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PRICE TRANSMISSION AND MARKET INTEGRATION OF CASSAVA AND MAIZE IN RURAL AND URBAN MARKETS OF BENUE AND OYO STATES, NIGERIA

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A THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGER STATE NIGERIA, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF DEGREE OF DOCTOR OF PHILOSOPHY (PhD) IN AGRICULTURAL ECONOMICS.

FEBRUARY, 2022

DECLARATION

I hereby declare that this thesis titled **"Price Transmission and Market Integration of Cassava and Maize in Rural and Urban Markets of Benue and Oyo States, Nigeria"** is a collection of my original research and it has not been presented for other qualification anywhere. Information obtained from different sources (published and unpublished) has been duly acknowledged.

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CERTIFICATION

This thesis titled **"Price Transmission and Market Integration of Cassava and Maize**

in Rural and Urban Markets of Benue and Oyo States, Nigeria" by ALEGE, Adeku nle Mukaila (PhD/SAAT/2017/997) meets the regulations governing the award of the Degree of Doctor of Philosophy (PhD) of the Federal University of Technology, Minna Niger State and it is approved for its contribution to scientific knowledge and literary presentation.

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DEDICATION

This thesis is dedicated to my loving wife Funmilayo Alege and my children, Bimpe and Gbenga Alege for their support and understanding throughout the duration of this project.

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ABSTRACT

This study analyzed price transmission and market integration of cassava and maize in rural and urban markets of Benue and Oyo States, Nigeria. The specific objectives were to analyse the trend of rural and urban market prices, determine the market integration of cassava and maize prices in rural and urban markets, determine the speed of adjustment and price transmission of integrated markets and ascertain the direction of movement of integrated markets in the study area. Purposive sampling technique was adopted in the selection of states for the study and Multi-stage stratified sampling technique was used in the selection of marketers .Secondary data were used for this study; average monthly price series in ₦/kg of cassava and maize spanning from January, 2008 to December, 2017 were obtained from National Bureau of Statistics (NBS) and Agricultural Development Programme (ADP) offices in Benue and Oyo States respectively. Data collected were analyzed using descriptive and inferential statistics such as means, frequency distributions and percentages; charts; Augmented Dickey Fuller (ADF) unit root test; Johansen co-integration test; Error Correction Model (ECM) and Granger causality test. Results of trend analysis of maize price series in both States showed a steady decline and a general fluctuation while for cassava price series; there were irregular, decreasing and increasing trends during the period of study. Results of ADF test for maize markets showed that all the price series were non stationary at levels but became stationary after first differencing with all markets significant at 0.01 probability level except for Aarada and Otukpo which were at 0.05 probability level. For cassava markets, the price series were all stationary at levels with Bodija, Aarada and Omi-Adio being significant at 0.05 probability level while others were at 0.01 probability level. Moreover, the Johansen co-integration test revealed the presence of co-integration between the rural and urban market prices of maize and cassava in both States. The results of Error Correction Model (ECM) revealed that the speed of price transmission between rural and urban markets was weak as indicated by 0.1% and 0.3% in Omi-Adio and Taraku maize markets respectively. The ECM of cassava in Otukpo market was 3.6% showing slow adjustment towards the long run equilibrium in the short run. The Granger causality test showed both unidirectional and bidirectional causalities between rural and urban prices of cassava and maize at 0.01 and 0.05 probability levels respectively. Based on these findings, the study concluded that there were both long and short run relationships between rural and urban prices of cassava and maize with speed of adjustment of about 1 – 3 months. It was therefore recommended that, marketers should come together in group to partner with public and private sectors in order to address some of the marketing challenges which in turn will ensure smooth and efficient marketing operations in Benue and Oyo States.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Market integration is a central issue in many contemporary debates concerning market liberalization. It is perceived as a precondition for effective market reform in developing countries: “Without spatial integration of markets, price signals will not be transmitted from urban food deficit to rural food surplus areas, prices will be more volatile, agricultural producers will fail to specialize according to long term comparative advantage and gains from trade will not be realized" (Adenegan and Anifat, 2014).

According to Adenegan *et al*. (2012), market integration is the co-movement of prices and the smooth transmission of price signals and information across spatially separated markets. Several researchers have dealt on food crop price transmission and market integration issues in Nigeria. For instance, Okoh and Egbon (2005) revealed that cassava root and garri markets were weakly associated. Bopape and Christy (2002) alleged that there are three forms of market integration; integration across space, integration across product and integration across time. Markets are integrated across space if, when trade takes place between them, price in the importing market equals price in the exporting market plus transportation and other costs of moving the product between the two markets. When integrated across product form, markets are vertically integrated and the price differential between two related commodities should not exceed transportation and processing costs. Markets are said to be integrated across time (inter-temporally integrated) when the expected price differential does not exceed the cost of storage. However, government’s intervention in the pricing and marketing of food and poor marketing infrastructure may impair the role of market mechanism in price transmission between surplus and deficit areas (Ifejirika *et al.,* 2013).

Empirical research on agricultural price transmission has gathered considerable attention over time. Interest in this topic unquestionably increased after the so-called food crisis of 2007-2008 in which international agricultural markets were shocked by increased volatility, shown by a rapid rise and fall of the so-called price bubbles as well as a possible change in the long-term downward trend of agricultural prices (Guilia and Roberto, 2012).

Price transmission is important for two main reasons. First, because price transmission conveys unbiased information on prices to agricultural producers, it is a prerequisite for a good allocation of resources. Incomplete price transmission creates biased incentives to producers, which in turns leads to sub-optimal decision-takings and reduced agricultural productivity. Secondly, because many policy reforms are implemented through the price channels (for example, tariffs), a lack of integration along the marketing chain prevents reforms from reaching the first partakers of the chain, agricultural producers in particular (Karla, 2012).

In the context of economic openness and international trade, completeness of price transmission allows agricultural producers to become competitive at the international level. On a more global level, this stimulates economic development and helps to alleviate poverty and inequalities (Alemu and Biacuana, 2006). According to Sadiq *et al*. (2017), in a developing economy like Nigeria, the dynamics of the exchange of information and its effect on the pricing processes are not well understood. The cropping pattern is no longer dictated by what the producers need for personal consumption but what is responsive to the market in terms of prices received by the farmers.

While the trade is much organized the farmers are not conversant with the complexities of the marketing system which is becoming more and more complicated. The cultivator is handicapped by several disabilities as a seller. He sells his produce at an unfavourable place, time and price. An efficient marketing system stimulates production. Producers are likely to produce more if they are able to sell at reasonable prices. Similarly, an efficient marketing system stimulates consumption as consumers are ready to buy more, if they are able to purchase their requirements in the right form, place, time and at a minimum satisfaction (Adenegan *et al.*, 2012).

According to Onyuma *et al.* (2006), majority of agricultural markets in African countries are inefficient and poorly integrated and that agricultural marketing efficiency in Nigeria is dismally low. Agricultural prices greatly influence the pace and direction of agricultural development. Prices serve as market signals of the relative scarcity or abundance of a given product; prices also serve as incentive to direct the allocation of economic resources and to a large extent they determine the structure and rate of economic growth. The liberalization of agricultural markets implies accepting potentially substantial variation in prices across time, space and product form.

According to Ibrahim (2013), market segmentation refers to a situation whereby two distinct markets do not exhibit cointegration either in one direction or the other. For instance, if the two distinct markets are very far away from each other, the lack of co-integration may be due to transportation costs. It became more interesting to focus on those markets, that inspite of being separated by less than a critical distance; do not exhibit co-integration.

A critical distance for example is the maximum distance that could be covered by a one-day trip of a truck loaded with the commodity under consideration. Under the

assumptions, segmented markets can be defined as those markets that are not co-integrated with each other and that are separated by less than a critical distance. The reasons for lack of integration between markets could be adduced to lack of information flow across the markets and also the uncompetitive conduct of the participants (Ibrahim, 2013).

Maize (*Zea mays*) has been a diet for Nigerians for centuries. It started as a subsistence crop and has gradually become more important crop. Maize has now risen to a commercial crop on which many agro-based industries depend on as raw material. Maize is an important source of carbohydrate and if eaten in the mature stage, it provides useful quantities of Vitamin C and the yellow grain varieties have Vitamin A. It is a source of income and its leaves and stalks contain about thirty percent of the total nutrients in maize plants; hence, it is utilized for pasture (Bamidele *et al*., 2010).

Cassava (*Manihot esculenta* Crantz), a perennial woody shrub, is endowed with an edible root that can be processed into a wide variety of granules, pastes and flours, or at times consumed freshly boiled or raw. It is a staple food crop cultivated I several developing tropical countries (International Institute of Tropical Agriculture (IITA), 2016). Cassava is ideally grown in the tropical areas of the world. In Nigeria, it is a staple food and is the cheapest source of carbohydrate which contributes significantly to improve food security for humans as well as livestock.

Cassava has the ability to enter into divers market through processing or modification into various products. Apart from human consumption, the crop is processed and used for animal consumption and industrial uses. Fresh cassava roots could be boiled or processed into slices, chips, pellets, spent-pulp, sago, flakes garri noddles, marsh, paste, flour, starch, granules. Development of market opportunities for cassava can contribute

substantially to poverty eradication, especially for resources constrained household. Those who cannot directly farm can buy from farmers who cultivate and process and create a market (Akinpelu *et al*., 2011).

Maize and Cassava are major staple foods in Nigeria. A staple as defined by International Institute of Tropical Agriculture (IITA) (2016) is one that is eaten regularly and which provide a large proportion of the population's energy and/or nutrients. Poverty reduction and improved standard of living can be attained in the rural and urban areas by improving the technical and economic efficiencies of these crops.

However, the importance of maize and cassava to the livelihoods of many poor people in Nigeria has made the commodities a target for intervention. The potential of these crops is that it offers the cheap source of food calories and the highest yield per unit area (Ospina and Ezedinma, 2015). Presently, most of the maize and cassava grown in Nigeria are processed and sold through traditional market channels for food commodities. Apart from Oyo and Benue states, there are several cassava and maize market that support the traditional food needs of the increasing population especially the urban and rural population (Ezedinma *et al.,* 2009). It has become necessary to know whether these rural and urban markets for maize and cassava products are integrated, since prices in geographical markets are not co-integrated and such markets might become unprofitable while some markets may become isolated which have implications for market efficiency.

1.2 Statement of Research Problem

Price of agricultural commodity is one of the major factors to be considered in the demand and supply chain of commodities by farmers and consumers. Instability of product price among agricultural commodities is a regular occurrence across markets in

Nigeria. This is based on the premise that prices of farm products are generally low during harvesting periods due to surpluses; in the off season, prices rise due to reduced production and seasonal changes.

Therefore, commodity price instability among markets could be detrimental to the marketing system and the economy as a whole. This could cause inefficiency in the allocation of resources among sellers and consumers depending on the source of variability. It could also increase poverty level among low-income earners in the society (Yohanna, 2015). It therefore follows that producers and consumers will not realize the gains from liberalization unless agricultural markets are integrated. The correct price signals will not be transmitted through the marketing channels, as a result of which farmers will not be able to specialize according to long-term competitive advantages.

According to Ayinde and Idris (2014), some inefficiency remains in market performance despite the progress made in that regard overtime. However, these inefficiencies and absence of the necessary storage infrastructures, market information, standardized weights and measures and other market support services still impairs further free flow of goods and services. This situation has led to the low prices of cassava and maize at harvest and high during off-season as a result of knowledge gap in preservation by farmers. The research in agricultural marketing in sub-Saharan Africa, particularly of applied nature, has been meager and scanty because of the strenuous and time-consuming job of collecting and maintaining a credible data from different market functionaries, because in most cases market functionaries are not ready to part with correct information and data, thus, making marketing research in sub-Saharan Africa not to make headway for long, as such, a lot of scope exists for research in this field (Sadiq *et al.*, 2017).

This research therefore looks into the perspective of cassava and maize market integration in the rural and urban markets of Benue and Oyo States of Nigeria. Beyond the laws of demand and supply, there are wider economic drivers which have a major influence on the causes of commodity price volatility. Government intervention or lack of it is often the cause of commodity price volatility. Although, several studies (Adenagan and Adeoye, 2011, Ibrahim 2013, Obayelu and Alimi 2013, Ifejirika 2013, Akpan *et al.,* 2014a and Edet *et al.,* 2014 among others) on price transmission and/or market integration have been carried out but studies on price transmission and market integration of cassava and maize in rural and urban markets of Benue and Oyo States, Nigeria is yet to be explored.

Since the decline in the number of extension agents in rural areas and the problem of market information dissemination, marketers have been faced with the menace of embarking on ventures without adequate information and uncertainties. For efficient price transmission within the market system, accurate and adequate market information is essential to determine the profitability of marketing any commodity. The justification of this study therefore stems from the need to fill the research gap created by price volatility within the study area, most especially in staple crops like maize and cassava marketing. In this regard, this study therefore sought to provide answers to the following research questions:

i. What is the trend of the market prices of cassava and maize in rural and urban markets in Benue and Oyo States?
ii. What is the market integration of prices of cassava and maize in rural and urban markets in Benue and Oyo States?
iii. What is the speed of adjustment and price transmission of cassava and maize in the short run and long run?

iv. What is the direction of movement of integrated markets in the short run and long run?

1.3 Aim and Objectives of the Study

The aim of the study was to examine the price transmission and market integration of cassava and maize in rural and urban markets in Benue and Oyo States of Nigeria. The specific objectives were to:

i. analyze the trend of prices of cassava and maize in rural and urban markets in Benue and Oyo States,
ii. determine the market integration of prices of cassava and maize in rural and urban markets in Benue and Oyo States,
iii. determine the speed of adjustment and price transmission of cassava and maize in the short run and long run, and
iv. ascertain the direction of movement of prices in the integrated markets in the short run and long run.

1.4 Research Hypothesis

The null hypothesis formulated and empirically tested in the study states that, there is no granger causality between rural and urban markets of the producing State (Benue State) and rural and urban markets of the consuming State (Oyo State).

1.5 Justification of the Study

Nigeria produces a wide range of agricultural commodities such as maize and cassava which could serve as raw materials for industries and food crop for human consumption. The dual nature of these crops makes them to be in high demand. Nigeria consumed more of carbohydrate which is mostly found in crops like maize and cassava, which amount to the high demand for this farm produce (Ifeanyi *et al.*, 2012).

Maize is an important livestock feed both as silage and as grain and is used industrially for starch and oil extraction. Maize and cassava can be processed and prepared in various forms. However, with proper protein balance, cassava meal could completely replace maize in poultry diets. The use of cassava as an alternative to conventional energy feed stuffs like maize could help to reduce feed costs (International Institute of Tropical Agriculture (IITA), 2016). Almost all the cassava produced is used for human consumption and less than 5 percent is used in industries. Compared to grains like maize, cassava is more tolerant to low soil fertility and more resistant to drought, pests and diseases. Furthermore, its roots store well in the ground for months after maturity (Markelova *et al.,* 2009).

The extent of market integration has often been used to measure the success of market liberalization and structural adjustment policies in developing countries. As part of several ways to increase agricultural production and economic growth of the state, efficient marketing policy based on sound empirical facts is one of the prerequisites. Hence, understanding the direction and magnitude of maize and cassava price transmission between the rural and urban markets in Oyo and Benue states will provide indispensable input to policy makers to formulate workable policies for the agricultural sector. Seasonal price manner of maize and cassava are as a result of its production sequence. The two periods of glut and shortage nature of these products production prompted a research of this type (Yohana, 2015).

This study therefore will provide the current knowledge of cost and returns, price change, price relation and price responses to the market actors. The findings of this research would be useful in providing empirical results in price transmission and market integration, thereby contributes to the existing knowledge and serve as a book of reference to other researchers. In addition, this research will also go a long way in

improving maize and cassava marketing as it relates to intra and inter market and seasonality of price trends within and across geographical locations. Furthermore, the findings of the study will highlight the profitability of maize and cassava marketing so that each actor can determine whether or not to go into the business. It will also keep the market actors abreast of whether price transmission in one market to another is immediate or not so as to take advantage of market prices.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 THEORETICAL FRAMEWORK

A theoretical framework comprises of different theories and theoretical constructs that help explain a phenomenon. It sets out the various expectations that a theory posits and how they would apply to a specific case under consideration and how one would use theory to explain a particular phenomenon (Raul, 2018).

2.1.1 Basic Marketing Concepts

The review of literature on basic marketing concept in this section is centered on price and price functions as well as market and marketing functions.

2.1.1.1 Price and price function

Price of a commodity refers to the value of the goods in terms of monetary units. Consumers go to the market in order to purchase required commodities. In the process of purchasing, consumers pay for the value of the commodity in terms of currency units of the nation. Prices give signals to the producer regarding what are all the commodities to be produced in the economy and how to earn money and sustain in the process of production. Similarly, prices also give signals to the consumer to sustain demand or restrain the demand. Change in the supply and demand of a commodity changes the price level and consequently the welfare of producers and consumers in a free economy. In countries where consumers and producers enjoy more economic freedom, prices play a greater role compared to the centrally planned economies, where less freedom is given to producers and middlemen (Abbott, 2009).

In establishing the relationship of prices of cassava and maize, the study will also employ the theory of price to determine how to produce, strikes a balance between demand and supply, serve as basis for allocation of resources in the production process,

assist the consumers on proper allocation of income, enable adequate distribution of income among different groups of farmers, aid movement of commodity over time and place, affect capital formation in agriculture, and gives room for the formation of fiscal and monetary policies.

In agricultural-based countries, prices of farm products undergo wide variations than the prices of industrial goods. They have profound effect on the growth, equity and stability of the economy. The incomes and living standards of the farmers, labourers and non-farming population, that is, consumers are very much affected by price fluctuations. High and rising prices in general provide incentives to the producers to increase the output, the reverse also holds if the prices are allowed to fall over time (Ayinde and Idris, 2014).

In the competitive economic system, prices of commodities give signals to the producers regarding the type and quantity of commodity to be produced in a particular place at a given time and consumers plan their purchases from the given income, so as to maintain their desired level of living. Thus, the directions given by the prices vary according to various groups of consumers and producers. For example, in a situation of inflation, producers would get higher incentives to produce the required quantities at higher magnitude (Food Price Watch, 2014).

According to Arowosoge *et al*. (2011), understanding the price of a commodity from price theory point of view helps in understanding the working of a free enterprise economy. It provides the analytical tools for assessing the economic policies of a country, spells out the standards and norms of a welfare state and compares the actual economic condition with the ideal condition. It also reveals how far off the ideal state is with the economic conditions and analyses the efficiency with which productive

resources are employed and the efficiency of allocation of the output of productive efforts. The maximization of economic welfare from available resources and stimulating production through appropriate pricing of resources and output is important. The advantages of price theory can only be achieved through efficient pricing, which invariably depends on the structure of the market (Arowosoge *et al.,* 2011). Prices are the most readily available and reliable information that guide farmers' planting decisions. A farmer's planting decisions depend on anticipated profits which in fact depend on anticipated prices of planted crops. This has made prices an important tool in the economic analysis of markets (Arowosoge *et al.,* 2011).

2.1.2 Market and Marketing

Marketing and market do not mean the same thing. Market is a medium where buyers and sellers engage in transaction. On the other hand, marketing involves all the physical exchange and facilities services which are necessary to make products from the firm available to the consumers. However, for marketing and price efficiency, farm product must be made available in a form and amount desired by the consumers, at the place decided by the consumers, at the time desired by the consumers and at the price consumers and middlemen are willing to take possession (Ismail *et al*., 2014). Thus, marketing leads to the creation of form, place, time and possession utility. A market on the other hand, is generally an area or setting in which price defining forces (demand and supply) operate (Siyan, 2005). It may be a city, state or place of business in a given town. A market also refers to any arrangement that brings buyers and sellers together. It could be physical contact between buyers and sellers or contact by letter writing, telephone, e-mail or other means of communication (Ismail *et al*., 2014).

The nature of marketing system is profoundly influenced by the economic and physical characteristics of the commodities handled, their value, processing required to make the

commodity fit for use by end users and the condition of production and consumption (Jones, 2002). Synchronous movement over time among prices in different markets is an important indicator of market efficiency. Markets play a fundamental role in managing risk associated with demand and supply shocks, in that well-integrated markets facilitate adjustment in net export flows across space, thereby reducing price variability faced by consumers and producers (Ohwo and Adeyemi, 2015).

2.1.3 Price transmission

The science of prices and transmission had significant progress over the past several decades. According to Goodwin and Holt (1999), end of the last century was the point in time when many Economists focus was on the analysis of vertical price transmission. Different kinds of literature were written by Economists about the price transmission in different levels of the food marketing chains. Nevertheless, the science has progressed and literature about spatial and vertical price transmission has grown, most recent critical review is in Fackler *et. al*., (2002). The given attention by the Economists to start writing literature at the end of the last century was in general provoked by the social and political concerns. This has initiated progressive processes in the food industry and the whole food distribution sector.

Price transmission analysis measures the effect of prices in one market on prices in another market. For example, if the harvest is above average in a maize and cassava surplus area, then the maize price in that area will usually fall. The low price will cause an increased flow of maize from the surplus region to the capital city, as traders try to profit from the price difference, thus lowering the price in the city as well. The effect of the surplus zone price on the city price may be small if there is a long distance between them or if the roads are poor. The effect may be weak if the city gets most of its maize and cassava from another region, or the effect may be limited if there are barriers to free

movement (such as an international border) between the surplus zone and the city. Price transmission analysis uses price data to measure various aspects of the relationship between the prices in the two markets (Iruansi, 2007).

The degree to which a price shock is transmitted from one point affects a price at another point can broadly indicate whether efficient arbitrage exists in the space that includes the two points. At two extremes, one may assume that a full transmission of price shocks can indicate the presence of a frictionless and well-functioning market, while at the other extreme a total absence of transmission may make the very existence of a market questionable (Ani, 2015).

Therefore, the degree of price transmission can provide at least a broad assessment of the extent to which markets are functioning in a predictable way, and price signals are passing-through consistently between different markets" (FAO, 2009). In order to assess the price transmission and market integration the individual have to understand the properties of the price transmission. Literature points out that the properties are very similar to those of the standard competition model. Standard competition model reveals that in single undistorted world, the simple Law of One Price (LOP) is supposed to regulate the spatial price relations. Nevertheless, transmission of the price changes among different markets and different levels of the chain, from producers, purchasers and traders in one market depends on many factors (Food Security Organization, 2016).

2.1.3.1 Factors that affect price transmission

Some of the factors that affect price transmission include:

2.1.3.1.1 Transport and transaction costs

These costs are considered to be the main factors that affect the price transmission. According to Williamson (2008), they can be classified into three groups of information, negotiation, and monitoring and enforcement costs. They take the role of

wedges between prices in different markets. The objective is to overcome by the total price differences between the two markets, doing so, to let for arbitrage and integration to take place. Literature suggests these costs to be assumed as stationary (Blazhe, 2010).

2.1.3.1.2 Exchange rates

This factor affects the price transmission in terms of the extent to which changes in the exchange rates are "passed through" on the output prices from one market to another in order to study the relationship between the two markets (Mundlak and Larson, 2001).

2.1.3.1.3 Border and domestic policies

Factors that directly affect price transmission are trade policies. Domestic policies affect price formation and affect both vertical and spatial price relations (Mundlak and Larson, 2001). Barriers have strong effects on price transmission. Among the border measures are: tariffs, variable tariff, tariff rate quota, prohibitive tariffs, and technical barriers. All these tariffs have strong effect on price transmission. Taxes that are based on the quantity and the fixed tariffs act exactly like fixed transaction costs respectively.

2.1.3.1.4 Type of the product

According to (Kohls and Uhl, 2002) different types of products have different rate of price transmission. Products such as vegetables, fruit, fresh milk which are perishable and undergo minimal processing are expected to have relatively quick price transmission mechanism. On other hand, products such as maize, wheat, sunflower are not perishable products and undergo certain levels of processing are expected to have slower price transmission mechanism.

2.1.3.2 Output of price transmission analysis

According to International Food Policy Research Institute (IFPRI) (2012), the output of price transmission analysis consists of the answers to the following questions:

i. Is there a long-term relationship between the prices in the two markets?
ii. Do prices in market A influence those in market B, the reverse, or do they both influence each other?
iii. If the price in one market changes by 10%, by how much will it cause the other price to change after one month?
iv. If the price in one market changes by 10%, by how much will it cause the other price to change in the long run?
v. How many months will it take for half of the price change to be transmitted to the other market?

According to IFPRI (2012), there are at least three ways in which the results of price transmission analysis can help in the interpretation of price trends. First, it can help interpret recent changes in prices in a given market.

i. If the analysis shows that there is no relationship between international prices and the local price in question, one can focus on explanations in terms of domestic supply and demand, thus avoiding mistakenly attributing the change to world prices.
ii. If there is a relationship, the analysis allows you to say how quickly we can expect local prices to react to a change in world prices.
iii. If there is a relationship between international prices and the local price, the analysis will allow you to say whether the current domestic price is above or below the long-run equilibrium given the international price.

Second, in the context of two domestic prices, it tells us whether market A is influencing market B, or B is influencing A, or if both are influencing each other. This causation analysis helps in understanding and describing trends in local prices.

Third, price transmission analysis may help predict local prices over the next 1 – 3 months. Information about seasonality, inflation, and trends in international prices can be fed into the model to make projections of local prices over the next few months. The prediction will be better if a) there is a strong relationship between local and international prices, b) if we have enough data to calculate seasonal trends, and c) if production data can be incorporated into the analysis (IFPRI, 2012).

Fourth, by looking at the degree of price transmission for many markets and commodities, allows us to identify patterns which can be used to interpret price trends in markets that were not analyzed. Although price transmission analysis is a useful tool for understanding and predicting price trends, it only tells us about the relationship between two prices over time. It does not tell us why the price transmission is strong or weak, fast or slow. This interpretation can only be done with local knowledge of transportation routes, seasonal flows in staple foods, trade and agricultural marketing policies, the availability of foreign exchange and credit, the ease of obtaining permits, and the competition for overland freight, among other factors (Food Security Organization, 2016).

2.1.3.3 Possible relationship between prices

Investigating the relationships between prices is a common tool in market integration analysis. There are certain laws to consider when investigating the price relationships and integration in two spatially separated markets, according to Blazhe (2010) they are:

i. **Law of One price holds:** This is the case when the relationship between the two prices is following equation (1). Therefore, these markets are considered to be integrated. Nevertheless, this case is unlikely to occur, especially not in the short run.

$$P1t = p2t + C \quad (1)$$

Where C = Transport cost

ii. **Conclude absences of Integration:** This is the case when mutual distribution of two prices is established to be completely independent. Thus, there is great possibility to be no market integration and no price transmission.

iii. **Conclude that there is market integration:** From spatial arbitrage in general is expected to confirm that the time series of prices for a homogeneous product will differ by the same amount as the transfer costs. Therefore, the relationship between prices is identified as specified in equation (2):

$$P_{2t} - P_{1t} \leq c \qquad (2)$$

Where P_1 and P_2 are mutual distribution of two prices and c is the transfer price. This relationship is given by Fackler *et. al.* (2002) illustrates the spatial arbitrage condition. It is categorized as the weak form of the Law of One Price and represents an equilibrium condition. There is high possibility examined prices to depart from this relationship. However, spatial arbitrage will cause the difference between the two prices to move in the direction of the transfer cost. Nevertheless, if spatial arbitrage condition is concluded then there is market integration. Therefore, this integration is explained and evaluated by number of co-integration tests (Fackler *et. al.*, 2002).

Literature and economic theory do not give suggestion about the direction of the relationship. However, some researchers choose one price to be exogenous. This price is determined outside the system. Regarding the market integration this is possible only if researcher suppose that one market is the leading price, sort of central market in geographical context. Therefore, this central market price will be exogenous (Blazhe, 2010).

The case in simultaneous systems is that there is a high possibility to be causation in both directions. The system is simultaneous and all prices respond to changes in the other prices in the system. Demand or supply shock in any of the markets will then transfer to other markets. The causality of prices, price leadership and determination of central market can be tested by Granger test of causality. This test is used to determine the direction of shocks. If there is influence by market one on market two or vice versa (Blazhe, 2010).

2.1.4 Market integration

Market integration (MI) can be understood from two aspects. First, it refers to vertical integration and horizontal integration. Second, the integration includes spatial market integration, temporal market integration, integration across price form and integration across product form (Iruansi, 2007). Market integration occurs when prices among different locations or related goods follow similar patterns over a long period of time. Groups of prices often move proportionally to each other and when this relation is very clear among different markets it is said that the markets are integrated. Thus, market integration is an indicator that explains how much different markets are related to each other. Spatial market integration reflects the effects of price change in one market on another market (Olukosi and Isitor, 1990; Amobi, 1996; Arene, 2003). Theoretically, under the assumption of full competition, when two regions trade, the product price in the importing region equals to the price in the exporting region plus transportation cost. Therefore, the price change in the export region will induce a price change in the import region in the same direction and of the same degree. If this is the case, the two markets are completely integrated (Laping, 2004).

Market integration is a term that is also used to identify a phenomenon in which markets of goods and services that are somehow related to one another begin to experience

similar patterns of increase or decrease in terms of the prices of those products. The term can also refer to a situation in which the prices of related goods and services sold in a defined geographical location also begin to move in some sort of similar pattern to one another. At times, the integration may be intentional, with a government implementing certain strategies as a way to control the direction of the economy. At other times, the integrating of the markets may be due to factor such as shifts in supply and demand that have a spillover effect on several markets (Ali and Rahman, 2009).

Spatial market integration includes long-run market integration and short-run market integration. The former refers to such cases in which there exists a long run and stable price relationship between two markets. Even if this long-run relationship "balance" is broken in the short run, eventually the balance will be renewed. Short-run integration shows that the price change in one market in some period will bring "in the next period" (that is, immediately) the price change in another market. This reflects the sensitivity of the spread of product prices between markets. Integration across marketing stages reflects the effects of price change in one marketing stage on the price change in next stage. If the prices in different marketing stages meet the condition of "next stage price = this stage price + market charge", there exists integration between market stages. The integration between wholesale and retail markets is one example of integration across marketing stages (Laping, 2004).

Integration across product form reflects the effect of price change of one product on price change of other related product, which usually refers to the price relationship between a primary product and a processed product. If the condition that "processed product price = primary product price + processing cost" is met, the markets are integrated. The research on the integration of related product markets is very important.

Its result can indicate whether the price relations between two products are reasonable and whether these related product markets could coordinate effectively (Iruansi, 2007). When market integration exists, the events occurring within two or more markets are exerting effects that also prompt similar changes or shifts in other markets that focus on related goods. For example, if the demand for poultry within a given geographical market were to suddenly be reduced by 50%, there is a good chance that the demand for egg would also decrease in proportion within that same geographical market. Should the poultry market increase, this would usually mean that the market for egg would also increase. Both markets would have the chance to adjust pricing in order to deal with the new circumstances surrounding the demand, as well as adjust other factors, such as production (Ali and Rahman, 2009).

Market integration can often be a very positive situation, especially if the emerging pattern regarding pricing is indicative of an increasingly prosperous economy. At the same time, assessing integration between markets can also be a useful tool in identifying trends that are less than desirable, and having the chance to begin reversing those trends while there is still time. For this reason, financial analysts as well as economists will often monitor activity in related markets, identify any signs of integration and make recommendations on what strategies (Wisegeek, 2016).

2.1.4.1 The Law of One Price (LOP)

The study is premised on the theory of the Law of One Price (LOP) in that it seeks to provide information on market integration of maize and cassava in Oyo and Benue States. The Law of One Price (LOP) presents that in the absence of friction between global markets, the price for any asset will be the same. The law of one price is achieved by eliminating price differences through arbitrage opportunities between markets.

The law of one price (LOP) is the cornerstone of most empirical studies of market integration. The LOP asserts that for a single homogenous commodity, if efficient arbitrage occurs and competitive equilibrium holds between two markets linked by trade, then a price change in one of the markets will be translated on a one-for-one basis (instantaneously) to the other market. A weaker form of the LOP allows for temporary deviations from equilibrium following a price shock, with the tendency however to return to this equilibrium in the long run. Analysis of the LOP assume that market agents have all the relevant information required to undertake optimal arbitrage and there are no impediments to trade (Jensen, 2007). Since this assumption is rarely the case in practice, using the LOP as a measure of market integration is only idealistic. As noted in McNew (2006), the LOP is just a necessary condition for spatial price efficiency since it holds only when there are no obstacles to trade or when transportation costs between markets is insignificant.

2.1.4.2 Price and Market Integration

Markets can be defined with respect to locations, seasons and products. The most common factor with which markets can be integrated is price of the product. Thus, the principle of market integration is hinged on the "Law of One Price" (LOP) which is the hallmark of the model or theory of perfect competition (Jensen, 2007). Perfect competition is a market situation wherein there are so many firms (sellers) and buyers that no single one of them has a significant influence on price (Hill and Myatt, 2010). Other prevailing conditions are homogenous product, ease of new firm's entry into the market, and perfect market information. A central prediction of the theory of perfect competition is that the price of all transactions will tend to uniformity, allowing for difference in transportation cost between different spatial markets.

LOP is a market principle which holds that under perfectly competitive condition, all prices within markets will be uniform after the costs of adding place, time and form utility are taken into consideration (Jensen, 2007). According to Chirwa (2000), Law of One Price assumes that if markets are integrated, price changes in one market will be transmitted in a one-for-one basis to other markets instantaneously. LOP is a special relationship among prices in space, time and form markets; it can implicitly be expressed in equation (3)

$$Y_{1t} = K + Y_{2t} \quad (3)$$

Where Y_{1t} and Y_{2t} are equal prices of a commodity in two spatially different markets, rural and urban respectively, and K is the intercept.

If K = 0 then the two prices are equal. This is the strict version of the LOP. If, on the other hand, K is not equal to 0, then the prices have a proportional relationship, but their levels would differ owing to factors such as transportation costs, interest rates, market fees and quality differences. This is the weak version of the LOP (Asche *et al.,* 1999).

The most common expression of the LOP is shown in equation (4)

$$P_{t^i} = \alpha + \beta P_{j^i} \quad (4)$$

Where P_t^i and P_j^i are the natural logarithm of prices of homogenous goods in markets i and j, respectively.

The LOP in its strict form requires that β =1 and α = 0. Empirically, only β = 1 is tested and the constant term is assumed to account for transport and transfer costs which are assumed to be proportional to prices (or constant when prices are in levels) during period of analysis (Chirwa, 2000).

In empirical work, the LOP is tested by running the following regression as in eqn. (5).

$$P_{t^i} = \alpha + \beta P_{j^i} + \varepsilon t \quad (5)$$

Where: εt is the error term.

According to Chirwa (2000), this test whether equation (5) reduces to equation (4) by testing the null hypothesis that β=1. New developments in time-series econometrics suggest that if the price series are non-stationary, normal influence is not valid on the parameters and results from equation (5) are spurious. However, if the price series are integrated of the same order, then equation (5) can be used to test for co-integration using the Johansen vector auto-regression (VAR) method.

Prices of products in different markets can be expected to tend to uniformity in a competitive market structure, since they are influenced by the cost of transfer of the four main types of utility. However, price disparity occurs between and among markets due to non-satisfaction of the conditions for perfect homogeneity and perfect knowledge of market conditions (Maiyaki, 1998). These lapses can be associated with market inefficiency and efficiency in pure competition. Market efficiency is said to be high in competitive markets than in less competitive markets.

The law of one price can be very useful in determining the size of a market, predicting price changes within a market and evaluating the pricing efficiency of a market. Price efficiency is maximized when there is a tendency for prices to maintain the relationship suggested by the law of one price. Under these conditions, resources will be allocated correctly between their alternative uses, prices will serve as accurate guide for food industry decisions, and total industry output will be maximized (Iruansi, 2007).

2.1.4.3 Price and market concentration

Consider a typical price-concentration regression model where the relationship between the prices, exogenous market characteristics, and the market structure variables can be specified in equation (6).

$$InP_m = Z_m\theta + f(\mathrm{N}_m, +\delta) + \varepsilon_m^p. \quad (6)$$

Where:

P_m are the observed prices in market m, Z_m are all exogenous market characteristics that affect prices except the market structure variables. The function f (Nm, δ) represents the impact of the underlying market structure on prices. In empirical applications, the market variables are typically captured using measures such as index of market concentration for price relation and concentration ratio or Herfindahl Index. Finally, ε_m^p are market specific un-observables that influence prices. In context of this study, one of our dependent variable P_m would be the price of maize and cassava in each market, and the exogenous variables Zm would include demand and cost conditions at the market (Newmark, 2004).

The price equation in (6) represents a typical model used in the price-concentration literature (Audretsch, 1991). As is well known, ordinary least squares estimator applied to such a model is inconsistent if the unobservable ε_m^p are correlated with explanatory variables in the regression. The particular concern in eqn. (6) are the variables that capture the competitive structure in the market, f(Nm, δ). This is because there are likely to be unobservable demand and cost conditions in a market that not only influence prices, but also the number of sellers that operate in the market. For instance, markets with unusually high costs are likely to have higher prices, but these markets are also likely to attract fewer entrance. Similarly, unobserved positive or negative demand shocks can influence a firm's pricing as well as decision to operate in the market (Newmark, 2004). A possible solution to this econometric problem is to use instrumental variable techniques. For example, one could look for variables that impact the long-term entry decisions of marketers, but do not impact the short-term prices.

However, such instruments are, in general, difficult to find. Instead, we use a two-stage estimation procedure to address the endogeneity of market structure. In the first stage, we estimate an equilibrium model of entry that predicts the number of competitive marketers in a market. In the second stage, estimates from the entry model are used to derive correction terms that are inserted in the price equation to alleviate the correlation between the price errors and the market structure variables (Audretsch, 1991).

2.1.4.4 Measures of integration

The intuitive idea behind the measurement of market integration is to understand the interaction among prices in spatially separated markets. In the extreme case of two markets A and B completely separated from each other, the prices of the same commodity should not be related. If the areas where market A is located experiences a bad harvest, prices will suddenly increase. In market B, there is no reason to assume that a bad harvest has also occurred. In the absence of communication flows between the two markets, prices in B would not show any movement. On the other hand, if A and B were integrated, the price in B would also increase (Ospina and Ezedinma, 2015).

This is because some food would flow from B to A decreasing the available supply in B. At the same time the price in A would be lower than B in the absence of market integration. Therefore, the co-movement of prices gives an indication of the degree of market integration. However, it is conceivable that two pairs of market (A, B) and (A_1, B_1) exhibit the same price co-movement and yet show a different process of price adjustment. That suggests that the dynamics of price adjustment may also give important information about the integration of the two markets. If for example, price shocks from A to B take longer to be transmitted, than from A_1 to B_1, even though the index of price co-movement between A and B is the same as between A_1 and B_1, then

we may think of the second pair more integrated than the first one (Macro and Chuma, 2015).

The analysis of and testing for unit roots naturally lead to the theory of co-integration. This is because, basically, co-integration deals with the methodology of modeling non-stationary times series variables. In one way, co-integration can be looked upon as an attempt to improve on the Box-Jenkins methodology. Co-integration retains the focus and emphasis on the dynamic structure of the time series while bringing in explanatory variables as suggested by traditional economic theory of an econometric modeling. According to Maddala and Kim (1998), "the theory of co-integration explains how to study the interrelationship between the long-term trends in the variables, trends that are differenced away in the Box-Jenkins methods. Another way to conceptualize co-integration and error-correction modeling is that it is an extension and generalization of the traditional approach to modeling short-run disequilibrium by use of the partial adjustment (Also called stock adjustment) model. It will be seen later that the error correction model (ECM) which incorporates the previous period's disequilibrium, in the final equation, can be conceptualized as a straight forward generalization of the partial adjustment model. However, use of the methodology of co-integration and ECM adds more richness, flexibility and versatility to the econometric modeling of dynamical systems and the integration of short-run with long-run equilibrium.

2.1.5 Approaches and methods of testing market integration

Empirical research in market integration, both spatially and vertically, has applied a number of different quantitative techniques to test market integration and price transmission between different markets. The most used are the following:

i. Co-integration

ii. Parity bound analysis

iii. Causality

iv. Symmetry

v. Error correction mechanism.

2.1.5.1 The Co-Integration Method

On the concept of co-integration (Granger, 1981) and the methods for estimating a co-integration relationship, Engle and Granger (1987) and Johansen (1991) provide a framework that allows estimating and testing for long-run equilibrium relationships between non-stationary integrated variables. Co-integration has been extensively discussed and applied in the literature; Maddala and Kim (1999) provide a thorough and extensive review of co-integration. Co-integration, as previously seen, implies that prices of two markets move closely together in the long run, although in the short run they may drift apart, and thus are consistent with the concept of market integration. If two prices in spatially separated markets (or different levels of the supply chain) contain stochastic trends, and are integral of the same order, the prices are said to be co-integrated. A potential shortcoming of co-integration in testing for market integration is the implicit assumption that transfer costs are stationary.

However, Fackler *et. al.* (2002) argue that co-integration techniques are considered unreliable if transaction costs are non-stationary. Failure to find co-integration between two price series may be consistent with market integration. Otherwise, the rejection of the co-integration hypothesis may not necessarily mean lack of market integration, which can be an indicator of transfer costs being non-stationary. Several empirical studies based on co-integration, according to Rashid (2004), have concluded in favour of market integration where in fact there was lack of integration. The second criticism against the co-integration method is its inability to distinguish whether there is efficient arbitrage, autarchy or arbitrage failure. Although the above-mentioned criticisms are

important, there is no best approach that addresses all the shortcomings of the spatial market integration techniques (Sanago, 2007). Co-integration techniques have largely been used, and are used in this study, to estimate the level of market integration.

2.1.5.2 Parity bound analysis

Blauch (1997) used transfer costs to determine the parity bounds within which commodity prices in two markets may vary independently. Testing the hypothesis of spatial price differentials equal to, or less or greater than transfer costs, he found that the higher the incidence of outside parity bounds, the lower the market integration. The major drawback of this technique is the lack of series on transaction costs. Basically, these series are generated by the technique of extrapolation that may not reflect the speed of the price adjustment when there are profitable trade opportunities. Furthermore, this framework does not account for trade reversals. According to Barrett (2005), it also relies on distributional assumptions in estimation and typically ignores the time-series properties of the data, not permitting analysis of inter-temporal adjustment to short-run deviations from long-run equilibrium, and potentially important distinctions between short-run and long-run integration, as at tempted by price equilibrium approaches.

2.1.5.3 Causality technique

Another important implication of co-integration is that co-integration between two variables implies the existence of causality between them in at least one direction (Granger, 1988). If two markets are integrated, the price in one market will normally be found to Granger-cause the price in the other market. Lack of co-integration between the two trending price series may indicate that markets are not integrated, as other factors such as transaction costs may determine the movements of one of the price series. Therefore, Granger causality provides additional evidence as to whether, and in

which direction, price transmission is occurring between two series. The hypothesis that market price one Granger-causes market price two and vice versa, can be assessed within a Vector Auto Regression (VAR) framework by testing the null hypothesis that the coefficients of a subset of these jointly determined variables, the lagged p1 terms, are equal to zero. In addition, Granger (1988) proposed a test for long-run Granger causality in which the presence and direction of Granger causality in the long run can be assessed within the context of the error correction representation of a co-integrated system of variables.

It is important to note that Granger causality may exist, indicating that although the two price series drift apart due to other factors such as non-stationary transaction costs, some price signals are passing through from one market to another. On the other hand, lack of Granger causality may not imply an absence of transmission, as price signals may be transmitted instantaneously under special circumstances. However, given the inherent dynamics of markets, it is believed that this is highly improbable.

2.1.5.4 Symmetry

The literature on symmetry attempts to take into account the possible sources of asymmetry and discontinuity in the responses of commodity market prices. This group introduces the dynamic transaction costs considered as a major factor that influences arbitrage relations between different markets. Using the price series of a particular commodity, the law of one price is adjusted by transaction costs. This approach suggests that transaction costs determine the efficiency of price band (parity) for a homogeneous commodity between two geographical markets (Blauch, 1997; Barrett and Li, 2002). As Blauch (1997) puts it, if transaction costs equal the inter-market price differential, prices in the two markets move on a tandem basis and the spatial arbitrage conditions are binding. However, if transaction costs exceed the inter-market price

differential, the spatial arbitrage conditions are violated, which results in impediments to trade efficiency that weaken market integration.

2.1.5.5 Error Correction Mechanism (ECM)

The error correction coefficient measures the extent of corrections of the errors that the market initiates by adjusting prices in a local market and prices in a reference market towards restoring the long-run equilibrium relationship (Blauch, 1997). The speed with which the market returns to its equilibrium depends on the proximity of the error correction coefficient to one. Within this context, short-run adjustments are directed by, and consistent with, the long-run equilibrium relationship, allowing the researcher to assess the speed of adjustment that shapes the relationship between the two prices. The error correction is presented in the literature as an important framework for testing asymmetric and non-linear adjustment to long-run equilibrium (Fackler *et. al.*, 2002). The model provides a structure within which gradual, rather than instantaneous price transmission can be tested, thus taking into account discontinuities in trade and other factors that may impede market integration over time.

Most importantly, the proximity of the error correction coefficient to -1 can be used to assess the extent to which policies, transaction costs and other distortions delay full adjustment to the long-run equilibrium. Granger and Lee (1989) proposed an Asymmetric ECM (AECM) where the speed of the adjustment of the endogenous variable depends on whether the deviation from the long-run equilibrium is positive or negative. Within this context, asymmetry occurs in the event when positive and negative divergences from the long-run equilibrium result in changes that have different magnitudes. In the context of market integration and price transmission studies, the ECM, as well as its further applications, is perhaps the most useful tool as it provides a stylized picture of the relationship between two prices (FAO, 2009).

2.2 Conceptual Framework

According to Raul (2018), a conceptual framework describes the different concepts one would need to know to understand a particular phenomenon, without pretending to create a casual links across variables and outcomes. Conceptual framework is therefore like lenses through which you can see a particular phenomenon.

The conceptual framework used in this study for market integration in the maize and cassava market in the study area is presented in Figure 2.1. The entire framework operates in line with the objectives of price transmission and market integration of this study. The Index of market concentration will determine the price relation between integrated markets. The movement in price gives a significant indicator to derive a conclusion as to whether markets are integrated. If prices among different markets move in similar patterns, those markets present a high potential of integration. In case the series are found to have a negative co-movement in price, a tentative no market integration is suggested. This can imply non-functioning markets, non-availability of food and high price volatility. To assess whether prices move in tandem or not, the study uses a Pearson bivariate correlation coefficient. A high correlation coefficient, close to 1, shows that markets are potentially integrated, since the price co-movement can be influenced by other factors. If the series are found to be close to 1, outliers and price stability series over time are sorted. The stability of prices is analyzed by using the error correction mechanism and calculating the average of price difference in different periods. Actual and lag price convergence indicate whether markets are integrated in the short run and long run.

A zero average suggests that markets may not be integrated in the short run. A non-zero average points to relative convergence in price movement. In other words, prices move in tandem in the long run even if they may drift apart in the short run as a result of other

factors such as transaction costs and entry barriers. High transaction costs between two markets indicate that there is no incentive for traders to move food from surplus to deficit markets at a given period of time. Other reasons why traders might not move food will also be checked. Among different plausible reasons, these are notably: seasonal food availability, transport hindrances, insecurity and changes in policy. The implication can be drawn for programming and response options. If markets are found to be integrated, there is evidence that food is available in the markets and prices are stable. Cash transfer may be a good option for food accessibility. This conceptual framework provides a qualitative assessment of market integration and different actions to determine the efficiency in the analysis. This is complemented and detailed by statistical and econometrics analyses presented in the methodological section.

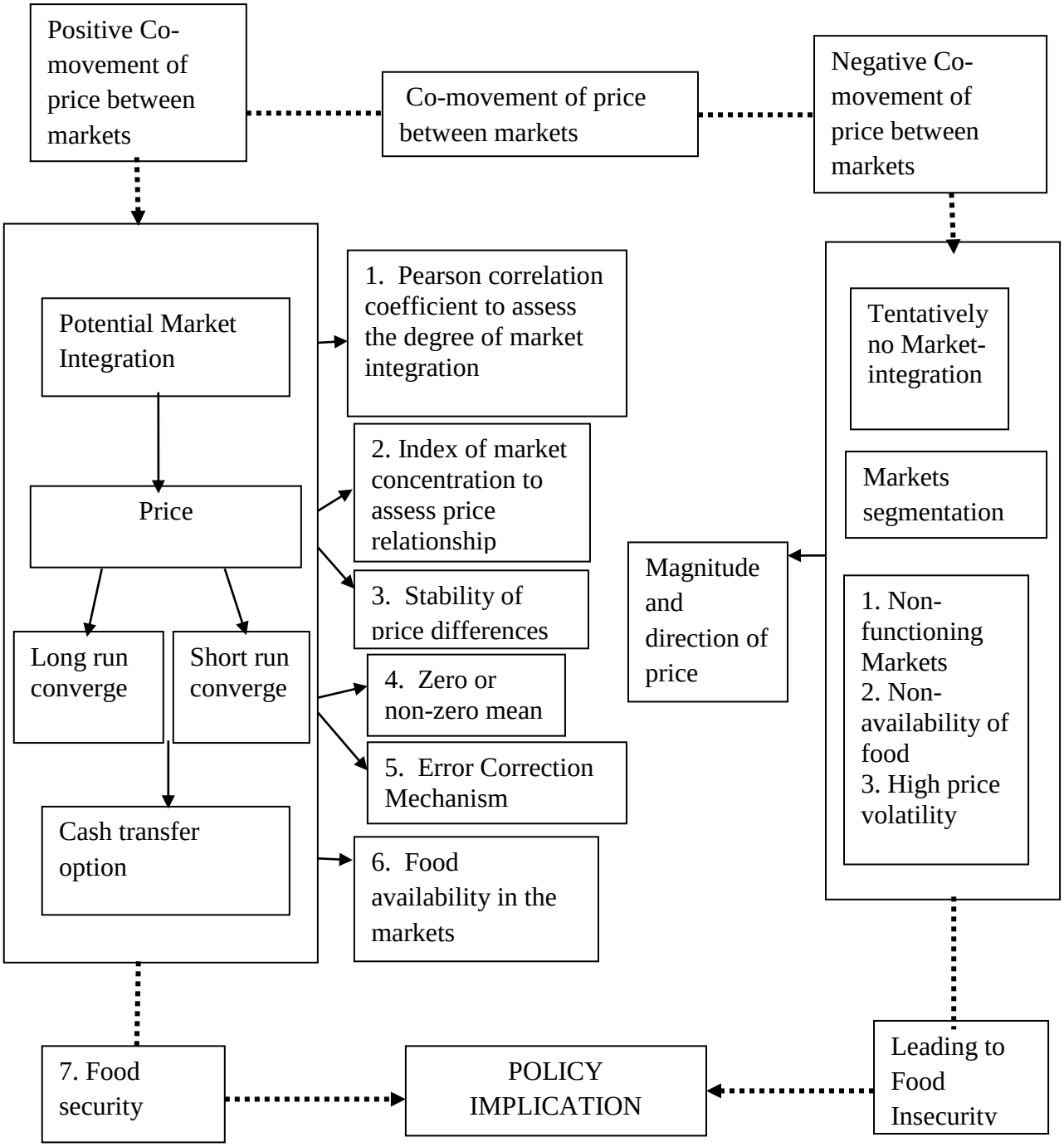


Figure 2.1: Conceptual framework for maize and cassava market integration analysis. Source: Author's construction (2020).

2.3 Review of Empirical Studies

Empirical studies revealed the findings of different researchers in a specific area of studies. According to Samuel *et al.* (2012), an empirical study is the basis for comparison and further building of a research work.

2.3.1 Empirical studies on market structure

The basic component of the structure, conduct and performance (SCP) is the market structure, that is, the number and size distribution of buyers and sellers, the conditions of entry and the degree of product differentiation. Several studies have been carried out on market structure in Nigeria and other countries, Nsikan *et al.* (2013) examined the structure, conduct and performance of rice marketing in Akwa Ibom State, Nigeria. The Gini Coefficient (GC) and Herfendahl Index (HHI) values of 0.683 and 0.295 showed that the rice markets were highly concentrated with non-competitive practices showing disparity in earnings. The prevailing duration stocks were held in shops by traders and sources of obtaining market information were three weeks to one month and mobile phone (66.7%) respectively. The use of shared trucks to convey stocks prevailed in the study area and the prevalence promotion strategy was friendly attitude to customer. Furthermore, Aba market accounted for the major source of stock supply in the area. In a study carried out on the assessment of gari marketing in South –West by Afolabi (2009). The findings indicated a Gini-coefficient of 0.4426 was obtained indicating a high level of concentration in the gari market.

Samuel *et al.* (2012) conducted a study to analyze the market structure and socio-economics of yam marketing in Benue State, Nigeria. The author revealed an equal distribution of yam amongst the market participants. A Gini coefficient of 0.4256 was obtained in the study indicating a high level of concentration in yam market.

In a similar study conducted by Garba *et al.* (2015), the research work analyzed the structure and performance of Shea butter market and the constraints associated with the marketing of Shea butter within the sampled communities in Borgu and Bosso local government areas of Niger state. The authors pointed out an equal distribution of Shea butter amongst the three categories of the market participants (rural buyers, wholesalers and retailer) with Gini coefficients values of 0.077, 0.083 and 0.12 respectively. The marketing efficiency of rural buyer, wholesaler and retailer were 788%, 765%, and 667% while the marketing margin were 13.4%, 12.7% and 9.8% respectively. The major problems faced by Shea butter marketers were lack of standard butter measurement, poor access to credit, poor storage facilities and transportation means, low and unstable market prices.

Ibrahim *et al.* (2014) in their work, assessed the consumer preference for cowpea quality characteristics and price trends in Niger state using a random sampling technique to select three markets from there different regions across the state and using descriptive analysis to draw up inferences for consumer preference. The results revealed that consumers showed a preference for quality characteristics such as rough texture, white eye, white test colors and minimum insect damaged grams and the price trend showed increase in prices of cowpea grams from January to July in all the markets.

2.3.2 Empirical studies on the cost and returns of marketing agents

Costs and returns analysis are very important to any agricultural productivity. Cost involves all the expenses incurred during the period of production which involve both the fixed and variable cost of production. However, returns are the earning realized as a result of production activities. Empirical studies on cost and returns enabled the study to

review the profitability of farm enterprise. Other studies have been carried out on the cost and returns of food crop production, Obasi *et al.* (2015) in the study of Net returns to Cassava-Based crop mixtures in Imo State, Nigeria. The primary objective among others was to estimate the net returns to cassava-based crop mixtures in the area. The result of the analysis showed that the net return to cassava/yam/maize/melon crop mixture was ₦124,776.58, while the return per naira invested by the farmer was 46 kobo.

Ndubueze and Ekin (2014) estimated the profitability of cassava production in the floodplain area of Rivers State, Nigeria. Result from the study shows that the total revenue was estimated as ₦262,358.76, total variable cost was ₦108,992.73. Gross margin was estimated at ₦153,366.03, total cost was estimated as ₦110,088.81 while Net Income was recorded as ₦152,269.95. Rapid weed growth, high transportation cost were the most pressing problems faced by cassava floodplain farmers in Rivers State.

Ibrahim *et al.* (2016) examined the costs and returns of yam/maize (mixed cropping) production in Bosso Local Government Area, Niger State. Primary data were obtained by multistage sampling techniques from the small-scale farmers using structured questionnaires administered to eighty farmers. Descriptive statistic and gross margin analysis were used to analyze the data. The findings showed that a typical yam/maize farmer incurred a total fixed cost of ₦34,333.41/ha, realized a gross income of ₦234,582.50/ha and a profit of ₦200,249.09/ha in the production year. This implies that yam/maize cropping enterprise is a viable venture since the profit value is positive and large in magnitude. Cost of fertilizer constitutes about 42% of total variable cost.

According to Segun and Bamire (2010), net gains on agricultural investments promote sustainable farm production in a cost and returns analysis on maize-cowpea intercrop

conduced in Oyo state. Results showed that the difference between gross revenues and total variable costs for male and female maize-cowpea intercrop farmers was statistically significant at 5% level. Maize-cowpea intercropping was found to be profitable as indicated by mean gross margins of ₦31, 200 and ₦19, 900 per hectare for male and female farmers respectively. However, the difference in the mean gross margin was not significant at the 5% level.

Nkonya *et al. (*2010) carried out a study on the profitability of crop production in the *fadama* region in Nigeria. According to the result of the study the dry savannah zone accounted for 60 percent of the maize and rice production between 1994 and 2005, but the most profitable crops in the dry savannah zone were pepper, tomatoes, and yams. In the humid forest zone, which was the second largest producer of yams and cassava accounted for about 30 percent of total yams and cassava production between 1994 and 2004. It was further revealed that leafy vegetables, yam and cassava were the most profitable crops in the humid zone while in the moist savannah; yam and cassava were the most productive, with yam, pepper and cassava identified as the most profitable crops grown in this zone.

In a related study by Abdulhameed and Onuk (2016) on the resource-use efficiency and profitability of maize production in Lafia Local Government Area of Nasarawa State, Nigeria, primary data were collected with the aid of structured questionnaire administered on 70 respondents who were purposively selected through random sampling technique. The study revealed that the total variable cost of maize production was ₦51,901.2/ha, the total farm revenue was ₦61,764.0439/ha, the gross margin obtained was ₦9,862.8439/ha and the average rate of returns was 0.19 indicating that the maize farmers in the study area earn 19kobo on every naira invested in maize

production. Various constraints encountered by the groups of farmers were identified. The study revealed that maize farmers in Lafia were making profit.

Ettah *et al.* (2015) analyzed the cost and returns among cassava farmers in Cross River State, Nigeria. Gross margin analysis was used to analyze the data collected. The result indicated that the total variable cost (TVC) of cassava farmers was estimated at ₦1135,54.99, which represents expenses on cassava cuttings (12.80%), transportation (4.95), rent on land (8.98%), cost of labour (48.45%), fertilizers (7.40%) pesticides (5.58%), herbicides (11.85%). Total revenue and gross margin was estimated at ₦251424.80 and ₦137869.81 respectively, during the production period. This result indicated that cassava production was a profitable venture in the study area. In a study that examined the earning performance of maize enterprise in Gombe State, Nigeria. Aina *et al.* (2015) observed that the total cost of production was ₦20,035, total revenue was ₦31,075 and net farm income was ₦11,040. Maize production in the study area was profitable with ₦1.55 derived from every naira invested.

Toluwase and Abduraheem, (2013) conducted another study to examine the cost and returns analysis of cassava production in Ekiti State. A sample of two hundred food crops farmers engaging in cassava production was randomly selected from four randomly sampled Local Government Areas of the State. Cross sectional data from both primary and secondary sources were used. Data was analyzed to give the descriptive statistical accounts of the research participants and the economic profitability of cassava production was determined through a cost-benefit analysis. The result revealed gross margin of ₦68, 662.50 for cassava production in the study area and cost -benefit ratio of 1:2.19.

Sadiq *et al.* (2017) also investigated the profitability of small-scale maize production in Niger state, using farm budgeting technique. Available reports on profitability studies in

the state suggested little improvement among maize farmers inspite of massive investment in the sector by government. Data were collected using the multi-stage sampling technique, and administering structured questionnaires to a total of 200 randomly selected respondents from two LGAs of Niger State. Data collected were analyzed using descriptive statistics, net farm income analysis. The costs and returns analysis indicated that maize production was profitable with an average net farm income of ₦48, 109.00/hectare, and a gross ratio of 0.39; a production efficiency index (2.50) per farmer further adjudged the profitability of the enterprise, that is, the returns cover the cost of production almost three times.

2.3.3 Empirical studies on price transmission and market integration

Obayelu and Alimi (2013) studied the rural – urban price transmission and market integration of selected Horticulture crops in Oyo State, Nigeria. These researchers found out that one market is the leading market between the rural and urban market and used trend analyses, Augmented Dickey-Fuller (ADF) test, Granger causality test and index of market concentration. The price of onion, chilli pepper and fresh pepper were non-stationary in their various level forms but stationary at first difference; while price of fresh tomato and sweet pepper in urban market were stationary at their level form at probability of 5% respectively. The indices of market concentration for onion, sweet pepper, fresh pepper, Chilli pepper were the less than one suggesting high short-run market integration, where as fresh tomato achieved low short-run market integration. Further, urban markets were the leading markets for fresh tomato and pepper.

Adenegan and Adeoye (2011) reported that a major characteristic of Agricultural markets in Oyo state is the inter-and intra-pricing variations among its urban and rural retail markets due to the forces of demand and that majority of farmers and retailers have poor access to credit which may reduce their ability to respond to price changes

(Okoh and Egbon, 2005). Consequent to these factors, market service area covered by traders may overlap with several sellers operating within the same market or village. Therefore, there exists a probability that the price change in one market would result in a series of price responses that spread throughout contiguous market areas in this case such price change may not have discernible effect more distant market making the attainment of an integrated foodstuff market system a mirage (Akintunde *et al.,* 2012)

Ibrahim (2013) investigated cowpea market integration in Niger state, Nigeria in which secondary data from 6 markets were analyzed through the use of the Dicky Fuller unit root test, Johansen Co-integration test, Error correction model and Granger causality tests. The study concluded that markets in Niger state displayed a relatively long run integration of cowpea prices which was adduced to the flow, ease and use of market into between these markets, the competitive conduct of the market participants and the preserve of arbitrage. However, on the Granger Causality tests, the markets exhibited both unidirectional and bidirectional causation meaning that no market was a market leader where price changes influence all other markets.

Sharma (2002), in a paper aiming to assess market integration between several Asian wheat markets and the world market, estimated Error Correction Models (ECMs) and conducted an extensive policy review. His findings suggest that in countries such as Pakistan, India, Sri Lanka and Indonesia, where governments intervene in the domestic market through various policy instruments, the error correction coefficients were estimated to lie between -0.01 and -0.07, indicating a slow adjustment to the long-run relationship.

Ibrahim *et al.* (2013) further investigated the demand analysis for consumer preference of cowpea attributes in Niger state, Nigeria, the study employed a multistage stratified

and systematic random sampling to select markets from three different regions of the state, time serves data for the price/quality information obtained from the respondents and data analyzed using the Hedonic model. Findings from the study revealed that consumers were willing to pay a premium for additional unit of gram weight, rough test a texture and on the other hand ready to discount Prices for bruchid/insect hole damaged grains.

Akpan *et al.* (2014b) in their publication on Monthly price analysis of Cowpea (Beans) and Maize in Akwa Ibom State, Southern Nigeria used trend analysis, Pearson correlation coefficient, Granger causality test, Co-integration, Error correction model (ECM), and Index of market connection to analyze data collected. The trend analysis showed exponential growth rate that was less than unity for Maize and Cowpea prices suggesting a co-movement of these prices. The Pearson correlation coefficient generated for the pair of rural and urban prices of Maize and Cowpea revealed a significant linear symmetric relationship. There was a bi-directional relationship between the rural and urban price of Maize and Cowpea from the Granger causality test. The co-integration test revealed the presence of co -integration between the rural and urban prices of Maize and Beans. The results of the error correction model (ECM) also confirm the existence of the short run market integration between the rural and urban prices of Maize and Beans but quickly noted that the rural price of Maize adjusted faster to the stable state in the long run than the urban price. Likewise, the urban price of Beans adjusted faster than its corresponding rural price. The index of market connection (IMC) supported the high short run market integration for price of maize and Beans in rural and urban markets.

Edet *et al.* (2014) investigated the dynamics of Price transmission and market integration of Pawpaw and Leafy Telfaria in Akwa Ibom State. The trend analysis revealed a positive relationship and exponential growth rate in the prices of pawpaw and leafy fluted pumpkin in the rural and urban markets. The study also revealed a significant positive and symmetric relationship for each pair of rural and urban price of these crops as evident in the Pearson correlation coefficient. The bivariate granger causality test revealed bi-directional relationships between the rural and urban price of pawpaw and leafy fluted pumpkin in the State. This further substantiates the strong co-movement of prices of pawpaw and leafy fluted pumpkin in the rural and urban markets and strong evidence of market integration.

Ifejirika *et al.* (2013) investigated the price transmission and integration of rural and urban price markets in Nigeria. The price variables used in the analysis were non-stationary and were made stationary by first difference. The researchers reported that rice markets in the study area were integrated but the level of integration was very low. The Vector Error Correction Model had a coefficient of -0.0061872 which was significant of 1% level and was negative. The Market Integration Function had Coefficient of Determination (R^2) of 0.78 showing that the independent variables explained about 78% of the of the variations in the price of rice in the rural and urban rice markets.

Akpan *et al.* (2014a) analyzed the price transmission of fresh Tomato and Pineapple in the rural and urban markets of Akwa Ibom state. The finding revealed that, price of fresh Tomato and Pineapple in rural and urban markets had an exponential growth rate of 1.099% and 1-054% for fresh Tomato and 0.808% for Pineapple. Also, the Pearson correlation coefficient matrix revealed that the rural price of fresh Tomato and

Pineapple has linear, positive and symmetric relationship with their corresponding urban prices. The Granger causality test revealed bi-directional relationship between the rural and urban. The co-integration test revealed the presence of co-integration between the rural and urban price of fresh tomato and pineapple. The results of the Error Correction Model (ECM) confirmed the existence of the short run market integration rural and urban prices of fresh Tomato and pineapple in the study area. The index of market of market connection for fresh Tomato and pineapple supported the existent of the short run market integration between the rural and urban markets.

Ohwo and Adeyemi (2015) examined the price transmission and market integration of Sawn-wood in Delta State, Nigeria. Secondary data on monthly retail prices of the Pogaoleosa and dimensions spanning 2004 to 2013 were sourced from the sale records of sawn-wood sellers in the urban and rural markets of the state. The study employed Ravallion model, Augmented Dicker Fuller (ADF) test, Engle-Granger Co-integration test and Error Correction Mechanisms and revealed that there was a high efficiency of price information flow in Sawn-wood markets in Delta State. The Index of Market Concentration (IMC) indicated that the market exhibited high short run for some dimensions while others exhibited low short run market integration. Both the rural and urban markets were co-integrated in the long run and the error correction model result indicated that there was high degree of price transmission.

Oladapo and Momoh (2007) examined the market integration of main staple agricultural commodities in Oyo State in their paper, Food Prices Differences and Market Integration in Oyo State, Nigeria using the Indices of Market Concentration (IMC) to measure the degree of spatial market integration and concluded that there was a high short-run market integration between the urban and rural markets and suggested that the degree of market integration can be enhanced by the provision of not only transport

infrastructure but also by provision of adequate formal market information and standardization of weights and measures in the system.

Akpan *et al.* (2014c) analyzed the monthly price transmission of local and foreign rice in rural and urban markets of Akwa Ibom State, Nigeria. Data was collected from the quarterly publication of the Akwa Ibom State Agricultural Development Programme (AKADEP) from January 2005 to June 2013. The researchers reported that the prices of local and foreign rice in rural and urban markets have constant exponential growth rate of 0.59% which suggests perfect co-movement for rural and urban prices of local and foreign rice in the study area. Also, the Pearson correlation coefficient matrix revealed that, the rural price of local and foreign rice has linear symmetrical relationships with their corresponding urban prices. The result connotes the existence of symmetric market information flows between the rural and urban rice markets in the state. The Granger causality test revealed bidirectional relationship between rural and urban price of local and foreign rice in Akwa Ibom State, Nigeria. The results of the co-integration test revealed the presence of co-integration between the rural and urban prices of local and foreign rice as well as support the hypothesis of perfect price transmission between the two markets in the study area. The coefficients of the price variable in the co-integration equations for local and foreign rice markets converge to unity which connotes perfect market integration in the long run. The results of the error correction model (ECM) also confirm the existence of the short run market integration between the rural and urban prices of local and foreign rice in the study area. In addition, the result shows that, the price of local rice in both rural and urban markets adjusted faster than prices of foreign rice once there is an exogenous shock in the marketing process of rice in Akwa Ibom State. The index of market concentration (IMC) supports the high short run market integration between prices in rural and urban

markets for local and foreign rice commodities and the quick adjustment of rural price of local rice in relative to rural price of foreign rice.

Sunday *et al.* (2014) studied the price transmission and extent of market integration of yellow Garri and Fufu (fermented cassava tubers) in the rural and urban markets of Akwa Ibom State in Southern region of Nigeria. Average monthly prices (measured in naira per kilogram) of Garri and Fufu in the rural and urban markets were used in the analysis. The data was obtained from the quarterly publications of the Akwa Ibom State Agricultural Development Programme. The data covered January 2005 to June 2013. The trend analysis showed that, prices of Garri and Fufu in the rural and urban markets have exponential growth rates less than unity, which suggests possible co-movement of these prices in the study area. Also, the Pearson correlation coefficient generated for the pair of rural and urban prices of Garri and Fufu revealed significant linear symmetric relationships. The Granger causality test further revealed bi-directional relationships between the rural and urban price of Garri and *Fufu* in Akwa Ibom State, Nigeria. The results of the co-integration test revealed the presence of co-integration between the rural and urban prices of Garri. The theory of one price was tested for; in the Fufu markets and the result implies weak Fufu market integration in the study area. The results of the error correction model (ECM) confirm the existence of short run market integration between rural and urban prices of Garri in the study area. In addition, the result revealed that, the price of Garri in urban market adjusted faster than that of the rural market once there is exogenous shock in the marketing system in the State. The estimated index of market connection (IMC) supported the high short run market integration between prices in rural and urban markets for Garri.

An advanced time series econometric technique was used to study the interaction between the prices of Cassava fresh roots in typical urban-demand and rural-supply markets in Nigeria by Ojiako *et al., (*2014). The Augmented Dickey-Fuller (ADF) test was used to investigate stationarity in the prices while Johansen co-integration test procedure, with its associated vector error correction model (VECM) was used to measure the speed of adjustment coefficients that characterized the long-run dynamics of the system. Unit root tests revealed non-stationarity in both urban and rural prices series: in levels the ADF-test statistics were calculated as -1.68 for the rural price and -2.69 for the urban price while in first differences they were -13.98 and -11.91 respectively. Co-integration test revealed that both prices were co-integrated with the trace- and maximum eigen value statistics calculated as 18.79 and 16.38, each being statistically significant ($p<0.5$). There was no clear trend in price leadership as the Granger causality test did not reveal any significant causality link between the rural and urban market prices.

Patrick and Philip (2016) examined price transmission from world, neighboring country, and internal commercial hub markets to Nigerian urban markets, as well as from urban to rural markets within the country, for seven key food security crops (maize, millet, sorghum, rice, cassava, yams and cowpeas). There are three key findings reported by Patrick and Philip (2016) are (i) tradability matters for price transmission, but tradability varies across crops and regions. The strongest international linkages are with neighbouring countries. Rice price transmission is high across all markets, while coarse grain price correspondence is low with world prices but high with neighbour country market prices; (ii) their results implied that local conditions matter for price transmission, and are relatively more important than trade for some crops (e.g. yams, cassava) than others (e.g. imported rice, maize); (iii) larger than expected long-run price

transmission parameters in world and neighbour countries for rice and coarse grains suggested that, in these select markets, there are either large transactions costs or quality premiums that vary systematically with border prices, and/or mark-ups captured by traders with market power.

Ojo (2014) examined the spatial and temporal pricing efficiency of rice marketing in Kwara and Niger States, Nigeria. Analytical tools used included descriptive statistics, gini coefficient analysis, marketing margin analysis, efficiency ratios, Error correction model, model of spatial price relationship and multiple regression analysis. The overall analysis of the degree of market integration showed that the λ-trace and λ_i-max. test statistics of 19.15 and 17.40 exceeded the critical values of 15.49 and 14.26, respectively at 5% level. This revealed the significance of long-run linear relationship among the rural and urban markets of Niger and Kwara States. Hence, they were well integrated in the long-run but not in the short-run. The spatial analysis revealed that most of the markets had negative price spread except in Owode market where there was positive price spread (656) which was an indication that most of them were spatially inefficient. In conclusion, rice marketing efficiency in respect to the spatial and temporal pricing efficiency revealed that marketers of rice in the study area were not efficient.

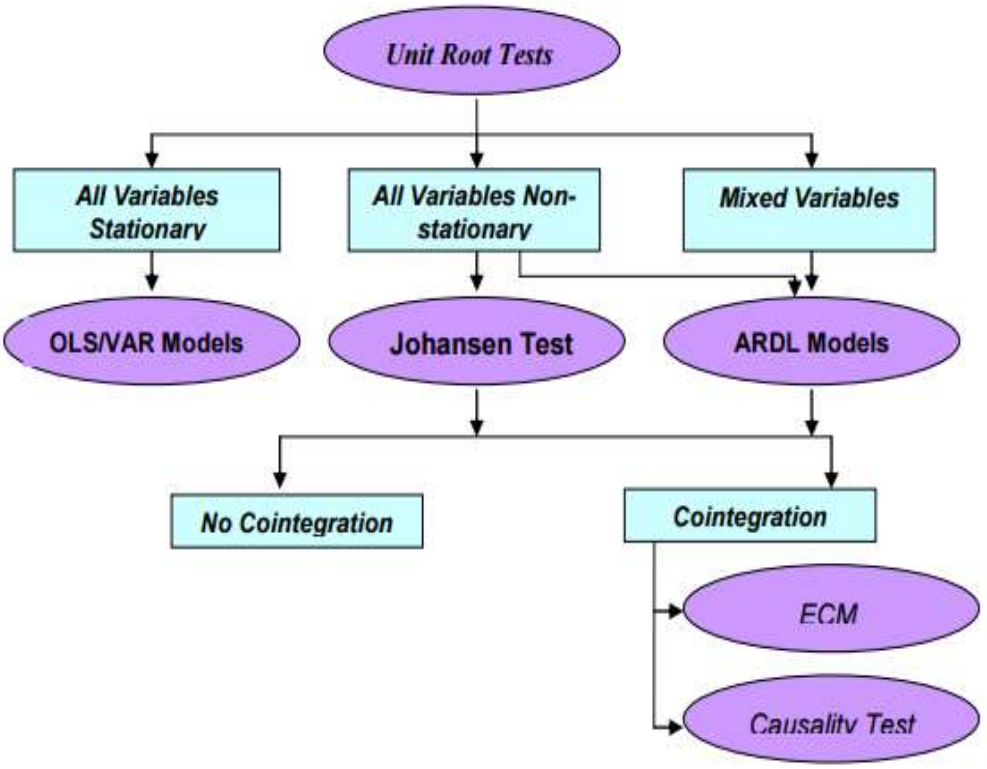
2.4 Analytical Framework

An analytical framework according to Raul (2018) is a model that helps explain how certain type of analysis will be conducted. Analytical framework can also be regarded as a conceptual framework that helps analyse particular phenomena; it therefore helps to support and guide the collection and analysis of data by identifying key analytical outputs and products at each step of the analysis.

2.4.1 Selection framework for time series analysis

Applying appropriate methodology for the time series data is most crucial part of the time series analysis as wrong specification of the model or using wrong method provides biased and unreliable estimates. Primarily, the method selection for time series analysis is based on the unit root test results which determine the stationarity of the variable. Methods commonly used to analyze the stationary time series cannot be used to analyze non-stationary series. If all the variables of interest are stationary, the methodology becomes simple. In such a case, ordinary least square (OLS) or vector autoregressive (VAR) models can provide unbiased estimates. If all the variables of interest are non-stationary, OLS or VAR models may not be appropriate to analyze the relationship. Similarly, additional problem arises when variables used in the analysis are of mixed type, i.e., some are stationary and others are non-stationary.

The method selection criteria of figure 2.2 should be treated as the most basic approach. This is because there are several other considerations in time series models. The non-stationary variables can be made stationary by taking first difference. Similarly, the non-stationary data with a persistent long-run trend can be made stationary with either i) putting time variable in the regression or ii) extracting trends and cycles from the single series by using popular filtering techniques such as Hodric Prescott (HP) filter. Nevertheless, it should be noted that the long-run relationship/information of the variables may be lost when we modify them to make stationary such as by differencing, de-trending or filtering (Shrestha and Bhatta, 2017).



OLS: Ordinary Least Squares; VAR: Vector Autoregressive;
ARDL: Autoregressive Distributed Lags; ECM: Error Correction Models

Figure 2.2: Selection framework for time series analysis
Source: Shrestha and Bhatta, (2017).

2.4.2 Procedures for testing market integration

This study employed Error Correction Models as suggested by Engle and Grangler (1987). There are four steps in the application of the above technique. The first involves carrying out a unit root test on univariate time series to determine the order of integration through successive differencing. Secondly, Johansen co-integration method was estimated using variables of the same order of integration. The residuals of the co-integration were tested for stationarity in the third step. Lastly, the Error Correction Model (ECM) was estimated.

2.4.2.1 Stationarity test

Using the Augmented Dickey-Fuller (ADF) test (Dickey and Fuller, 1979) the order of integration of each time series variable was tested to find out if the data were trend stationary or not. The market integration model (showing the basic relationship to be investigated) is expressed in equation (7).

$$lnP_{Bt} = \alpha + \beta lnP_{At} + \gamma lnP_{Bt-1} + \varepsilon it \quad (7)$$

Where:

P_{Bt}= the price of the crop in B^{th}market in t^{th} month

P_{At}= the price of the crop in A^{th} market in t^{th} month

P_{Bt-1} = the price of the crop in B^{th}market in the previous month

α = a constant term

β gives the relationship between the prices

γ = the error correction term

ε = white noise term

A prori conditions specify that if:

$\beta = 1$, the law of one price holds and the relative price is constant. This implies that the two markets are perfectly spatially integrated, that is, a price change in the supplying market is fully reflected in the consuming market.

$0 < \beta < 1$, there is a relationship between the prices, but the relative price is not constant. The degree of integration is evaluated by investigating how far the deviation of β is from unity.

The ADF test for this study was formulated as given in equations (8) and (9):

$$\Delta P_{Bt} = \beta_0 + \beta_t P_{Bt-i} + \sum C_i \Delta p_{Bt-1} + \varepsilon_t \quad (8)$$

$$\Delta P_{At} = \gamma_0 + \gamma_t P_{Bt-i} + \sum di \Delta p_{At-1} + \varepsilon_t \quad (9)$$

Where:

Δ = the first difference operator

ε = the stochastic error term that follows the classical assumptions

The other variables in equations (8) and (9) are as defined in equation (7). The null hypothesis in equations (8) and (9) is that unit root exists, that is, $\beta = \gamma = 1$ against the alternative hypothesis, that $\beta \neq \gamma < 1$.

The decision rule here is that, if the value of the ADF statistic is less the critical value at the conventional significant level (usually the five per cent significance level) then the series (P_t) is said to be non-stationary and vice versa. Once the series are found to be stationary, then there should exist a linear combination of these variables, which is integrated of order one. The general representation for equations (7) and (8) is given in equation (10):

$$\Delta P_{it} = \beta + \beta_t T + \delta_i P_{t-1} + b_i \Delta P_{t-1} + \varepsilon_t \quad (10)$$

Where,

Δ = the difference operator

P_{it} = the price of crop in market i, at time, t

β= drift parameter

T = time trend

P_{t-1} = the price of crop in the previous month

β_i, $\delta_i$and b_i = coefficients

ε= white noise error term with zero mean and constant variance

$\Delta P_{t-1} = (P_{t-1} + P_{t-2})$, $\Delta P_{t-2} = (P_{t-2} + P_{t-3})$ that is, using lagged difference terms.

The number of lagged difference term to include is often determined empirically, the idea being to include enough terms so that the error term is serially independent (Gujarati, 1995).

2.4.2.2 Co-integration

Model for evaluating the relationship of prices of a homogenous good between locations as used by Mari (2009) is specified in equation (11).

$$p_{t^1} = \alpha + \beta p_{t^2} + V_t \qquad (11)$$

Where P_t^1 and P_t^2 represent commodity prices in two alternative regional markets at time t; α and β are parameters, and $V_t$is the error term. If two markets are perfectly spatially integrated, then β = 1. In this case, price changes in one market are fully reflected in alternative market. When β ≠ 1 (β < 1 or β > 1), then degree of integration is evaluated by investigating how far is β from the value of one.

The Maximum likelihood method of co-integration (Johansen procedure)

Following Johansen and Juselius (1990), the ML method of co-integration may be described as follows: if P_t denotes an (n×1) vector of I(1) prices, then the k-th order vector autoregressive (VAR) representation of P_t may be written in equation (12) as:

$$P_t = \sum_{i=1}^{k} \Pi_i P_{t-I} + \mu + \beta_t + e_t \qquad (t = 1, 2,\ldots\ldots\ldots\ldots..T) \qquad (12)$$

The procedure for testing co-integration is based on the error correction model (ECM) representation of P_t given by equation (13)

$$\Delta P_t = \sum_{i=1}^{k=i} \Gamma \Delta P_{t-1} + \Pi_i p_{t-k} + \mu + \beta_t + e_t \quad (13)$$

Where $\Pi = (1 - \Pi_1 - \ldots\ldots - \Pi_t)$; i = 1,2, …… k-1; $-(1- \Pi_1 - \ldots\ldots - \Pi_k)$. Each of Π_1 is an n x n matrix of parameters; e_t is an identically and independently distributed n dimensional vector of residuals with zero mean and variance matrix, Ω ε ; μ is a constant term, β is trend coefficient and t is trend . So, it is the Π matrix that conveys information about the long-run relationship among the variables in P_t. The rank of Π, r, determines the number of co-integrating vectors, as it determines how many linear combinations of Pt are stationary. The matrix α measures the strength of the co-integrating vectors in the ECM, as it represents the speed of adjustment parameters.

2.4.2.3 Error Correction Models (ECMs)

The idea behind the mechanism of error correction is that a proportion of disequilibrium from one period is corrected in the next period in an economic system (Engle and Granger, 1987). The process of transforming a data series into stationary series leads to loss of valuable long run information (Engle and Granger, 1987). Error correction models helps to solve this problem. The Granger representation theorem is the basis for the error correction model which indicates that if the variables are co-integrated, there is a long-run relationship between them and can be described by the error correction model. The following equation shows an ECM of agricultural supply response involving the variables Y and X in its simplest form shown in equation (14):

$$\Delta Yt = \alpha \Delta X_t - \theta(Y_{t-1} - \gamma X_{t-1}) + \mu_t \quad (14)$$

Where μ_t = disturbance term with zero mean, constant variance and zero covariance. Parameter α takes into account the short run effect on Y of the changes in X, while γ measures the long-run equilibrium relationship between Y and X in equation (15) that is:

$$Y_t = \gamma X_t + \mu_t \quad (15)$$

Where; $Y_{t-1} - \gamma Y_{t-1} + \mu_{t-1}$ measures the divergence (errors) from long-run equilibrium. Also, ɵ measures the extent of error correction by adjustment in Y and its negative sign indicates that the adjustment is in the direction which restores the long-run relationship (Hallam and Zanoli, 1993). The Error Correction Model (ECM) has several advantages. It contains a well-behaved error term and avoids the problem of autocorrelation. It allows consistent estimation of the parameters by incorporating both short-run and long-run effects. Most importantly all terms in the ECM are stationary. It ensures that no information on the levels of the variables is lost or ignored by the inclusion of the disequilibrium terms (Mohammed, 2005). ECM solves the problems of spurious correlation because ECMs are formulated in terms of first difference which eliminates trends from the variables (Granger, 1988). It avoids the unrealistic assumption of fixed supply based on stationary expectations in the partial adjustment mode.

2.4.3 Measurement of market structure and performance

Marketing can be assessed or measured to determine their efficiency in the areas of marketing structure and performance, market efficiency, marketing margin and market channels. Market structure may be defined as those characteristics of an organization to a market which seem to influence strategically the nature of competition and pricing within the market (Olukosi *et al*., 2005). A marketing system is said to be good, if the structure, conduct and performance is critically examined. This structure, conduct and performance have been widely used in marketing studies of agriculture (Harris, 1982;

Okunmadewa, 1990). Market performance is therefore the assessment of how well the process of marketing is carried out and how successfully its aims are accomplished. However, market performance could be regarded as the appraisal of the extent to which the interactions of buyers and sellers in a market stimulate result that is consistent with social purposes (Olukosi *et al*., 2005). The marketing inputs are the costs of providing marketing services while outputs are the benefits or satisfaction created or value added to the commodity as it passes through the marketing system.

Eniola, (2011) defined marketing efficiency as the movement of crops and livestock from producers to consumers at the lowest cost consistent with the provision of services consumer desires. Markets are efficient when the ratio of the values of output to the value of input throughout the marketing system is maximized. The higher the ratio, the greater the marketing efficiency is considered to be (Arene, 2003). On the other hand, marketing margin could be described as the difference in the price of a given commodity as it moves from the primary producer to the ultimate consumer (Olukosi *et al*., 2005)

CHAPTER THREE

3.0 METHODOLOGY

3.1 The Study Area

The study was conducted in Benue and Oyo States, Nigeria. Benue State is one of the Middle Belt States in Nigeria with a projected population of 6,408,041 in 2020 (National Bureau of Statistics, 2020). The State lies between longitude 7°47' and 10°0' East. Latitude 6°25' and 8°8' north; and shares boundaries with five other States namely; Nassarawa State to the north, Taraba State to the east, Cross-River State to the south, Enugu State to the south-west and Kogi State to the west. It occupies a landmass of 34,059 square kilometers and experiences two distinct seasons; the wet season which lasts from April to October with annual rainfall in the range of 100-200mm and the dry season which begins in November and ends in March. Average daily temperature ranges between 21^0C and 37^0C throughout the year.

The State consists of twenty-three (23) Local Government Areas inhabited predominantly by the Tiv, Idoma and Igede peoples. Benue State is the nation's acclaimed food basket because of its rich agricultural produce which includes yam, rice, beans, cassava, sweet-potato, maize, soybean, sorghum *etc*. Agriculture is the mainstay of the economy, engaging over 75% of the state farming population. In addition, it has twenty-four (24) urban and eighty-five (85) rural markets, in which two urban and rural markets, namely Otukpo and Aliade, and Taraku and Adoka were selected for the urban and rural markets respectively.

Oyo State is located in the South West geopolitical zone of Nigeria. The state lies between Latitudes 7°3' and 9°12' North of the equator and Longitudes 2°47' and 4°23' East of Meridian. It has a projected population of 8,026,442 in 2020 (National Bureau of Statistics, 2020) and bounded in the South by Ogun State, in the north by Kwara State, in the west it is partly bounded by Ogun State and partly by the Republic of

Benin, while in the east, it is bounded by Osun State. It has a land mass of 28,454 sq km.

Oyo State has an eruptional climate with dry and wet seasons and relatively high humidity. The dry season lasts from November to March while the wet season starts from April and ends in October. The topography is about 0 to 5m above sea level and the mean rainfall is within the range of 1000-1400mm. Average daily temperature ranges between 25°C and 35°C almost throughout the year. The vegetation pattern of the State is that of rain forest in the South and guinea savannah in the north. The State consists of 33 Local Government Areas (LGAs) while the major ethnic groups mainly comprise the Oyos, the Oke-Oguns, the Ibadans and the Ibarapas, all belonging to the Yoruba family. The crops grown include both annual and perennial crops maize, cassava, yam, oranges, cocoa, tobacco, cashew and sugar cane (Oladapo and Momoh, 2007). Oyo State has thirty-five (35) urban and one hundred and forty (140) rural markets, among which Bodija, Aarada and Saabo were selected from the urban markets while Iluju, Ilora and Omi-Adio were selected from the rural markets.

A total of ten (10) markets were selected for this study, comprising of five (5) rural and five (5) urban markets. In Oyo State, six (6) markets were selected which is made up of three (3) rural and three (3) urban markets while the four (4) markets in Benue State comprises of two (2) rural and urban markets each.

Rural markets in general are usually old and historic markets where you can get variety of farm produce ranging from pepper, tomatoes, and fruits, raw foods, cooked foods down to beefs, and are cheap in this market because it is directly from the farmers. The market is reputed for not only for the host community but also for the neighboring environment. Rural markets are generally characterized by lower degree of competition, inadequate market infrastructure, low consumerism, joint family structure, small shops,

limited display, lower influence of social media, less awareness of consumer rights, low penetration of plastic money and higher band loyalty among others.

Urban markets on the other hand, are popular open air markets usually located in the city. The location of such markets is close to the interstate road network which allows produce farmers easier access to transport their produce to the market from different rural areas. The design of this type of market is such that each produce such as pepper, beans, potatoes, rice and yam have its own rows of stalls which is a mixture of open space trading and concrete and wooden stalls all together. The following characteristics are peculiar to urban markets; concentrated and dense, developed with more sellers, highly responsive and well defined distinct segments, higher influence of social media, more awareness of consumer rights, lower brand loyalty and high penetration of plastic money.

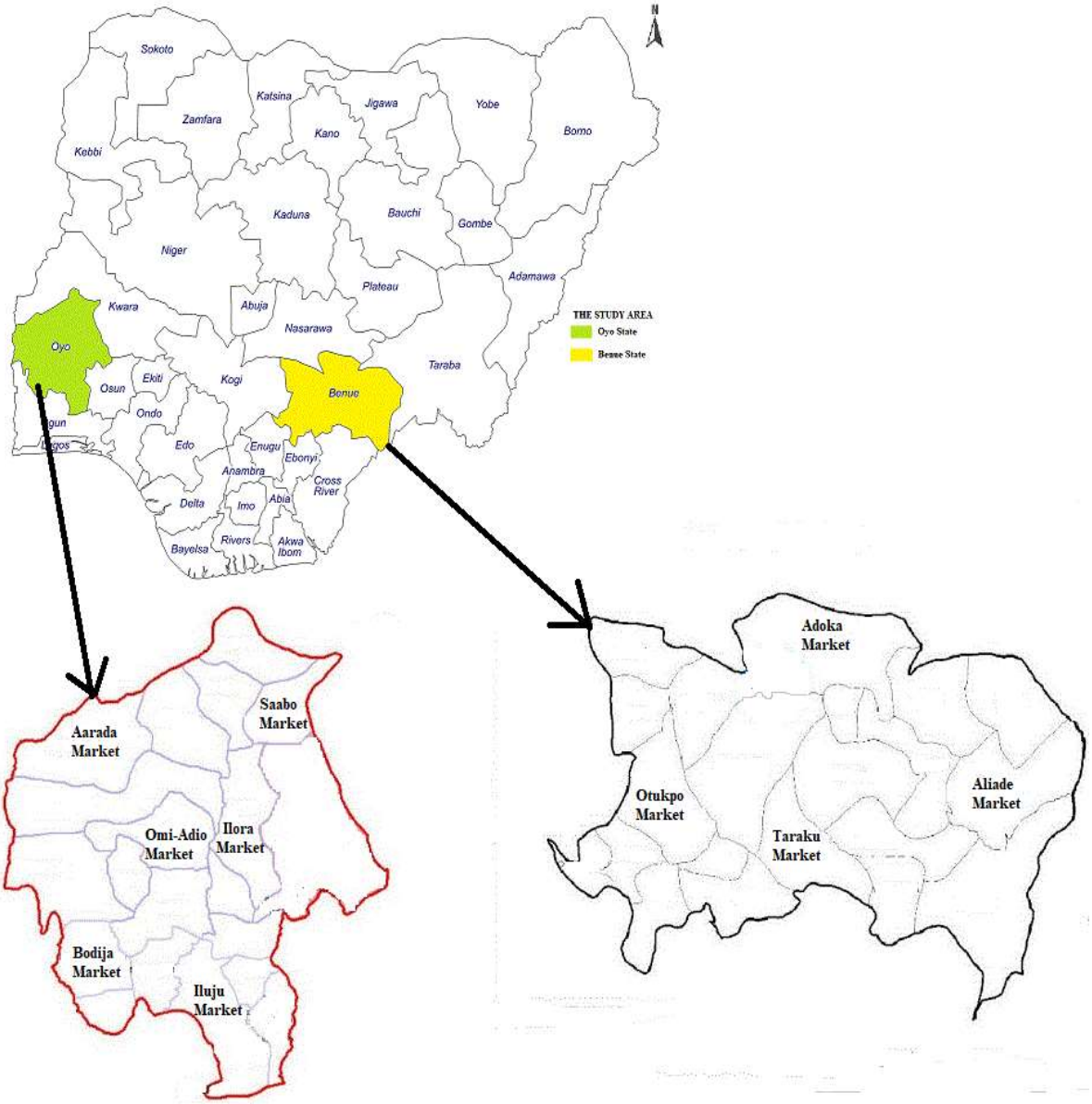


Figure 3.1: Map of the study area showing selected markets.

Source: Office of the Surveyor General of the Federation (2021).

3.2 Sampling Procedure and Sample Size

Purposive sampling technique was employed in the selection of two States for the study. This decision was based on the premise that Benue State reputed to be the food basket of the nation, producing over 120 agricultural products is a producing State (Ahungwa *et al*., 2013), while Oyo State being the 4th most populous State in Nigeria with high population density according to National Bureau of Statistics (2020), is a consuming state. The technique involved listing of all the rural and urban markets in Benue and Oyo states sourced from the Agricultural Development Project (ADP) offices in both States. Benue State has 24 urban markets and 85 rural markets while Oyo has 35 urban markets and 140 rural markets.

Following Ojo (2014), Probability Proportionate to Size (PPS) was employed to select ten (10) markets from the two states.

Probability Proportionate to Size (PPS) is given by:

$$n = \frac{ph}{N} \tag{24}$$

Where:

n = no of markets to be selected from each state,

P = Predetermined number of markets to be selected,

h = Population of markets type in each state and

N= Population of market type in the state.

Table 3.1: Classification of markets into urban and rural.

States	**Urban**	**Rural**
Oyo	5 x 35 /59 = 3	5 x 140/225 = 3
Benue	5 x 24/59 = 2	5 x 85/225 = 2

Source: Oyo and Benue States ADP, 2018

Based on Probability Proportionate to Size (PPS) as in eqn. (24), 5 urban and 5 rural markets were randomly selected which comprises of 3 urban and 3 rural markets from

Oyo State and 2 urban and 2 rural markets from Benue State based on the number of urban and rural markets from each state and the outcome is presented in Table 3.1.

The sample frame was then obtained which constituted the list of cassava and maize marketers obtained from the leaders of the selected market's associations assisted by enumerators from the two state's ADP offices. In the final stage, Taro Yamane's formula as in equation (25) was used to determine the sample size used for this study at 5% precision level based on the sample frame obtained.

The Yamane's (1967) formula is given as:

$$n = \frac{N}{1 + N(e)^2} \tag{25}$$

Where:

n = Sample size,

N = Finite population,

e = limit of error (5% precision level).

Table 3.2: Summary of sampling procedure for the study

			Maize Marketers				Cassava Marketers			
State	**Location**	**Markets**	**Sample Frame**	**Sample Size (5%)**	**Wholesalers (5%)**	**Retailers (5%)**	**Sample Frame**	**Sample Size (5%)**	**Wholesalers (5%)**	**Retailers (5%)**
Oyo	Rural	Iluju	18	18	10	8	19	18	10	8
		Ilora	20	19	10	9	19	18	8	10
		Omi-Adio	29	27	12	15	22	21	13	8
	Urban	Bodija	22	21	13	8	26	26	13	13
		Aarada	34	32	17	15	33	31	16	15
		Saabo	19	18	9	9	18	17	8	9
	Sub-Total		**142**	**135**	**71**	**64**	**137**	**131**	**68**	**63**
Benue	Rural	Taraku	24	22	9	13	22	21	4	17
		Adoka	29	26	1	25	21	19	1	18
	Urban	Otukpo	37	35	12	23	25	24	10	14
		Aliade	21	20	7	13	18	18	11	7
	Sub-Total		**111**	**103**	**29**	**74**	**86**	**82**	**26**	**56**
	Total		**253**	**238**	**100**	**138**	**223**	**213**	**94**	**119**

Source: Field Survey, (2019).

3.3 Method of Data Collection

Secondary data were used for this study. Data were collected on monthly wholesale and retail prices (₦/kg) of cassava and maize for the period of 2008 to 2017 from National Bureau of Statistics (NBS) as well as Benue and Oyo States ADP offices.

3.4 Analytical Techniques

The analytical tools used to achieve the research objectives include mean, frequency distribution and percentages, trend analysis, Error Correction Model (ECM) and Granger causality. Descriptive statistics was used to achieve objective (i), Johansen co-integration test was used to achieve objective (ii), Error Correction Model (ECM) was used to achieve objective (iii), Granger causality was used to achieve objective (iv), while the research hypothesis was tested from the result obtained from the granger causality test.

3.4.1 Descriptive statistics

Objective (i) was achieved using descriptive statistics such as graphs and tables to examine the trend in rural and urban prices of cassava and maize during the period of study.

3.4.2 Market Integration

Objectives ii and iii were achieved using the Error Correction Model (ECM) as suggested by Engle and Granger (1987) and objective iv was achieved with the use of Granger causality.

3.4.2.1 Stationarity test

The study employed Error Correction Model as suggested by Engle and Granger (1987). There are four steps in the application of the ECM technique. The first involves carrying out a unit root test on univariate time series to determine the order of integration through successive differencing. Secondly, Johansen co-integration test was estimated

using variables of the same order of integration. The residuals of the co-integration were then tested for stationarity in the third step. Lastly, the Error Correction Model (ECM) was estimated (Ojo, 2014).

Using the Augmented Dickey – Fuller (ADF) test (Dickey and Fuller, 1979), the order of integration of each time series variable was tested to determine if the data were trend stationary or not. The ADF test for this study is represented in equations (26) and (27):

$$\Delta P_{Bt} = \beta_0 + \beta_t P_{Bt-i} + {}_{\sum} c_i \Delta P_{bt-I} + \varepsilon_i \quad (26)$$

$$\Delta P_{At} = \gamma_0 + \gamma_t P_{At-i} + {}_{\sum} d_i \Delta P_{At-I} + \varepsilon_i \quad (27)$$

Where:

Δ = first difference operator

ε_t= stochastic error term that follows the classical assumptions.

The decision rule here is that, if the value of the ADF statistic is less than the critical value at the conventional significance level (usually the five percent significance level) then the series (P_t) is said to be non-stationary and vice versa. Once the series are found to be stationary, then there should exist a linear combination of these variables, which is integrated of order one. The general representation is given in equation (28):

$$\Delta P_{it} = \beta + \beta_i T + \delta_i P_{t-1} + \sum_{j=1}^{k} b_i \Delta P_{t-1} + \varepsilon_t \quad (28)$$

Where:

Δ = the difference operator,

P_{it}= the price of commodity in market i. at time, t,

β = drift parameter,

T = time trend,

P_{i-1}= the price of commodity in the previous month,

b_i= Coefficients and

ε_t= white noise error term with zero mean and constant variance.

$\Delta P_{t-1} = (P_{t-1} + P_{t-2})$, $\Delta P_{t-2} = (P_{t-2} + P_{t-3})$ that is, using lagged difference terms.

The number of lagged difference term to include is often determined empirically, the idea being to include enough terms so that the error term is serially independent (Gujarati, 1995).

3.4.2.2 Johansen co-integration

The next logical step was to test for co-integration using Johansen co-integration techniques (Trace and Eigen-value Test). It was used to test the hypothesis.

H_0 : The time series variables are not co integrated (r = 0)

If two series are individually stationary at same order, the Johansen and Juselius (1990) and Juselius (2006) can be used to estimate the long run co-integrating vector from a Vector Auto Regression (VAR) model of the form in equation (29):

$$\Delta_{pt} = \alpha + \sum_{i=1}^{k=1} \Gamma_i \Delta P_{t-1} + \Pi P_{t-1} + \mu_t \qquad (29)$$

Where:

P_t is a (n x 1) vector containing the price series at time (t), Δ is the first difference operator. Γ_i and Π are (m x n) matrix of parameters on the i^{th} and k^{th} lag of p_t, Γ_i = $\left(\sum_{i=1}^{k} A\right) - I_g$, , $\Pi_i = \left(\sum_{i=1}^{k} A\, i\right) - I_g$, I_g is the identity matrix of dimension g, α is constant term, μ_t is (n x 1) white noise vector. Throughout, p is restricted to be (at most) integrated of order one, denoted by 1(1), where 1(j) variable requires j^{th} differencing to make it stationary. Equation (28) tests the co-integrating relationship between stationary series. Johansen and Juselius (1990) and Juselius (2006) derived two maximum likelihood statistics for testing the ranking of Π, and for identifying possible co-integration as follows in equations (30) and (31):

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{m} In(1 - \lambda_i) \qquad (30)$$

$$\lambda_{\max}(r, r+1) = -TIn(1-\lambda_{i+1}) \quad (31)$$

Where:

r = the co-integration number of pair-wise vector,

λ_i = i^{th} eigenvalue's values of matrix Π,

T = the number of observations.

λ_{trace} is not a dependent test, but a series of tests corresponding to different r – values. λ_{max} tests each eigenvalue separately. The null hypothesis of the two statistical tests is that there is existence of r co-integration relations while the alternative hypothesis is that there is existence of more than r co-integration relations.

3.4.3 Error Correction Model (ECM)

This involved estimating the Error Correction Model (ECM). ECM captures the short-run disequilibrium situations as well as the long-run equilibrium adjustments between prices. Even if one demonstrates market integration through co-integration, there could be disequilibrium in the short-run i.e. price adjustments may not happen instantaneously. It may take some time for the spatial price adjustments to take place. ECM can incorporate such short-run and long-run changes in the price movement.

An ECM formulation, which describes both the short-run and long-run behaviors of prices, is expressed as follows in equation (32):

$$\Delta P_{Bt} = \gamma_1 + \gamma_2 \Delta P_{At} + \pi \upsilon_{Bt-i} + V_{it} \quad (32)$$

In this model,

γ_2 = the impact multiplier (the short-run effect) that measure the immediate impact that a change in P_{At} will have on a change in P_{Bt}.

π = the feedback effect or the adjustment effect that shows how much of the disequilibrium is being corrected, that is the extent to which any disequilibrium in the

previous affects any adjustment in the P_{Bt} period. Note that, $\ddot{v}_{t-I} = P_{Bt-1} - \rho_1 - \rho_2 P_{At-1}$ therefore from this equation we also have ρ_2 being the long-run response.

3.4.4 Granger causality

If a pair of series is co-integrated, then there must be Granger-causalities in at least one direction, which reflects the direction of influence between series (in this case, price). Theoretically, if the current or lagged terms of a time-series variable, says P_{At}, determine another time-series variable, say P_{Bt} then there exist a Granger-causality relationship between P_{At} and P_{Bt} in which $P_{Bt}$is Granger caused by P_{At}..

$$\Delta P_{Bt} = \theta_{11}\Delta P_{Bt-1} + ... + \theta_{In}\Delta P_{Bt-n} + \theta_{21}\Delta P_{At-1} + \theta_{2n}\Delta P_{At-n} - \gamma_1(P_{Bt-1} - \alpha P_{At-1} - \delta) + \varepsilon_{1t} \quad (33)$$

$$\Delta P_{Bt} = \theta_{31}\Delta P_{Bt-1} + ... + \theta_{3n}\Delta P_{Bt-n} + \theta_{41}\Delta P_{At-1} + \theta_{4n}\Delta P_{At-n} - \gamma_2(P_{Bt-1} - \alpha P_{At-1} - \delta) + \varepsilon_{2t} \quad (34)$$

The following two assumptions have to be tested using the above two models (equations (33) and (34) to determine the Granger causality relationship between prices.

$$\theta_{21} = \Lambda = \theta_{2n} = \Lambda = \gamma_1 = 0 \text{ (No causality from } P_{Bt} \text{ to } P_{At}) \quad (35)$$

$$\theta_{41} = \Lambda = \theta_{4n} = \Lambda = \gamma_2 = 0 \text{ (No causality from } P_{Bt} \text{ to } P_{At}) \quad (36)$$

The above test procedures offer a framework for the assessment of which market (local or urban) cause the integration and in which direction is the movement (Ojo *et al.*, 2015).

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Summary Statistics of Cassava and Maize Price

The summary statistics of cassava and maize price series for the time series data set used for analysis in this study were analyzed for Benue State, Oyo State and the pooled sample and the results were presented in Tables 4.1 and 4.2 for cassava and maize price series respectively.

4.1.1 Summary statistics of cassava price used for the analysis

The summary statistics of the price series used in the empirical models for investigation in this study for cassava marketers were presented in Table 4.1. The results showed that the prices of cassava attained a maximum of ₦173.94/kg and ₦183.99/kg in Oyo and Benue States respectively, while the minimum prices for both States indicated ₦68.95/kg and ₦112.27/kg respectively. The mean cassava price showed ₦76.65/kg and ₦136.26/kg for rural and urban prices in Oyo State and ₦138.49/kg and ₦144.26/kg for rural and urban prices in Benue State. This implied that the average prices of maize and cassava in the rural markets were lower when compared to the prices in the urban markets. The standard deviation in the study area showed ₦20.38/kg and ₦31.83/kg in the rural and urban markets as indicated by the pooled data set. The result further revealed that the rural and urban market price series in Oyo and Benue States were all positively skewed, thereby indicating a skewness of variables matching that of a normal distribution.

Table 4.1: Summary Statistics of Cassava Price used in the study (₦/Kg)

	Oyo State		Benue State		Pooled	
Parameters	**Rural**	**Urban**	**Rural**	**Urban**	**Rural**	**Urban**
Mean	76.65	136.26	138.49	144.26	215.14	280.52
Median	74.81	132.94	139.18	135.78	214.69	279.11
Minimum	68.95	109.35	112.27	118.72	183.1	233.08
Maximum	91.94	164.5	173.94	183.99	265.88	342.57
S.D	6.64	18.65	15.27	21.80	20.38	31.83
C.V (%)	44.09	47.93	33.27	75.23	95.26	93.32
Skewness	1.31	0.17	0.85	0.65	1.33	0.39
Kurtosis	3.95	1.69	4.67	2.09	5.50	2.62

Source: Data Analysis, (2020)
Note: S.D implies Standard Deviation, C.V implies Coefficient of Variation.

4.1.2 Summary statistics of maize price used for the analysis

The results as presented in Table 4.2 showed that in Oyo State, the average price of maize were ₦62.35/kg and ₦88.78/kg in the rural and urban markets respectively. The average price in Benue State was higher in both rural and urban markets at ₦80.49/kg and ₦107.96/kg respectively. This could be attributed to changes in demand, supply and consumption patterns of the people. The findings also revealed that, there was no significant deviation between the rural and urban price of maize in Oyo State with standard deviation of ₦6.18/kg and ₦6.89/kg for rural and urban maize prices respectively. However, in Benue State, there was a significant deviation between the rural and urban maize prices as indicated by the standard deviation of ₦6.85/kg and ₦35.26/kg for rural and urban markets respectively. The deviation could be due to the spatial distribution of farm products from area of surplus to area of scarcity.

In addition, the coefficient of variation in maize price series in the rural and urban markets were 38.20% and 47.48% respectively in Oyo State, while 46.87% and 64.24% were obtained for the rural and urban markets respectively in Benue State. The finding

showed that, the urban price of maize exhibited higher variations compared to the rural price in both States. The result further indicated that the price of maize in the urban market of Oyo State was negatively skewed to the left, while other price series were positively skewed to the right.

Table 4.2: Summary Statistics of Maize Price used in the study (₦/Kg)

	Oyo State		Benue State		Pooled	
Parameters	**Rural**	**Urban**	**Rural**	**Urban**	**Rural**	**Urban**
Mean	62.35	88.78	80.49	107.96	353.63	424.77
Median	60.06	90.37	79.40	92.31	142.43	185.46
Minimum	53.61	78.08	69.71	74.61	295.36	356.82
Maximum	73.91	96.06	90.92	168.43	439.81	526.56
S.D	6.18	6.89	6.85	35.26	35.40	51.27
C.V (%)	38.20	47.48	46.87	64.24	82.96	89.11
Skewness	0.49	-0.64	0.17	0.66	1.15	0.63
Kurtosis	2.31	1.88	2.04	1.85	5.24	2.60

Source: Data Analysis, 2020
Note: S.D implies Standard Deviation, C.V implies Coefficient of Variation.

4.2 Trend Analysis of Cassava and Maize Prices

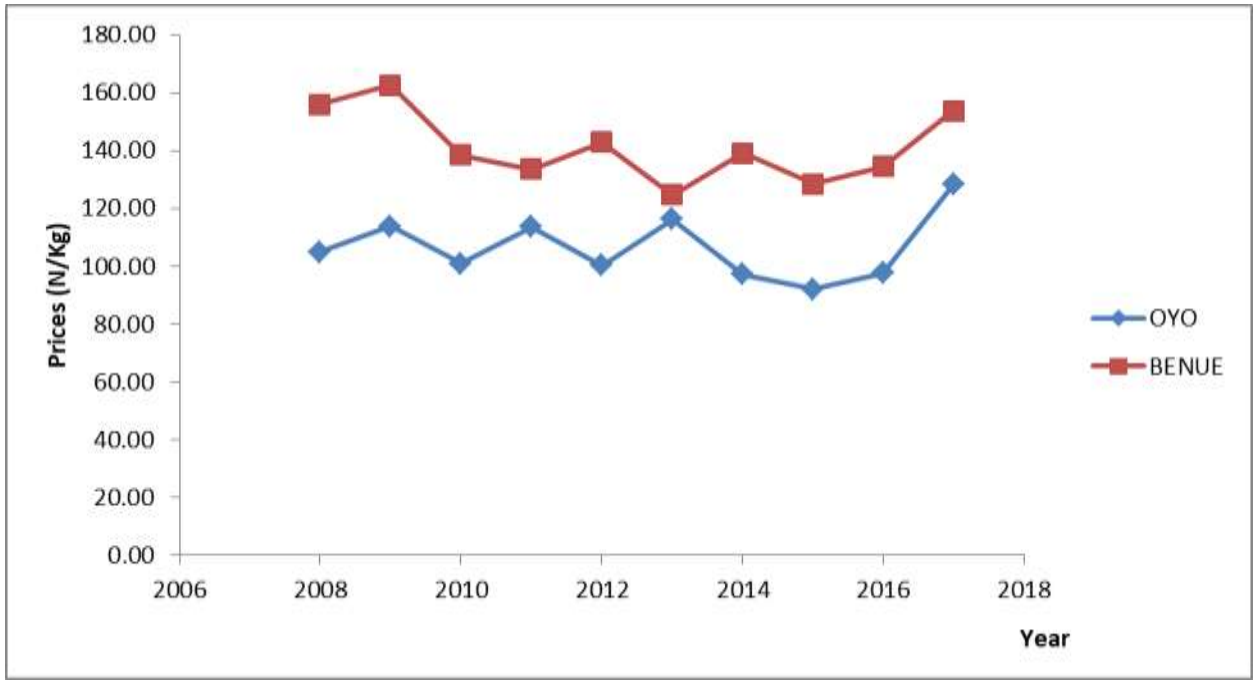
The trend analyses of cassava and maize prices for rural and urban markets of Benue and Oyo States during the period of study (2008 – 2017) were examined and the results presented.

4.2.1 Trend of cassava prices in Benue and Oyo States

Figure 4.1 showed the trend of cassava prices in the study area (Benue and Oyo States) over the period of 2008 – 2017.

The price behavior on a general note shows three major patterns; irregular, decreasing and increasing trends and the price in Benue State was higher than that of Oyo State over the study period. This may be due to higher level of cassava production in the Southwestern part of the country, thereby leading to surplus in the area and

consequently lower prices of the commodity as opposed to what was obtainable in Benue State. For Benue State, there was a decreasing trend from 2009 – 2011, followed by an irregular pattern which suggest price instability from 2011 – 2015 and an increase trend up to 2017. However, in Oyo State, the commodity price was relatively stable from 2008 – 2013 followed by a decline in 2014 and 2015. The downward cassava price trend observed in both Oyo and Benue States moved in similar pattern to what was reported by Akinpelu *et al*., (2011) in their study area.

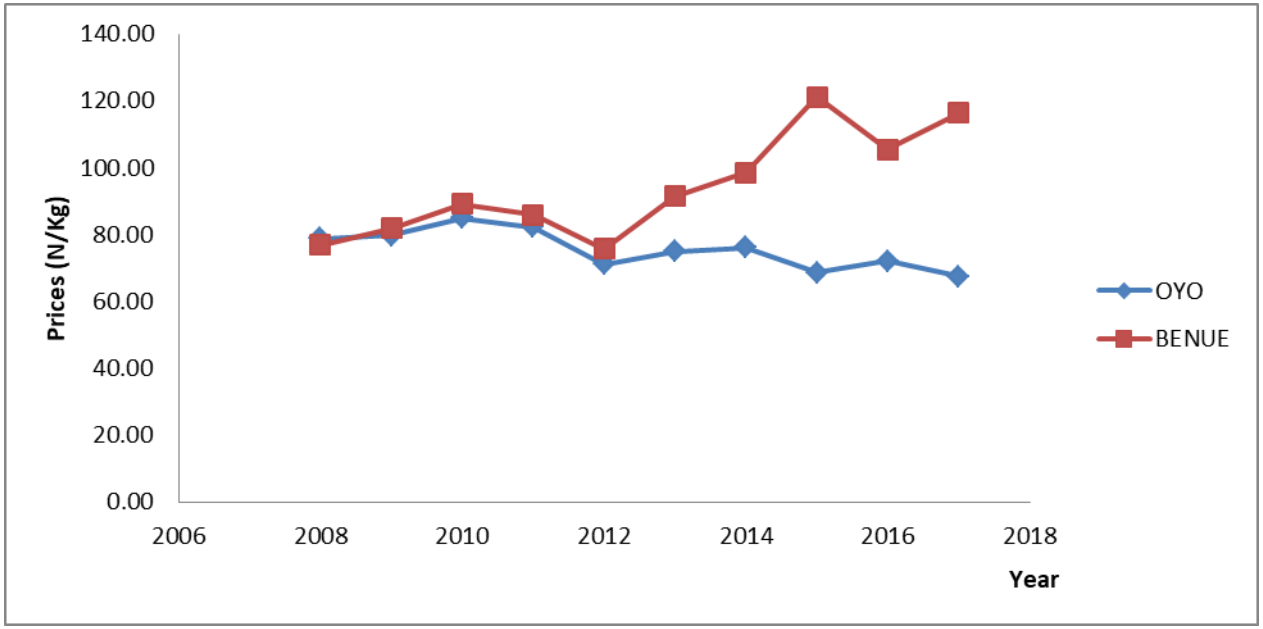


Source: Data Analysis, (2020).

Figure 4.1: Trend of cassava prices in Benue and Oyo States

4.2.2 Trend of maize prices in Benue and Oyo States

Figure 4.2 showed the trend of maize prices in Benue and Oyo States; the trend as presented revealed that maize price series in Benue State was higher than in Oyo State during the period of study. The higher price of maize in Benue State despite being a producing State, regarded as the food basket of the nation could be attributed to the influx of buyers from different parts of the country, leading to increase in price of the commodity due to high demand. There was however a similar pattern in the trend from 2008 – 2012, that is, a steady rise from 2008 – 2010 and a steady decline from 2010 – 2012. This was followed by a fluctuating trend from 2012 – 2017 in Oyo State while Benue State showed a rapid growth in trend from 2012 – 2015. The implication of this finding is that, rising prices may prompt farmers to increase production and as such brings about surplus which may in turn lead to decline in price of the commodity and vice versa. This is in line with Oyinbo *et al.* (2013) who studied the trend of rice demand and supply in Nigeria and found an increasing trend, fluctuating trend and rapid growth in trend over the period of study.



Source: Data Analysis, (2020).

Figure 4.2: Trend of maize prices in Benue and Oyo States

4.3 Market Integration of Cassava and Maize Prices in Rural and Urban Markets

4.3.1 Time series properties of cassava and maize prices in Benue and Oyo States

As a first step in the analysis involving the use of time series data, the stationarity of the variables is required. The properties of the time series data were tested using Augmented Dickey Fuller (ADF) test in order to determine the stationarity of the price series under consideration and the results presented in the appendix section of this research.

4.3.2 Johansen co-integration test for cassava prices in Benue and Oyo States

Table 4.3 shows the co-integration results for cassava price series in the study area. The results showed that there were at least four co-integrating equations in the rural and urban markets as indicated by 8.33 for both trace and max statistics, which is greater than the critical value of 3.76 at 5% level of significance and 10.71 for both trace and max statistics, which is greater than 3.76 at 5% level of significance in the urban and rural markets respectively.

Based on this, the null hypothesis of no co-integration among the cassava price series was rejected; this therefore implies that there was co-integration among the cassava price series in the rural and urban markets in the study area. The reason for such co-integration between the rural and urban markets may be due to effective and efficient transmission and utilization of market information within the study area. This result is in line with Akpan *et al*. (2014b) which revealed the presence of co-integration between the rural and urban prices of maize and beans, thereby implying a long run relationship among the rural and urban market prices and Ojo (2014) who examined the spatial and temporal pricing efficiency of rice marketing in Kwara and Niger States, Nigeria; and reported that the variables were well co-integrated.

Table 4.3: Results of Johansen co-integration rank test for cassava prices in rural and urban markets of Benue and Oyo States

Markets	Trace Statistics	Critical Value (5%)	Max Statistics	Critical Value (5%)
Rural Markets				
r = 0	150.60	68.52	67.04	33.46
r = 1	83.57	47.21	37.48	27.07
r = 2	46.09	29.68	19.81	20.97
r = 3	26.28	15.41	15.57	14.07
r = 4	10.71*	3.76	10.71**	3.76
Urban Markets				
r = 0	133.59	68.52	54.11	33.46
r = 1	79.48	47.21	29.88	27.07
r = 2	49.61	29.68	25.29	20.97
r = 3	24.33	15.41	16.00	14.07
r = 4	8.33*	3.76	8.33**	3.76

Source: Data Analysis, 2020

* and **: number of co-integrating equation at 5% levels of significance for Trace and Max statistics respectively.

r: Co-integrating equation

4.3.3 Johansen co-integration test for maize prices in Benue and Oyo States

The test for the existence of long run linear relationship was carried out for the rural and urban price series using Johansen Co-integration test and the results were presented in Table 4.4. For the urban markets, the results showed a trace statistic of 35.51 which is greater than the critical value of 29.68 at 5% level of significance ($P < 0.05$) and a max statistic of 62.40 which is also greater than the critical value of 27.07 at 5% level of significance. The results showed that there were at least two co-integration equations and one co-integrating equation among the maize price series for trace and max statistics respectively. The rural markets also showed that there were at least four co-integrating equations among the price series as indicated by 5.89 at 5% level of significance for both trace and max statistics.

Therefore, based on the decision rule, the null hypothesis of no co-integration among maize market price series in the rural and urban markets in the study area was rejected. This implied that there was a long run linear relationship among the maize price series

in the study area during the period of study and therefore the variables in the model were co-integrated. This is an indication that maize price series in the rural and urban markets form part of a system of maize prices that may vary independently in the short run but in the long run will vary simultaneously as part of a single market. Emokaro and Ayantoyinbo (2014) also reported the existence of co-integration at 5% significant level for rice price series thereby implying the presence of long run relationship among the variables.

Table 4.4: Results of Johansen co-integration rank test for maize prices in rural and urban markets of Benue and Oyo States

Markets	Trace Statistics	Critical Value (5%)	Max Statistics	Critical Value (5%)
Rural Markets				
r = 0	165.10	68.52	86.32	33.46
r = 1	79.68	47.21	34.85	27.07
r = 2	44.83	29.68	23.34	20.97
r = 3	21.49	15.41	15.60	14.07
r = 4	5.89*	3.76	5.89**	3.76
Urban Markets				
r = 0	187.16	68.52	89.25	33.46
r = 1	97.91	47.21	62.40**	27.07
r = 2	35.51*	29.68	20.90	20.97
r = 3	14.61	15.41	12.49	14.07
r = 4	2.12	3.76	2.12	3.76

Source: Data Analysis, 2020

* and **: number of co-integrating equation at 5% levels of significance for Trace and Max statistics respectively.

r: Co-integrating equation

4.4 Speed of Adjustment and Price Transmission of Integrated Markets in Benue and Oyo States.

The Error Correction Model (ECM) was employed in order to analyze the short run dynamics of the speed of adjustment and price transmission of integrated markets in the study area. This test therefore analyzes the speed of price transmission from one market to the other, that is, the number of days, weeks or months required for prices to be transmitted from one location to another. Lags were chosen based on the Akaike Information Criterion (AIC) and the nature of the commodity under study. The lags that

best suits the actual price changes in the market were tested and the lag that best minimized the AIC was chosen. This therefore resulted into an Error Correction Model (ECM) of 3 lags; which implies that prices of maize and cassava in the study area were expected to change significantly within one to three months within the rural and urban markets.

4.4.1 Error Correction Model (ECM) for cassava prices in Benue and Oyo States

The ECM results presented in Table 4.5 revealed that the short run market integration as measured by the magnitude of market interdependence and the speed of price transmission between the urban markets was weak. The result showed that among the urban markets considered, only the estimated short run coefficient of Otukpo market was statistically significant at 1% level of significance, while all other estimated short run coefficients in the urban markets were statistically insignificant. This suggests that the transmission of price changes from one market to another within 1 – 3 months was weak. The weak price transmission observed may be due to certain exogenous factors in the market system. Price changes in Otukpo market was transmitted to other markets at a rate of 3.6% within the period; this shows that adjustment towards the long run equilibrium in the short run was very slow. Similar pattern was also observed in the rural markets where only Iluju and Taraku markets transmitted price changes to other markets at a rate of 69% and 36% respectively.

Therefore, based on the results, it can be deduced that cassava markets in the study area were not well integrated in the short run. In other words, price adjustment across markets did not happen instantaneously within the study area. Mkpado *et al*. (2013) in their study on price transmission and integration of rural and urban rice markets in Nigeria reported that it took time for spatial price adjustment to take place between rural and urban markets, implying a weak price transmission and as such the markets were

not well integrated. Also, Sunday *et al.* (2014) studied the price transmission and extent of market integration of yellow Garri and Fufu in the rural and urban markets of Akwa Ibom State in Southern region of Nigeria and obtained similar result. Their Error Correction Model (ECM) results confirm the existence of short run market integration between rural and urban prices of garri in the study area. In addition, the result revealed that, the price of garri in urban market adjusted faster than that of the rural market once there is exogenous shock in the marketing system in the State.

Table 4.5: Estimates of Error Correction Model (ECM) for cassava prices in rural and urban markets of Benue and Oyo States

	Oyo State			**Benue State**	
Rural Market	**Omi-Adio**	**Iluju**	**Ilora**	**Adoka**	**Taraku**
CointEq1	-0.0512	-0.6933	0.2260	-0.1333	0.3610
	(0.0270)	(0.1130)	(0.0707)	(0.0938)	(0.1764)
	[-1.89]	[-6.14] ***	[3.19] ***	[-1.42]	[2.10] **
CointEq2	-0.1830	-0.0270	-0.3273	-0.1489	-0.3594
	(0.0917)	(0.0975)	(0.0856)	(0.0924)	(0.0885)
	[-1.99] **	[-0.28]	[-3.83] ***	[-1.61]	[-4.06] ***
F – Statistic		15.03***			
Urban Market	**Bodija**	**Aarada**	**Saabo**	**Aliade**	**Otukpo**
CointEq1	-0.0032	0.0006	0.0001	-0.0060	0.0366
	(0.0019)	(0.0013)	(0.0010)	(0.0076)	(0.0058)
	[-1.67]	[0.44]	[0.08]	[-0.78]	[6.27] ***
CointEq2	-0.1700	-0.2572	-0.3299	-0.1504	0.0513
	(0.0949)	(0.0931)	(0.0908)	(0.0949)	(0.0977)
	[-1.79]	[-2.76] ***	[-3.63] ***	[-1.58]	[0.52]
F – Statistic		46.13***			

Source: Data Analysis, 2020.
*******and******implies significant at 1% and 5% significance levels respectively.
Figures in brackets (…) and […] are standard errors and t-values respectively.

4.4.2 Error Correction Model (ECM) for maize prices in Benue and Oyo States

The ECM results for rural and urban maize markets in the study area were presented in Table 4.6. The results as indicated by the adjustment coefficients showed that, the adjustments towards long run equilibrium in the short run within three months was fast for some markets and slow for other markets in the study area. In the urban markets,

adjustment towards equilibrium was found to be relatively fast in four markets out of the five urban markets in the study area (equations 1 and 2), with adjustment coefficient of 22% for Bodija market (Eqn 2), Aarada 59% (Eqn 1), Saabo 31% (Eqn 2) and Otukpo 28% (Eqn 1).

Also, all the stated markets were statistically significant at 5% (Bodija market) and 1% (Aarada, Saabo and Otukpo markets) level of significance; this implied that the transmission of price changes from one market to another within 1 – 3 months was averagely strong. The markets however show a negative relationship except for Otukpo market which was positively related. This implies that the adjustment towards equilibrium in these markets is from a higher price to the long run price level.

Furthermore, the rural markets however showed a very weak price transmission from one market to the other within 3 months as indicated by the coefficient of price transmission of 0.1%, 0.3% and 16% for Omi-Adio, Taraku and Ilora markets respectively with no price transmission in Iluju and Adoka markets as indicated by the error correction term. This result is in line with Ojiako *et al. (*2014) who also reported a weak price transmission between integrated markets in their study area. However, for equation 2, the price transmission coefficient for Omi-Adio, Adoka and Taraku were 34%, 35% and 30% respectively, showing a relatively fast price transmission between the rural markets in the study area.

Based on the results, price transmission was better in the urban markets as against the rural markets and therefore maize markets in the study area were not well integrated in the short run. This may be due to the fact that urban markets are more populated with more activities such as arbitrage, processing, branding among others, going on within the market. Also, marketers in urban centers are usually well informed with price

information. This finding supports the assertion of Ani *et al*. (2017) who reported that soyabean markets in Benue and Enugu States were not well integrated as indicated by a very low speed of adjustment to equilibrium in the short run.

Table 4.6: Estimates of Vector Error Correction Model (VECM) for maize prices in rural and urban markets of Benue and Oyo States

	Oyo State			Benue State	
Rural Market	**Omi-Adio**	**Iluju**	**Ilora**	**Adoka**	**Taraku**
CointEq1	-0.0018	0.0007	-0.1615	-0.0008	0.0033
	(0.0041)	(0.0031)	(0.0222)	(0.0019)	(0.0016)
	[-0.43]	[0.22]	[-7.28] ***	[-0.41]	[2.12] **
CointEq2	-0.3482	0.0406	-0.0227	-0.3568	-0.3075
	(0.1001)	(0.0966)	(0.0983)	(0.0910)	(0.0905)
	[-3.48] ***	[0.42]	[-0.23]	[-3.92] ***	[-3.40] ***
F – Statistic		65.21***			
Urban Market	**Bodija**	**Aarada**	**Saabo**	**Aliade**	**Otukpo**
CointEq1	-0.0285	-0.5981	-0.0022	-0.0067	0.2816
	(0.2803)	(0.8118)	(0.0266)	(0.0261)	(0.0899)
	[-1.02]	[7.37] ***	[-0.08]	[-0.26]	[3.13] ***
CointEq2	-0.2207	0.0090	-0.3103	-0.0746	0.0085
	(0.0905)	(0.0980)	(0.0966)	(0.0931)	(0.0003)
	[-2.44] **	[0.09]	[-3.21] ***	[-0.80]	[2.54] **
F – Statistic		77.45***			

Source: Data Analysis, 2020.
******* and******implies significant at 1% and 5% significance levels respectively.
Figures in brackets (…) and […] are standard errors and t-values respectively.

4.5 Direction of Movement of Integrated Markets in Benue and Oyo States

4.5.1 Pair-wise Granger causality test for cassava markets in Benue and Oyo States

The test statistics for the pair-wise granger causality test on cassava markets in Benue and Oyo States were presented in Table 4.7. Lags were chosen based on the Akaike Information Criterion (AIC) and the nature of the commodity under study. The lags that best suits the actual price changes in the markets were tested and the lag that best minimized the AIC was chosen. This therefore resulted into a causality of 4 lags; which implies that prices of cassava in the rural and urban markets are expected to significantly granger cause each other within one to four months.

The results as presented showed that the null hypothesis of no causality was rejected for eight (8) market pairs in Oyo State and ten (10) market pair in Benue State. In Oyo State, four (4) market links exhibited a unidirectional causality and the other four (4) shows bidirectional causality while in Benue State, only two (2) market pairs had unidirectional causality and the remaining eight (8) had bidirectional causality. Ilora market showed strong granger causality with Bodija and Aarada at 5% level of significance and with Iluju at 1% level of significance while Iluju market granger caused Bodija and Aarada at 5% level of significance. Aarada and Iluju markets manifested a one-way causality with Bodija, Iluju had one-way causality with Aarada and Ilora while the other market pairs considered in Oyo State had bidirectional causality with each other. This suggests that the movement of prices in Ilora market caused the movement in prices in Bodija, Aarada and Iluju while the prices in Iluju were the drivers of that in Bodija and Aarada.

However, in Benue State, Otukpo market exhibited bidirectional causality with Aliade and Adoka and unidirectional with Taraku, Aliade also shows bidirectional relationship with Taraku and Adoka while Adoka had a one-way relationship with Taraku as presented in Table 4.7. The market pairs of Otukpo – Adoka, Taraku – Aliade, Aliade – Adoka and Adoka – Taraku were significant at 5% level of significant while the other market links were significant at 1% level of significant. This implies that price changes in Otukpo market affects price formation in Aliade and Adoka, and price changes in Aliade market affects price formation Adoka and Taraku markets with a corresponding feedback to the causal markets and vice versa while price changes in Otukpo and Adoka markets affects price formation in Taraku market without a feedback to any of the causal markets. The results obtained conform to Adenegan and Bolariwa (2011) who reported both unidirectional and bidirectional granger causalities for rural and urban

market links in their study area but it is against the assertion of Ohwo and Adeyemi (2015) who reported only bidirectional granger causalities for all the pairs of rural and urban markets tested in Delta State, Nigeria. Based on these findings, it can be deduced that the price formation process was not led by a single market but rather, a combination of causal markets in the study area. In conclusion, the results of the pair-wise granger causality of cassava in Oyo and Benue States revealed that there was no dominant market whose price changes affects all other prices within the rural and urban markets of the States.

Table 4.7: Pair-wise Granger causality test on cassava markets in Benue and Oyo States

Null Hypothesis	F-Statistics	P-Value	Direction of Causality
Oyo State			
Aarada → Bodija	3.1718**	0.0347	Unidirectional
Iluju → Bodija	3.4163**	0.0266	Unidirectional
Bodija ↔ Ilora	3.0802**	0.0383	Bidirectional
Ilora ↔ Bodija	3.9553**	0.0152	Bidirectional
Iluju → Aarada	3.9606**	0.0151	Unidirectional
Aarada ↔ Ilora	4.3506**	0.0102	Bidirectional
Ilora ↔ Aarada	3.6388**	0.0210	Bidirectional
Iluju → Ilora	4.8602***	0.0062	Unidirectional
Benue State			
Otupko ↔ Aliade	5.9855***	0.0001	Bidirectional
Aliade ↔ Otupko	4.0176***	0.0013	Bidirectional
Otupko → Taraku	4.3162***	0.0029	Unidirectional
Otupko ↔ Adoka	2.0612**	0.0264	Bidirectional
Adoka ↔ Otupko	5.9322***	0.0023	Bidirectional
Aliade ↔ Taraku	4.8695***	0.0062	Bidirectional
Taraku ↔ Aliade	3.7488**	0.0188	Bidirectional
Aliade ↔ Adoka	3.9345**	0.0155	Bidirectional
Adoka ↔ Aliade	4.1636***	0.0012	Bidirectional
Adoka → Taraku	2.4585**	0.0416	Unidirectional

Source: Data Analysis, 2020

↔ and →: indicates direction of causality

******* and****** means significant at 1% and 5% levels of significance respectively.

4.5.2 Pair-wise Granger causality test for maize markets in Benue and Oyo States

The granger causality test was used to determine the market that causes integration and the direction of causality of the listed maize markets in the study area. Lags were chosen

on the basis of Akaike Information Criterion (AIC) and the nature of the product. The lags of best fit with the actual price changes in the market were tested and chosen based on the capacity to minimize the AIC. Therefore, 4 lags were used for the lag length of maize markets in Oyo and Benue States.

The results as presented in Table 4.8 showed that the F-statistics for both rural and urban markets in Oyo State were all statistically significant at 1% level of significance while in Benue State, four market pairs and five market pairs were statistically significant at 1% and 5% significant levels respectively. This therefore led to the rejection of the null hypotheses of no granger causality between maize market pairs in the study area. In Oyo State, from the nine (9) markets with causal relationships, three (3) market pairs showed one-way causal relationships (unidirectional causality) while the remaining six (6) had two ways causal relationships (bidirectional causality) while Benue State also showed similar pattern with three (3) having unidirectional causalities and six (6) market pairs had bidirectional causalities.

The implication of unidirectional causalities between two markets is that, a change in price in the former market in each pair granger causes the price formation in the latter market, whereas the price change in the latter market was not fed back by the price change in the former market in each pair while the bidirectional causalities implied that the former market in each pair granger caused the price formation in the latter market which in turn provided the feedback to the former market as well. This result further substantiates the strong co-movement of the price of maize in the rural and urban markets and strong evidence of market integration in the study area. Adenegan and Adeboye (2011) reported a contradictory result that none of the rural and urban market links in the study area exhibited bidirectional granger causality. Based on the results of the pair-wise granger causality of maize in Oyo and Benue State, it was deduced that

there was no market leader whose prices changes affects all other prices within the rural and urban markets.

Table 4.8: Pair-wise Granger causality test on maize markets in Benue and Oyo States

Null Hypothesis	F-Statistics	P-Value	Direction of Causality
Oyo State			
Bodija → Aarada	8.2725***	0.0003	Unidirectional
Bodija ↔ Iluju	5.0495***	0.0048	Bidirectional
Iluju ↔ Bodija	6.1743***	0.0017	Bidirectional
Ilora → Bodija	11.536***	0.0000	Unidirectional
Iluju → Aarada	15.414***	0.0000	Unidirectional
Aarada ↔ Ilora	5.2521***	0.0040	Bidirectional
Ilora ↔ Aarada	49.265***	0.0000	Bidirectional
Iluju ↔ Ilora	19.353***	0.0000	Bidirectional
Ilora ↔ Iluju	71.277***	0.0000	Bidirectional
Benue State			
Otupko → Aliade	5.0684***	0.0048	Unidirectional
Otupko ↔ Taraku	6.9017***	0.0000	Bidirectional
Taraku ↔ Otupko	2.6745**	0.0367	Bidirectional
Adoka → Otupko	3.7033**	0.0188	Unidirectional
Taraku → Aliade	12.319***	0.0000	Unidirectional
Aliade ↔ Adoka	2.5905**	0.0412	Bidirectional
Adoka ↔ Aliade	3.5195**	0.0229	Bidirectional
Taraku ↔ Adoka	12.495***	0.0000	Bidirectional
Adoka ↔ Taraku	2.7094**	0.0412	Bidirectional

Source: Data Analysis, 2020

↔ and →: indicates direction of causality

******* and****** means significant at 1% and 5% levels of significance respectively.

4.5.3 Inter-state pairwise Granger causality test for cassava and maize markets

The results for the inter-state pairwise granger causality for cassava and maize in Benue and Oyo rural and urban markets are as presented in Table 4.9. The null hypothesis of no causality was accepted for the unidirectional causality between rural maize markets of Benue and Oyo States. In contrast, the null hypothesis of no causality was rejected in favour of the alternative hypothesis of the existence of causal relationships for the bidirectional causality between the market pairs of rural Oyo – urban Benue, urban Oyo – rural Benue, and urban Oyo – urban Benue. This simply implies the movement of maize from Oyo State to Benue State and vice versa due to variations in demand, supply

and price of the commodity. However, for cassava markets, the null hypothesis of no granger causality was rejected for all the market pairs considered in the rural and urban markets of Oyo and Benue States; implying that there was movement of cassava between the States over the period of study.

Among the total of eight (8) market pairs considered each for maize and cassava, the maize market had two (2) market pair with unidirectional causality and there were six (6) market pairs with bidirectional causality while the eight (8) market pairs considered for cassava market all had bidirectional causality. Also, the granger causality between these markets was strong as indicated by 1% level of significant for nine (9) market pairs and 5% level of significant for seven (7) market pairs from the total of sixteen (16) market pairs considered for both maize and cassava markets in Oyo and Benue States. This suggests that price changes in the rural and urban markets of Oyo State (consuming State) acted as major driver of the price formation in the rural and urban markets of Benue State (producing State) and vice versa. Therefore, based on the observed causal relationships between markets in the study area, it can be concluded that price formation process in Oyo and Benue markets was not led by a single market but a combination of markets in the study area dominated the leadership position.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study analyzed price transmission and market integration of cassava and maize in rural and urban markets of Benue and Oyo States, Nigeria and therefore concludes that; there was irregular and general fluctuations in the price trend of cassava and maize, there was a long run relationship among cassava and maize price series as indicated by the co-integration test and the rate of price transmission was slow and fast for cassava and maize respectively within 1 – 3 months. The result from granger causality showed that the rural and urban market pairs of the producing State (Benue State) granger caused the rural and urban market pairs of the consuming State (Oyo State).

5.2 Recommendations

Based on the findings of this study, it was therefore recommended that;

i. The trend analysis showed that there was general fluctuation in the price trend of maize and cassava in Oyo and Benue States. Effort should therefore be made by the marketers to equip themselves with the necessary marketing strategies in order to make more reliable price forecasts for correct marketing decisions so as to cushion the effects of unstable prices.

ii. Since cassava price transmission between Benue and Oyo States was slow, marketers should take advantage of available Information and Communication Technology (ICT) such as phones, computer and the internet as well as other media such as television, radio and print media for efficient flow of information that will enable them read price signals more accurately and promptly.

iii. Arising from the bidirectional movement of price signal and information between Benue and Oyo States, cassava and maize marketers should be alert to the

happenings within the market and the necessary price information in order to take advantage of price changes.

iv. Market actors should come together in group to partner with public and private sectors in order to address some of the marketing challenges which in turn will ensure smooth and efficient marketing operations in Benue and Oyo States.

v. Since maize and cassava marketing was profitable in Oyo and Benue States, therefore, rural and urban marketers should take maize and cassava marketing as a profitable venture capable of improving their socio-economic status and standard of living.

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APPENDIX A

Results of ADF unit root test for maize price in Benue and Oyo States

Price Series	Lags	ADF Values	Critical Values	Order
Oyo State				
Bodija	1	4.486	3.594*** 2.936**	I(1)
Aarada	1	3.960	3.594*** 2.936**	I(1)
Saabo	1	4.636	3.594*** 2.936**	I(1)
Omi – Adio	1	5.622	3.594*** 2.936**	I(1)
Iluju	1	4.142	3.587*** 2.933**	I(1)
Ilora	1	4.929 p	3.587*** 2.933**	I(1)
Benue State				
Otukpo	1	4.896	3.504*** 2.889**	I(1)
Aliade	1	3.708	3.504*** 2.889**	I(1)
Adoka	1	4.083	3.504*** 2.889**	I(1)
Taraku	1	5.035	3.504*** 2.889**	I(1)

Source: Data Analysis, 2020.

- ***and**implies critical values at 1% and 5% respectively.
- Lag length were chosen based on Akaike Information Criteria (AIC).

Results of ADF unit root test for cassava price in Benue and Oyo States

Price Series	Lags	ADF Values	Critical Values	Order
Oyo State				
Bodija	0	3.616	3.504*** 2.889**	I(0)
Aarada	0	3.760	3.504*** 2.889**	I(0)
Saabo	0	3.553	3.504*** 2.889**	I(0)
Omi – Adio	0	3.996	3.504*** 2.889**	I(0)
Iluju	0	4.290	3.504*** 2.889**	I(0)
Ilora	0	3.997	3.504*** 2.889**	I(0)
Benue State				
Otukpo	0	7.419	3.504*** 2.889**	I(0)
Aliade	0	4.435	3.504*** 2.889**	I(0)
Adoka	0	4.312	3.504*** 2.889**	I(0)
Taraku	0	3.881	3.504*** 2.889**	I(0)

Source: Data Analysis, 2020.

- ***and**implies critical values at 1% and 5% respectively.
- Lag length were chosen based on Akaike Information Criteria (AIC).

APPENDIX B

Department of Agricultural Economics and Farm Management

School of Agriculture and Agricultural Technology

Federal University of Technology

Minna, Niger State

Research Questionnaire

Dear Respondent,

I am a PhD student in the Department of Agricultural Economics and Farm Management, Federal University of Technology, Minna, carrying out a research titled **"Price Transmission and Market Integration of Maize and Cassava in the Rural and Urban markets of Oyo and Benue States, Nigeria.** I request that you fill/complete the questionnaire. Informationsought for is strictly for academic purpose and would be treated confidentially.

Adekunle Alege (Researcher)
PhD/SAAT/2017/997

BACKGROUND INFORMATION ON THE QUESTIONNAIRE

(i) Questionnaire No.: ……..……..

(ii) Interviewer: …….

(iii) Date of interview: ……..….

(iv) Commodity: ……

(v) Urban/Rural Market: ……..……..…..

(vi) Wholesaler/Retailer: ……...

(vii) GPS Coordinates: N…….

E…….…..

(viii) Phone Contact of the Interviewer: ……

(A) Socio-Economic and Demographic Analysis of Marketers

(I) Biographical Data

Name of market:……

Village/Location:……

….

Local Govt Area:……

(II) Marketer's personal Data

1. Sex (i)Male (ii) Female
2. Age of respondent……..(Years)
3. Marital status (i) Single (ii) Married (iii) Divorce (iv) Widow(er)
4. Highest level of education attained (i) Primary school (ii) Secondary school (iii) Post secondary school (specify) (iv) others (specify)……
5. Number of years spent in school……
6. Is marketing of Maize /Cassava your full time job? (i)Yes (ii) No
7. If no, what is your primary occupation? (i) Civil service (ii) Business (iii) Farming (iv) Others (specify)
8. What is the revenue from other occupation per year…… per month…….
9. Member of the household: please indicate your household members in the table below:

Members	**Male**	**Female**	**No that participate in marketing**
No of spouse			
No of children			
No of relatives			
Total			

10. How long have you been involved in the marketing of maize/cassava?……
11. How many mudu/kg do you get from a bag of maize/cassava?…….
12. What is the distance from rural to urban market?.....
13. What category of marketers do you belong to? (i) Producer (ii) Rural buyer (iii) Wholesaler (iv) Retailer
14. Do you belong to any association? Yes…….. No……..
15. If yes, how many of you are there in the association?.....
16. If yes, name the association/union? .....
17. Are you compelled or forced to register with the union before selling or marketing
    of your produce? Yes ( ), No ( )
18. What do you gain by being a member of the union?.....
    a. Buying and selling together ( ),
    b. Opportunity for better supply of soyabeans ( ),
    c. Dissemination of news about prices, demand and supply ( ),
    d. Others (specify).....
19. Are you free to sell your produce anywhere? Yes ( ), No ( )
20. Where do you obtain your marketing information about prices of produce and its availability? (other traders)
    a. Middlemen ( ),
    b. Media (e.g Radio, TV) ( ),
21. In your opinion, what are the problems of maize/cassava marketing in your area? (i) Long distance (ii) Bad road (iii) High transportation fares (iv) inadequate credit facilities (v) Instability in prices (vi) others (specify)……..

(B) Information on Marketing, Conduct, Structure and Performance

22. What means of transportation do you often use?.....
23. What does it cost you to transport your produce to the market?.....
24. Where do you store your products after harvest?.....
25. How much do you pay for storage per month?.....
26. What is the capacity of your storage facilities? .....(no of bags or Tons)
27. How much do you sell a 100kg bag of Maize/Cassava?.....
28. What factors determine the time you sell your produce?.....
29. What factors determine the place you sell your produce?.....
30. Do you buy or sell your produce for any company? Yes ( ), No ( )
31. If yes, name the company.....
32. What factors determine the quantity of Maize/Cassava in the market?.....
33. Do you have access to extension services in produce marketing? Yes ( ), No ( )
34. Please provide necessary information in the table below:

No of bags of maize/cassava sold/month	**Price/bag (~~₦~~)**	**Method of payment**	**Volume of sales**	**Average no of buyers**

35. What type of unit do you use to sell? (i) bag (ii) mudu (iii) basket (iv) heaps
36. From whom do you buy? (i) Farmer (ii) rural buyers (iii) wholesalers (iv) retailer
    (v) others (specify)…….

37. Why do you prefer to buy from the supplier chosen above? (i) prices of maize/cassava are low (ii) buying on credit if possible (iii) maize/cassava is always available for sale at the right time (iv) availability of delivery services (v) others (specify)……..
38. At what price do you buy during: (i) off season ₦…… (ii) peak season ₦…….
39. How many bags do you buy per month during: (i) off season…… (ii) peak season……..
40. To whom do you sell? (i) Farmer (ii) rural buyers (iii) wholesalers (iv) retailers (v) others (specify)……
41. How often do you sell to him/her/them? In a day ( ), 4 days ( ), week ( ), month ( )
42. How many wholesalers of maize/cassava are there in the market?.....
43. How many retailers of maize/cassava are there in the market?.....
44. How many bags, basket heaps do you sell in a month?.....
45. How many kilogram is in one basket……
46. How many kilogram is in one bag……..
47. What was your selling price per bag/basket heaps of maize/cassava during:
    (i) off season: bag ₦……mudu₦……..basket ₦…….heap ₦……
    (ii) peak season: bag ₦……..mudu₦…….basket ₦…….heap ₦…..
48. What is the quantity of maize/cassava you sell per month? (in bags)……. Per year….
49. Where do you sell?.....
50. Who determines the price of maize/cassava in the market?.....
51. How much is your capital investment in the business per year?.....

52. What is the source of your finance for maize/cassava marketing? (i) personal savings (ii) bank loan (iii) co-operatives (iv) Money lenders (v) others (specify)…….
53. If (ii) –(iv) above is applicable, what is the term of payment of the credit? Tick as appropriate (i) instalment ( ) (ii) cashdown ( ) (iii) others (specify) ( )
54. What is the interest rate on borrowed fund?.....
55. What is the wholesale price of maize/cassava in the feeder/supplying market?.....
56. What is the wholesale price of maize/cassava in the consuming market?.....
57. Please indicate which of these marketing equipment you own , rent, or borrow and the cost of each.

Equipment	No	Cost	Lifespan	Own	Rent	Borrow
Mudu						
Packaging bags						
Leather spread						
Sales bowls						
Others (specify)						

(C) Market Share (Cost & Margins)

58. What quantity of maize/cassava do you buy in 4 days (kg), week (kg), month (kg), year (kg) ?.
59. Atwhat price per quantity?.....

60. For each of the buying trips, how much do you spend on the following per 100kg bag in different markets:

S/NO	Market	Activities	Amount spent (₦)
		Purchase cost	
		Transportation	
		Loading	
		Off-loading	
		Produce	
		Revenue/ Levies at road	
		Blocks	
		LG fees	
		Cleaning/packing	
		Bagging, sewing and shaking	
		Commission fee	
		Storage per month	
		Chemicals /month	
		Market fees	
		Alalo/ packing	
		Others (specify)	

61. How many of these trips do you make in a year?.....

62. At what quantity do you sell? Cups ( ), Mudu ( ), Paint bucket ( ), 100kg Bags ( ), Heaps ( )

63. At what price do you sell? Cups ( ), Mudu ( ), Paint bucket ( ), 100kg Bags ( ), Heaps ( )

64. How much profit do you make per trip?.....

65. How often do you finish your stock? In a day ( ),4 days ( ),Week ( ),month ( ),3 months( )

66. Fill the following about how you buy your produce

Month	**Quantity bought(kg)**	**Bought from**	**Unit price (₦)**
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			

67. Fill the following about how you sell your produce

Month	**Quantity sold**	**Sold to**	**Unit price (₦)**
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			

68. What factor determine your rate of sale?.....

a. Good seeds of produce ( ),b. High demand ( ),

c. Others (specify).....

(D) PRICING EFFICIENCY

69. How do you settle the price of your produce?

a. By bargaining each time ( ),

b. Fixed market price ( ),

c. By commission agent ( ),

d. By Govt buying agents ( ),

e. Individual determine price (Middlemen/ brokers) ( ),

f. Price arrangement with buyers ( ),

g. Others (specify).....

70. At what price do you often settle for your product ?

……..

71. Quantity sold?

……..

72. Are individuals allowed to buy in the open market? Yes ( ), No ( )

73. Are there any restrictions or barriers to entry into the market? Yes ( ), No ( )

74. Are sellers permitted to sell to anybody in the market? Yes ( ), No ( )

75. Are there many buyers and sellers in the market? Yes ( ), No ( )

(E) MARKET INTEGRATION

76. How much does a 100kg bag of maize/cassava cost in your market?.....

77. How much does it cost to transfer a 100kg of maize/cassava from where you buy it to where you sell it?.....

78. How much is a mudu sold for?.....

79. How much is a cup sold here?.....

80. Please, provide the monthly prices for maize/cassava in 2015 in this market

Month	**Prices**	**Quantity**
January		
February		
March		
April		
May		
June		
July		
August		
September		
October		
November		
December		

(F) Information on Transportation

81. What means of transportation do you use to convey maize/cassava commodity to the market?

(i) Pick up (ii) Buses (iii) Cars (iv) Wheelbarrow (v) Donkey (vi) Others (specify)……

82. How much do you pay per trip on the means of transportation indicated above?.....

83. How many of such trips do you make per month during (i) off season…… (ii) peak season……..

84. How many bags of maize/cassava do you transport on a trip during (i) off season…….. (ii) peak season……

85. What is the distance from rural to urban market?.....

86. What is the estimate of damages experience per month?.....

(G) CONSTRAINTS TO PRODUCE MARKETING

87. What are the risks you normally face in the marketing of your produce?

a. Low price offered by buyers ( ),

b. Low demand for produce ( ),

c. Price fluctuation ( ),

d. Poor rural roads ( ),

e. Robbery attack ( ),

f. Storage space ( ),

g. High taxes ( ),

h. Others (specify).....

88. Mention the problems you face in marketing of your produce in order of their importance? (a).....

(b).....

.

(c).....

.

89. To what extent are you affected by the following constraints in the marketing of your produce? Please, rank accordingly; 1- very important, 12- least important.

S/NO	**Problems**	**Ranks (1,2,3,……..,12)**
1	High transportation cost	
2	Low initial investment/capital	
3	Poor storage facilities	
4	Lack of access to credit	
5	Small scale of operation	
6	Numerous Middlemen	
7	Dishonesty of buying agents and farmers	
8	Inadequate infrastructural facilities	
9	Lack of standardization of measure andquality	
10	Ineffective dissemination of information	
11	Heavy imposition of Produce/taxes or levies	
12	Others (specify)	

90. Suggest ways how these challenges can be overcome?.

(a).....

(b).....

.

(c).....

.

(d).....

91. What is your advice to farmers about produce marketing?.....

(a).....

(b).....

92. What is your advice to the Government towards improving produce marketing?

(a).....

(b).....

.

(c).....

93. What is your advice to your fellow marketers of maize/cassava?

(a).....

...

(b).....

(c)……

……