into changes in the prices of the same goods in another market. It is ovious that the rural markets for agricultural products serve as the leaders while the urban markets serve as the followers. A frequent change in the price of agricultural goods in the urban markets is caused by the changes in the prices of the same goods in the rural markets. It was observed that the skyrocketing prices especially of agricultural products during lean periods tended to be low during harvest periods when the goods are sufficiently available.

It was also observed that, the prices of both products (agricultural and industrial) increases sharply between weeks 196-216 due the post election violence of 18 April, 2011 in the region. The imposition of three days curfew by the State governments of the region slowed down businesses activities in the region, which brought about scarcity or non-availability of goods, thereby jacking up the prices by about 70%.

As can be seen from the figures, the pattern of price movement of industrial/manufactured products did not reflect seasonality like the price of agricultural products. The prices of the industrial goods fluctuated but not by as much as those of agricultural products. In most cases the price of industrial/manufactured food changed with change in government policy in one way or the other, unlike the prices of agricultural products.

The implication of these frequent changes in the prices of foodstuff specifically in North West region and Nigeria as a whole is that for producers it will serve as an incentive for producers to produce more of the products thereby increasing their income earning from the sale of goods produced but when the market experience a glut the price falls and it discourages them to produce and supply to the market. This reduces their earnings. On the other hand increases in the prices of goods destabilize household consumption pattern as it deprives them from purchasing sufficient goods because prices have risen. Therefore, households in the region become vulnerable to food insecury especially transitory food insecurity that is rooted in higher prices. This can lead to hunger and diseases.

Table 4.1: Stationarity Test Results

S/N	Commodity	Markets (series)	ADF Statistic	Critical Value (%)	Order of Integration
1.	Maize	Samaru (first difference)	-9.218311	-3.4320	1
		(level)	-2.234311	-3.4310	
		Giwa (first difference)	-6.893949	-3.4320	1
		(level)	-2.12241	-3.4310	
		Kafanchan (first difference)	-5.726308	-3.4322	1
		(level)	-3.01242	-3.4310	
		Katsina (first difference)	-5.180514	-3.4322	1
		(level)	-2.42335	-3.4310	
		Funtua (first difference)	-4.533183	-3.4322	1
		(level)	-2.28541	-3.4310	
		Mai'adua (first difference)	-3.563596	-3.4322	1
		(level)	-2.26076	-3.4310	
2.	Guinea corn	Samaru (first difference)	-5.146477	-3.4322	1
		(level)	-2.14563	-3.4310	
		Giwa (first difference)	-4.774206	-3.4322	1

		(level)	-2.42334	-3.4310	
		Kafanchan (first difference)	-5.117730	-3.4322	1
		(level)	-1.22451	-3.4310	
		Katsina (first difference)	-5.227796	-3.4322	1
		(level)	-2.60911	-3.4310	
		Funtua (first difference)	-4.585455	-3.4322	1
		(level)	-3.14121	-3.4310	
		Mai'adua (first difference)	-5.253505	-3.4322	1
		(level)	-3.04210	-3.4310	
3.	Millet	Samaru (first difference)	-6.256733	-3.4322	1
		(level)	-2.41121	-3.4310	
		Giwa (first difference)	-5.935571	-3.4322	1
		(level)	-2.85212	-3.4310	
		Kafanchan (first difference)	-5.699635	-3.4322	1
		(level)	-2.65341	-3.4310	
		Katsina (first difference)	-5.317204	-3.4322	1
		(level)	-2.48223	-3.4310	

		Funtua (first difference)	-5.679862	-3.4322	1
		(level)	-2.28694	-3.4310	
		Mai'adua (first difference)	-6.364575	-3.4322	1
		(level)	-1.67124	-3.4310	
4.	White Beans	Samaru (first difference)	-5.124307	-3.4322	1
		(level)	-2.58341	-3.4310	
		Giwa (first difference)	-4.473356	-3.4322	1
		(level)	-2.22561	-3.4310	
		Kafanchan (first difference)	-4.797558	-3.4322	1
		(level)	-1.85243	-3.4310	
		Katsina (first difference)	-4.486706	-3.4322	1
		(level)	-3.12210	-3.4310	
		Funtua (first difference)	-4.236763	-3.4322	1
		(level)	-2.63120	-3.4310	
		Mai'adua (first difference)	-4.427409	-3.4322	1
		(level)	-2.06142	-3.4310	

5.	Soya bean	Samaru (first difference)	-4.573056	-3.4322	1
		(level)	-1.73212	-3.4310	
		Giwa (first difference)	-5.271255	-3.4322	1
		(level)	-2.22413	-3.4310	
		Kafanchan (first difference)	-4.193399	-3.4322	1
		(level)	-2.95320	-3.4310	
		Katsina (first difference)	-4.744740	-3.4322	1
		(level)	-1.49253	-3.4310	
		Funtua (first difference)	-4.660521	-3.4322	1
		(level)	-2.62304	-3.4310	
		Mai'adua (first difference)	-5.736682	-3.4322	1
		(level)	-3.01245	-3.4310	
6.	Local rice	Samaru (first difference)	-4.80607	-3.4322	1
		(level)	-2.52932	-3.4310	
		Giwa (first difference)	-4.944675	-3.4322	1
		(level)	-3.02451	-3.4310	
		Kafanchan (first difference)	-4.205851	-3.4322	1

		(level)	-2.33204	-3.4310	
		Katsina (first difference)	-4.051398	-3.4322	1
		(level)	-2.75310	-3.4310	
		Funtua (first difference)	-4.907497	-3.4322	1
		(level)	-2.46230	-3.4310	
		Mai'adua (first difference)	-4.859199	-3.4322	1
		(level)	-3.14221	-3.4310	
7.	Fresh meat	Samaru (first difference)	-7.642392	-3.4322	1
		(level)	-2.42312	-3.4130	
		Kafanchan (first difference)	-6.989027	-3.4322	1
		(level)	-2.38532	-3.4130	
		Katsina (first difference)	-3.702806	-3.4321	1
		(level)	-1.83474	-3.4130	
		Funtua (first difference)	-6.862424	-3.4322	1
		(level)	-2.52641	-3.4310	

8.	Peak milk	Samaru (first difference)	-3.24851	-3.4101	
		(level)	-7.800875	-3.4322	0
		Kafanchan (first difference)	-2.62024	-3.4101	
		(level)	-6.647037	-3.4322	0
		Katsina (first difference)	-2.28402	-3.4101	
		(level)	-6.080365	-3.4322	0
		Funtua (first difference)	-2.23416	-3.4101	
		(level)	-6.115084	-3.4322	0
9.	Sugar	Samaru (first difference)	-2.21132	-3.4101	0
		(level)	-7.985542	-3.4322	
		Kafanchan (first difference)	-3.04242	-3.4101	0
		(level)	-7.450680	-3.4322	
		Katsina (first difference)	-2.24442	-3.4101	0
		(level)	-6.821920	-3.4322	
		Funtua (first difference)	-2.16678	-3.4101	0
		(level)	-6.967172	-3.4322	

10.	Flour	Samaru (first difference)	-2.79820	-3.4101	0
		(level)	-4.04881	-3.4322	
		Kafanchan (first difference)	-2.39234	-3.4101	0
		(level)	-4.298131	-3.4321	
		Katsina (first difference)	-2.32012	-3.4101	0
		(level)	-4.720401	-3.4321	
		Funtua (first difference)	-2.62111	-3.4101	0
		(level)	-5.059075	-3.4321	

Source: Computer Print-out, 2012

Table 4.1 shows the result of stationarity test using ADF method which was estimated from equation 3.19. The result indicates that none of the series is stationary. Consequently, the levels of the series will generate spurious results if used for estimation. The table also shows that the order of integration for agricultural products is unity meaning that they are non-stationary. The justification for the non-statinarity of especially agricultural products is that agricultural production is seasonal. Because of seasonality in agricultural production, prices can never be stable as there is period of harvest and off-harvest; while that of the industrial products shows that the order of integration is zero meaning that the series are stationary at levels. This is an indication that the prices of the industrial/manufactured foodstuff are relatively stable because they are not affected by seasonality unlike the prices of the agricultural products in all the markets studied.

The implication of this is that, since the price of industrial products in the region is relatively stable, the consumption pattern of such products will also be stable because consumers/household in the region can be able to purchase such products over a specified period of time. In terms of the non-stability of the agricultural product prices, the consumption pattern of the people in the region will also be unstable since if the price keep on rising especially during period of scarcity of the goods and consumers will be deprived of such goods which eventually lead to food insecurity because of limited income by most of the households in the region. It is therefore found that the key instrument that causes food insecurity is price variability.

4.3 ARCH/GARCH Estimation Results

The result of the ARCH/GARCH estimation from equation 3.10-3.14 which is shown by Table 4.2 indicates that the coefficients of the price changes of the mean equation are significant at 5% level. As expected, the current price changes of virtually all the agricultural foodstuff is positively related to the previous price of the goods while the current price of the industrial/manufactured products is not related by previous prices but factors such as government policy.

The estimation result of the conditional variance equation for the price show that prices of both agricultural and industrial/manufactured foodstuff in the markets studied are volatile because, the coefficient of the ARCH component is significant at 5%. Also, the summation of the coefficient of the ARCH and GARCH component for most of the foodstuff (agricultural and industrial manufactured) is close to 1. We therefore observed the presence of volatility persistence.

The result of estimation of the mean equation of food prices shows that there is significant relationship between current prices and previous prices at 5%. This can be seen for example by the coefficient of most of the foodstuff. The ARCH component of the conditional variance equation shows that there is evidence of volatility at 5% level of significant. Also, the summation of the coefficient of ARCH and GARCH component is close to one for the entire foodstuff in the markets studied. There is therefore an indication of the presence of volatility persistence in the markets.

Table 4.2: Estimation Result of ARCH/GARCH

S/N	Commodity	Market	Arch (1)	Garch (1)	R-Squared	Adjusted R-Squared	DW-Statistics
1.	Maize	Samaru	0.793279	0.155466	0.12	0.09	2.252884
		Kafanchan	0.344774	0.356476	0.51	0.49	1.980994
		Giwa	0.746534	-0.045920	0.27	0.25	2.073332
		Katsina	0.507975	0.111788	0.32	0.30	1.986285
		Funtua	0.103344	-0.149311	0.25	0.23	1.944349
		Maiadua	-0.022349	0.923386	0.26	0.23	2.093767
2.	Millet	Samaru	1.326746	0.000974	0.10	0.07	2.003678
		Kafanchan	0.401497	-0.127171	0.40	0.38	2.463286
		Giwa	1.331371	-0.005902	0.06	0.03	1.742619
		Katsina	0.548604	0.497145	-0.08	-0.11	2.807789
		Funtua	1.697607	-0.053250	-0.09	-0.12	2.680190
		Maiadua	-0.042634	1.019173	0.07	0.05	1.919377

3.	Guinea Corn	Samaru	0.091254	0.764267	0.40	0.38	2.071781
		Kafanchan	0.860331	-0.034870	0.37	0.36	2.084321
		Giwa	0.494083	0.257606	0.35	0.33	2.071781
		Katsina	0.507670	0.296204	0.65	0.63	2.258347
		Funtua	0.118139	0.638293	0.13	0.10	2.102192
		Maiadua	0.384520	0.321232	0.18	0.16	2.182895
4.	Local Rice	Samaru	0.328662	-0.143746	0.43	0.42	2.220011
		Kafanchan	0.578030	0.014823	-0.04	-0.07	2.564399
		Giwa	0.497443	0.178649	0.48	0.47	1.794328
		Katsina	0.820866	0.130225	0.33	0.31	1.979357
		Funtua	0.788576	0.203660	0.44	0.42	1.729605
		Maiadua	1.970646	-0.016236	0.19	0.16	2.347163
5.	White Beans	Samaru	0.635356	-0.072356	0.38	0.36	1.499745
		Kafanchan	0.821006	0.151852	0.58	0.56	2.265465
		Giwa	0.633108	0.524944	0.17	0.15	1.811543

		Katsina	0.682104	0.203893	0.65	0.64	1.540557
		Funtua	0.776315	0.005904	0.37	0.35	2.331273
		Maiadua	0.843206	0.100944	0.14	0.12	2.044437
6.	Soya Beans	Samaru	0.261982	0.512541	0.22	0.19	2.464090
		Kafanchan	0.596508	0.176052	0.19	0.16	2.366803
		Giwa	1.594436	0.299987	0.32	0.30	1.826038
		Katsina	0.971721	0.044395	0.37	0.35	2.235502
		Funtua	0.435025	0.080774	0.39	0.37	2.424064
		Maiadua	0.077536	0.822652	-0.13	-0.16	2.868600
7.	Fresh Meat	Samaru	0.350660	0.676205	-0.01	-0.04	2.311883
		Kafanchan	0.334316	0.316931	0.99	0.99	1.972029
		Katsina	0.326211	0.312102	0.99	0.99	1.986710
		Funtua	0.299064	0.696715	0.04	0.02	2.021381
8.	Peak Milk	Samaru	0.155818	0.438896	0.02	-0.01	2.083793
		Kafanchan	0.211266	-0.053583	0.10	0.08	2.6698118

		Katsina	0.440871	-0.116257	0.25	0.23	2.200625
		Funtua	1.006988	-0.002854	0.08	0.06	1.601197
9.	Sugar	Samaru	0.884312	0.018395	0.35	0.34	1.954414
		Kafanchan	1.679084	-0.009593	-0.14	-0.16	2.103493
		Katsina	0.827557	-0.060335	0.33	0.32	1.826959
		Funtua	0.856494	0.041111	-0.07	-0.10	1.682830
10.	Flour	Samaru	0.156096	0.080638	0.99	0.99	2.059745
		Kafanchan	2.998878	0.164978	0.99	0.99	1.934646
		Katsina	2.271803	0.026372	0.99	0.99	1.593631
		Funtua	0.861554	-0.035955	0.99	0.99	1.138900

Source: Computer Print-out, 2012

4.4 Coefficient of Variation

To test the hypothesis of the research work by estimating equation 3.15, it means looking at the analysis of variance table, comparing the mean and the standard deviation of each of the commodity across the markets studied. This is because in the analysis of coefficient of variation both the mean and the standard deviation are important for rejecting or accepting the hypothesis. In this analysis, the condition to accept or reject either HO or H1 at 5 percent level of significance is as follows: if $Fc < F(n-1, n-2)$ = we reject H1 and accept Ho and if $F(n-1, n-2) < Fc$ = we reject Ho and accept H1.

4.5 Coefficient of Variation of the Selected Foodstuff in the Markets

Table 4.3: Maize Coefficient of Variation

S/N	Market	Mean	STDEV	CV	Variance
1	Samaru	136.9	26.0	19.0	674.5
2	Kafanc	131.3	24.0	18.3	576.9
3	Giwa	112.3	21.7	19.3	471.4
4	Katsina	127.8	22.6	17.7	511.6
5	Funtua	125.4	22.9	18.3	524.7
6	Mai'ad	111.0	21.3	19.2	452.5

Source: Computer Print-out, 2012

Table 4.4: Guinea Corn Coefficient of Variation

S/N	Market	Mean	STDEV	CV	Variance
1	Samaru	128.3	25.2	19.7	635.7
2	Kafanc	124.5	25.1	20.2	631.2
3	Giwa	110.4	22.4	20.3	502.1
4	Katsina	121.4	22.9	18.9	525.2
5	Funtua	119.7	23.4	19.5	546.7
6	Mai'ad	108.0	21.3	19.7	452.4

Source: Computer Print-out, 2012

Table 4.5: Millet Coefficient of Variation

S/N	Market	Mean	STDEV	CV	Variance
1	Samaru	162.6	25.6	15.6	655.9
2	Kafanc	153.0	24.0	15.7	575.3
3	Giwa	126.2	17.4	13.8	303.3
4	Katsina	147.7	23.0	15.6	529.0
5	Funtua	140.5	19.2	13.7	369.7
6	Mai'ad	108.8	15.4	14.1	236.3

Source: Computer Print-out, 2012

Table 4.6: Local Rice Coefficient of Variation

S/N	Market	Mean	STDEV	CV	Variance
1	Samaru	315.3	58.5	18.6	3425.6
2	Kafanc	299.7	54.2	18.1	2935.2
3	Giwa	253.7	45.0	17.7	2021.7
4	Katsina	287.9	50.9	17.7	2595.2
5	Funtua	281.2	45.2	16.1	2044.1
6	Mai'ad	259.6	47.6	18.3	2267.1

Source: Computer Print-out, 2012

Table 4.7: White Beans Coefficient of Variation

S/N	Market	Mean	STDEV	CV	Variance
1	Samaru	253.4	58.4	23.0	3405.0
2	Kafanc	240.3	56.1	23.4	3151.8
3	Giwa	196.4	48.2	24.5	2320.1
4	Katsina	233.8	53.4	22.8	2849.7
5	Funtua	218.0	48.8	22.4	2383.2
6	Mai'ad	196.1	48.0	24.5	2303.9

Source: Computer Print-out, 2012

Table 4.8: Soya Beans Coefficient of Variation

S/N	Market	Mean	STDEV	CV	Variance
1	Samaru	197.2	36.5	18.5	1331.3
2	Kafanc	183.6	35.8	19.5	1280.7
3	Giwa	153.4	29.5	19.2	870.1
4	Katsina	174.4	32.4	18.6	1052.3
5	Funtua	169.1	29.1	17.2	849.7
6	Mai'ad	154.3	30.9	20.0	957.3

Source: Computer Print-out, 2012

Table 4.9: Fresh Meat Coefficient of Variation

S/N	Market	Mean	STDEV	CV	Variance
1	Samaru	699.0	82.5	11.8	6810.2
2	Kafanc	673.9	81.5	12.1	6644.8
3	Katsina	653.0	87.4	13.4	7631.9
4	Funtua	640	89.8	14.0	8060.8

Source: Computer Print-out, 2012

Table 4.10: Peak Milk Coefficient of Variation

S/N	Market	Mean	STDEV	CV	Variance
1	Samaru	91.0	14.6	16.0	212.2
2	Kafanc	89.7	14.8	16.5	218.7
3	Katsina	89.3	15.0	16.7	223.6
4	Funtua	89.1	15.0	16.9	225.4

Source: Computer Print-out, 2012

Table 4.11: Sugar Coefficient of Variation

S/N	Market	Mean	STDEV	CV	Variance
1	Samaru	502.1	133.0	26.5	17698.0
2	Kafanc	494.7	130.8	26.4	17108.3
3	Katsina	490.3	128.0	26.1	16386.0
4	Funtua	490.2	130.1	26.5	16923.0

Source: Computer Print-out, 2012

Table 4.12: Flour Coefficient of Variation

S/N	Market	Mean	STDEV	CV	Variance
1	Samaru	285.0	31.6	11.1	998.5
2	Kafanc	279.5	31.6	11.3	999.0
3	Katsina	275.5	32.8	11.9	1073.2
4	Funtua	275.6	30.8	11.2	949.8

Source: Computer Print-out, 2012

The above tables depict the results of the coefficient of variation estimation for the six markets studied with mean price, standard deviation and the variance. We also observed that even though in all the markets studied the coefficient of variation were two digit numbers indicating that variability is high, but the urban markets have higher prices than the rural markets. It is observed from the table that the prices in Samaru are the highest followed by Kafanchan and the other urban markets for all the agricultural commodities while the prices in Giwa and Mai'adua are the lowest. This shows that the four markets where prices are highest are the urban markets which are characterized by excessive demand of the commodities because they have to be transported from the production areas. Those markets where prices are lowest are the rural markets because they are characterized by excessive supply as they are close to the production areas, and therefore goods tend to be relatively cheap compared to the goods in the urban markets. This is an indication that locations with higher food prices can experience food shortages or food insecurity especially by fixed income earners households.

The overall result of the coefficient of variation for all the commodities indicates that markets in Kaduna State had higher prices variation than markets in Katsina State. This could be attributed to the demand factor caused by the establishment of many institutions of learning and so many government parastatals which the rural locations are lacking. This increased demand of the commodities especially in the urban areas can invariably have a multiplier effect on the communities surrounded by these markets.

4.6 The VAR Estimation Result

In estimating the VAR model, the preliminary test and data transformation are presented. For the export model, VAR in first difference was used because the I (1) variables included in the VAR were not cointegrated. In the import model, VEC was used because the variables were all I (1) and cointegrated.

4.6.1 Test of Stationarity

Results for the tests of stationarit was estimated from equation 3.16 using the Augmented Dickey Fuller (ADF) are presented in Table 4.24.

The ADF statistics in table 4.24 suggest that all the variables are integrated of order one, where as the first-differenced are integrated of order zero. This is because the critical values at 5% level are greater than their corresponding ADF statistics for all the variables at level. However, at first difference of all the variables, the ADF statistics are greater than the respective critical values. This suggests that all the variables are I(1). This implies that the variables are cointegrated.

Table 4.13: Results of Unit root test for stationarity and order of integration

	LEVEL		First Difference		
Variance	ADF Statistics	Critical value	ADF statistics	Critical value	Comment
AGE (Log)	0.1629	-1.9504	-6.6841	-3.5443	I (1)
AGI(Log)	1.4501	-1.9504	-11.3132	-3.5443	I (1)
COP (Log)	0.2810	-1.9510	-5.7477	-3.5485	I (1)
EXCH (Log)	1.6440	-1.9504	-5.2309	-3.5443	I (1)
ROP (Log)	1.1725	-1.9504	-5.8519	-3.5443	I (1)
MS1(Log)	-0.4991	-2.9458	-5.1842	-3.5443	I (1)
MS2 (Log)	-0.0258	-2.9458	-5.1842	-3.5443	I (1)
RGDP (Log)	-2.1576	-3.6268	-6.224	-3.5443	I (1)

4.6.2 Cointegration Test

We tested for cointegration among the series for the two models using the Johansen cointegration approach which tests for the cointegration rank for a VAR process, estimates the TRACE, maximum eigenvalues and the eigen vectors. Two separate models were tested i.e. the model for agricultural import and that of agricultural export.

Table 4.14 below shows the results of cointegration test (Trace test) for the model of agricultural import estimated from equation 3.17 (Series: LROP, LCOP, LEXCH, LMS, LIMPORT).

Table 4.14: Cointegration Test for Agricultural Import

Ho	Eigen Value	Trace test	5% Critical Value
r=0	0.708201	114.3200	95.75
r=1	0.616931	71.21082	69.82
r=2	0.424089	37.62690	47.86
r=3	0.316731	18.31385	29.80
r=4	0.119295	4.983498	15.50
r=5	0.015235	0.537340	3.84

From the result of the cointegration test for the model of agricultural import, the trace test indicates two cointegrating equation(s) at both 5% level. The result therefore suggests the existence of long-run relationship between the agricultural import and the variables included i.e Real Oil Price (ROP), Crude Oil Production (COP), Real Exchange Rate (EXCH), Money Supply (MS) and Agricultural Import (AGM) Nigeria.

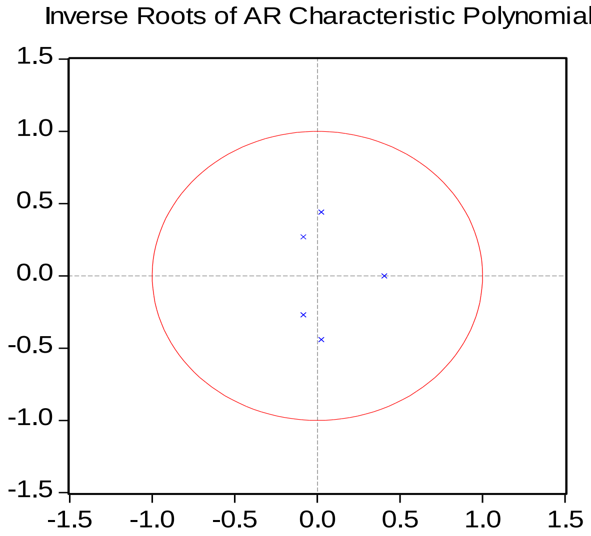
Given that a cointegrating relationship is found in the Agricultural Import response model but not in the Agricultural Export response model, we proceed to estimate a VEC for the Import model but a VAR in first difference for the Export model in the following sections.

4.6.3 Agricultural Import Model

To proceed with VEC, we first determine the optimal lag structure using the AIC, SIC and HQ. The optimal lag was found to be one for the Import.

We also employed stability test in order to test the robustness of the models. The inverse roots of characteristic polynomial are all within the unit circles as shown in figure 14, suggesting that the VAR model has satisfied the stability condition.

Figure 14: Stability condition for the model of Agricultural Import



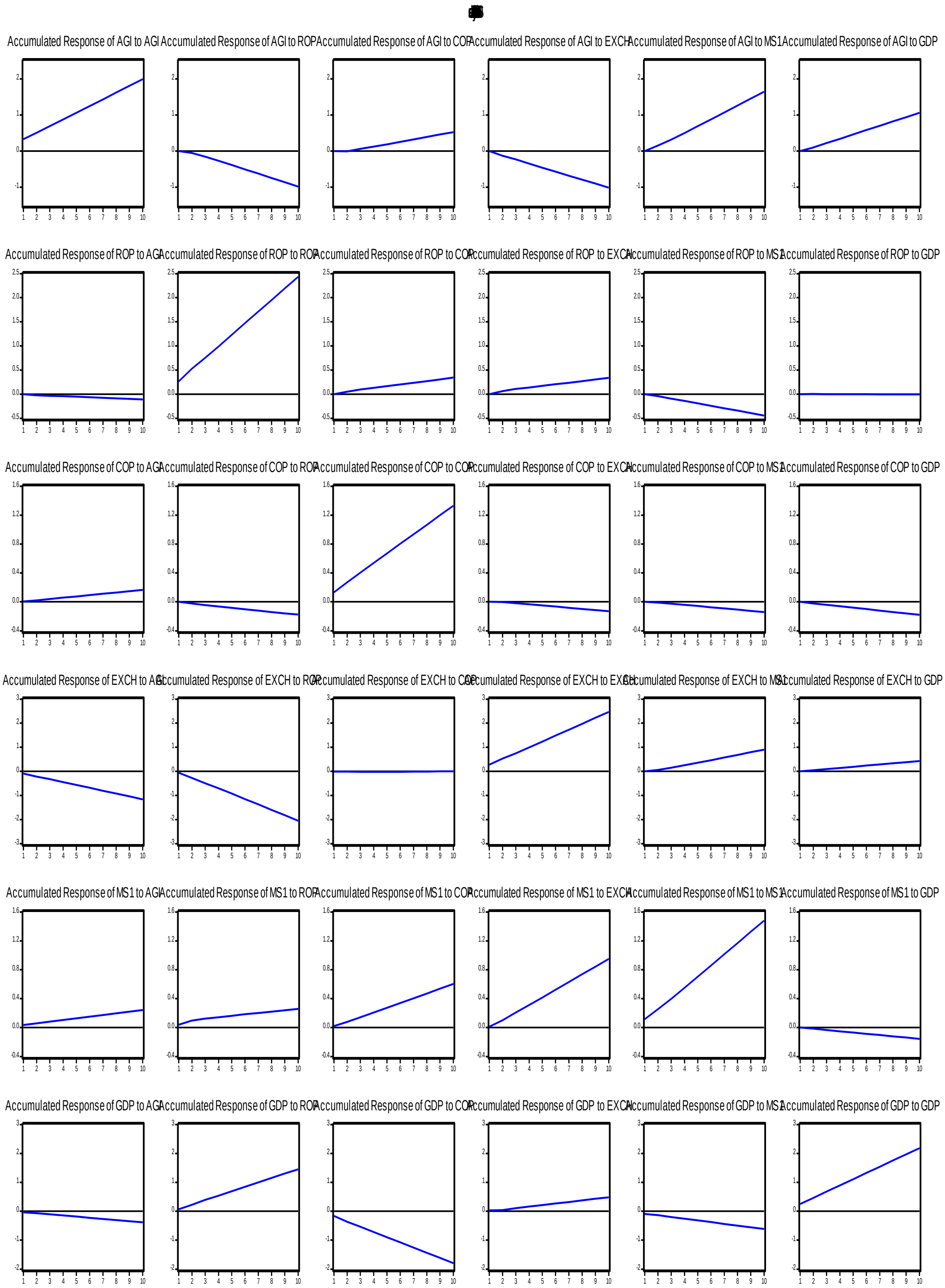
The VEC results as seen in appendix 4 show that the explanatory power of the agricultural import is high across the specifications. The R^2 and even the adjusted R^2 in all the results are satisfactory. The first part of the table shows the long run relation for the long run equation, while the lower part shows the short run dynamics. From the results in appendix 4 also, crude oil production has positive effect on agricultural import. Exchange rate is negatively related to agricultural import. The result also shows the positive relationship between money supply (MS) and AGI while it was expected that there would be a positive relationship between real oil price (ROP) and AGI but the result of the model showed an inverse relationship.

The results obtained evidently show that all the variables i.e. COP, EXCH, RGDP and MS conformed with the theoretical expectation while only ROP does not conformed with the expectation.

4.6.4 Impulse response function for Agricultural Import

The figure below show the impulse response functions for agricultural import. In impulse response analysis, ordering of the variables is important and the analysis is subject to change under different ordering. The Cholesky factorization allows us to make decision on which variable behaves more exogenously, then that same variable comes first. Therefore, the Cholesky factorization was used for the impulse response function on the basis of a priori expectation. We then applied the following ordering on the basis of economic theory to the Cholesky factorization. The Volume of agricultural import was assumed to be exogenous and is a function of real oil price (ROP), crude oil production (COP), exchange rate (EXCH), money supply (alternatively M1) and real gross domestic product. We expected COP, MS1 ROP and GDP to have positive effect on the volume of agricultural import while EXCH was expected to have negative effect on the volume of agricultural import. The impulse response function for agricultural import shows that a shock in real oil price has a negative impact on Agricultural import. Thus from the analysis of impulse responses of oil price innovation to real exchange rate, it is clear that while the economy's real GDP grows as oil price hike, the country's real exchange rate depreciates to consolidate the gains from oil increase. The response of agricultural import to oil production shows a very small negative but insignificant effect. This may be due to rise in the cost of agricultural input that dampens the output growth which make government to resort to importation.

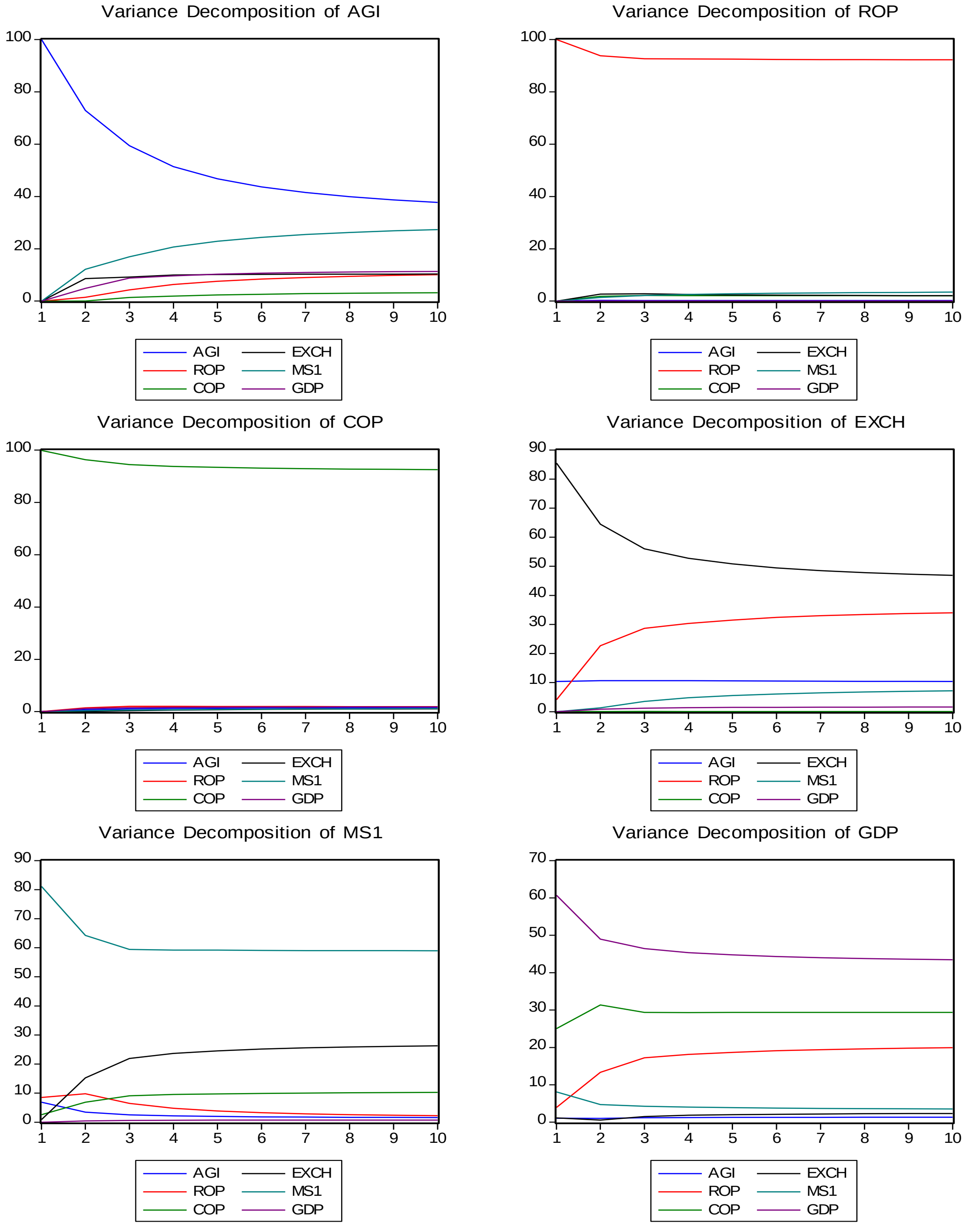
Figure 15: Impulse Response Function for Agricultural Import



4.6.5 Variance Decomposition of Agricultural Import

The forecast error variance decomposition results are presented in figure 3. Own shocks in respect of agricultural import ranged between 38 percent and 100 percent over the ten year period. From this result, own shocks constitute the greatest source of variations in the volume of agricultural import while variation in oil price and oil production are not much felt as they affected the volume of agricultural import by a small margin of just 3.2 percent and 10 percent respectively

Figure 16: Variance Decomposition of Agricultural Import



From the figure 16 above, they show the effect of oil price shock on the volume of import. This indicates that increase in oil price leads to huge importation because it retards local production which forces the country to import as the local production could not meet the local demand.

4.6.6 Agricultural Export Model

Table 4.15 below shows the results of co integration test (trace test) for the model of agricultural export from equation 3.18 (Series: LROP, LMS, LEXCH, L COP, LEXPORT).

Table 4.15: Cointegration Test for Agricultural Eport

Ho	Eigen Value	Trace test	5% Critical Value
r=0	0.464317	57.51524	69.82
r=1	0.407525	35.66781	47.86
r=2	0.262751	17.34721	29.80
r=3	0.165581	6.678184	15.50
r=4	0.009738	0.342484	3.84

From the result of the cointegration test for the model of agricultural export, the trace test indicates no cointegrating equation(s) at both 5% level. The result, therefore, indicates that all the series in the mode does not have long run relationship.

Given that a cointegrating relationship is found in the Agricultural Import response model but not in the Agricultural Export response model, we proceed to estimate a VEC for the Import model but a VAR in first difference for the Export model in the following section.

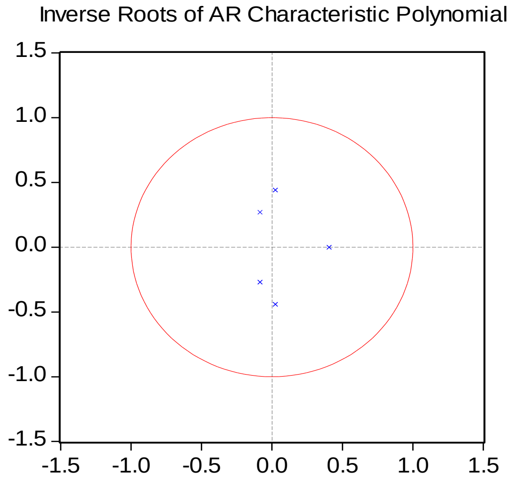
Optimal Lag Structure

To proceed with VAR, we first determine the optimal lag structure by testing the Akaike Information Criterian(AIC), Schwarz Information Criterion (SIC), Hannan Quin Information Criterion (HQ) and Final Prediction Error (FPE). The LR indicate lag length of one while the FPE, AIC, SIC and HQ shows lag length of five.The optimal lag was found to be one for the Import.

Stability Test for Agricultural Export

To ensure the reliability of the coefficients of the Normalized cointegration model for the long-run and Vector Error Correction model for the short-run, we therefore employ stability test in order to test the robustness of the models. The inverse roots of characteristic polynomials are all within the unit circles as shown in figure 17 suggesting that the VAR model has satisfied the stability condition. The VAR estimates in appendix 5 also show that the t-values and the standard error are significant as expected.

Figure 17: Stability condition for the model of Agricultural Export

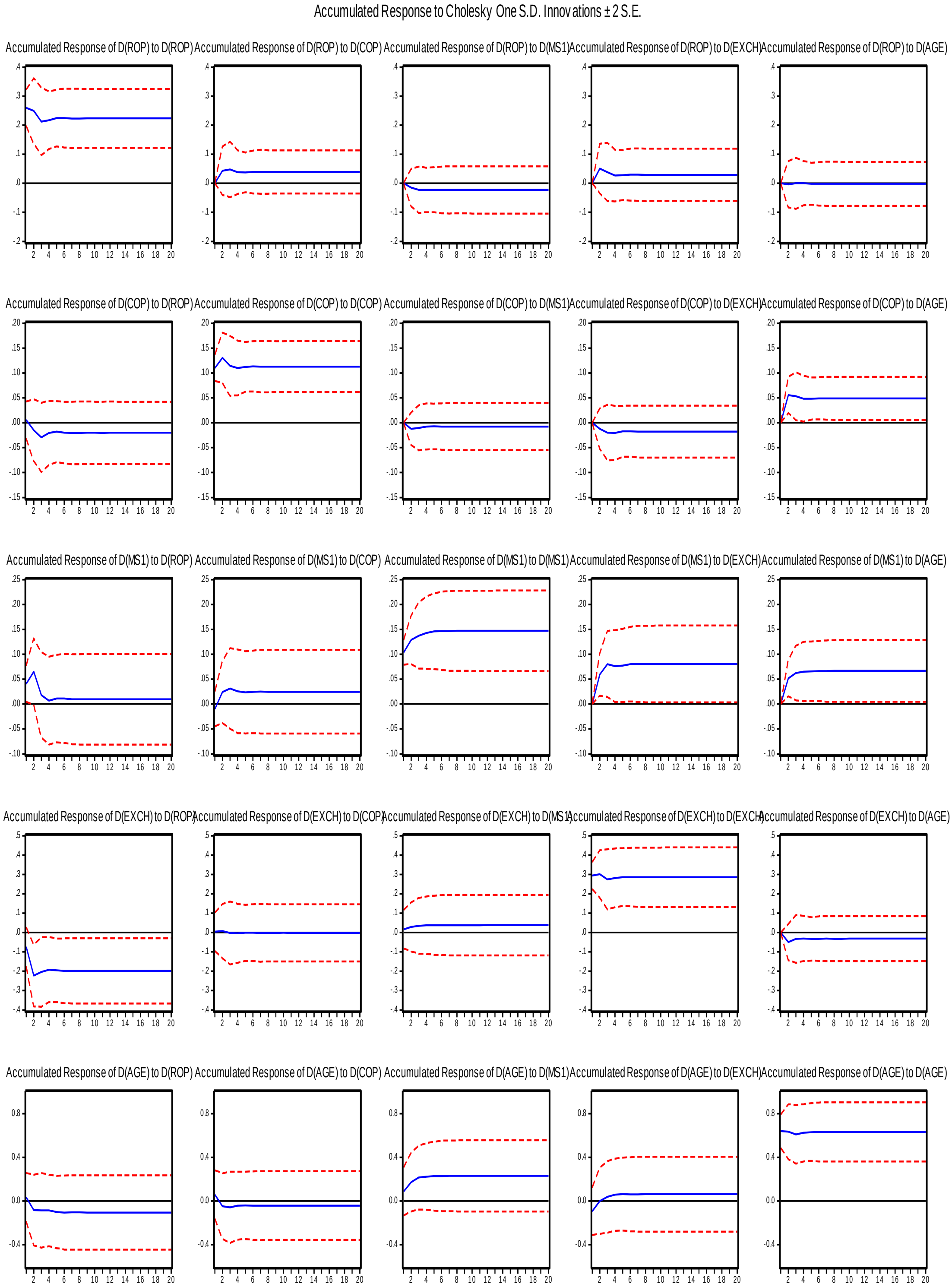


4.6.7 Impulse response function for Agricultural Export

Figure 18 below shows the results of the impulse response function (IRF) for the agricultural export. The impulse response function for the agricultural export suggests that changes in oil price and output impacted negatively on the volume of agricultural export.

Also, positive oil price shocks decrease agricultural production thereby leading to reduction in the volume of exports. This may be due to the constraints in the agricultural sector such as poor infrastructural facilities, the neglect of the agricultural sector, high costs of production in terms of increase in the costs of input such as fertilizer and macroeconomic instability in the economy while money supply is observed to be positively related to the volume of export. The response of oil price to exchange rate is negative this is because shocks to oil price lead to the depreciation of naira.

Figure 18: Impulse response function for Agricultural Export



4.6.8 Variance Decomposition of Agricultural Export

From the result, the forecast error variance decomposition results are presented in figure 19. Own shock constitute the greatest source of variation in the volume of agricultural export, followed by variation in exchange rate, money supply, oil production and oil price, with 86%, 4%, 3% and 3% variation respectively.

Figure 19: Variance Decomposition of Agricultural Export

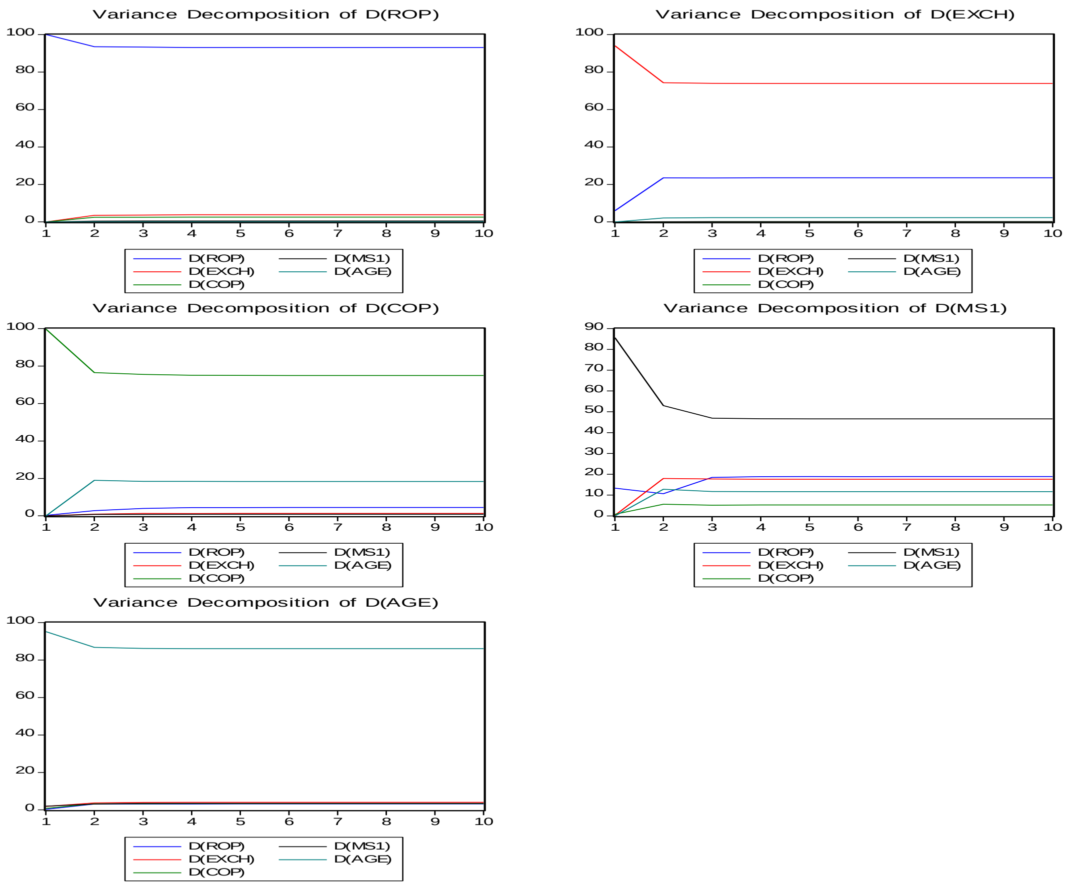


Figure 19 above, shows the effect of oil price shock on the volume of export. This indicates that increase in oil price lowers export as domestic production fails to produce surplus for export. This therefore implies a negative relation between export and oil price.

4.6.9 Discussion of Findings

This dissertation has assessed the nature, pattern and extent of staple foodstuff price variability in the North-West zone of Nigeria and the extent of the response of agricultural sector to oil price shocks in Nigeria 1974-2010. Within the context of the stated research objectives, various measures of food price variability were used- They include Trend Analysis, Coefficient of Variation and ARCH/ GARCH Analysis. The results from the various analyses have provided empirical evidences to support food price variability. Other major findings of the dissertation indicate that the prices of agricultural foods were more volatile than the prices of industrial/manufactured food stuff which are relatively stable.

Some other key findings of the study suggest that the prices of agricultural foodstuff in the studied markets were higher than the prices of industrial/manufactured foodstuff. There were periods of higher prices and periods of relatively low prices for agricultural foodstuffs because of the seasonal nature of the products. This indicates that higher prices of the goods during off-season create scarcity and hunger period which is observed to threaten food security because it distorts the household's consumption pattern in the region. The prices of both agricultural and industrial foodstuff are always higher in Kaduna than in Katsina State. The higher prices of foodstuffs in Kaduna State is also attributed to the presence of numerous institutions of higher learning and many government parastatals which is due to large number of students and staff; which pushes the demand for goods.

This dissertation has explained why prices of agricultural commodities fluctuate more widely than industrial prices. Unlike manufactured goods, the supply of agricultural goods is difficult to control due to vagaries of wheather, diseases, storage facilities and prices of inputs, particularly labour and fertilizer.

The result of the ARCH/GARCH analysis revealed that volatility persistence is more in the prices of agricultural staple food than the industrial/manufactured foodstuff. The volatility persistence in the prices of agricultural foodstuff is attributed to several factors including government policies and programmes. Also, the Arch/Garch result implies that higher price volatility of food could affect households adversely by causing hunger or severe food insecurity and thereby leading to malnutrition and riots.

The effect of oil price shock on the agricultural sector confirmed the a priori expectation. The VAR result estimated the response of the agricultural sector to real oil price (ROP) and output (COP) shocks in Nigeria from 1974-2010 using vector autoregression (VAR) model. Impulse response function and variance decomposition are obtained to assess how real oil price (ROP) and oil production (COP) shocks contribute to variability in the volume of agricultural import and export. This modeling framework affords us the opportunity of getting the feedback effects of other variables on import and export of agricultural commodities. The results of the impulse response (IRF) show that the response of oil price and output on the volume of agricultural import and export are negative. Nigeria is a net oil exporting country, and large inflow of oil revenue does not lead to exchange rate appreciation. This is not unconnected with the fact that Nigeria had embarked on SAP since July, 1986, and a component of the programme is the deregulation of the foreign exchange market. The results therefore show that the accumulated responses report larger real exchange rate depreciation while large inflow of oil revenue lead to increase in money supply.

The variance decomposition from the estimated models shows the overall performance of agricultural export can not be attributable to oil as it accounts for only 3% of its total variability while that of agric import accounted for less than 3% of its total variability. The variance decomposition also appears to suggest that oil price and output contribute very little in the variation of both agricultural export and import.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

The purpose of this chapter is to present the summary of the major findings, conclusions and recommendations.

5.1 Summary

This study used various estimation techniques: trend analysis, coefficient of variation, ARCH/GARCH analysis and Vector Autoregressive (VAR) model to empirically analyse staple food price variability as well as agricultural sector response to random oil price shocks in Nigeria. The study has two components: the micro and macro studies. The price data was collected for the micro component for a period of 216 weeks i.e four years, that is from 2007-2011 while the time frame for the macro component covers the years, 1974-2010 because the first oil price shocks was in the year 1974.

The trend analysis, coefficient of variation and the ARCH/GARCH analysis provided an empirical evidence of the extent and pattern of staple food price volatility in the study area. The prices of agricultural and manufactured/industrial food stuff varied overtime and space. They served as a threat to food security in the study area especially during the scarcity period.

The macro study shows that the response of oil price shocks on agricultural output was positive and it manifests in higher import of agricultural goods as local production fails to meet local demand. As for agricultural export, it responded negatively as domestic output failed to produce surplus for export. It was suggested that there is the need for Government and private sector to find ways of stabilizing food stuff prices as they play a major role in the economy. It was also suggested that policy makers in Nigeria should address the poor performance of the agricultural sector so that the economy would stop relying on crude oil at the expense of the Nigerian agricultural sector

5.2 Conclusion

Agriculture in North-West is seriously in state of decline over the years. The current high food prices have added impetus for the North-West region in particular and Nigeria as a whole to review its agricultural policies and programs. Government is yet to remove constraints that impede access by smallholder farmers to the knowledge, technology, and financial services they need to increase farm productivity in a profitable and environmentally sustainable manner.

Within the context of the stated research questions and objectives, the study has further concluded that frequent changes in the prices of foodstuff is a threat to both the producers and consumers, specifically in Kaduna and Katsina States and generally in the North-West zone of Nigeria. It is also observed that frequent increases in the prices of goods served as an incentive to producers. This is because farmers/producers apart from producing in large quantities make huge profit from the sales of such goods.

On the other hand, frequent increases in the prices of goods serve as a source of poverty to the consumers, because it reduced their purchasing power and consumption, resulting to food insecurity. The general observation from the study was that volatility/variability in the prices of foodstuff in North-Western zone of Nigeria affect either the rural and urban households in one way or the other.

Evidence from this study has shown that frequent price fluctuations of agricultural and industrial/manufactured foodstuff exist in Kaduna and Katsina States. The high food price fluctuation in the zone suggests the prevalence of food insecurity in the zone.

The results of this study revealed that within the study period, agricultural food importation responded positively to oil shocks, while the agricultural food exportation responded negatively to oil price shocks.

5.3 Policy Recommendations

Based on the findings of the study, the following recommendations are made;

i) Government should reduce the unit cost of production by subsidizing production inputs which will result to higher productivity and thereby lead to reduction in the price of crops. This reduction/decrease in food crop prices will increase the consumption patterns of household's in the study area and also make food secure.

ii) Both public and private sectors should invest in physical infrastructure and other public goods linking the production areas to the consumption areas to reduce the effect of the cost of bad roads on prices of goods in the markets. This is because transportation cost is an integral part of food price changes. An increase in the cost of transportation transcends into increase in the price of the goods, this can result to reduction in the consumption behavior of household's in the study area as they bear the burden of such increase.

iii) Government should revert back to the ''Marketing Board'' policy. This is to reduce the role of middlemen in causing higher food prices. They buy at the farm-gate price from the producer and sell at a very high price to the retailers while the final consumers suffer from the price increase.

iv) There should be the establishment of sustainable small and medium scale industries for the industrial commodities in the study areas. By so doing, it will lead to increase in employment opportunity in the study area. This helps to raise the living standard of the households by reducing incidence of households being vulnerable to food insecurity. This is because the resulting effect of food insecurity is hunger and diseases.

v) Government and the private sector should find ways of stabilizing food crop prices as they play a major role in the economy of the zone especially an agrarian society like the North-Western zone, where the majority of the people are farmers. In doing so, the government should involve not only administrators, but agriculturist, economists, econometrician, statisticians and the middlemen. According to FAO (1987), every country is different and there is no single blue-print for a national food price policy and associated programmes. However, government must grapple with certain issues, which recur frequently especially price variation. The government in seeking to stabilize price should ensure that prices are not too low, so as not to have an adverse effect on the farmer's income, or prices become too high that the average consumer can not afford food thereby leading to food insecurity.

vi) There is the need to improve agricultural production and productivity both in the short and long term in order to meet the growing demand for the commodities.

vii) Government should improve and develop risk management tools for firms and farmers in order to build capacity to manage and mitigate the risks associated with food price volatility/variability.

viii) Public and private sectors should come together to support the procurement, blending and packaging of fertilizer. Together they can also support the breeding and multiplication of improved seed. Government policies should support agro-dealers to ensure that improved seeds and other inputs are available to farmers.

ix) There is the need to strengthen agricultural research, revitalize agricultural training, and streamline the extension delivery system and involve NGOs and opinion leaders in extension delivery.

x) Review the agricultural input supply and distribution system with a view to developing an effective and sustainable private sector-led input supply and distribution system.

xi) There is the need to adequately capitalize the Nigerian Agricultural, Cooperative and Rural Development Bank to provide soft agricultural credit scheme to farmers with low interest rate. This is done in order to encourage small holder farmers to boost/increase agricultural production so as to over come or reduce the menace of food insecurity in the study area.

xii) Promote multicommodity development and market companies to stabilize prices and provide alternative markets for farm produce through a buyer-of-last-resort mechanism.

A major policy implication of the response of the agriculture to oil price shocks in Nigeria, in line with our findings, is that serious efforts should be made by policy makers to address the poor performance of the agricultural sector as a whole in Nigeria. This is because the continuous reliance on oil which leads to the neglect of the agricultural sector is an indication that Nigeria, over time, would be a net importer of food in the long run. Nigeria can reposition her self as a self sufficient country in terms of food globally through provision of inputs to farmers at a subsidized price. The over-reliance on oil revenue resulted to high level of corruption; therefore, there is the need to diversify the economy in terms of boosting the productive capacity of other sectors especially industrial sector. However, Nigeria's continued dependency on oil might therefore plunge it into more crisis situation in the future if appropriate policy and reform measures are not taken.

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Appendix I: Stationarity Test Results

Maize

ADF Test Statistic	-9.218311	1%	Critical Value*	-4.0041
		5%	Critical Value	-3.4320
		10%	Critical Value	-3.1394

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(SAMMZ,2)

Method: Least Squares

Date: 12/08/11 Time: 00:05

Sample(adjusted): 4 216

Included observations: 213 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SAMMZ(-1))	-0.695110	0.075405	-9.218311	0.0000
D(SAMMZ(-1),2)	0.132313	0.068229	1.939262	0.0538
C	0.613353	0.634478	0.966706	0.3348
@TREND(1)	-0.002787	0.005043	-0.552679	0.5811

ADF Test Statistic	-5.726308	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(KAFMZ,2)

Method: Least Squares

Date: 12/08/11 Time: 01:31

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(KAFMZ(-1))	-0.592705	0.103506	-5.726308	0.0000
D(KAFMZ(-1),2)	-0.041964	0.100063	-0.419373	0.6754
D(KAFMZ(-2),2)	-0.039063	0.094005	-0.415548	0.6782
D(KAFMZ(-3),2)	0.096596	0.083049	1.163113	0.2461
D(KAFMZ(-4),2)	0.044998	0.070386	0.639303	0.5233
C	0.572015	0.622785	0.918479	0.3595
@TREND(1)	-0.003298	0.004905	-0.672313	0.5021

R-squared	0.324342	Mean dependent var	0.004762
Adjusted R-squared	0.304372	S.D. dependent var	5.136880

S.E. of regression	4.284380	Akaike info criterion	5.780594
Sum squared resid	3726.250	Schwarz criterion	5.892164
Log likelihood	-599.9624	F-statistic	16.24131
Durbin-Watson stat	1.994696	Prob(F-statistic)	0.000000

ADF Test Statistic	-5.180514	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(KATMZ,2)

Method: Least Squares

Date: 12/08/11 Time: 01:33

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(KATMZ(-1))	-0.511000	0.098639	-5.180514	0.0000
D(KATMZ(-1),2)	-0.147422	0.097861	-1.506442	0.1335
D(KATMZ(-2),2)	0.022965	0.091731	0.250355	0.8026
D(KATMZ(-3),2)	-0.017534	0.085535	-0.204990	0.8378
D(KATMZ(-4),2)	-0.014836	0.071018	-0.208908	0.8347
C	0.359737	0.553311	0.650154	0.5163

@TREND(1)	-0.001641	0.004358	-0.376634	0.7068

R-squared	0.319025	Mean dependent var	-0.011905
Adjusted R-squared	0.298898	S.D. dependent var	4.527545
S.E. of regression	3.790997	Akaike info criterion	5.535900
Sum squared resid	2917.447	Schwarz criterion	5.647471
Log likelihood	-574.2695	F-statistic	15.85033
Durbin-Watson stat	1.997492	Prob(F-statistic)	0.000000

ADF Test Statistic	-4.533183	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(FUNMZ,2)

Method: Least Squares

Date: 12/08/11 Time: 01:33

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FUNMZ(-1))	-0.457351	0.100890	-4.533183	0.0000
D(FUNMZ(-1),2)	-0.222642	0.102611	-2.169754	0.0312

D(FUNMZ(-2),2)	-0.212953	0.095886	-2.220904	0.0275
D(FUNMZ(-3),2)	-0.094198	0.084753	-1.111441	0.2677
D(FUNMZ(-4),2)	-0.024325	0.070442	-0.345321	0.7302
C	0.337723	0.524274	0.644173	0.5202
@TREND(1)	-0.001258	0.004121	-0.305191	0.7605

R-squared	0.338751	Mean dependent var	0.000000
Adjusted R-squared	0.319207	S.D. dependent var	4.361511
S.E. of regression	3.598691	Akaike info criterion	5.431783
Sum squared resid	2628.967	Schwarz criterion	5.543353
Log likelihood	-563.3372	F-statistic	17.33247
Durbin-Watson stat	1.994511	Prob(F-statistic)	0.000000

ADF Test Statistic	-3.563596	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(MAIMZ,2)

Method: Least Squares

Date: 12/08/11 Time: 01:34

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MAIMZ(-1))	-0.340048	0.095423	-3.563596	0.0005
D(MAIMZ(-1),2)	-0.306877	0.100945	-3.040050	0.0027
D(MAIMZ(-2),2)	-0.212689	0.098530	-2.158636	0.0321
D(MAIMZ(-3),2)	-0.090448	0.088684	-1.019888	0.3090
D(MAIMZ(-4),2)	-0.074183	0.073616	-1.007706	0.3148
C	0.035018	0.444549	0.078773	0.9373
@TREND(1)	0.001387	0.003501	0.396105	0.6924
R-squared	0.307377	Mean dependent var		0.026190
Adjusted R-squared	0.286905	S.D. dependent var		3.606617
S.E. of regression	3.045605	Akaike info criterion		5.098042
Sum squared resid	1882.970	Schwarz criterion		5.209612
Log likelihood	-528.2944	F-statistic		15.01478
Durbin-Watson stat	1.997307	Prob(F-statistic)		0.000000
ADF Test Statistic	-6.893949	1% Critical Value*		-4.0041
		5% Critical Value		-3.4320
		10% Critical Value		-3.1394

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(GIWMZ,2)

Method: Least Squares

Date: 12/08/11 Time: 01:35

Sample(adjusted): 4 216

Included observations: 213 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GIWMZ(-1))	-0.482267	0.069955	-6.893949	0.0000
D(GIWMZ(-1),2)	-0.063616	0.068974	-0.922324	0.3574
C	0.297500	0.435590	0.682981	0.4954
@TREND(1)	-0.000912	0.003462	-0.263446	0.7925

R-squared	0.260806	Mean dependent var	-0.011737
Adjusted R-squared	0.250195	S.D. dependent var	3.583387
S.E. of regression	3.102900	Akaike info criterion	5.121152
Sum squared resid	2012.250	Schwarz criterion	5.184275
Log likelihood	-541.4027	F-statistic	24.58009
Durbin-Watson stat	2.017047	Prob(F-statistic)	0.000000

Millet

ADF Test Statistic	-6.256733	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(SAMML,2)

Method: Least Squares

ADF Test Statistic	-5.699635	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(KAFML,2)

Method: Least Squares

Date: 12/08/11 Time: 01:38

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(KAFML(-1))	-0.746228	0.130926	-5.699635	0.0000
D(KAFML(-1),2)	0.024678	0.120803	0.204279	0.8383
D(KAFML(-2),2)	-0.160815	0.110364	-1.457133	0.1466
D(KAFML(-3),2)	-0.008169	0.090426	-0.090343	0.9281
D(KAFML(-4),2)	-0.031325	0.073875	-0.424025	0.6720
C	0.577832	0.594956	0.971218	0.3326
@TREND(1)	-0.003234	0.004680	-0.691018	0.4903

R-squared	0.411447	Mean dependent var	0.021429
Adjusted R-squared	0.394052	S.D. dependent var	5.230868
S.E. of regression	4.071848	Akaike info criterion	5.678836

Sum squared resid	3365.729	Schwarz criterion	5.790406
Log likelihood	-589.2778	F-statistic	23.65231
Durbin-Watson stat	1.996380	Prob(F-statistic)	0.000000

Date: 12/08/11 Time: 01:37

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SAMML(-1))	-0.776500	0.124106	-6.256733	0.0000
D(SAMML(-1),2)	0.173252	0.113311	1.528988	0.1278
D(SAMML(-2),2)	-0.006679	0.098510	-0.067799	0.9460
D(SAMML(-3),2)	-0.041357	0.081815	-0.505486	0.6138
D(SAMML(-4),2)	0.025159	0.070338	0.357685	0.7210
C	0.634624	0.653755	0.970737	0.3328
@TREND(1)	-0.002819	0.005140	-0.548414	0.5840

R-squared	0.361451	Mean dependent var	0.011905
Adjusted R-squared	0.342578	S.D. dependent var	5.543314
S.E. of regression	4.494607	Akaike info criterion	5.876398
Sum squared resid	4100.902	Schwarz criterion	5.987969
Log likelihood	-610.0218	F-statistic	19.15138
Durbin-Watson stat	1.998657	Prob(F-statistic)	0.000000

ADF Test Statistic	-5.699635	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(KAFML,2)

Method: Least Squares

Date: 12/08/11 Time: 01:38

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(KAFML(-1))	-0.746228	0.130926	-5.699635	0.0000
D(KAFML(-1),2)	0.024678	0.120803	0.204279	0.8383
D(KAFML(-2),2)	-0.160815	0.110364	-1.457133	0.1466
D(KAFML(-3),2)	-0.008169	0.090426	-0.090343	0.9281
D(KAFML(-4),2)	-0.031325	0.073875	-0.424025	0.6720
C	0.577832	0.594956	0.971218	0.3326
@TREND(1)	-0.003234	0.004680	-0.691018	0.4903

R-squared	0.411447	Mean dependent var	-0.021429
Adjusted R-squared	0.394052	S.D. dependent var	5.230868
S.E. of regression	4.071848	Akaike info criterion	5.678836
Sum squared resid	3365.729	Schwarz criterion	5.790406
Log likelihood	-589.2778	F-statistic	23.65231
Durbin-Watson stat	1.996380	Prob(F-statistic)	0.000000

ADF Test Statistic	-5.317204	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(KATML,2)

Method: Least Squares

Date: 12/08/11 Time: 01:39

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(KATML(-1))	-0.716390	0.134731	-5.317204	0.0000
D(KATML(-1),2)	-0.267413	0.129704	-2.061714	0.0405
D(KATML(-2),2)	-0.188019	0.116955	-1.607626	0.1095
D(KATML(-3),2)	-0.152289	0.099095	-1.536789	0.1259
D(KATML(-4),2)	0.132840	0.070954	1.872205	0.0626
C	0.346216	0.579631	0.597304	0.5510
@TREND(1)	-0.001415	0.004564	-0.310086	0.7568

R-squared	0.559077	Mean dependent var	0.007143
Adjusted R-squared	0.546045	S.D. dependent var	5.861536

S.E. of regression	3.949281	Akaike info criterion	5.617709
Sum squared resid	3166.155	Schwarz criterion	5.729280
Log likelihood	-582.8595	F-statistic	42.89960
Durbin-Watson stat	2.033579	Prob(F-statistic)	0.000000

ADF Test Statistic	-5.678962	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(FUNML,2)

Method: Least Squares

Date: 12/08/11 Time: 01:39

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FUNML(-1))	-0.888193	0.156401	-5.678962	0.0000
D(FUNML(-1),2)	-0.082071	0.141074	-0.581754	0.5614
D(FUNML(-2),2)	-0.006864	0.122074	-0.056229	0.9552
D(FUNML(-3),2)	-0.104238	0.103416	-1.007948	0.3147
D(FUNML(-4),2)	-0.076267	0.073724	-1.034491	0.3021
C	0.662174	0.647900	1.022032	0.3080

@TREND(1)	-0.004517	0.005101	-0.885443	0.3770

R-squared	0.494168	Mean dependent var	-0.040476
Adjusted R-squared	0.479217	S.D. dependent var	6.174460
S.E. of regression	4.455817	Akaike info criterion	5.859063
Sum squared resid	4030.424	Schwarz criterion	5.970633
Log likelihood	-608.2016	F-statistic	33.05312
Durbin-Watson stat	1.988991	Prob(F-statistic)	0.000000

ADF Test Statistic	-6.364575	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(MAIML,2)

Method: Least Squares

Date: 12/08/11 Time: 01:40

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MAIML(-1))	-0.808355	0.127008	-6.364575	0.0000

D(MAIML(-1),2)	0.092790	0.115111	0.806098	0.4211
D(MAIML(-2),2)	-0.006966	0.102958	-0.067656	0.9461
D(MAIML(-3),2)	0.075568	0.085838	0.880359	0.3797
D(MAIML(-4),2)	0.024675	0.070845	0.348299	0.7280
C	0.309590	0.453509	0.682654	0.4956
@TREND(1)	-0.000537	0.003581	-0.150033	0.8809

R-squared	0.381213	Mean dependent var	-0.009524
Adjusted R-squared	0.362924	S.D. dependent var	3.939726
S.E. of regression	3.144573	Akaike info criterion	5.161998
Sum squared resid	2007.332	Schwarz criterion	5.273568
Log likelihood	-535.0098	F-statistic	20.84355
Durbin-Watson stat	1.991537	Prob(F-statistic)	0.000000

ADF Test Statistic	-5.935713	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(GIWML,2)

Method: Least Squares

Date: 12/08/11 Time: 01:41

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GIWML(-1))	-0.868308	0.146285	-5.935713	0.0000
D(GIWML(-1),2)	-0.006505	0.133819	-0.048613	0.9613
D(GIWML(-2),2)	-0.021866	0.117057	-0.186798	0.8520
D(GIWML(-3),2)	-0.098573	0.099085	-0.994839	0.3210
D(GIWML(-4),2)	-0.022739	0.075184	-0.302448	0.7626
C	0.443929	0.713613	0.622087	0.5346
@TREND(1)	-0.002277	0.005641	-0.403708	0.6869
R-squared	0.437047	Mean dependent var		-0.069048
Adjusted R-squared	0.420408	S.D. dependent var		6.484523
S.E. of regression	4.936727	Akaike info criterion		6.064047
Sum squared resid	4947.369	Schwarz criterion		6.175618
Log likelihood	-629.7250	F-statistic		26.26644
Durbin-Watson stat	1.979590	Prob(F-statistic)		0.000000

Guinea Corn

ADF Test Statistic	-5.146477	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(SAMGCN,2)

Method: Least Squares

Date: 12/08/11 Time: 01:43

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SAMGCN(-1))	-0.439697	0.085436	-5.146477	0.0000
D(SAMGCN(-1),2)	0.041727	0.087723	0.475668	0.6348
D(SAMGCN(-2),2)	-0.191585	0.085274	-2.246689	0.0257
D(SAMGCN(-3),2)	0.126366	0.074791	1.689577	0.0926
D(SAMGCN(-4),2)	-0.018489	0.070422	-0.262544	0.7932
C	0.393821	0.435934	0.903395	0.3674
@TREND(1)	-0.002521	0.003424	-0.736178	0.4625

R-squared	0.300214	Mean dependent var	-0.002381
Adjusted R-squared	0.279531	S.D. dependent var	3.503757
S.E. of regression	2.974004	Akaike info criterion	5.050460
Sum squared resid	1795.474	Schwarz criterion	5.162031
Log likelihood	-523.2983	F-statistic	14.51481
Durbin-Watson stat	2.000256	Prob(F-statistic)	0.000000

ADF Test Statistic	-5.117730	1%	Critical Value*	-4.0047
		5%	Critical Value	-3.4322
		10%	Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(KAFGCN,2)

Method: Least Squares

Date: 12/08/11 Time: 01:44

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(KAFGCN(-1))	-0.532296	0.104010	-5.117730	0.0000
D(KAFGCN(-1),2)	-0.126328	0.101726	-1.241855	0.2157
D(KAFGCN(-2),2)	-0.175475	0.095653	-1.834488	0.0680
D(KAFGCN(-3),2)	0.025238	0.082969	0.304186	0.7613
D(KAFGCN(-4),2)	-0.020512	0.069553	-0.294918	0.7684
C	0.417141	0.522852	0.797818	0.4259
@TREND(1)	-0.002051	0.004102	-0.499914	0.6177
R-squared	0.353120	Mean dependent var		-0.004762
Adjusted R-squared	0.334000	S.D. dependent var		4.376697
S.E. of regression	3.571771	Akaike info criterion		5.416765
Sum squared resid	2589.782	Schwarz criterion		5.528335

Log likelihood	-561.7603	F-statistic	18.46899
Durbin-Watson stat	2.000170	Prob(F-statistic)	0.000000

ADF Test Statistic	-5.227796	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(KATGCN,2)

Method: Least Squares

Date: 12/08/11 Time: 01:44

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(KATGCN(-1))	-0.497066	0.095081	-5.227796	0.0000
D(KATGCN(-1),2)	-0.052082	0.096406	-0.540233	0.5896
D(KATGCN(-2),2)	-0.097305	0.090142	-1.079470	0.2817
D(KATGCN(-3),2)	-0.016581	0.081228	-0.204133	0.8385
D(KATGCN(-4),2)	0.054436	0.072109	0.754908	0.4512
C	0.365028	0.429285	0.850316	0.3962
@TREND(1)	-0.001915	0.003369	-0.568448	0.5704

R-squared	0.286322	Mean dependent var	-0.007143
Adjusted R-squared	0.265228	S.D. dependent var	3.408573
S.E. of regression	2.921788	Akaike info criterion	5.015034
Sum squared resid	1732.980	Schwarz criterion	5.126604
Log likelihood	-519.5786	F-statistic	13.57369
Durbin-Watson stat	1.987555	Prob(F-statistic)	0.000000

ADF Test Statistic	-4.585455	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(FUNGCN,2)

Method: Least Squares

Date: 12/08/11 Time: 01:45

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FUNGCN(-1))	-0.484458	0.105651	-4.585455	0.0000
D(FUNGCN(-1),2)	-0.194276	0.104631	-1.856769	0.0648

D(FUNGCN(-2),2)	-0.310490	0.098919	-3.138814	0.0019
D(FUNGCN(-3),2)	-0.048221	0.084844	-0.568353	0.5704
D(FUNGCN(-4),2)	-0.066711	0.070310	-0.948810	0.3438
C	0.328543	0.466468	0.704321	0.4820
@TREND(1)	-0.001336	0.003655	-0.365482	0.7151

R-squared	0.390617	Mean dependent var	-0.002381
Adjusted R-squared	0.372606	S.D. dependent var	4.021919
S.E. of regression	3.185690	Akaike info criterion	5.187980
Sum squared resid	2060.170	Schwarz criterion	5.299550
Log likelihood	-537.7379	F-statistic	21.68733
Durbin-Watson stat	2.000203	Prob(F-statistic)	0.000000

ADF Test Statistic	-5.253505	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(MAIGCN,2)

Method: Least Squares

Date: 12/08/11 Time: 01:46

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MAIGCN(-1))	-0.565078	0.107562	-5.253505	0.0000
D(MAIGCN(-1),2)	-0.068717	0.101568	-0.676564	0.4995
D(MAIGCN(-2),2)	-0.040531	0.092293	-0.439157	0.6610
D(MAIGCN(-3),2)	-0.038782	0.082143	-0.472128	0.6373
D(MAIGCN(-4),2)	-0.096569	0.069599	-1.387514	0.1668
C	0.388568	0.460058	0.844607	0.3993
@TREND(1)	-0.001900	0.003612	-0.526156	0.5994

R-squared	0.320331	Mean dependent var	0.000000
Adjusted R-squared	0.300243	S.D. dependent var	3.761108
S.E. of regression	3.146223	Akaike info criterion	5.163048
Sum squared resid	2009.440	Schwarz criterion	5.274618
Log likelihood	-535.1200	F-statistic	15.94583
Durbin-Watson stat	2.007700	Prob(F-statistic)	0.000000

ADF Test Statistic	-4.774206	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(GIWGCN,2)

Method: Least Squares

Date: 12/08/11 Time: 01:46

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GIWGCN(-1))	-0.485341	0.101659	-4.774206	0.0000
D(GIWGCN(-1),2)	-0.128986	0.098912	-1.304043	0.1937
D(GIWGCN(-2),2)	-0.167781	0.092716	-1.809613	0.0718
D(GIWGCN(-3),2)	-0.007500	0.081899	-0.091577	0.9271
D(GIWGCN(-4),2)	-0.131799	0.070831	-1.860760	0.0642
C	0.240813	0.446717	0.539072	0.5904
@TREND(1)	-0.000543	0.003507	-0.154968	0.8770

R-squared	0.336128	Mean dependent var	-0.007143
Adjusted R-squared	0.316506	S.D. dependent var	3.702604
S.E. of regression	3.061081	Akaike info criterion	5.108178
Sum squared resid	1902.154	Schwarz criterion	5.219748
Log likelihood	-529.3587	F-statistic	17.13027
Durbin-Watson stat	2.000967	Prob(F-statistic)	0.000000

Local Rice

ADF Test Statistic	-4.806057	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(SAMLR,2)

Method: Least Squares

Date: 12/08/11 Time: 01:48

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SAMLR(-1))	-0.493335	0.102649	-4.806057	0.0000
D(SAMLR(-1),2)	-0.192103	0.103732	-1.851923	0.0655
D(SAMLR(-2),2)	-0.149762	0.096268	-1.555678	0.1213
D(SAMLR(-3),2)	-0.082981	0.085457	-0.971030	0.3327
D(SAMLR(-4),2)	0.037252	0.070445	0.528813	0.5975
C	0.589685	1.522656	0.387274	0.6990
@TREND(1)	-0.003460	0.012068	-0.286701	0.7746
R-squared	0.340811	Mean dependent var		-0.033333
Adjusted R-squared	0.321327	S.D. dependent var		12.86724
S.E. of regression	10.60024	Akaike info criterion		7.592395
Sum squared resid	22810.11	Schwarz criterion		7.703965
Log likelihood	-790.2015	F-statistic		17.49233
Durbin-Watson stat	1.975879	Prob(F-statistic)		0.000000

ADF Test Statistic	-4.205851	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(KAFLR,2)

Method: Least Squares

Date: 12/08/11 Time: 01:48

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(KAFLR(-1))	-0.455904	0.108398	-4.205851	0.0000
D(KAFLR(-1),2)	-0.434674	0.109211	-3.980123	0.0001
D(KAFLR(-2),2)	-0.231298	0.106776	-2.166194	0.0315
D(KAFLR(-3),2)	-0.096154	0.096404	-0.997403	0.3198
D(KAFLR(-4),2)	-0.062970	0.072178	-0.872423	0.3840
C	0.595495	1.534672	0.388027	0.6984
@TREND(1)	-0.004298	0.012170	-0.353121	0.7244

R-squared	0.449261	Mean dependent var	-0.016667
Adjusted R-squared	0.432983	S.D. dependent var	14.18760
S.E. of regression	10.68334	Akaike info criterion	7.608013

Sum squared resid	23169.15	Schwarz criterion	7.719584
Log likelihood	-791.8414	F-statistic	27.59925
Durbin-Watson stat	1.982090	Prob(F-statistic)	0.000000

ADF Test Statistic	-4.051398	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(KATLR,2)

Method: Least Squares

Date: 12/08/11 Time: 01:49

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(KATLR(-1))	-0.361935	0.089336	-4.051398	0.0001
D(KATLR(-1),2)	-0.177630	0.096846	-1.834160	0.0681
D(KATLR(-2),2)	-0.232150	0.093529	-2.482100	0.0139
D(KATLR(-3),2)	-0.101124	0.085765	-1.179073	0.2397
D(KATLR(-4),2)	-0.085420	0.080067	-1.066865	0.2873
C	-0.083726	1.202266	-0.069641	0.9445
@TREND(1)	0.003336	0.009537	0.349770	0.7269

R-squared	0.270731	Mean dependent var	0.122381
Adjusted R-squared	0.249176	S.D. dependent var	9.663527
S.E. of regression	8.373457	Akaike info criterion	7.120776
Sum squared resid	14233.30	Schwarz criterion	7.232346
Log likelihood	-740.6815	F-statistic	12.56013
Durbin-Watson stat	1.863887	Prob(F-statistic)	0.000000

ADF Test Statistic	-4.907497	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(FUNLR,2)

Method: Least Squares

Date: 12/08/11 Time: 01:50

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FUNLR(-1))	-0.418709	0.085320	-4.907497	0.0000
D(FUNLR(-1),2)	0.075971	0.089781	0.846186	0.3984
D(FUNLR(-2),2)	-0.088721	0.083386	-1.063986	0.2886
D(FUNLR(-3),2)	-0.069556	0.075632	-0.919669	0.3588

D(FUNLR(-4),2)	-0.011277	0.071740	-0.157197	0.8752
C	-0.000265	1.041921	-0.000254	0.9998
@TREND(1)	0.002284	0.008267	0.276263	0.7826

R-squared	0.233065	Mean dependent var	-0.004762
Adjusted R-squared	0.210397	S.D. dependent var	8.165599
S.E. of regression	7.255920	Akaike info criterion	6.834277
Sum squared resid	10687.62	Schwarz criterion	6.945848
Log likelihood	-710.5991	F-statistic	10.28166
Durbin-Watson stat	1.964585	Prob(F-statistic)	0.000000

ADF Test Statistic	-4.859199	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(MAILR,2)

Method: Least Squares

Date: 12/08/11 Time: 01:50

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MAILR(-1))	-0.429969	0.088486	-4.859199	0.0000
D(MAILR(-1),2)	-0.095021	0.092815	-1.023763	0.3072

D(MAILR(-2),2)	-0.124554	0.087866	-1.417547	0.1579
D(MAILR(-3),2)	-0.006439	0.079256	-0.081238	0.9353
D(MAILR(-4),2)	0.023181	0.070172	0.330346	0.7415
C	-0.072780	1.106986	-0.065746	0.9476
@TREND(1)	0.002988	0.008805	0.339309	0.7347

R-squared	0.266080	Mean dependent var	-0.002381
Adjusted R-squared	0.244388	S.D. dependent var	8.875332
S.E. of regression	7.714966	Akaike info criterion	6.956966
Sum squared resid	12082.70	Schwarz criterion	7.068537
Log likelihood	-723.4815	F-statistic	12.26617
Durbin-Watson stat	1.990899	Prob(F-statistic)	0.000000

ADF Test Statistic	-4.944675	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(GIWLR,2)

Method: Least Squares

Date: 12/08/11 Time: 01:51

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GIWLR(-1))	-0.416222	0.084176	-4.944675	0.0000
D(GIWLR(-1),2)	0.165683	0.088302	1.876320	0.0620
D(GIWLR(-2),2)	-0.064097	0.082788	-0.774233	0.4397
D(GIWLR(-3),2)	-0.051017	0.076950	-0.662991	0.5081
D(GIWLR(-4),2)	-0.031564	0.076776	-0.411118	0.6814
C	0.184519	0.995633	0.185328	0.8532
@TREND(1)	-0.000845	0.007915	-0.106752	0.9151
R-squared	0.224102	Mean dependent var		-0.080952
Adjusted R-squared	0.201169	S.D. dependent var		7.761278
S.E. of regression	6.936825	Akaike info criterion		6.744330
Sum squared resid	9768.266	Schwarz criterion		6.855901
Log likelihood	-701.1547	F-statistic		9.772047
Durbin-Watson stat	1.982565	Prob(F-statistic)		0.000000

White beans

ADF Test Statistic	-5.124307	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(SAMWB,2)

Method: Least Squares

Date: 12/08/11 Time: 01:52

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SAMWB(-1))	-0.416933	0.081364	-5.124307	0.0000
D(SAMWB(-1),2)	0.034123	0.085878	0.397349	0.6915
D(SAMWB(-2),2)	-0.031676	0.081415	-0.389068	0.6976
D(SAMWB(-3),2)	0.026187	0.075157	0.348428	0.7279
D(SAMWB(-4),2)	-0.013031	0.070215	-0.185590	0.8530
C	0.862000	1.143272	0.753977	0.4517
@TREND(1)	-0.005074	0.009021	-0.562510	0.5744
R-squared	0.207942	Mean dependent var		0.002381
Adjusted R-squared	0.184532	S.D. dependent var		8.702623
S.E. of regression	7.858753	Akaike info criterion		6.993898
Sum squared resid	12537.28	Schwarz criterion		7.105468
Log likelihood	-727.3593	F-statistic		8.882416
Durbin-Watson stat	1.997579	Prob(F-statistic)		0.000000
ADF Test Statistic	-4.797558	1% Critical Value*		-4.0047
		5% Critical Value		-3.4322
		10% Critical Value		-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(KAFWB,2)

Method: Least Squares

Date: 12/08/11 Time: 01:55

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(KAFWB(-1))	-0.482667	0.100607	-4.797558	0.0000
D(KAFWB(-1),2)	-0.218894	0.100251	-2.183461	0.0301
D(KAFWB(-2),2)	-0.093333	0.094425	-0.988437	0.3241
D(KAFWB(-3),2)	-0.045377	0.085696	-0.529514	0.5970
D(KAFWB(-4),2)	-0.046247	0.070115	-0.659581	0.5103
C	0.885850	1.310636	0.675893	0.4999
@TREND(1)	-0.005249	0.010342	-0.507565	0.6123
R-squared	0.337822	Mean dependent var		-0.002381
Adjusted R-squared	0.318250	S.D. dependent var		10.91348
S.E. of regression	9.011058	Akaike info criterion		7.267547
Sum squared resid	16483.43	Schwarz criterion		7.379117
Log likelihood	-756.0925	F-statistic		17.26068
Durbin-Watson stat	1.997502	Prob(F-statistic)		0.000000

ADF Test Statistic	-4.486706	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(KATWB,2)

Method: Least Squares

Date: 12/08/11 Time: 01:56

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(KATWB(-1))	-0.378407	0.084340	-4.486706	0.0000
D(KATWB(-1),2)	0.037292	0.090587	0.411673	0.6810
D(KATWB(-2),2)	-0.259816	0.084565	-3.072364	0.0024
D(KATWB(-3),2)	-0.082803	0.074168	-1.116414	0.2656
D(KATWB(-4),2)	-0.027654	0.070400	-0.392818	0.6949
C	0.667698	1.014327	0.658267	0.5111
@TREND(1)	-0.003746	0.007998	-0.468405	0.6400

R-squared	0.292787	Mean dependent var	-0.004762
Adjusted R-squared	0.271884	S.D. dependent var	8.165746
S.E. of regression	6.967807	Akaike info criterion	6.753243
Sum squared resid	9855.718	Schwarz criterion	6.864814

Log likelihood	-702.0905	F-statistic	14.00703
Durbin-Watson stat	1.995272	Prob(F-statistic)	0.000000

ADF Test Statistic	-4.236763	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(FUNWB,2)

Method: Least Squares

Date: 12/08/11 Time: 01:57

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FUNWB(-1))	-0.424104	0.100101	-4.236763	0.0000
D(FUNWB(-1),2)	-0.167291	0.098490	-1.698564	0.0909
D(FUNWB(-2),2)	-0.226892	0.090423	-2.509241	0.0129
D(FUNWB(-3),2)	-0.156346	0.079645	-1.963046	0.0510
D(FUNWB(-4),2)	-0.205124	0.068805	-2.981239	0.0032
C	0.615939	1.091864	0.564117	0.5733
@TREND(1)	-0.003040	0.008608	-0.353169	0.7243

R-squared	0.329363	Mean dependent var	-0.011905

Adjusted R-squared	0.309541	S.D. dependent var	9.049497
S.E. of regression	7.519577	Akaike info criterion	6.905662
Sum squared resid	11478.44	Schwarz criterion	7.017232
Log likelihood	-718.0945	F-statistic	16.61620
Durbin-Watson stat	1.985729	Prob(F-statistic)	0.000000

ADF Test Statistic	-4.427409	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(MAIWB,2)

Method: Least Squares

Date: 12/08/11 Time: 01:57

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MAIWB(-1))	-0.416484	0.094069	-4.427409	0.0000
D(MAIWB(-1),2)	-0.158157	0.096030	-1.646964	0.1011
D(MAIWB(-2),2)	-0.192441	0.090697	-2.121796	0.0351
D(MAIWB(-3),2)	-0.071585	0.081289	-0.880626	0.3796

D(MAIWB(-4),2)	-0.096398	0.071363	-1.350818	0.1783
C	0.451729	1.100159	0.410604	0.6818
@TREND(1)	-0.001471	0.008692	-0.169222	0.8658

R-squared	0.295325	Mean dependent var	-0.007143
Adjusted R-squared	0.274497	S.D. dependent var	8.944470
S.E. of regression	7.618583	Akaike info criterion	6.931823
Sum squared resid	11782.69	Schwarz criterion	7.043393
Log likelihood	-720.8414	F-statistic	14.17934
Durbin-Watson stat	1.999085	Prob(F-statistic)	0.000000

ADF Test Statistic	-4.473356	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(GIWWB,2)

Method: Least Squares

Date: 12/08/11 Time: 01:58

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GIWWB(-1))	-0.415475	0.092878	-4.473356	0.0000
D(GIWWB(-1),2)	-0.163937	0.095158	-1.722790	0.0864

D(GIWWB(-2),2)	-0.080844	0.087793	-0.920842	0.3582
D(GIWWB(-3),2)	-0.128037	0.081174	-1.577318	0.1163
D(GIWWB(-4),2)	-0.087103	0.071433	-1.219365	0.2241
C	0.407594	1.088537	0.374442	0.7085
@TREND(1)	-0.000885	0.008600	-0.102920	0.9181

R-squared	0.282368	Mean dependent var	0.002381
Adjusted R-squared	0.261158	S.D. dependent var	8.769987
S.E. of regression	7.538325	Akaike info criterion	6.910642
Sum squared resid	11535.75	Schwarz criterion	7.022212
Log likelihood	-718.6174	F-statistic	13.31249
Durbin-Watson stat	2.001870	Prob(F-statistic)	0.000000

Soya beans

ADF Test Statistic	-4.573056	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(SAMSB,2)

Method: Least Squares

Date: 12/08/11 Time: 01:59

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SAMSB(-1))	-0.408961	0.089428	-4.573056	0.0000
D(SAMSB(-1),2)	-0.216222	0.093864	-2.303571	0.0223
D(SAMSB(-2),2)	-0.068813	0.090016	-0.764453	0.4455
D(SAMSB(-3),2)	-0.042549	0.085147	-0.499717	0.6178
D(SAMSB(-4),2)	-0.024012	0.071956	-0.333706	0.7389
C	0.135325	0.756741	0.178826	0.8583
@TREND(1)	0.001272	0.006002	0.212001	0.8323

R-squared	0.292267	Mean dependent var	0.000000
Adjusted R-squared	0.271349	S.D. dependent var	6.168488
S.E. of regression	5.265486	Akaike info criterion	6.192989
Sum squared resid	5628.245	Schwarz criterion	6.304559
Log likelihood	-643.2639	F-statistic	13.97190
Durbin-Watson stat	1.999172	Prob(F-statistic)	0.000000

ADF Test Statistic	-4.193399	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(KAFSB,2)

Method: Least Squares

Date: 12/08/11 Time: 02:00

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(KAFSB(-1))	-0.344159	0.082072	-4.193399	0.0000
D(KAFSB(-1),2)	-0.147129	0.087219	-1.686888	0.0932
D(KAFSB(-2),2)	-0.096926	0.084479	-1.147329	0.2526
D(KAFSB(-3),2)	-0.005784	0.081978	-0.070550	0.9438
D(KAFSB(-4),2)	-0.156196	0.075240	-2.075987	0.0392
C	-0.036163	0.719075	-0.050291	0.9599
@TREND(1)	0.002553	0.005708	0.447219	0.6552
R-squared	0.255979	Mean dependent var		-0.002381
Adjusted R-squared	0.233989	S.D. dependent var		5.708949
S.E. of regression	4.996591	Akaike info criterion		6.088154
Sum squared resid	5068.082	Schwarz criterion		6.199724
Log likelihood	-632.2562	F-statistic		11.64032
Durbin-Watson stat	1.985502	Prob(F-statistic)		0.000000
ADF Test Statistic	-4.744740	1% Critical Value*		-4.0047
		5% Critical Value		-3.4322
		10% Critical Value		-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(KATSB,2)

Method: Least Squares

Date: 12/08/11   Time: 02:00

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(KATSB(-1))	-0.437274	0.092160	-4.744740	0.0000
D(KATSB(-1),2)	-0.051091	0.094759	-0.539167	0.5904
D(KATSB(-2),2)	-0.122651	0.088754	-1.381924	0.1685
D(KATSB(-3),2)	-0.054743	0.080705	-0.678317	0.4983
D(KATSB(-4),2)	-0.041590	0.075293	-0.552378	0.5813
C	-0.021156	0.800711	-0.026422	0.9789
@TREND(1)	0.002654	0.006366	0.416908	0.6772
R-squared	0.257951	Mean dependent var		-0.002381
Adjusted R-squared	0.236019	S.D. dependent var		6.376260
S.E. of regression	5.573234	Akaike info criterion		6.306593
Sum squared resid	6305.371	Schwarz criterion		6.418164
Log likelihood	-655.1923	F-statistic		11.76117
Durbin-Watson stat	1.997790	Prob(F-statistic)		0.000000
ADF Test Statistic	-4.660521	1% Critical Value*		-4.0047
		5% Critical Value		-3.4322
		10% Critical Value		-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(FUNSB,2)

Method: Least Squares

Date: 12/08/11 Time: 02:01

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FUNSB(-1))	-0.442732	0.094996	-4.660521	0.0000
D(FUNSB(-1),2)	-0.102508	0.099009	-1.035339	0.3017
D(FUNSB(-2),2)	-0.204522	0.094296	-2.168936	0.0312
D(FUNSB(-3),2)	-0.059576	0.083523	-0.713286	0.4765
D(FUNSB(-4),2)	0.055743	0.075077	0.742480	0.4587
C	-0.117851	0.759952	-0.155076	0.8769
@TREND(1)	0.003632	0.006031	0.602319	0.5476

R-squared	0.309628	Mean dependent var	-0.004762
Adjusted R-squared	0.289223	S.D. dependent var	6.269847
S.E. of regression	5.285956	Akaike info criterion	6.200749
Sum squared resid	5672.090	Schwarz criterion	6.312319
Log likelihood	-644.0787	F-statistic	15.17409
Durbin-Watson stat	1.998721	Prob(F-statistic)	0.000000

ADF Test Statistic	-5.736682	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(MAISB,2)

Method: Least Squares

Date: 12/08/11 Time: 02:02

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MAISB(-1))	-1.044094	0.182003	-5.736682	0.0000
D(MAISB(-1),2)	-0.167379	0.164891	-1.015085	0.3113
D(MAISB(-2),2)	-0.197330	0.144020	-1.370157	0.1722
D(MAISB(-3),2)	-0.126007	0.114779	-1.097821	0.2736
D(MAISB(-4),2)	-0.065543	0.073153	-0.895982	0.3713
C	-0.447265	1.771993	-0.252408	0.8010
@TREND(1)	0.010628	0.014117	0.752837	0.4524

R-squared	0.604407	Mean dependent var	-0.002381
Adjusted R-squared	0.592715	S.D. dependent var	19.34363
S.E. of regression	12.34489	Akaike info criterion	7.897127
Sum squared resid	30936.46	Schwarz criterion	8.008697
Log likelihood	-822.1983	F-statistic	51.69227
Durbin-Watson stat	2.001818	Prob(F-statistic)	0.000000

ADF Test Statistic	-5.271255	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(GIWSB,2)

Method: Least Squares

Date: 12/08/11 Time: 02:02

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GIWSB(-1))	-0.601455	0.114101	-5.271255	0.0000
D(GIWSB(-1),2)	-0.074545	0.111060	-0.671210	0.5028
D(GIWSB(-2),2)	-0.153439	0.103597	-1.481111	0.1401
D(GIWSB(-3),2)	-0.013910	0.088879	-0.156511	0.8758
D(GIWSB(-4),2)	0.040685	0.072557	0.560733	0.5756
C	-0.205006	0.998062	-0.205404	0.8375
@TREND(1)	0.005362	0.007944	0.674967	0.5005

R-squared	0.362208	Mean dependent var	-0.002381
Adjusted R-squared	0.343357	S.D. dependent var	8.578723
S.E. of regression	6.951640	Akaike info criterion	6.748597
Sum squared resid	9810.036	Schwarz criterion	6.860168

Log likelihood	-701.6027	F-statistic	19.21427
Durbin-Watson stat	1.997862	Prob(F-statistic)	0.000000

Fresh Meat

ADF Test Statistic	-7.642392	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(SAMFM,2)

Method: Least Squares

Date: 12/08/11 Time: 02:07

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SAMFM(-1))	-1.144861	0.149804	-7.642392	0.0000
D(SAMFM(-1),2)	0.175541	0.130846	1.341587	0.1812
D(SAMFM(-2),2)	0.240637	0.113831	2.113979	0.0357
D(SAMFM(-3),2)	0.208529	0.096088	2.170186	0.0312
D(SAMFM(-4),2)	0.096851	0.069662	1.390298	0.1660
C	3.569244	1.544088	2.311555	0.0218
@TREND(1)	-0.017276	0.011866	-1.455894	0.1470

R-squared	0.491267	Mean dependent var	0.000000

Adjusted R-squared	0.476230	S.D. dependent var	14.11674
S.E. of regression	10.21656	Akaike info criterion	7.518661
Sum squared resid	21188.74	Schwarz criterion	7.630231
Log likelihood	-782.4594	F-statistic	32.67173
Durbin-Watson stat	2.008867	Prob(F-statistic)	0.000000

ADF Test Statistic	-6.989027	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(KAFFM,2)

Method: Least Squares

Date: 12/08/11 Time: 02:07

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(KAFFM(-1))	-1.066657	0.152619	-6.989027	0.0000
D(KAFFM(-1),2)	0.112149	0.136704	0.820377	0.4130
D(KAFFM(-2),2)	0.068206	0.116607	0.584924	0.5592
D(KAFFM(-3),2)	-0.005299	0.094159	-0.056275	0.9552
D(KAFFM(-4),2)	0.090838	0.067751	1.340765	0.1815
C	3.340484	1.505185	2.219317	0.0276

@TREND(1)	-0.018009	0.011502	-1.565708	0.1190

R-squared	0.497481	Mean dependent var	-0.047619
Adjusted R-squared	0.482629	S.D. dependent var	13.50590
S.E. of regression	9.714592	Akaike info criterion	7.417900
Sum squared resid	19157.78	Schwarz criterion	7.529471
Log likelihood	-771.8795	F-statistic	33.49419
Durbin-Watson stat	2.007871	Prob(F-statistic)	0.000000

ADF Test Statistic	-3.702806	1% Critical Value*	-4.0045
		5% Critical Value	-3.4321
		10% Critical Value	-3.1395

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(KATFM)

Method: Least Squares

Date: 12/08/11 Time: 02:10

Sample(adjusted): 6 216

Included observations: 211 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
KATFM(-1)	-0.067825	0.018317	-3.702806	0.0003
D(KATFM(-1))	0.022454	0.067523	0.332540	0.7398
D(KATFM(-2))	-0.011306	0.067523	-0.167439	0.8672
D(KATFM(-3))	0.015625	0.067502	0.231476	0.8172

D(KATFM(-4))	-0.076511	0.067488	-1.133708	0.2582
C	39.81445	9.679031	4.113474	0.0001
@TREND(1)	0.058963	0.024557	2.401056	0.0172

R-squared	0.090132	Mean dependent var	1.635071
Adjusted R-squared	0.063371	S.D. dependent var	9.170579
S.E. of regression	8.875251	Akaike info criterion	7.237023
Sum squared resid	16069.10	Schwarz criterion	7.348222
Log likelihood	-756.5059	F-statistic	3.368038
Durbin-Watson stat	1.988849	Prob(F-statistic)	0.003459

ADF Test Statistic	-6.862424	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(FUNFM,2)

Method: Least Squares

Date: 12/08/11 Time: 02:08

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FUNFM(-1))	-1.052269	0.153338	-6.862424	0.0000
D(FUNFM(-1),2)	0.276807	0.135198	2.047420	0.0419

D(FUNFM(-2),2)	0.040625	0.113001	0.359513	0.7196
D(FUNFM(-3),2)	-0.047858	0.088351	-0.541679	0.5886
D(FUNFM(-4),2)	0.015309	0.069985	0.218745	0.8271
C	3.994650	1.201215	3.325509	0.0010
@TREND(1)	-0.020279	0.008869	-2.286635	0.0232

R-squared	0.453590	Mean dependent var	0.000000
Adjusted R-squared	0.437440	S.D. dependent var	9.867544
S.E. of regression	7.401051	Akaike info criterion	6.873886
Sum squared resid	11119.44	Schwarz criterion	6.985457
Log likelihood	-714.7581	F-statistic	28.08601
Durbin-Watson stat	1.996313	Prob(F-statistic)	0.000000

Peak milk

ADF Test Statistic	-7.800875	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(SAMPM,2)

Method: Least Squares

Date: 12/08/11 Time: 02:12

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SAMPM(-1))	-1.311678	0.168145	-7.800875	0.0000
D(SAMPM(-1),2)	0.387083	0.147111	2.631241	0.0092
D(SAMPM(-2),2)	0.131551	0.125362	1.049369	0.2953
D(SAMPM(-3),2)	0.149729	0.094561	1.583402	0.1149
D(SAMPM(-4),2)	0.110160	0.069565	1.583557	0.1149
C	0.309132	0.175321	1.763235	0.0794
@TREND(1)	-0.000528	0.001356	-0.389483	0.6973
R-squared	0.512711	Mean dependent var		0.000000
Adjusted R-squared	0.498308	S.D. dependent var		1.679457
S.E. of regression	1.189563	Akaike info criterion		3.217813
Sum squared resid	287.2570	Schwarz criterion		3.329384
Log likelihood	-330.8704	F-statistic		35.59840
Durbin-Watson stat	1.992973	Prob(F-statistic)		0.000000

ADF Test Statistic	-6.647037	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(KAFPM,2)

Method: Least Squares

Date: 12/08/11   Time: 02:12

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(KAFPM(-1))	-1.276144	0.191987	-6.647037	0.0000
D(KAFPM(-1),2)	0.160240	0.168779	0.949402	0.3435
D(KAFPM(-2),2)	-0.076384	0.140014	-0.545544	0.5860
D(KAFPM(-3),2)	-0.090400	0.103711	-0.871650	0.3844
D(KAFPM(-4),2)	-0.069348	0.069175	-1.002506	0.3173
C	0.265787	0.160567	1.655303	0.0994
@TREND(1)	-0.000173	0.001223	-0.141621	0.8875

R-squared	0.573371	Mean dependent var	-0.007143
Adjusted R-squared	0.560761	S.D. dependent var	1.619616
S.E. of regression	1.073402	Akaike info criterion	3.012308
Sum squared resid	233.8948	Schwarz criterion	3.123878
Log likelihood	-309.2923	F-statistic	45.47052
Durbin-Watson stat	1.990546	Prob(F-statistic)	0.000000

ADF Test Statistic	-6.080365	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(KATPM,2)

Method: Least Squares

Date: 12/08/11 Time: 02:13

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(KATPM(-1))	-1.176529	0.193496	-6.080365	0.0000
D(KATPM(-1),2)	-0.131632	0.174279	-0.755296	0.4509
D(KATPM(-2),2)	-0.176213	0.149113	-1.181739	0.2387
D(KATPM(-3),2)	-0.111239	0.115606	-0.962224	0.3371
D(KATPM(-4),2)	-0.031013	0.069978	-0.443183	0.6581
C	0.208786	0.163326	1.278342	0.2026
@TREND(1)	0.000290	0.001258	0.230331	0.8181
R-squared	0.648242	Mean dependent var		0.000000
Adjusted R-squared	0.637845	S.D. dependent var		1.835326
S.E. of regression	1.104486	Akaike info criterion		3.069402
Sum squared resid	247.6374	Schwarz criterion		3.180972
Log likelihood	-315.2872	F-statistic		62.35029
Durbin-Watson stat	1.999677	Prob(F-statistic)		0.000000
ADF Test Statistic	-6.115084	1% Critical Value*		-4.0047
		5% Critical Value		-3.4322
		10% Critical Value		-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(FUNPM,2)

Method: Least Squares

Date: 12/08/11 Time: 02:14

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FUNPM(-1))	-0.715201	0.116957	-6.115084	0.0000
D(FUNPM(-1),2)	0.068486	0.107763	0.635522	0.5258
D(FUNPM(-2),2)	0.044033	0.095617	0.460518	0.6456
D(FUNPM(-3),2)	0.011298	0.083086	0.135976	0.8920
D(FUNPM(-4),2)	0.008395	0.069793	0.120287	0.9044
C	0.156979	0.101018	1.553971	0.1217
@TREND(1)	-0.000126	0.000778	-0.162026	0.8714
R-squared	0.330610	Mean dependent var		0.000000
Adjusted R-squared	0.310825	S.D. dependent var		0.822820
S.E. of regression	0.683077	Akaike info criterion		2.108347
Sum squared resid	94.71863	Schwarz criterion		2.219917
Log likelihood	-214.3764	F-statistic		16.71023
Durbin-Watson stat	1.999340	Prob(F-statistic)		0.000000

Sugar

ADF Test Statistic	-7.985542	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(SAMSG,2)

Method: Least Squares

Date: 12/08/11 Time: 02:16

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SAMSG(-1))	-1.538939	0.192716	-7.985542	0.0000
D(SAMSG(-1),2)	0.491571	0.166790	2.947252	0.0036
D(SAMSG(-2),2)	0.221729	0.139257	1.592222	0.1129
D(SAMSG(-3),2)	0.150663	0.104735	1.438511	0.1518
D(SAMSG(-4),2)	0.059519	0.072418	0.821882	0.4121
C	0.523757	1.474840	0.355128	0.7229
@TREND(1)	0.020796	0.011941	1.741621	0.0831

R-squared	0.545443	Mean dependent var	-

			0.004762
Adjusted R-squared	0.532008	S.D. dependent var	15.00630
S.E. of regression	10.26580	Akaike info criterion	7.528278
Sum squared resid	21393.48	Schwarz criterion	7.639848
Log likelihood	-783.4692	F-statistic	40.59815
Durbin-Watson stat	2.009043	Prob(F-statistic)	0.000000

ADF Test Statistic	-7.450680	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(KAFSG,2)

Method: Least Squares

Date: 12/08/11 Time: 02:17

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(KAFSG(-1))	-1.229376	0.165002	-7.450680	0.0000
D(KAFSG(-1),2)	0.273117	0.144779	1.886437	0.0607
D(KAFSG(-2),2)	0.133426	0.124055	1.075538	0.2834

D(KAFSG(-3),2)	0.123800	0.098162	1.261187	0.2087
D(KAFSG(-4),2)	0.077783	0.071250	1.091703	0.2763
C	0.550940	0.959624	0.574120	0.5665
@TREND(1)	0.014068	0.007812	1.800742	0.0732

R-squared	0.492096	Mean dependent var	-0.004762
Adjusted R-squared	0.477084	S.D. dependent var	9.218116
S.E. of regression	6.665887	Akaike info criterion	6.664648
Sum squared resid	9020.112	Schwarz criterion	6.776218
Log likelihood	-692.7881	F-statistic	32.78036
Durbin-Watson stat	2.002852	Prob(F-statistic)	0.000000

ADF Test Statistic	-6.821920	1% Critical Value*	-4.0047
		5% Critical Value	-3.4322
		10% Critical Value	-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(KATSG,2)

Method: Least Squares

Date: 12/08/11 Time: 02:17

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(KATSG(-1))	-1.234467	0.180956	-6.821920	0.0000
D(KATSG(-1),2)	0.295485	0.158101	1.868958	0.0631
D(KATSG(-2),2)	0.060298	0.138538	0.435244	0.6638
D(KATSG(-3),2)	0.103662	0.104983	0.987417	0.3246
D(KATSG(-4),2)	-0.011139	0.079055	-0.140905	0.8881
C	-0.011521	1.041230	-0.011065	0.9912
@TREND(1)	0.020723	0.008637	2.399365	0.0173
R-squared	0.506874	Mean dependent var		0.000000
Adjusted R-squared	0.492299	S.D. dependent var		10.17679
S.E. of regression	7.251280	Akaike info criterion		6.832998
Sum squared resid	10673.96	Schwarz criterion		6.944569
Log likelihood	-710.4648	F-statistic		34.77659
Durbin-Watson stat	1.993510	Prob(F-statistic)		0.000000
ADF Test Statistic	-6.967172	1% Critical Value*		-4.0047
		5% Critical Value		-3.4322
		10% Critical Value		-3.1396

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(FUNSG,2)

Method: Least Squares

Date: 12/08/11   Time: 02:18

Sample(adjusted): 7 216

Included observations: 210 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FUNSG(-1))	-0.907843	0.130303	-6.967172	0.0000
D(FUNSG(-1),2)	0.322668	0.113922	2.832362	0.0051
D(FUNSG(-2),2)	0.017713	0.103466	0.171197	0.8642
D(FUNSG(-3),2)	0.136324	0.081554	1.671579	0.0961
D(FUNSG(-4),2)	0.003074	0.071190	0.043179	0.9656
C	0.005153	0.779628	0.006610	0.9947
@TREND(1)	0.015175	0.006522	2.326665	0.0210
R-squared	0.395133	Mean dependent var		0.000000
Adjusted R-squared	0.377255	S.D. dependent var		6.884036
S.E. of regression	5.432480	Akaike info criterion		6.255434
Sum squared resid	5990.904	Schwarz criterion		6.367004
Log likelihood	-649.8205	F-statistic		22.10184
Durbin-Watson stat	2.000506	Prob(F-statistic)		0.000000

Flour

ADF Test Statistic	-4.048881	1% Critical Value*	-4.0045
		5% Critical Value	-3.4321
		10% Critical Value	-3.1395

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(SAMFL)

Method: Least Squares

Date: 12/08/11 Time: 02:22

Sample(adjusted): 6 216

Included observations: 211 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SAMFL(-1)	-0.073789	0.018224	-4.048881	0.0001
D(SAMFL(-1))	-0.029050	0.066008	-0.440099	0.6603
D(SAMFL(-2))	-0.215291	0.066005	-3.261765	0.0013
D(SAMFL(-3))	-0.049834	0.065697	-0.758532	0.4490
D(SAMFL(-4))	-0.073493	0.065740	-1.117943	0.2649
C	19.62653	4.427759	4.432611	0.0000
@TREND(1)	0.021261	0.008410	2.527994	0.0122

R-squared	0.130695	Mean dependent var	0.568720
Adjusted R-squared	0.105127	S.D. dependent var	3.067692
S.E. of regression	2.901967	Akaike info criterion	5.001267
Sum squared resid	1717.968	Schwarz criterion	5.112466
Log likelihood	-520.6337	F-statistic	5.111683
Durbin-Watson stat	1.971395	Prob(F-statistic)	0.000065

ADF Test Statistic	-4.198131	1% Critical Value*	-4.0045
		5% Critical Value	-3.4321
		10% Critical Value	-3.1395

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(KAFFL)

Method: Least Squares

Date: 12/08/11 Time: 02:23

Sample(adjusted): 6 216

Included observations: 211 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
KAFFL(-1)	-0.082574	0.019669	-4.198131	0.0000
D(KAFFL(-1))	-0.001727	0.065941	-0.026193	0.9791
D(KAFFL(-2))	-0.226942	0.065684	-3.455070	0.0007
D(KAFFL(-3))	-0.034878	0.064751	-0.538655	0.5907
D(KAFFL(-4))	-0.123985	0.064803	-1.913272	0.0571
C	21.17028	4.641481	4.561104	0.0000
@TREND(1)	0.026087	0.009108	2.864041	0.0046

R-squared	0.140455	Mean dependent var	0.568720
Adjusted R-squared	0.115175	S.D. dependent var	3.054858
S.E. of regression	2.873557	Akaike info criterion	4.981591
Sum squared resid	1684.495	Schwarz criterion	5.092790

Log likelihood	-518.5579	F-statistic	5.555832
Durbin-Watson stat	2.014816	Prob(F-statistic)	0.000023

ADF Test Statistic	-4.720401	1% Critical Value*	-4.0045
		5% Critical Value	-3.4321
		10% Critical Value	-3.1395

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(KATFL)

Method: Least Squares

Date: 12/08/11 Time: 02:24

Sample(adjusted): 6 216

Included observations: 211 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
KATFL(-1)	-0.098533	0.020874	-4.720401	0.0000
D(KATFL(-1))	-0.084571	0.065080	-1.299487	0.1952
D(KATFL(-2))	-0.253719	0.062805	-4.039796	0.0001
D(KATFL(-3))	-0.079678	0.062095	-1.283150	0.2009
D(KATFL(-4))	-0.124529	0.062106	-2.005108	0.0463
C	24.62250	4.810223	5.118786	0.0000
@TREND(1)	0.033168	0.009945	3.335162	0.0010

R-squared	0.162743	Mean dependent var	0.578199
Adjusted R-squared	0.138117	S.D. dependent var	3.160364

S.E. of regression	2.934008	Akaike info criterion	5.023228
Sum squared resid	1756.114	Schwarz criterion	5.134427
Log likelihood	-522.9506	F-statistic	6.608777
Durbin-Watson stat	2.035227	Prob(F-statistic)	0.000002

ADF Test Statistic	-5.059075	1% Critical Value*	-4.0045
		5% Critical Value	-3.4321
		10% Critical Value	-3.1395

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(FUNFL)

Method: Least Squares

Date: 12/08/11 Time: 02:24

Sample(adjusted): 6 216

Included observations: 211 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FUNFL(-1)	-0.112287	0.022195	-5.059075	0.0000
D(FUNFL(-1))	-0.010018	0.066001	-0.151779	0.8795
D(FUNFL(-2))	-0.252861	0.065369	-3.868186	0.0001
D(FUNFL(-3))	-0.028755	0.065539	-0.438739	0.6613
D(FUNFL(-4))	-0.090644	0.065452	-1.384891	0.1676
C	27.59837	5.141284	5.367991	0.0000
@TREND(1)	0.039729	0.010084	3.939939	0.0001

R-squared	0.173125	Mean dependent var	0.601896
Adjusted R-squared	0.148805	S.D. dependent var	3.087270
S.E. of regression	2.848321	Akaike info criterion	4.963949
Sum squared resid	1655.039	Schwarz criterion	5.075148
Log likelihood	-516.6967	F-statistic	7.118684
Durbin-Watson stat	1.990076	Prob(F-statistic)	0.000001

Appendix II: ARCH/GARCH ESTIMATION RESULTS

Maize

Dependent Variable: D(SAMMZ,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 08:34

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 149 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.195765	0.211257	-0.926665	0.3541
D(SAMMZ(-1),1)	0.570766	0.092687	6.157990	0.0000
D(KAFMZ(-1),1)	0.053874	0.088872	0.606197	0.5444
D(GIWMZ(-1),1)	0.251032	0.047168	5.322068	0.0000
		Variance Equation		
C	9.564016	0.691751	13.82581	0.0000
ARCH(1)	0.793279	0.168608	4.704863	0.0000
GARCH(1)	-0.155466	0.041068	-3.785577	0.0002
R-squared	0.115592	Mean dependent var		0.488318
Adjusted R-squared	0.089957	S.D. dependent var		4.919407
S.E. of regression	4.692927	Akaike info criterion		5.385879
Sum squared resid	4558.877	Schwarz criterion		5.495981
Log likelihood	-569.2891	F-statistic		4.509138
Durbin-Watson stat	2.252884	Prob(F-statistic)		0.000257

Dependent Variable: D(SAMMZ,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 08:35

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 213 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.265892	0.185602	-1.432590	0.1520
D(SAMMZ(-1),1)	0.425231	0.063308	6.716820	0.0000
D(KAFMZ,1)	0.415203	0.054510	7.616927	0.0000
D(GIWMZ,1)	0.162038	0.050180	3.229140	0.0012
		Variance Equation		
C	3.683150	0.400890	9.187430	0.0000
ARCH(1)	1.254180	0.313172	4.004761	0.0001
GARCH(1)	0.128790	0.056124	2.294757	0.0217

R-squared	0.227932	Mean dependent var	0.488318
Adjusted R-squared	0.205553	S.D. dependent var	4.919407
S.E. of regression	4.384755	Akaike info criterion	5.191239
Sum squared resid	3979.797	Schwarz criterion	5.301341
Log likelihood	-548.4626	F-statistic	10.18516
Durbin-Watson stat	2.419537	Prob(F-statistic)	0.000000

Dependent Variable: D(KAFMZ,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 08:36

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 29 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.029419	0.174505	0.168586	0.8661
D(KAFMZ(-1),1)	-0.088120	0.078618	-1.120869	0.2623
D(SAMMZ(-1),1)	0.646743	0.026607	24.30690	0.0000
D(GIWMZ(-1),1)	0.270372	0.039780	6.796600	0.0000
		Variance Equation		
C	3.319767	0.625508	5.307314	0.0000
ARCH(1)	0.344774	0.111360	3.096026	0.0020
GARCH(1)	0.356476	0.095910	3.716776	0.0002
R-squared	0.507624	Mean dependent var		0.385514
Adjusted R-squared	0.493352	S.D. dependent var		4.594059
S.E. of regression	3.270015	Akaike info criterion		5.049429
Sum squared resid	2213.451	Schwarz criterion		5.159531
Log likelihood	-533.2889	F-statistic		35.56836
Durbin-Watson stat	1.980994	Prob(F-statistic)		0.000000

Dependent Variable: D(KAFMZ,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 08:37

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 78 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.164701	0.123256	-1.336255	0.1815
D(KAFMZ(-1),1)	0.206743	0.065284	3.166833	0.0015
D(SAMMZ,1)	0.439149	0.019019	23.08963	0.0000
D(GIWMZ,1)	0.219455	0.030257	7.252980	0.0000
		Variance Equation		
C	2.390993	0.482326	4.957209	0.0000
ARCH(1)	0.906634	0.201096	4.508466	0.0000
GARCH(1)	0.188441	0.071717	2.627584	0.0086
R-squared	0.431118	Mean dependent var		0.385514
Adjusted R-squared	0.414628	S.D. dependent var		4.594059
S.E. of regression	3.514895	Akaike info criterion		4.814018
Sum squared resid	2557.379	Schwarz criterion		4.924120
Log likelihood	-508.0999	F-statistic		26.14524
Durbin-Watson stat	2.540912	Prob(F-statistic)		0.000000

Dependent Variable: D(GIWMZ,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 08:39

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 69 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.170746	0.155245	1.099851	0.2714
D(GIWMZ(-1),1)	0.440378	0.103159	4.268941	0.0000
D(SAMMZ(-1),1)	0.128248	0.046531	2.756210	0.0058
D(KAFMZ(-1),1)	-0.014190	0.058471	-0.242683	0.8083
		Variance Equation		
C	5.188591	0.541718	9.578027	0.0000
ARCH(1)	0.746534	0.180594	4.133759	0.0000
GARCH(1)	-0.045920	0.051973	-0.883526	0.3770

R-squared	0.274101	Mean dependent var	0.434579
Adjusted R-squared	0.253060	S.D. dependent var	3.527946
S.E. of regression	3.049051	Akaike info criterion	4.943519
Sum squared resid	1924.420	Schwarz criterion	5.053621
Log likelihood	-521.9565	F-statistic	13.02726
Durbin-Watson stat	2.073332	Prob(F-statistic)	0.000000

Dependent Variable: D(GIWMZ,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 08:40

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Failure to improve Likelihood after 32 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.173341	0.104503	1.658711	0.0972
D(GIWMZ(-1),1)	0.351226	0.077637	4.523946	0.0000
D(SAMMZ,1)	0.087547	0.031328	2.794516	0.0052
D(KAFMZ,1)	0.192015	0.054441	3.526994	0.0004
		Variance Equation		
C	3.776596	0.304937	12.38485	0.0000
ARCH(1)	1.078023	0.185359	5.815879	0.0000
GARCH(1)	-0.023482	0.018548	-1.266030	0.2055
R-squared	0.303705	Mean dependent var		0.434579
Adjusted R-squared	0.283522	S.D. dependent var		3.527946
S.E. of regression	2.986231	Akaike info criterion		4.805423
Sum squared resid	1845.938	Schwarz criterion		4.915525
Log likelihood	-507.1803	F-statistic		15.04793
Durbin-Watson stat	2.055286	Prob(F-statistic)		0.000000

Millet

Dependent Variable: D(SAMML,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 09:01

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 187 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.138887	0.188381	0.737268	0.4610
D(SAMML(-1),1)	0.263542	0.098825	2.666751	0.0077
D(KAFML(-1),1)	0.281594	0.098180	2.868136	0.0041
D(GIWML(-1),1)	0.081814	0.058709	1.393543	0.1635
		Variance Equation		
C	6.662204	0.388907	17.13056	0.0000
ARCH(1)	1.326746	0.120717	10.99053	0.0000
GARCH(1)	0.000974	0.028220	0.034520	0.9725
R-squared	0.099299	Mean dependent var		0.441589
Adjusted R-squared	0.073192	S.D. dependent var		4.775977
S.E. of regression	4.597875	Akaike info criterion		5.399284
Sum squared resid	4376.074	Schwarz criterion		5.509386
Log likelihood	-570.7234	F-statistic		3.803495
Durbin-Watson stat	2.003678	Prob(F-statistic)		0.001286

Dependent Variable: D(SAMML,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 09:02

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 97 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.238186	0.187345	1.271377	0.2036
D(SAMML(-1),1)	0.294296	0.059361	4.957740	0.0000
D(KAFML,1)	0.610264	0.031418	19.42400	0.0000
D(GIWML,1)	0.030746	0.023109	1.330498	0.1834
		Variance Equation		
C	4.302160	0.542869	7.924855	0.0000
ARCH(1)	1.010040	0.108019	9.350563	0.0000
GARCH(1)	0.040980	0.046840	0.874897	0.3816

R-squared	0.364171	Mean dependent var	0.441589
Adjusted R-squared	0.345741	S.D. dependent var	4.775977
S.E. of regression	3.863111	Akaike info criterion	5.056681
Sum squared resid	3089.190	Schwarz criterion	5.166783
Log likelihood	-534.0648	F-statistic	19.75983
Durbin-Watson stat	2.441198	Prob(F-statistic)	0.000000

Dependent Variable: D(KAFML,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 09:03

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 66 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.177976	0.218815	0.813364	0.4160
D(KAFML(-1),1)	0.044155	0.116095	0.380340	0.7037
D(SAMML(-1),1)	0.546998	0.049942	10.95266	0.0000
D(GIWML(-1),1)	0.161130	0.038184	4.219834	0.0000
		Variance Equation		
C	7.954543	1.103805	7.206472	0.0000
ARCH(1)	0.504573	0.199589	2.528068	0.0115
GARCH(1)	0.021957	0.128726	0.170568	0.8646
R-squared	0.073885	Mean dependent var		0.341121
Adjusted R-squared	0.047041	S.D. dependent var		4.188963
S.E. of regression	4.089250	Akaike info criterion		5.325907
Sum squared resid	3461.447	Schwarz criterion		5.436009
Log likelihood	-562.8721	F-statistic		2.752377
Durbin-Watson stat	1.886079	Prob(F-statistic)		0.013538

Dependent Variable: D(KAFML,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 09:15

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Failure to improve Likelihood after 11 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.009160	0.177624	0.051569	0.9589
D(KAFML(-1),1)	0.180162	0.057392	3.139152	0.0017
D(SAMML,1)	0.544958	0.021060	25.87645	0.0000
D(GIWML,1)	0.060650	0.043320	1.400043	0.1615
		Variance Equation		
C	7.085009	0.682178	10.38587	0.0000
ARCH(1)	0.401497	0.107402	3.738259	0.0002
GARCH(1)	-0.127171	0.061785	-2.058267	0.0396

R-squared	0.400115	Mean dependent var	0.341121
Adjusted R-squared	0.382727	S.D. dependent var	4.188963
S.E. of regression	3.291130	Akaike info criterion	4.855303
Sum squared resid	2242.128	Schwarz criterion	4.965405
Log likelihood	-512.5174	F-statistic	23.01105
Durbin-Watson stat	2.463286	Prob(F-statistic)	0.000000

Dependent Variable: D(GIWML,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 09:16

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Failure to improve Likelihood after 110 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.160669	0.295056	-0.544536	0.5861
D(GIWML(-1),1)	-0.016080	0.055570	-0.289365	0.7723
D(SAMML(-1),1)	-0.051949	0.034107	-1.523124	0.1277
D(KAFML(-1),1)	0.283642	0.045432	6.243284	0.0000
		Variance Equation		
C	9.997671	0.817860	12.22418	0.0000
ARCH(1)	1.634986	0.191454	8.539836	0.0000
GARCH(1)	-0.002689	0.035359	-0.076057	0.9394

R-squared	-0.020202	Mean dependent var	0.252336
Adjusted R-squared	-0.049773	S.D. dependent var	4.893645
S.E. of regression	5.013951	Akaike info criterion	5.724405
Sum squared resid	5203.919	Schwarz criterion	5.834507
Log likelihood	-605.5113	Durbin-Watson stat	1.804523

Dependent Variable: D(GIWML,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 09:17

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Failure to improve Likelihood after 53 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.178621	0.226470	-0.788718	0.4303
D(GIWML(-1),1)	-0.024892	0.049137	-0.506581	0.6124
D(SAMML,1)	-0.046732	0.074594	-0.626491	0.5310
D(KAFML,1)	0.305365	0.045576	6.700084	0.0000
		Variance Equation		
C	9.908863	0.715011	13.85834	0.0000
ARCH(1)	1.331371	0.147739	9.011645	0.0000
GARCH(1)	-0.005902	0.021992	-0.268391	0.7884
R-squared	0.057717	Mean dependent var		0.252336
Adjusted R-squared	0.030405	S.D. dependent var		4.893645
S.E. of regression	4.818676	Akaike info criterion		5.599420
Sum squared resid	4806.466	Schwarz criterion		5.709522
Log likelihood	-592.1380	F-statistic		2.113213
Durbin-Watson stat	1.742619	Prob(F-statistic)		0.053150

Guinea Corn

Dependent Variable: D(SAMGCN,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 10:19

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 58 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.032048	0.205921	0.155633	0.8763
D(SAMGCN(-1),1)	0.308497	0.079410	3.884849	0.0001
D(KAFGCN(-1),1)	0.356489	0.055536	6.419025	0.0000
D(GIWGCN(-1),1)	0.122873	0.071770	1.712038	0.0869
		Variance Equation		
C	1.119396	0.558507	2.004266	0.0450
ARCH(1)	0.091254	0.049711	1.835670	0.0664
GARCH(1)	0.764267	0.093116	8.207723	0.0000

R-squared	0.397650	Mean dependent var	0.376168
Adjusted R-squared	0.380191	S.D. dependent var	3.621122
S.E. of regression	2.850836	Akaike info criterion	4.875575
Sum squared resid	1682.344	Schwarz criterion	4.985677
Log likelihood	-514.6866	F-statistic	22.77570
Durbin-Watson stat	2.084321	Prob(F-statistic)	0.000000

Dependent Variable: D(SAMGCN,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11   Time: 10:20

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 117 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.029361	0.156102	-0.188090	0.8508
D(SAMGCN(-1),1)	0.422594	0.051366	8.227101	0.0000
D(KAFGCN,1)	0.251061	0.028592	8.780725	0.0000
D(GIWGCN,1)	0.317255	0.035771	8.869061	0.0000
		Variance Equation		
C	0.984040	0.465518	2.113858	0.0345
ARCH(1)	0.311109	0.130974	2.375346	0.0175
GARCH(1)	0.598803	0.129234	4.633486	0.0000

R-squared	0.514162	Mean dependent var	0.376168
Adjusted R-squared	0.500080	S.D. dependent var	3.621122
S.E. of regression	2.560315	Akaike info criterion	4.657480
Sum squared resid	1356.929	Schwarz criterion	4.767582
Log likelihood	-491.3504	F-statistic	36.51138
Durbin-Watson stat	2.117965	Prob(F-statistic)	0.000000

Dependent Variable: D(KAFGCN,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 10:21

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 35 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.209173	0.227132	0.920930	0.3571
D(KAFGCN(-1),1)	0.188662	0.098902	1.907577	0.0564
D(SAMGCN(-1),1)	0.258212	0.079919	3.230926	0.0012
D(GIWGCN(-1),1)	0.148385	0.057721	2.570725	0.0101
		Variance Equation		
C	5.554079	1.088633	5.101884	0.0000
ARCH(1)	0.285581	0.092145	3.099250	0.0019
GARCH(1)	0.264785	0.116906	2.264951	0.0235

R-squared	0.134607	Mean dependent var	0.441589
Adjusted R-squared	0.109523	S.D. dependent var	3.842571
S.E. of regression	3.626045	Akaike info criterion	5.244072
Sum squared resid	2721.678	Schwarz criterion	5.354174
Log likelihood	-554.1157	F-statistic	5.366279
Durbin-Watson stat	2.071781	Prob(F-statistic)	0.000036

Dependent Variable: D(KAFGCN,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 10:22

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 105 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.254686	0.104346	2.440788	0.0147
D(KAFGCN(-1),1)	-0.036371	0.073715	-0.493406	0.6217
D(SAMGCN,1)	0.530209	0.048001	11.04575	0.0000
D(GIWGCN,1)	0.276513	0.051746	5.343608	0.0000
		Variance Equation		
C	4.325567	0.374154	11.56093	0.0000
ARCH(1)	0.860331	0.193302	4.450706	0.0000
GARCH(1)	-0.034870	0.026630	-1.309415	0.1904

R-squared	0.373857	Mean dependent var	0.441589
Adjusted R-squared	0.355708	S.D. dependent var	3.842571
S.E. of regression	3.084347	Akaike info criterion	4.821542
Sum squared resid	1969.232	Schwarz criterion	4.931644
Log likelihood	-508.9050	F-statistic	20.59923
Durbin-Watson stat	2.038775	Prob(F-statistic)	0.000000

Dependent Variable: D(GIWGCN,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11   Time: 10:23

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 64 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.132005	0.199766	0.660799	0.5087
D(GIWGCN(-1),1)	0.314908	0.104420	3.015773	0.0026
D(SAMGCN(-1),1)	0.001873	0.072414	0.025863	0.9794
D(KAFGCN(-1),1)	0.317167	0.037114	8.545721	0.0000
		Variance Equation		
C	1.817821	0.670764	2.710077	0.0067
ARCH(1)	0.213992	0.087839	2.436193	0.0148
GARCH(1)	0.574724	0.137971	4.165530	0.0000

R-squared	0.268105	Mean dependent var	0.434579
Adjusted R-squared	0.246891	S.D. dependent var	3.335035
S.E. of regression	2.894205	Akaike info criterion	4.864099
Sum squared resid	1733.920	Schwarz criterion	4.974201
Log likelihood	-513.4586	F-statistic	12.63794
Durbin-Watson stat	2.105096	Prob(F-statistic)	0.000000

Dependent Variable: D(GIWGCN,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 10:24

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 20 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.073477	0.158112	0.464717	0.6421
D(GIWGCN(-1),1)	0.225815	0.061653	3.662669	0.0002
D(SAMGCN,1)	0.201259	0.046887	4.292430	0.0000
D(KAFGCN,1)	0.280197	0.030695	9.128492	0.0000
		Variance Equation		
C	2.552395	0.373594	6.832000	0.0000
ARCH(1)	0.494083	0.096566	5.116506	0.0000
GARCH(1)	0.257606	0.082247	3.132119	0.0017

R-squared	0.345270	Mean dependent var	0.434579
Adjusted R-squared	0.326292	S.D. dependent var	3.335035
S.E. of regression	2.737387	Akaike info criterion	4.685575
Sum squared resid	1551.111	Schwarz criterion	4.795677
Log likelihood	-494.3566	F-statistic	18.19347
Durbin-Watson stat	2.077148	Prob(F-statistic)	0.000000

Local Rice

Dependent Variable: D(SAMLR,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 10:58

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 48 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.121672	0.503377	0.241712	0.8090
D(SAMLR(-1),1)	0.097599	0.071718	1.360869	0.1736
D(KAFLR(-1),1)	0.791254	0.019869	39.82357	0.0000
D(GIWLR(-1),1)	-0.112193	0.088781	-1.263707	0.2063
Variance Equation				
C	52.14236	6.153656	8.473395	0.0000
ARCH(1)	0.328662	0.100451	3.271873	0.0011
GARCH(1)	-0.143746	0.092417	-1.555407	0.1198

R-squared	0.433838	Mean dependent var	0.481308
Adjusted R-squared	0.417428	S.D. dependent var	11.23802
S.E. of regression	8.577578	Akaike info criterion	6.936246
Sum squared resid	15229.99	Schwarz criterion	7.046348
Log likelihood	-735.1783	F-statistic	26.43665
Durbin-Watson stat	2.220011	Prob(F-statistic)	0.000000

Dependent Variable: D(SAMLR,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 10:59

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 67 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.653947	0.439945	1.486430	0.1372
D(SAMLR(-1),1)	0.407253	0.061529	6.618900	0.0000
D(KAFLR,1)	-0.206851	0.018276	-11.31806	0.0000
D(GIWLR,1)	0.485079	0.040076	12.10405	0.0000
		Variance Equation		
C	32.56119	5.004321	6.506615	0.0000
ARCH(1)	1.041476	0.220326	4.726970	0.0000
GARCH(1)	-0.023718	0.046315	-0.512096	0.6086

R-squared	0.237952	Mean dependent var	0.481308
Adjusted R-squared	0.215864	S.D. dependent var	11.23802
S.E. of regression	9.951431	Akaike info criterion	6.995600
Sum squared resid	20499.41	Schwarz criterion	7.105702
Log likelihood	-741.5292	F-statistic	10.77274
Durbin-Watson stat	2.013888	Prob(F-statistic)	0.000000

Dependent Variable: D(KAFLR,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 11:00

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Failure to improve Likelihood after 16 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.601158	1.066058	0.563907	0.5728
D(KAFLR(-1),1)	0.299101	0.144340	2.072194	0.0382
D(SAMLR(-1),1)	0.147147	0.124130	1.185419	0.2359
D(GIWLR(-1),1)	0.399981	0.118975	3.361899	0.0008
		Variance Equation		
C	97.03818	8.209494	11.82024	0.0000
ARCH(1)	0.300353	0.121343	2.475242	0.0133
GARCH(1)	-0.054202	0.052911	-1.024406	0.3056

R-squared	0.142384	Mean dependent var	0.392523
Adjusted R-squared	0.117525	S.D. dependent var	11.14238
S.E. of regression	10.46717	Akaike info criterion	7.197626
Sum squared resid	22679.26	Schwarz criterion	7.307728
Log likelihood	-763.1460	F-statistic	5.727772
Durbin-Watson stat	2.564399	Prob(F-statistic)	0.000016

Dependent Variable: D(KAFLR,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 11:01

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 230 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.040064	0.674576	0.059392	0.9526
D(KAFLR(-1),1)	0.333341	0.075675	4.404901	0.0000
D(SAMLR,1)	0.264253	0.062003	4.261966	0.0000
D(GIWLR,1)	0.364242	0.076998	4.730548	0.0000
		Variance Equation		
C	43.87710	3.875993	11.32022	0.0000
ARCH(1)	0.578030	0.170891	3.382447	0.0007
GARCH(1)	0.014823	0.071033	0.208675	0.8347

R-squared	-0.042734	Mean dependent var	0.392523
Adjusted R-squared	-0.072958	S.D. dependent var	11.14238
S.E. of regression	11.54169	Akaike info criterion	6.994679
Sum squared resid	27574.61	Schwarz criterion	7.104781
Log likelihood	-741.4306	Durbin-Watson stat	2.903377

Dependent Variable: D(GIWLR,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 11:01

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 79 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.455974	0.313190	-1.455902	0.1454
D(GIWLR(-1),1)	0.614594	0.040213	15.28328	0.0000
D(SAMLR(-1),1)	-0.038288	0.049388	-0.775242	0.4382
D(KAFLR(-1),1)	0.219024	0.027850	7.864478	0.0000
		Variance Equation		
C	28.37127	2.580178	10.99586	0.0000
ARCH(1)	0.631574	0.209878	3.009237	0.0026
GARCH(1)	-0.068787	0.053214	-1.292648	0.1961

R-squared	0.415550	Mean dependent var	0.308411
Adjusted R-squared	0.398610	S.D. dependent var	8.791974
S.E. of regression	6.818119	Akaike info criterion	6.518442
Sum squared resid	9622.757	Schwarz criterion	6.628544
Log likelihood	-690.4733	F-statistic	24.52988
Durbin-Watson stat	1.794328	Prob(F-statistic)	0.000000

Dependent Variable: D(GIWLR,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 11:02

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 120 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.440128	0.325125	-1.353720	0.1758
D(GIWLR(-1),1)	0.484070	0.086355	5.605583	0.0000
D(SAMLR,1)	0.276425	0.028285	9.772747	0.0000
D(KAFLR,1)	0.078228	0.038613	2.025950	0.0428
		Variance Equation		
C	16.88616	4.331985	3.898018	0.0001
ARCH(1)	0.497443	0.155247	3.204203	0.0014
GARCH(1)	0.178649	0.164615	1.085254	0.2778
R-squared	0.482892	Mean dependent var		0.308411
Adjusted R-squared	0.467904	S.D. dependent var		8.791974
S.E. of regression	6.413298	Akaike info criterion		6.379106
Sum squared resid	8513.992	Schwarz criterion		6.489208
Log likelihood	-675.5643	F-statistic		32.21727
Durbin-Watson stat	1.614726	Prob(F-statistic)		0.000000

White Beans

Dependent Variable: D(SAMWB,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11   Time: 12:30

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Failure to improve Likelihood after 24 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.614048	0.407296	1.507621	0.1317
D(SAMWB(-1),1)	0.141786	0.054381	2.607276	0.0091
D(KAFWB(-1),1)	0.119910	0.056156	2.135313	0.0327
D(GIWWB(-1),1)	0.344428	0.040825	8.436629	0.0000
		Variance Equation		
C	48.93270	3.784351	12.93027	0.0000
ARCH(1)	0.635356	0.102239	6.214418	0.0000
GARCH(1)	-0.072356	0.035488	-2.038911	0.0415

R-squared	0.377267	Mean dependent var	0.785047
Adjusted R-squared	0.359216	S.D. dependent var	9.570865
S.E. of regression	7.661379	Akaike info criterion	6.691486
Sum squared resid	12150.22	Schwarz criterion	6.801588
Log likelihood	-708.9890	F-statistic	20.90091
Durbin-Watson stat	1.499745	Prob(F-statistic)	0.000000

Dependent Variable: D(SAMWB,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11   Time: 12:33

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 22 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.221499	0.262927	0.842436	0.3995
D(SAMWB(-1),1)	0.317448	0.040815	7.777735	0.0000
D(KAFWB,1)	0.478470	0.018459	25.92115	0.0000
D(GIWWB,1)	0.158933	0.022662	7.013160	0.0000
		Variance Equation		
C	7.604893	1.323707	5.745150	0.0000
ARCH(1)	0.921006	0.173631	5.304383	0.0000
GARCH(1)	0.151852	0.047906	3.169761	0.0015

R-squared	0.577196	Mean dependent var	0.785047
Adjusted R-squared	0.564941	S.D. dependent var	9.570865
S.E. of regression	6.312848	Akaike info criterion	6.032695
Sum squared resid	8249.373	Schwarz criterion	6.142797
Log likelihood	-638.4984	F-statistic	47.09812
Durbin-Watson stat	2.265465	Prob(F-statistic)	0.000000

Dependent Variable: D(KAFWB,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11   Time: 12:41

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 98 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	1.735395	0.416163	4.169985	0.0000
D(KAFWB(-1),1)	0.318909	0.063838	4.995622	0.0000
D(SAMWB(-1),1)	-0.006897	0.069940	-0.098611	0.9214
D(GIWWB(-1),1)	0.096856	0.038667	2.504893	0.0122
		Variance Equation		
C	8.914357	2.693291	3.309838	0.0009
ARCH(1)	1.494765	0.259404	5.762298	0.0000
GARCH(1)	0.218851	0.046623	4.694091	0.0000

R-squared	0.149382	Mean dependent var	0.731308
Adjusted R-squared	0.124726	S.D. dependent var	9.617521
S.E. of regression	8.997774	Akaike info criterion	6.705645
Sum squared resid	16758.71	Schwarz criterion	6.815747
Log likelihood	-710.5040	F-statistic	6.058745
Durbin-Watson stat	2.068736	Prob(F-statistic)	0.000007

Dependent Variable: D(KAFWB,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 12:42

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 83 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.545670	0.236818	-2.304169	0.0212
D(KAFWB(-1),1)	0.208787	0.049613	4.208330	0.0000
D(SAMWB,1)	0.505744	0.029249	17.29125	0.0000
D(GIWWB,1)	0.273817	0.026553	10.31210	0.0000
		Variance Equation		
C	11.13482	1.627805	6.840390	0.0000
ARCH(1)	1.602657	0.237320	6.753137	0.0000
GARCH(1)	0.006389	0.024909	0.256499	0.7976

R-squared	0.410976	Mean dependent var	0.731308
Adjusted R-squared	0.393903	S.D. dependent var	9.617521
S.E. of regression	7.487458	Akaike info criterion	6.305985
Sum squared resid	11604.84	Schwarz criterion	6.416087
Log likelihood	-667.7404	F-statistic	24.07143
Durbin-Watson stat	2.512921	Prob(F-statistic)	0.000000

Dependent Variable: D(GIWWB,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11   Time: 12:42

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 52 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	1.800037	0.378880	4.750948	0.0000
D(GIWWB(-1),1)	0.317295	0.085649	3.704584	0.0002
D(SAMWB(-1),1)	-0.090331	0.067403	-1.340168	0.1802
D(KAFWB(-1),1)	0.236073	0.029210	8.081810	0.0000
		Variance Equation		
C	4.697599	1.442829	3.255825	0.0011
ARCH(1)	0.633108	0.134838	4.695336	0.0000
GARCH(1)	0.524944	0.047056	11.15577	0.0000

R-squared	0.171094	Mean dependent var	0.735981
Adjusted R-squared	0.147068	S.D. dependent var	8.399176
S.E. of regression	7.757002	Akaike info criterion	6.565901
Sum squared resid	12455.41	Schwarz criterion	6.676003
Log likelihood	-695.5514	F-statistic	7.121139
Durbin-Watson stat	1.811543	Prob(F-statistic)	0.000001

Dependent Variable: D(GIWWB,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 12:43

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 38 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.826559	0.349105	2.367653	0.0179
D(GIWWB(-1),1)	0.223149	0.058933	3.786470	0.0002
D(SAMWB,1)	0.199530	0.035053	5.692263	0.0000
D(KAFWB,1)	0.332918	0.033322	9.991053	0.0000
		Variance Equation		
C	1.568755	0.975708	1.607813	0.1079
ARCH(1)	0.779560	0.165290	4.716313	0.0000
GARCH(1)	0.488542	0.043372	11.26400	0.0000
R-squared	0.240432	Mean dependent var		0.735981
Adjusted R-squared	0.218416	S.D. dependent var		8.399176
S.E. of regression	7.425481	Akaike info criterion		6.221867
Sum squared resid	11413.52	Schwarz criterion		6.331969
Log likelihood	-658.7398	F-statistic		10.92057
Durbin-Watson stat	1.802768	Prob(F-statistic)		0.000000

Soya Beans

Dependent Variable: D(SAMSB,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 12:15

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 347 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.305227	0.326252	0.935557	0.3495
D(SAMSB(-1),1)	0.465540	0.106287	4.380047	0.0000
D(KAFSB(-1),1)	0.141346	0.073971	1.910836	0.0560
D(GIWSB(-1),1)	0.067087	0.043374	1.546689	0.1219
		Variance Equation		
C	5.617122	1.581906	3.550856	0.0004
ARCH(1)	0.261982	0.067391	3.887473	0.0001
GARCH(1)	0.512541	0.110679	4.630890	0.0000

R-squared	0.216313	Mean dependent var	0.668224
Adjusted R-squared	0.193597	S.D. dependent var	5.887220
S.E. of regression	5.286721	Akaike info criterion	5.881334
Sum squared resid	5785.529	Schwarz criterion	5.991436
Log likelihood	-622.3028	F-statistic	9.522651
Durbin-Watson stat	2.464090	Prob(F-statistic)	0.000000

Dependent Variable: D(SAMSB,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 12:16

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 25 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.038828	0.195215	-0.198900	0.8423
D(SAMSB(-1),1)	0.134039	0.042961	3.120036	0.0018
D(KAFSB,1)	0.563006	0.037440	15.03753	0.0000
D(GIWSB,1)	0.159221	0.033249	4.788747	0.0000
		Variance Equation		
C	0.107648	0.049240	2.186170	0.0288
ARCH(1)	-0.034987	0.008868	-3.945380	0.0001
GARCH(1)	1.036127	0.012272	84.42932	0.0000
R-squared	0.584111	Mean dependent var		0.668224
Adjusted R-squared	0.572056	S.D. dependent var		5.887220
S.E. of regression	3.851268	Akaike info criterion		5.347523
Sum squared resid	3070.279	Schwarz criterion		5.457625
Log likelihood	-565.1850	F-statistic		48.45478
Durbin-Watson stat	2.110448	Prob(F-statistic)		0.000000

Dependent Variable: D(KAFSB,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 12:17

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 59 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.166849	0.242265	0.688703	0.4910
D(KAFSB(-1),1)	0.253523	0.083272	3.044534	0.0023
D(SAMSB(-1),1)	0.307462	0.045171	6.806600	0.0000
D(GIWSB(-1),1)	0.332378	0.034606	9.604599	0.0000
		Variance Equation		
C	8.208313	1.626228	5.047455	0.0000
ARCH(1)	0.596508	0.123731	4.820998	0.0000
GARCH(1)	0.176052	0.128577	1.369239	0.1709
R-squared	0.186014	Mean dependent var		0.714953
Adjusted R-squared	0.162420	S.D. dependent var		5.989667
S.E. of regression	5.481706	Akaike info criterion		5.784166
Sum squared resid	6220.163	Schwarz criterion		5.894268
Log likelihood	-611.9058	F-statistic		7.884034
Durbin-Watson stat	2.366803	Prob(F-statistic)		0.000000

Dependent Variable: D(KAFSB,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11   Time: 12:17

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 30 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.035634	0.255062	0.139706	0.8889
D(KAFSB(-1),1)	0.209622	0.049905	4.200443	0.0000
D(SAMSB,1)	0.568225	0.036820	15.43240	0.0000
D(GIWSB,1)	0.145418	0.024520	5.930542	0.0000
		Variance Equation		
C	0.330557	0.318207	1.038811	0.2989
ARCH(1)	0.107075	0.032637	3.280743	0.0010
GARCH(1)	0.891480	0.042978	20.74271	0.0000

R-squared	0.611591	Mean dependent var	0.714953
Adjusted R-squared	0.600333	S.D. dependent var	5.989667
S.E. of regression	3.786623	Akaike info criterion	5.410541
Sum squared resid	2968.072	Schwarz criterion	5.520643
Log likelihood	-571.9278	F-statistic	54.32385
Durbin-Watson stat	2.126096	Prob(F-statistic)	0.000000

Dependent Variable: D(GIWSB,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 12:18

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 196 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.741449	0.108255	6.849064	0.0000
D(GIWSB(-1),1)	0.341856	0.051196	6.677441	0.0000
D(SAMSB(-1),1)	0.172023	0.022437	7.667069	0.0000
D(KAFSB(-1),1)	0.200990	0.039908	5.036337	0.0000
		Variance Equation		
C	8.028320	0.740310	10.84453	0.0000
ARCH(1)	2.915988	0.402578	7.243293	0.0000
GARCH(1)	-0.013229	0.008337	-1.586796	0.1126
R-squared	0.121664	Mean dependent var		0.654206
Adjusted R-squared	0.096205	S.D. dependent var		7.264264
S.E. of regression	6.906001	Akaike info criterion		6.110158
Sum squared resid	9872.419	Schwarz criterion		6.220260
Log likelihood	-646.7869	F-statistic		4.778816
Durbin-Watson stat	2.246137	Prob(F-statistic)		0.000138

Dependent Variable: D(GIWSB,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11   Time: 12:19

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 76 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.384601	0.157528	2.441476	0.0146
D(GIWSB(-1),1)	0.100718	0.081156	1.241040	0.2146
D(SAMSB,1)	0.386962	0.024236	15.96647	0.0000
D(KAFSB,1)	0.436964	0.042009	10.40157	0.0000
		Variance Equation		
C	2.275843	0.825491	2.756955	0.0058
ARCH(1)	1.594436	0.237916	6.701675	0.0000
GARCH(1)	0.299987	0.046437	6.460100	0.0000

R-squared	0.324427	Mean dependent var	0.654206
Adjusted R-squared	0.304846	S.D. dependent var	7.264264
S.E. of regression	6.056647	Akaike info criterion	5.964203
Sum squared resid	7593.376	Schwarz criterion	6.074305
Log likelihood	-631.1697	F-statistic	16.56779
Durbin-Watson stat	1.826038	Prob(F-statistic)	0.000000

Fresh Meat

Dependent Variable: D(SAMFM,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 13:25

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 134 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	1.316924	0.674865	1.951387	0.0510
D(SAMFM(-1),1)	0.087181	0.103108	0.845531	0.3978
D(KAFFM(-1),1)	0.289391	0.045618	6.343837	0.0000
	Variance Equation			
C	2.748245	1.233683	2.227675	0.0259
ARCH(1)	0.350660	0.049942	7.021413	0.0000
GARCH(1)	0.766205	0.010903	70.27774	0.0000

R-squared	-0.014838	Mean dependent var	1.518692
Adjusted R-squared	-0.039233	S.D. dependent var	10.20481
S.E. of regression	10.40307	Akaike info criterion	7.259570
Sum squared resid	22510.55	Schwarz criterion	7.353943
Log likelihood	-770.7740	Durbin-Watson stat	2.311883

Dependent Variable: D(SAMFM,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 13:26

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 86 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.417168	0.411056	1.014868	0.3102
D(SAMFM(-1),1)	-0.082079	0.073270	-1.120218	0.2626
D(KAFFM,1)	0.730010	0.025882	28.20496	0.0000
		Variance Equation		
C	9.137231	1.155588	7.906996	0.0000
ARCH(1)	1.601649	0.180077	8.894225	0.0000
GARCH(1)	0.308916	0.023665	13.05380	0.0000

R-squared	-0.249135	Mean dependent var	1.518692
Adjusted R-squared	-0.279162	S.D. dependent var	10.20481
S.E. of regression	11.54164	Akaike info criterion	7.100494
Sum squared resid	27707.59	Schwarz criterion	7.194867
Log likelihood	-753.7529	Durbin-Watson stat	1.891243

Dependent Variable: D(KATFM,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 13:27

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 75 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	1.831718	0.664512	2.756487	0.0058
D(KATFM(-1),1)	-0.119923	0.116205	-1.031994	0.3021
D(SAMFM(-1),1)	0.080338	0.064655	1.242566	0.2140
		Variance Equation		
C	32.21865	6.228652	5.172652	0.0000
ARCH(1)	0.502664	0.169004	2.974273	0.0029
GARCH(1)	0.240434	0.104610	2.298384	0.0215

R-squared	-0.024505	Mean dependent var	1.635514
Adjusted R-squared	-0.049132	S.D. dependent var	9.110065
S.E. of regression	9.331180	Akaike info criterion	7.141216
Sum squared resid	18110.75	Schwarz criterion	7.235590
Log likelihood	-758.1102	Durbin-Watson stat	1.711367

Dependent Variable: D(KATFM,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 13:28

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 66 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	1.766060	0.649074	2.720892	0.0065
D(KATFM(-1),1)	-0.208132	0.099792	-2.085657	0.0370
D(SAMFM,1)	0.099337	0.031231	3.180688	0.0015
		Variance Equation		
C	31.16160	6.033062	5.165138	0.0000
ARCH(1)	0.571641	0.183462	3.115856	0.0018
GARCH(1)	0.220645	0.106101	2.079563	0.0376
R-squared	-0.040622	Mean dependent var		1.635514
Adjusted R-squared	-0.065637	S.D. dependent var		9.110065
S.E. of regression	9.404290	Akaike info criterion		7.134502
Sum squared resid	18395.66	Schwarz criterion		7.228875
Log likelihood	-757.3917	Durbin-Watson stat		1.591146

Dependent Variable: D(KATFM,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11   Time: 13:37

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 74 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	1.751734	0.718431	2.438278	0.0148
D(KATFM(-1),1)	-0.155554	0.112496	-1.382757	0.1667
D(FUNFM(-1),1)	0.102875	0.074551	1.379934	0.1676
		Variance Equation		
C	31.75243	6.444117	4.927351	0.0000
ARCH(1)	0.538950	0.180873	2.979714	0.0029
GARCH(1)	0.228078	0.114228	1.996694	0.0459
R-squared	-0.033367	Mean dependent var		1.635514
Adjusted R-squared	-0.058208	S.D. dependent var		9.110065
S.E. of regression	9.371454	Akaike info criterion		7.137489
Sum squared resid	18267.42	Schwarz criterion		7.231862
Log likelihood	-757.7113	Durbin-Watson stat		1.622752

Dependent Variable: D(KATFM,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11   Time: 13:38

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 86 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	1.784494	0.681603	2.618083	0.0088
D(KATFM(-1),1)	-0.148042	0.115767	-1.278787	0.2010
D(FUNFM,1)	0.070394	0.098072	0.717775	0.4729
		Variance Equation		
C	32.08232	6.125323	5.237653	0.0000
ARCH(1)	0.554084	0.185850	2.981348	0.0029
GARCH(1)	0.222921	0.105907	2.104865	0.0353

R-squared	-0.033902	Mean dependent var	1.635514
Adjusted R-squared	-0.058756	S.D. dependent var	9.110065
S.E. of regression	9.373879	Akaike info criterion	7.145005
Sum squared resid	18276.88	Schwarz criterion	7.239378
Log likelihood	-758.5155	Durbin-Watson stat	1.661202

Dependent Variable: D(FUNFM,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 13:39

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 95 iterations

Variance backcast: ON

	Coefficien	Std. Error	z-Statistic	Prob.

t

C	0.645584	0.412125	1.566474	0.1172
D(FUNFM(-1),1)	0.257642	0.083925	3.069919	0.0021
D(KATFM(-1),1)	0.275389	0.028729	9.585829	0.0000
		Variance Equation		
C	1.523232	0.576380	2.642759	0.0082
ARCH(1)	0.595037	0.083994	7.084283	0.0000
GARCH(1)	0.610319	0.028841	21.16124	0.0000

R-squared	0.004973	Mean dependent var	1.635514
Adjusted R-squared	-0.018946	S.D. dependent var	7.760369
S.E. of regression	7.833537	Akaike info criterion	6.411705
Sum squared resid	12763.77	Schwarz criterion	6.506078
Log likelihood	-680.0524	F-statistic	0.207927
Durbin-Watson stat	2.185501	Prob(F-statistic)	0.958897

Dependent Variable: D(FUNFM,1)

Method: ML - ARCH (Marquardt)

Date: 12/07/11 Time: 13:40

Sample(adjusted): 3 216

Included observations: 214 after adjusting endpoints

Convergence achieved after 204 iterations

Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.307542	0.325104	0.945979	0.3442
D(FUNFM(-1),1)	0.222253	0.076721	2.896906	0.0038
D(KATFM,1)	-0.145225	0.012403	-11.70862	0.0000
		Variance Equation		
C	6.940244	0.701040	9.899924	0.0000
ARCH(1)	1.321464	0.299869	4.406805	0.0000
GARCH(1)	0.279718	0.060600	4.615772	0.0000
R-squared	-0.009118	Mean dependent var		1.635514
Adjusted R-squared	-0.033376	S.D. dependent var		7.760369
S.E. of regression	7.888811	Akaike info criterion		6.519881
Sum squared resid	12944.53	Schwarz criterion		6.614255
Log likelihood	-691.6273	Durbin-Watson stat		1.817801

Appendix III: VAR Lag Order Selection Criteria

Exogenous variables: C

Date: 12/16/12 Time: 15:47

Sample: 1974 2010

Included observations: 31

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1.175827	NA	1.02e-06	0.398440	0.629729	0.473835
1	27.60632	46.42282*	8.23e-07	0.154431	1.542161	0.606796
2	45.14826	22.63477	1.53e-06	0.635596	3.179767	1.464932
3	71.50106	25.50270	2.06e-06	0.548319	4.248931	1.754626
4	107.4840	23.21479	2.55e-06	-0.160256	4.696797	1.423022
5	222.2796	37.03086	7.84e-08*	-5.953524*	0.059970*	-3.993275*

* indicates lag order selected by the criterion

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

FPE: Final prediction error

AIC: Akaike information criterion

SC:Schwarz information criterion

HQ: Hannan-Quinn information criterion

APPENDIX IV: VEC Estimate of the model of Agricultural Import

Vector Error Correction Estimates

Date: 12/15/12 Time: 16:14

Sample (adjusted): 1976 2010

Included observations: 35 after adjustments

Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
AGI(-1)	1.000000
COP(-1)	-1.689513
	(0.98892)
	[-1.70844]
EXCH(-1)	1.090576
	(0.25370)
	[4.29868]
GDP(-1)	-1.092335
	(0.30498)
	[-3.58170]
MS1(-1)	-1.865123
	(0.26513)
	[-7.03466]

ROP(-1)	2.216224					
	(0.30763)					
	[7.20419]					
C	38.37452					

Error Correction:	D(AGI)	D(COP)	D(EXCH)	D(GDP)	D(MS1)	D(ROP)
CointEq1	-0.657134	0.034854	-0.175444	-0.024837	0.051869	0.070883
	(0.10712)	(0.04192)	(0.09693)	(0.10324)	(0.04149)	(0.08522)
	[-6.13465]	[0.83148]	[-1.80997]	[-0.24056]	[1.25016]	[0.83175]
D(AGI(-1))	-0.123745	0.010416	0.018827	-0.037113	-0.024023	-0.018068
	(0.10562)	(0.04133)	(0.09557)	(0.10180)	(0.04091)	(0.08403)
	[-1.17165]	[0.25203]	[0.19699]	[-0.36458]	[-0.58723]	[-0.21502]
D(COP(-1))	-0.952757	0.068622	-0.173058	-0.641494	0.270974	0.615317
	(0.58872)	(0.23038)	(0.53274)	(0.56742)	(0.22803)	(0.46837)
	[-1.61836]	[0.29787]	[-0.32485]	[-1.13054]	[1.18833]	[1.31373]
D(EXCH(-1))	0.133063	-0.032047	0.040855	-0.059745	0.212963	0.163333
	(0.18504)	(0.07241)	(0.16745)	(0.17835)	(0.07167)	(0.14722)
	[0.71909]	[-0.44257]	[0.24399]	[-0.33499]	[2.97134]	[1.10948]
D(GDP(-1))	-0.328001	-0.046812	-0.022485	-0.197141	-0.002572	0.096466

	(0.21751)	(0.08512)	(0.19683)	(0.20964)	(0.08425)	(0.17305)
	[-1.50797]	[-0.54996]	[-0.11424]	[-0.94036]	[-0.03053]	[0.55745]
D(MS1(-1))	0.404416	-0.102984	0.264942	0.244162	0.242051	-0.240614
	(0.40292)	(0.15767)	(0.36460)	(0.38834)	(0.15606)	(0.32055)
	[1.00372]	[-0.65316]	[0.72666]	[0.62873]	[1.55098]	[-0.75062]
D(ROP(-1))	0.795561	-0.129247	-0.348099	0.394165	0.021335	-0.074118
	(0.28222)	(0.11044)	(0.25538)	(0.27201)	(0.10931)	(0.22453)
	[2.81896]	[-1.17030]	[-1.36305]	[1.44909]	[0.19518]	[-0.33011]
C	0.024285	0.049602	0.105630	0.058341	0.131190	0.085087
	(0.12063)	(0.04720)	(0.10916)	(0.11626)	(0.04672)	(0.09597)
	[0.20132]	[1.05079]	[0.96769]	[0.50180]	[2.80785]	[0.88661]
R-squared	0.694106	0.101023	0.290733	0.169225	0.384034	0.135769
Adj. R-squared	0.614800	-0.132045	0.106849	-0.046161	0.224339	-0.088290
Sum sq. resids	2.991619	0.458120	2.449716	2.779098	0.448816	1.893527
S.E. equation	0.332867	0.130259	0.301215	0.320826	0.128930	0.264822
F-statistic	8.752249	0.433451	1.581067	0.785682	2.404800	0.605952
Log likelihood	-6.621016	26.21666	-3.123765	-5.331471	26.57572	1.383018
Akaike AIC	0.835487	-1.040952	0.635644	0.761798	-1.061470	0.378113
Schwarz SC	1.190995	-0.685444	0.991152	1.117306	-0.705962	0.733621
Mean dependent	0.121622	0.010881	0.157054	0.097852	0.216988	0.057779
S.D. dependent	0.536325	0.122427	0.318723	0.313668	0.146392	0.253853

Determinant resid covariance (dof adj.)	8.60E-09
Determinant resid covariance	1.81E-09
Log likelihood	54.27625
Akaike information criterion	-0.015785
Schwarz criterion	2.383894

APPENDIX VI: Vector Autoregression Estimate

Vector Autoregression Estimates

Date: 12/16/12 Time: 15:48

Sample (adjusted): 1976 2010

Included observations: 35 after adjustments

Standard errors in ( ) & t-statistics in [ ]

	D(ROP)	D(COP)	D(MS1)	D(EXCH)	D(AGE)
D(ROP(-1))	0.025826	-0.067253	0.118705	-0.589536	-0.462262
	(0.18842)	(0.07989)	(0.08088)	(0.22027)	(0.47639)
	[0.13706]	[-0.84184]	[1.46765]	[-2.67638]	[-0.97035]
D(COP(-1))	0.374158	0.121047	0.268195	0.082927	-0.915197
	(0.36013)	(0.15269)	(0.15458)	(0.42100)	(0.91049)
	[1.03896]	[0.79279]	[1.73494]	[0.19698]	[-1.00516]
D(MS1(-1))	-0.168697	-0.189539	0.143691	0.178735	0.790668

	(0.31218)	(0.13236)	(0.13401)	(0.36495)	(0.78928)
	[-0.54038]	[-1.43201]	[1.07228]	[0.48975]	[1.00175]
D(EXCH(-1))	0.171133	-0.012805	0.227989	0.000421	0.320157
	(0.14352)	(0.06085)	(0.06161)	(0.16778)	(0.36286)
	[1.19238]	[-0.21044]	[3.70070]	[0.00251]	[0.88231]
D(AGE(-1))	-0.005527	0.086993	0.081011	-0.077426	-0.009153
	(0.06227)	(0.02640)	(0.02673)	(0.07279)	(0.15743)
	[-0.08876]	[3.29514]	[3.03084]	[-1.06363]	[-0.05814]
C	0.069404	0.056009	0.137976	0.149306	-0.232910
	(0.08760)	(0.03714)	(0.03760)	(0.10241)	(0.22148)
	[0.79227]	[1.50800]	[3.66926]	[1.45793]	[-1.05161]
R-squared	0.105888	0.308982	0.504613	0.224857	0.103995
Adj. R-squared	-0.048270	0.189841	0.419202	0.091212	-0.050489
Sum sq. resids	1.958998	0.352144	0.360958	2.677241	12.52218
S.E. equation	0.259907	0.110195	0.111565	0.303840	0.657114
F-statistic	0.686880	2.593416	5.908024	1.682494	0.673178
Log likelihood	0.788160	30.82076	30.38814	-4.678026	-31.67553
Akaike AIC	0.297819	-1.418329	-1.393608	0.610173	2.152887
Schwarz SC	0.564451	-1.151698	-1.126977	0.876804	2.419518
Mean dependent	0.057779	0.010881	0.216988	0.157054	-0.022426
S.D. dependent	0.253853	0.122427	0.146392	0.318723	0.641129

Determinant resid covariance (dof adj.)	3.11E-07
Determinant resid covariance	1.21E-07
Log likelihood	30.35869
Akaike information criterion	-0.020497
Schwarz criterion	1.312659

Appendix V: VAR Estimation Data

YEAR	MS1	MS2	EXCH	ROP	AGI	AGE	COP
1974	7.213	7.763	-0.47	2.373	6.26	9.061	2.204
1975	7.865	8.353	-0.48	2.373	8.44	11.63	2.454
1976	8.259	8.684	-0.47	2.4432	6.53	11.66	2.457
1977	8.623	8.974	-0.43	2.5169	6.74	11.66	2.456
1978	8.568	8.985	-0.51	2.5416	6.79	11.58	2.449
1979	8.756	9.233	-0.51	2.8478	6.68	11.57	2.449
1980	9.175	9.622	-0.61	3.3548	6.69	9.118	2.21
1981	9.202	9.69	-0.48	3.4815	6.8	9.106	2.209
1982	9.239	9.803	-0.39	3.4775	6.97	9.015	2.199
1983	9.352	9.947	-0.31	3.3687	7.03	8.963	2.193
1984	9.433	10.06	-0.26	3.3393	7.25	8.729	2.167
1985	9.538	10.18	-0.09	3.2962	7.34	8.326	2.119
1986	9.515	10.22	0.911	2.6532	7.5	6.524	1.875
1987	9.629	10.42	1.427	2.9178	7.54	6.85	1.924
1988	10.01	10.72	1.536	2.7147	7.55	7.026	1.95
1989	10.18	10.76	2.011	2.9232	7.65	7.406	2.002
1990	10.58	11.14	2.084	3.1847	8.15	7.664	2.036
1991	10.82	11.38	2.293	3.0229	8.02	7.69	2.04
1992	11.24	11.77	2.851	2.9932	9.46	8.719	2.166
1993	11.68	12.2	3.093	2.8662	9.54	8.75	2.169
1994	12.04	12.49	3.086	2.7856	9.54	8.795	2.174
1995	12.21	12.67	3.086	2.853	11.4	9.992	2.302
1996	12.33	12.82	3.086	3.0559	11.2	10.21	2.323

1997	12.5	12.97	3.086	2.9653	11.5	10.87	2.386
1998	12.67	13.17	3.086	2.5471	11.5	11.01	2.399
1999	12.88	13.46	4.529	2.8943	11.5	11.02	2.4
2000	13.37	13.85	4.626	3.3496	11.6	11.37	2.431
2001	13.61	14.09	4.718	3.1987	12	11.38	2.432
2002	13.76	14.29	4.796	3.2249	11.9	11.37	2.431
2003	14.02	14.5	4.863	3.3593	12.2	11.4	2.433
2004	14.1	14.63	4.894	3.6447	12.1	10.53	2.355
2005	14.36	14.85	4.884	4.0194	12.1	10.7	2.37
2006	14.64	15.21	4.855	4.2023	12.1	10.83	2.382
2007	14.95	15.58	5.091	4.3194	12.6	11.2	2.416
2008	15.33	15.96	4.787	4.6112	12.6	10.91	2.39
2009	15.35	16.07	5.008	4.1471	12.7	10.83	2.382
2010	15.46	16.23	5.013	4.3953	12.7	10.84	2.384