HOUSEHOLD DEMAND STRUCTURE FOR RICE CONSUMPTION IN KADUNA STATE, NIGERIA

BY

Oyakhilomen OYINBO
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FACULTY OF AGRICULTURE,
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DECLARATION

I hereby declare that this Thesis entitled "**Household Demand Structure for Rice Consumption in Kaduna State, Nigeria**" was written by me and it is a record of my research work. It has not been presented before in whole or in part for a higher degree. All borrowed ideas have been duly acknowledged by means of references.

_____ _____

Oyakhilomen **OYINBO** **Date**

CERTIFICATION

This Thesis, entitled "**Household Demand Structure for Rice Consumption in Kaduna State, Nigeria**" by Oyakhilomen**OYINBO**, meets the regulations governing the award of degree of Master of Science (M.Sc.) in Agricultural Economics of Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

_____ _____

Prof. Raphael Ajayi Omolehin **Date**
Chairman, Supervisory Committee

_____ _____

Prof. Zakari Abdulsalam **Date**
Member, Supervisory Committee

_____ _____

Prof. Zakari Abdulsalam **Date**
Head of Department

_____ _____

Prof. Adebayo A. Joshua **Date**
Dean, School of Postgraduate Studies,
Ahmadu Bello University, Zaria.

DEDICATION

This research is dedicated to The Almighty God.

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TABLE OF CONTENTS

Contents Pages

Title page----------i

Declaration----------ii

Certification----------iii

Dedication----------iv

Acknowledgement----------v

Table of Contents----------vi

List of Tables----------x

Appendix----------xii

Abstract----------xiii

Chapter 1

INTRODUCTION----------1

1.1 Background to the Study----------1

1.2 Statement of the Problem---------- 4

1.3 Objectives of the Study---------- 6

1.4 Justification of the Study ----------7

1.5 Hypothesis----------8

Chapter 2

LITERATURE REVIEW----------9

2.1 Rice consumption trend in Nigeria----------9

2.2 Rice production trend in Nigeria ----------10

2.3Households consumption preference for imported and domestic rice brand in

Nigeria----------11

2.4 Conceptual framework ----------13

2.4.1 Consumer demand theory----------13

2.4.2 Elasticity of demand ----------15

2.4.2.1 Price elasticity of demand----------16

2.4.2.2 Cross price elasticity of demand----------17

2.4.2.3 Expenditure elasticity of demand----------17

2.4.3 Demand functions ----------18

2.4.3.1 Hickian or compensated demand ----------18

2.4.3.2 Marshallian or uncompensated demand ----------19

2.5 Household socioeconomic characteristics in food demand structure----------20

2.6 Food budgeting and separability in demand structure----------22

2.7 Review of empirical studies on estimation of food demand structure----------24

2.8 Econometric models for estimation of food demand structure----------28

2.8.1 Econometric models for estimation of food demand structure----------28

Chapter3

METHODOLOGY----------35

3.1 Description of study area ----------35

3.2 Sampling procedure and sample size----------36

3.3 Method of data collection----------36

3.4 Analytical techniques----------37

3.4.1 Descriptive statistic----------37

3.4.2 Budget share index----------37

3.4.3 Linear Approximate Almost Ideal Demand Sytem (LA-AIDS) Model ---------38

3.4.4 Logit model----------41

3.4.5 Z statistic----------42

Chapter4

RESULTS AND DISCUSSION----------43

4.1 Socioeconomic characteristics of households ----------43

4.1.1 Gender distribution of household heads----------43

4.1.2 Age distribution of household heads ----------43

4.1.3 Educational distribution of household heads----------44

4.1.4 Occupational distribution of household heads ----------45

4.1.5 Distribution of households according to their household size----------45

4.1.6 Distribution of households according to number of income earning members--46

4.1.7 Distribution of households according to their monthly income earning----------47

4.1.8 Distribution of households according to their frequency of rice consumption ----------48

4.2 Households share of expenditure on rice in the total food expenditure----------48

4.2.1 Comparison of rice budget share with beans, maize, gari and yam budget shares ----------49

4.3 Estimated determinants of the demand for rice---------- 49

4.4 Estimated uncompensated and compensated demand elasticities of rice--------58

4.4.1 Uncompensated demand elasticities of rice----------58

4.4.2 Compensated demand elasticities of rice----------58

4.4.3 Expenditure elasticity of rice----------59

4.4.4 Test of hypothesis I of the study----------60

4.5 Determination of households consumption preference for foreign and local rice brands----------60

4.5.1 Test of hypothesis II of the study ----------61

4.6 Factors influencing households consumption preference for foreign and local rice brands----------62

Chapter 5

SUMMARY, CONCLUSION AND RECOMMENDATIONS----------69

5.1 Summary----------69

5.2 Conclusion----------71

5.3 Recommendations----------71

5.4 Contributions to knowledge ----------71

REFERENCES----------72

LIST OF TABLES

Table Page

4.1 Distribution of household heads based on gender - - - - 43

4.2 Distribution of household heads based on age - - - - 44

4.3 Distribution of household heads based on Education- - - - 45

4.4 Distribution of household heads based on their main occupation - - 45

4.5 Distribution of household heads on their household size - - - 46

4.6 Distribution of households based on their number of income earners - 46

4.7 Distribution of households based on their monthly income earnings - - 47

4.8 Distribution of households according to their frequency of rice consumption - - - - - - - - - 48

4.9 Share of households expenditure on rice in the total food expenditure - 48

4.10 Share of households monthly expenditure on rice, beans, maize, gari and yam consumption - - - - - - - - - 49

4.11 Seemingly unrelated regression estimates of LA-AIDS Model for Sabon Gari L.G.A - - - - - - - - - - 54

4.12 Seemingly unrelated regression estimates of LA-AIDS Model for Kaduna south L.G.A - - - - - - - - - - 55

4.13 Seemingly unrelated regression estimates of LA-AIDS Model for Soba L.G.A - - - - - - - - - - 56

4.14 Seemingly unrelated regression estimates of LA-AIDS Model for pooled sample - - - - - - - - - - - 57

4.15 Estimated uncompensated (Marshalian) own price and cross price elasticities of rice and other food items - - - - - - - 58

4.16 Estimated compensated (Hicksian) own price and cross price elasticities of rice andother food items within the demand system - - - - 59

4.17 Expenditure elasticity of rice and other food items within the demand system - 60

4.18 Result of consumer preference for foreign and local rice brands - - 61

4.19 Z - test result for the test of significance between income of households who preferred consuming foreign rice and those who preferred local rice brands- 62

4.20 Logit regression estimates of factors influencing consumer preference for foreign and local rice brands in Sabon-Gari L.G.A - - - - 65

4.21 Logit regression estimates of factors influencing consumer preference for foreign and local rice brands in Kaduna south L.G.A - - - - 66

4.22 Logit regression estimates of factors influencing consumer preference for foreign and local rice brands in Soba L.G.A - - - - - - 67

4.23 Logit regression estimates of factors influencing consumer preference for foreign and local rice brands for the pooled sample - - - - 68

APPENDIX

Questionnaire----------79

ABSTRACT

This research was undertaken to carry out an analysis of households demand structure for rice consumption in Kaduna state using household consumption data elicited from a sample of 310 households through the instrumentality of a structured questionnaire. The data were analysed using descriptive statistics, Logit regression and LA-AIDS model. The results of the data analysis indicated that the households monthly budget share on rice was 0.14 which indicates that the households spend 14% of their monthly food expenditure on rice consumption. Also, 75% of the sampled households' preferred imported rice to local rice and the factors that significantly influenced the households' rice consumption preference were household size ($p<0.10$), household income ($p<0.05$), frequency of rice consumption ($p<0.10$), price of rice ($p<0.01$), quality of rice ($p<0.10$) and ease of preparation of rice ($p<0.10$). The result of the LA-AIDS model showed that the price of rice ($p<0.01$), beans price ($p<0.10$), maize price ($p<0.01$), yam price ($p<0.1$), food expenditure ($p<0.01$), age of household head ($p<0.05$), household income ($p<0.05$) and number of household income earner ($p<0.01$) were all significant in influencing the households demand for rice. The estimated compensated (-0.7921) and uncompensated (-0.8887) own price elasticities of rice respectively indicated that rice was price inelastic and the estimated expenditure elasticity (0.69) of rice indicated that rice is not a luxury in the households food basket but a necessity. In the light of the findings of the study, it was recommended that adequate policy aimed at reducing the cost of rice production and increasing supply of local rice should be pursued as this will reduce the prices of local rice and invariably enhance demand for local rice by households as rice was estimated to be own-price inelastic. Also, the rice value chain of Nigeria's Agricultural Transformation Agenda (ATA) should lay more emphasis on local rice processing so as to ensure that the quality of locally produced rice is improved to make local rice highly competitive with foreign rice and thereby encourage shift in consumer preference from imported rice to locally produced rice.

CHAPTER 1

INTRODUCTION

1.1 Background of the study

Rice accounts for over 20% of global calorie intake and has been an important food commodity for most people in sub-Saharan Africa particularly West Africa. In Nigeria, rice is the fourth most consumed crop in terms of calories (Cadoni and Angelucci, 2013). It has assumed a strategic position in the food basket of rural and urban households and is cultivated in virtually all of Nigeria's agro-ecological zones, from the mangrove and swampy ecologies of the River Niger delta in the coastal areas to the dry zones of the Sahel in the north. The demand for rice in Nigeria has been increasing at a much faster rate than in any other African country since the mid-1970s (Daramola, 2005). The result is that local rice production has failed to catch up with the increasing pace of consumption over the years in Nigeria (Baoni, 2014).

Nigeria's rice consumption is projected to reach 35 million tonnes by 2050 from 5 million tonnes in 2010, rising at the rate of 7% yearly (Ayanwale and Amusan, 2012). This trend is attributed to rising population growth, urbanization, and income growth, as well as changes in family occupational structures. During the 1960s, Nigeria had the lowest per capita annual consumption of rice in the sub-region at an annual average of 3kg. Since then, Nigerian per capita consumption levels have grown significantly at 7.3% per annum. Consequently, per capita consumption during the 1980s averaged 18kg and then 22kg in 1995–2000(Ogundele and Okoruwa, 2006). Notably, even though Nigeria's rice trade policy has been and continues to be heavily protectionist, ranging from outright import bans in the 1980s to the 32.5% tariff/levy combination that is applied to rice imports, it has had little effect in stimulating local production to a level of significant import substitution(USAID, 2009).

Nigeria currently doubles as the largest rice producing nation in West African sub-region and the second largest importer of rice in the world, this anomaly is attributed to the inability of its local production to meet up with its demand which has been soaring at a very fast rate over the years. A combination of various factors seems to have triggered the structural increase in rice consumption over the years with consumption broadening across all socio-economic classes, including the poor. Rising demand is as a result of increasing population growth and income level(GAIN, 2012). Akande(2002) posited that, like elsewhere in West Africa, urbanization appears to be the most important cause of the shift in consumer preferences towards rice in Nigeria. The annual demand for rice in the country is estimated at 6.5 million tonnes, while production is 2.3, resulting in a deficit of 4.2 million tonnes (NRIF, 2008).

In a bid to address the demand-supply gap of rice in Nigeria, government have at various times come up with policies, programmes and institutes such as the Federal Rice Research Station (FRRS), established in 1970; National Accelerated Food Production Project (NAFPP), established in 1972; the National Cereals Research Institute (NCRI), launched in 1974; World Bank-Assisted Development Programs, set up in 1975; Operation Feed the Nation (OFN), started in 1976; the River Basin Development Authorities (RBDs), established in 1977; and Abakaliki Rice Project (ARP), established in 1978 and in recent times, the Presidential Initiative on Rice (PIR), established in 1999; the National Program for Food Security (NPFS); the first phase of which was launched in 2001 and the National Rice Development Committee(NRDC) in 2003. It is observed that some of the policy measures and programmes have not been consistent. The erratic policies and programmes reflect the dilemma of securing cheap rice for consumers and a fair price for the producers. Thus, the fluctuations in policy and the limited capacity of the Nigerian rice sector to match domestic demand have raised a number of pertinent questions both in policy cycles and among researchers (Ogundele and Okoruwa, 2006). In 2011, a rice transformation plan was set up

under the umbrella of the agricultural transformation agenda. The target is 6.0 million metric tonnes per annum of locally produced and internationally competitive milled rice by 2015(FMARD, 2012).

Over the years, Nigeria has relied upon the importation of rice to meet its growing demand for rice but the increased demand in recent years reflect more of increases in the demand for imported rice brands partly to meet the shortfalls in domestic demand and partly to meet consumers demand in the urban areas. The importation of rice to bridge the demand-supply gap is worth ₦365 billion(Ayanwale and Amusan, 2012) and this implies a loss of considerable foreign exchange for the country. Demand for rice will be sustained in Nigeria, as rice has remained the most popular staple food for the citizens. Besides the demand from households, which keeps rising, there is increase in the number of fast food joints that is also growing with increasing urbanization. More products like spaghetti and other industrial uses are constantly being developed for rice or are being expected and these will also drive up the demand for rice. Its importation bill on rice has increased from 1 million United states dollar in 1970s to as high as 800 million United states dollar in 2005(WARDA, 2007).

Oryza(2005) noted that urban consumers prefer and can afford to pay for high quality imported rice in contrast to local rice brands which are considered to be of poor quality because they often contain dirt, stones, chaff and large quantity of broken or irregular grains and so lack competitive advantage against the imported rice brand. Rice consumers in Nigeria appear to display a distinct preference for imported rice over domestic rice, which has led to a market price premium for imported rice. According to Akaeze(2010), habit persistence and perceived quality differentials are responsible for the continued consumer preference for imported rice in Nigeria. Therefore, policies designed to encourage production of relatively high quality local rice, thereby replacing imported rice in consumption baskets will face

considerable inertia due to the persistence of consumer habits and mindset regarding purchase and consumption of imported rice, even if the locally produced rice is of comparable quality. One way of addressing the demand-supply gap of rice in Nigeria is by understanding the rice demand structure of the economy; this is because knowledge of households' food demand is an important step in solving the problem of food shortages through well-articulated food and agricultural policies aimed at regulating supply and projecting the future food needs of the entire populace (Omonona*et al.*, 2009)

1.2 Problem statement

Equitable and sustainable economic development cannot ignore basic food commodities, particularly in developing countries such as Nigeria. Basic food commodities play an essential role in economic development as their availability and cost impinge directly on food security, expenditures and incomes of households, particularly amongst the poorer segments of population; both rural and urban. Of all the basic food commodities in Nigeria, rice is of particular importance having contributed to the socioeconomic well being of Nigeria both as a major element in the nation's food security calculations and as a commodity for internal commercial transactions (FAO, 2000).

The Nigerian rice sector has witnessed some remarkable developments, particularly in the last ten years. Both rice production and consumption in Nigeria have vastly increased during the aforementioned period (Ojohoemon *et al.*, 2009). However, the demand for rice has continued to outstrip production given the shift in consumption preference for rice especially by urban dwellers. Therefore, rice has become a strategic commodity in the Nigerian economy which have continue to attract the attention of all tiers of government, non-governmental agencies, policy makers, researchers and other stakeholders in the rice industry in an effort to address the widening demand-supply gap situation of rice in Nigeria.

The research efforts in ensuring a viable rice industry in Nigeria is very commendable but it is worth noting that a greater proportion of such previous researches on rice in Nigeria have *inter-alia* focused on issues bordering on enhancing the supply side of the Nigerian rice industry such as efficiency of rice production(Okoruwa and Ogundele, 2006; Shehu *et al*., 2007; Ayinde *et al.,* 2009), rice processing (Lancon *et al.,*2003; Basorun, 2008), profitability of rice production (Akpokodje, 2001; Kudi *et al.,* 2010; Ugochukwu and Ezedinma, 2011; Onoja and Herbert, 2012**)**, improved rice technologies (Imolehin and Wada, 2000; Saka and Lawal, 2009; Dontsop-Nguezet *et al.,* 2011), rice irrigation (Kebbeh *et al.,* 2003; Mohammmed, 2011)and problems of rice production (Ekeleme *et al.*, 2009; IRRI, 2008).

There exists a dearth of research on the demand side of the Nigerian rice industry with respect to determinants of rice consumption, changes in households rice consumption in response to changes in income level, changes in households rice consumption in response to changes in food prices, factors influencing consumer preference for foreign and local rice brand and the budget share of rice in the food basket expenditure of households which is the identified gap in the Nigerian rice industry that this study was designed to address. The need for how households adjust their consumption in response to changes in prices and income is a crucial determinant of the effects of various shocks to market prices and commodity supplies. In developing countries, where a large percentage of household expenditure is allocated to food, consumer expenditure surveys are particularly useful because they can provide information on specific subpopulation of households that are more likely to be affected by changes in commodity prices or household incomes.Therefore, this demand study was aimed at providing answers to the following research questions:

i. What are the socioeconomic characteristics of households in Kaduna State?
ii. What is the share of expenditure on rice in the total food budget of households?
iii. What are the determinants of households demand for rice consumption?

iv. What are the compensated and uncompensated rice demand elasticities of households?
v. What is the household's consumption preference between locally produced rice brands and imported rice brands?
vi. What are the commodity and non-commodity factors that influencehousehold's consumption preference between locally produced rice brands and imported rice brands in the state?

1.3 Objectives of the study

The broad objective of the study was to carry out an analysis of households demand structure for rice consumption in Kaduna state.

The specific objectives of this study were to:

i. describe the socioeconomic characteristics of households inKaduna State,
ii. estimate the share of expenditure on rice in the total food budget of households,
iii. ascertain the determinants of households demand for rice consumption,
iv. estimate the compensated and uncompensated rice demand elasticities of households,
v. examine the households consumption preference between locally produced rice brands and imported rice brands,
vi. determine the commodity and non-commodity factors that influence households consumption preference between locally produced rice brands and imported rice brands in the state.

1.4 Justification of the study

Food demand studies have been a subject of research all over the world and it is especially meaningful in developing countries where food expenditures account for a relatively large share of household income. These food demand studies provide estimates of how food consumption is affected by changes in prices, income, and taxation policies (Dunne and

Edkins, 2005). For instance, the recent policy change on fuel subsidy in Nigeria had impacted on food prices and relative income of food consumers in Nigeria and therefore an understanding of how the changes in food prices and relative income had impacted on food demand can be achievable from reliable estimates of a food consumption study. Food consumption in Nigeria has been an important issue, not only because it is related to poverty and food security, but also because it is highly correlated with living standards and household resource base. Consumption parameters provide necessary information on linkages from food consumption to incentives for agricultural production through the marketing sector (Kormawa and Akoroda, 2003). Efficient production and marketing techniques ensure large scale production and marketing at low cost in order to increase the quality and quantity of food available for consumption. However, before efficient production and marketing techniques are adopted, reliable food demand data has to be obtained. The knowledge of demand structure is essential for defining policy interventions to improve the nutritional status of particular individuals, households, or individuals within households such as infants and pregnant women and sectoral and macroeconomic policy analysis(Sadoulet and Janvry, 1995).

The result of this study would be useful in providing up to date information on rice consumers responsiveness to price and expenditure changes that are useful in designing people-oriented food policy, subsidy and tax policies as well as formulating long term policy for food security and poverty reduction. It is ultimately expected that policy makers will find the results of consumption preference between imported rice and locally produced rice from this study very relevant in formulating policies and programmes that will ensure consumer preference for high quality local rice, encourage local production and processing of rice and minimize the loss of foreign exchange earnings from rice importation into Nigeria. Therefore,

this study will contribute to the existing empirical information on rice consumption for the use of all stakeholders in the rice industry towards ensuring a viable rice industry in Nigeria.

1.5 Hypotheses

The hypotheses tested in this studywere stated in the null form:

1. There is no significant relationship between the households demand for rice and their socioeconomic characteristics.
2. There is no significant difference between income of households who preferred consuming imported rice brands and those who preferred consuming locally produced rice brand.

CHAPTER 2

LITERATURE REVIEW

2.1 Rice consumption trend in Nigeria

Nigeria is the largest consumer of rice in the West African region and its demand for rice has been soaring at a very fast rate over the years(Ezedinma, 2005). A combination of various factors seems have triggered the increase in the demand for rice. According to Akanji(1995) rising demand was partly the result of increasing population growth. Also, increased income level following the discovery of crude oil in Nigeria led to a rise in demand for the commodity. The most important factor contributing to the shift in consumer preference away from traditional staple and towards rice is rapid urbanization and associated changes in family occupational structure. Statistics from a rice consumption survey in 2003 showed that people in large cities like Lagos, Abuja and Makurdi (per capita consumption of 64, 64 and 72 kg/annum) consume significantly more rice than people in the rural areas, and the vast majority of the rice consumed in cities is imported(USAID, 2009). As women enter the work force, the opportunity cost of their time increases and convenience food such as rice which can be prepared easily rise in importance. Similarly as men work at greater distances away from their homes in urban setting, more meals are consumed from the market where the ease of rice preparation has given it a distinct advantage. These trends have meant that rice is no longer a luxury food in Nigeria but has become a major source of calories for the urban poor (Akande 2003).

Milled rice consumption has increased significantly over the years from 240 metric tonnes in 1961 to 850 metric tonnes in 1981 and 2757 metric tonnes in 1991 to 4970 metric tonnes in 2011. Local production has not been able to keep pace with the increase in rice consumption over the years which have resulted into a demand-supply gap for milled rice in

Nigeria(USDA FAS, 2012). In order to meet the increasing demand for milled rice, Nigeria has had to resort to importation of milled rice which has increased from 1000 tonne in 1961 to 394, 000 tonnes in 1981 and 2, 300, 000 tonnes in 2011(USDA FAS, 2012). This continual dependence on rice importation in meeting the domestic demand for milled rice has constituted a great drain in the foreign exchange earnings. Based on an estimated annual rice consumption of 5 million metric tonnes in Nigeria, per capita consumption is 32 kg per annum, which is consistent with the USDA estimates from the early 2000s. This consumption is higher in the urban areas, averaging 47 kg/annum(USAIDS, 2009).

2.2 Rice production trend in Nigeria

Nigeria is the largest rice producing country in the West African region and its production rose gradually over the years with area expansion to surpass major rice producing countries like Cote d' Ivoire and Sierra Leone (Ezedinma, 2005). Rice production occurs in all agro-ecological zones in Nigeria with the middle belt enjoying a comparative advantage in production over the other parts of the country. Production is primarily by small-scale producers, with average farm size of 1-2 hectares. Yield per hectare is low due to production systems, aging farming population and low competitiveness with imported rice(Daramola, 2005). Potential land area for rice production in Nigeria is between 4.6 million and 4.9 million ha. Out of this, only about 1.7 million ha or 35% of available land area is cropped to rice(Ezedinma, 2005). Nigeria has depended largely on increasing land area for rice cultivation to improve production. Rainfed lowland rice is the most predominant rice production system, accounting for nearly 50% of the total rice-growing area in Nigeria; 30% of production is rainfed upland rice, while just 16% is high yielding irrigated systems. Other production systems (deep water rice and mangrove swamp rice) make up the remaining 4%.There has been an increase in milled rice production over the years from 239, 000 tonnes in 1961 to 523, 000 tonnes in 1980 and 2, 670, 000 tonnes in 2010 with an associated

increase in area cultivated from 185 thousand hectares in 1961 to 550 thousand hectares in 1980 and 1208 thousand hectares in 1990 to 2150 thousand hectares in 2010(USDA FAS, 2012). Despite this laudable trend in rice production largely from increased area cultivated, local milled rice production has not been able to meet the increasing demand for milled rice over the years. despite the rise in domestic production,the demand/consumption of rice far exceeds local production, precipitating anincrease in the rice importation bill to as high as USD 160 million in 2003 (FAO,2003). The country's policy on rice has been inconsistent and has oscillated between import tariffs and import restrictions including outright ban. For instance, between 1986 and 1994 rice imports were illegal. In 1995, imports were allowed at a 100 % tariff. In1996, the tariff was reduced to 50% but came full cycle to 100 % in 2002, 150% in 2003 and was adjusted down to 30% (which consists of 20% tariffs and 10% tax) in 2009 for milled rice. The policy inconsistency in the rice sub sector has actually discouraged local production over the years. Since the removal of the ban on rice imports in 1992, the growth in domestic rice output declined significantly, with growth being negative in 1995. A similar negative growth rate exists to date justifying the overarching need to intervene proactively in domestic rice production and improve its quality and competitiveness in the domestic and perhaps regional markets.

2.3 Households consumption preference for imported and domestic rice brand in Nigeria

According to Akaeze (2010), in a study on consumer preference for imported rice in Nigeria-perceived quality differences or habit persistence revealed that habit persistence and consumers' perception of quality differences are both significant and important in explaining consumer preference for imported rice in Nigeria. The magnitudes of habit persistence and perceived quality differentials were estimated to be 0.491 and 0.176, respectively. Thus, any given amount of locally consumed rice only generates about one-fifth as much utility as the

same amount of imported rice. The resulting strong preference for imported rice may have resulted from a cultural mindset that foreign products are of higher quality than domestic products, rather than actual quality differences between the products. Lancon *et al.* (2003) conducted a survey of imported rice consumer's preferences and suggest that imported rice cleanliness is the overwhelming technical feature explaining the expansion of imported rice consumption in Nigeria at the cost of local rice market development. Next to cleanliness are swelling capacity (mostly preferred by restaurants and fast food joints), taste, availability and grain shape. Taste offers a more positive perspective for the local rice capacity to compete with imported rice. It was mentioned as one of the criteria by a third of the local rice purchasers in the survey which means that there is still a category of consumers that consider local rice as a product with specific attributes that cannot be found in imported rice. It was suggested that with a better management and handling of the product appearance and cleanliness along the marketing chain, the demand for local rice could increase significantly. This overall review of customers' preferences indicates that the major factors behind the preference for imported rice in spite of higher prices are more related to post-harvest management operations along rice marketing chain than to the physico-chemical properties of the imported rice. Erenstein *et al.* (2003) argued that locally produced rice has the potential to meet food (especially rice) demand of consumers in Nigeria if efficient production practices are employed. Oryza(2005) noted that urban consumers prefer and can afford to pay for high quality imported rice in contrast to local rice brands which are considered to be of poor quality because they often contain dirt, stones, chaff and large quantity of broken or irregular grains and so lack competitive advantage against the imported rice brand. Rice consumers in Nigeria appear to display a distinct preference for imported rice over domestic rice, which has led to a market price premium for imported rice. According to Ezedinma(2005), urban Nigerians have developed a tremendous taste for good quality rice and they will continue to

measure the quality and competitiveness of domestic rice by the current standard and quality found in imported rice.

2.4 Conceptualframework

2.4.1 Consumer demand theory

Consumer demand theory refers to the individual consumer's demand for individual commodities. Demand could be conditional or unconditional. Conditional demand is derived from using a subset of the consumer's total budget. An example would be estimating food demand using the budget only for food and therefore, the demand is conditional upon the food budget and not the entire budget. Unconditional demand is a demand system that uses the consumer's entire budget.Analysing consumer demand is essentially the act of analysing consumer preferences, that is, how consumers choose to allocate their income among different productsand the estimation of a demand system consistently relates demand analysis to consumer behaviour(James *et al.,* 2003). According to Sadoulet and Janvry (1995), the objective of analysing individual consumer behaviour is to explain the level ofdemand for the commodities an individual consumes given the structure of relative prices faced, real income, and a set of individual characteristics such as age, education, professional status, type of household to which he belongs, and geographical environment (for example, rural versus urban).Consumer demand theory characterizes the basic problem of a consumer as that of maximizing utility subject to a budget constraint(Browning *et al.,* 2006). This can be expressed as:

$$\text{Maximize } u = v(q_1, q_2, \dots \dots q_n) \qquad \text{subject to} \qquad \sum p\, q \; = x \dots \dots \dots . (1)$$

Where *u* is a utility function of the quantities of commodities consumed, *x* is total income while *p* and *q* are prices and quantities respectively. The Marshallian demand function is the solution to the consumer's problem of maximizing utility subject to the budget constraint. However, the consumer's problem can also be expressed as one of minimizing total

expenditures or costs subject to a predetermined utility level. This is expressed as:

$$\text{Minimize } x = \sum p\ q \text{ subject to} \qquad v(q_1, q_2, \dots \dots q_n) = u \dots \dots (2)$$

The solution to this problem is the Hicksian demand function, which is equivalent to the Marshallian demand function when evaluated at the optimal utility level.

Deaton and Muellbauer (1980) reviewed the properties of consumer demand which provide reasonable restrictions to demand models. These are (i) adding-up to total expenditure (value form) or to one (budget-share form) (ii) homogeneous of degree zero in prices alone (compensated or Hicksian demands), or jointly in prices and total expenditure (uncompensated or Marshallian demands) (iii) have negative compensated own-price responses and (iv) exhibition of symmetric compensated cross-price responses.Marshallian and Hicksian demand functions exhibit specific theoretical properties based on the assumptions used to derive the functions. Marshallian demand properties include additivity and homogeneity. Hicksian demand properties include additivity, homogeneity, negativity, and symmetry.

Additivity or Adding up: For both Marshallian and Hicksian demand functions, the budget constraint is satisfied for the given prices and income. The total expenditure is equal to the sum of individual expenditures on different commodities and goods. Additivity (or adding up) ensures that the income effects add up.In other words, the sum of the estimated expenditures on the different goods equals the consumer's total expenditures at any given time period and it implies that the marginal propensities to consume should sum to one.

Homogeneity: Marshallian demand functions are homogeneous of degree zero in both prices and income. Hicksian demand functions are homogenous of degree zero in prices only. The use of relative prices and real income in demand equation as exogenous variable makes the

demand equations homogeneous of degree zero in prices and income. This ensures that there is no money illusion in demand in the sense that it is not affected by a proportional increase in all prices and incomes(Surabhi, 2010). If both prices and income double, then Marshallian demand does not change. In Hicksian demand functions, if all prices double with a given level of utility, then demand does not change. If price and income increase by the same percentage, there is no change in demand.Therefore, if all prices and total expenditures are changed by an equal proportion, the quantity demanded must remain unchanged. This property is sometimes called "absence of money illusion".

Negativity: The negativity of own substitution effect is the law of the downward-sloping Hicksian demand curve. If the own-price increases and expenditure is adjusted to keep utility constant, then demand for the good will decrease. This is a property of the Hicksian demand function only, not of the Marshallian demand function.

Symmetry: The cross price elasticities of a Hicksian demand function are symmetric because of Slutsky symmetry conditions. Assuming there is no income effect of a price change, the cross-substitution effect between commodities X and Y must be the same as the cross-substitution effect between commodities Y and X. This relationship can be used to predict the change in demand for good X if the price of good Y increases.

2.4.2 Elasticity of Demand

Demand elasticity is a measure of how demand change in response to changes in prices or income. Since elasticity is a relative measure, it is independent of scale and thus, provides a useful measure of comparison across all ranges and quantities. Demand elasticities include price elasticity of demand, cross price elasticity of demand and expenditure elasticity of demand:

2.4.2.1Price elasticity of demand

Own-price elasticity is a measure of the responsiveness of demand for a commodity to changes in the commodity's own price. It is represented by the ratio between percentage change in quantity demanded and percentage change in price. If the percent change in the quantity demanded is greater than the percent change in the price of a commodity, demand is said to be price elastic or more responsive to price changes. If the percent change in the quantity demanded is less than the percent change in the price of a commodity, demand is said to be price inelastic, or less responsive to price changes. If the response is exactly equal to one percent, the demand is said to be unitary, where a one percent decrease in price results in a one percent increase in demand. The higher the price elasticity, the more sensitive consumer demand is to price changes. If the demand is inelastic, a price increase means that the decrease in the purchased quantity will be relatively smaller than the increase in price. So the consumer's total expense for the good in question increases. The opposite is the case at a price increase of a good where the demand is elastic (Fog, 1992). As the demand curves generally have a negative slope the own-price elasticity turns negative too, which corresponds to a decline in the demand when the price increases. The negative slope of the demand curve is caused by the fact that the demand is always given as a function of the price and the curve is depicted in a coordinate system with the price on the y-axis and the quantity on the x-axis. Yet, often the own-price elasticity is determined numerically in order not to question whether the demand for a good with an own-price elasticity of minus three is more or less elastic than the demand for a good with an elasticity of minus two. Own-price elasticity changes over time. This might be due to time lag in information about price levels and lack of information about substitution possibilities. This adjustment process makes the long-term elasticities bigger than the short-term elasticities.

2.4.4.2Cross - price elasticity of demand

Cross-Price Elasticity is a measure of responsiveness of demand for one good to a change in the price of another good. It is represented by the ratio of the percent change in the quantity demanded of good X to a percent change in the price of some other good Y. If the percent change in the quantity demanded of good X is greater than the percent change in the price of good Y, the demand for good X is said to be cross-price elastic with respect to good Y, or responsive to changes in the price of good Y. If the percent change in the quantity demanded of good X is less than the percent change in the price of good Y, the demand for good X is said to be cross-price inelastic with respect to good Y, or not responsive to changes in the price of good Y. Cross-price elasticities can be complements or substitutes. If the cross-price elasticity of demand is positive, the goods X and Y are substitutes. If the cross-price elasticity of demand is negative, the goods X and Y are complements. Cross-price elasticity for a good having a close substitution or complementarity would numerically be relatively big. If there is a close substitution the cross price elasticities will be positive as a price increase of good X will make the consumers substitute towards demanding good Y. For goods that are neither close substitutes nor complementary goods, the cross-price elasticity will be insignificant.

2.4.2.3 Expenditure elasticity of demand

Expenditure elasticity of demand is a measure of the responsiveness of demand to changes in expenditure on a bundle of similar goods and it shows how the quantity purchased changes in response to a change in the consumer's expenditure, which is a proxy for income. The expenditure is from a bundle of similar goods that can be separated from other goods. Some demand models, such as the Almost Ideal Demand System (AIDS) use budget shares or expenditure on goods and not household income in estimating the demand system. It is represented by the ratio between percentage change in quantity demanded and percentage change in expenditure. If the percent change in the quantity demanded is greater than the

percent change in consumer expenditure, the demand is said to be expenditure elastic, or responsive to changes in consumer expenditure. If the percent change in the quantity demanded is less than the percent change in consumer expenditure, the demand is said to be expenditure inelastic, or not responsive to changes in consumer expenditure. The higher the expenditure elasticity, the more sensitive consumer demand is to expenditure changes. The almost ideal demand system(AIDS) provides expenditure elasticities of demand. Modelling demand as commodity groups with budget shares and expenditures uses the composite commodity theorem, separability of commodities, and two-stage budgeting (Deaton and Muellbauer, 1980)

2.4.3 Demand functions

Economists use mathematical equations (functions) to model consumer demand. The causal relationship is between quantity demanded by the consumer, which is the dependent variable, and the price of a good and consumer income, which are the independent variables. Demand functions could be expressed in two forms namely Hickisan (compensated demand) and Marshalian (uncompensated demand).

2.4.3.1 Hicksian or compensated demand

Hicksian demand correspondence is the demand of a consumer over a bundle of goods that minimizes their expenditure while delivering a fixed level of utility. If the correspondence is actually a function, it is referred to as the Hicksian demand function, or compensated demand function (Jerry *et al.,* 1995). The Hicksian demand function is also known as the compensated demand function, since it represents demand when utility is held constant. Price elasticities derived from the Hicksian demand function are called "compensated" or "Slutsky" price elasticities and are equal to the uncompensated price elasticity plus the product of the income elasticity and the budget share(James *et al.,* 2003). The Hicksian demand function shows the relationship between the price of a commodity, P_1 and the

quantity purchased, Q_1 on the assumption that other prices, P_2, and utility, U_0 are held constant. Hicksian or compensated demand function is represented by the following equation: $Q_1 = f(P_1, P_2, U_0)$. This consumer demand function is obtained by minimizing the consumer's expenditures subject to the constraint that his/her utility (the satisfaction a consumer derives from a particular market basket) is fixed at utility level U_0. The Hicksian demand function is intimately related to the expenditure function and is often convenient for mathematical manipulation because they do not require income or wealth to be represented. The fundamental difference between the Hicksian demand function and the general or Marshallian demand function is that when you consider the change in the Hicksian demand at a price increase on a good the consumer should have the same utility level before and after the price increase. Therefore, we assume that the consumer gets compensated for the price increase through a rise of income. Consequently, the income effect is disregarded so that only the substitution effect is left. The opposite applies to the Marshallian demand, i.e. the income is constant while the utility level might change (Pedersen, 1998).

2.4.3.2 Marshallian or uncompensated demand

The Marshallian demand function shows the relationship between the price of a good, P_1 and the quantity purchased, Q_1 on the assumption that other prices, P_2 and the consumer's budget (or income) Y_0 is held constant. The Marshallian demand function is the solution to the consumer's problem of maximizing utility subjectto the budget constraint(James *et al.*, 2003). The demand function is obtained by maximizing the consumer's utility subject to the constraint that the customer's budget is fixed at the level Y_0 and so are other prices. Marshallian, Ordinary, and uncompensated Demand functions are the same and are represented by the following equation: $Q_1 = f(P_1, P_2, Y_0)$. Downward sloping Marshallian demand curves show the effect of price changes on quantity demanded (Jerry *et al.*, 1995). As the price of a good rises, presumably the quantity of that good demanded will fall, holding

wealth and other prices constant. However, this price changes due to both the income effect and the substitution effect. The substitution effect is a price change that alters the slope of the budget constraint but leaves the consumer on the same indifference curve (i.e., at the same level of utility.) By this effect, the consumer is posited to substitute toward the good that becomes comparatively less expensive. If the good in question is a normal good, then the income effect from the rise in purchasing power from a price fall reinforces the substitution effect. If the good is an inferior good, then the income effect will offset in some degree the substitution effect. Marshallian demand comes from the utility maximization problem and Marshallian demand functions of the form $x(p,w)$ that describe demand given prices p and income w are easier to observe directly.

2.5 Householdsocioeconomic variables in food demand estimation

Socioeconomic variables such as household size, sex composition, urbanization status and age composition play an important role in determining household demand patterns. From a policy standpoint, it is important to estimate the impact of these characteristics on demand to establish the determinants of observed household-specific consumption levels, help target government programs such as food aid on particular classes of households, and determine the amount of assistance needed to bring the malnourished to acceptable consumption standards(Sadoulet and Janvry, 1995).Socioeconomic/demographic variables are major determinants of consumer consumption patterns, and changes in demographic variables can cause shifts in demand structure. Although these shifts may be caused by changes in such non-economic factors as psychological needs, attitudes, and sociological influences, demographic variables are useful proxies when investigating the underlying shifts in demand and the differences in consumption patterns among individuals.

There are two reasons to incorporate demographic effects into a demand function (Muellbuaer, 1977). One is to estimate the equivalence scales (ES) and the other is to improve estimates. Estimation of the equivalence scale is usually used to provide information for income maintenance programs or for studies of poverty and income distribution. Estimation using pooled data without incorporation of demographic variables implicitly assumes identical tastes (or preferences) among the observations. This is not consistent with the observed facts in household data; hence, in order to get better estimates, several techniques for incorporating demographic effects have been developed. Ideally, there are two ways to incorporate demographic effects into a demand system; one is to use unpooled data and the other to use pooled data (Pollak and Wales, 1978). The first approach involves separating the entire dataset into sub-samples with identical demographic profiles and then estimating a demand system for each sub-sample separately. This approach allows all of the parameters of the demand system to depend on the demographic variables, so that there is no need to specify the form of the relationship between the parameters and the demographic variables. The major drawback of this approach, apart from its apparent inefficiency, is that it does not make it possible to draw inferences about households with one demographic profile from observations on the behaviour of households with different profiles. The second approach, which uses pooled data, involves three separate but interrelated steps (Pollak and Wales, 1980). The first step involves specifying a class of demand systems for every admissible demographic profile. The second involves specifying which parameters depend on the demographic variables and which do not, and the third involves specification of a functional form for each parameter which depends on the demographic variable.

Earlier attempts to incorporate demographic effects into complete demand systems using pooled data have led to the development demographic scaling of Barten (1964) and demographic translating of Pollak and Wales(1981). Linear demographic translation specifies

demographic variables as intercept shifters and is the most common specification in empirical demand studies. Demographic scaling involves applying scaling functions to prices and quantities. The scaling functions depend on demographic variables, and are interpreted as reflecting the number of 'equivalent adults" in the household (when the same scaling functions are the same for all goods), or as measuring the number of equivalent adults on a scale appropriate to each good (when the scaling functions differ from one good to another).

This procedure leads to the interpretation of the household's preferences as depending not on the quantity of the raw commodities it consumes, but on the quantity per equivalent adult. The challenge when using demographic scaling is the criteria for choosing scaling functions or for choosing numerical scaling values. The criteria for specifying scaling functions have been based on such factors as nutritional and physiological needs, poverty measures, and expenditure behaviour of households. While such criteria may be intuitively appealing, they are often inconsistent with theory. Scaling procedures that are made to be theoretically consistent typically lead to the imposition of implausible behavioural assumptions, such as zero substitution possibilities among goods (Deaton and Muellbauer, 1980).

2.6Food budgeting and separability in demand structure

The primary ideas of separability of preferences and two-stage budgeting are tightly related to one another (Deaton and Muellbauer, 1993). The basic concept of separability is that commodities can be partitioned into groups so that preferences within the same group can be described independently of the quantities in the other groups. If the marginal rate of substitution between any two goods belonging to the same group is independent of the consumption of goods within the other groups, we consider this as weak separability of preferences. By contrast, if the marginal rate of substitution between any two goods belonging to two different groups is independent of the consumption of any good in any third

group; this separability is called strong separability or block additivity. separability defines commodity groups using consumer preferences themselves. If preferences are weakly separable, then commodities can be partitioned into groups so that preferences groups can be described independently of consumption in other groups. This implies that a subutility function can be defined for each group, so that the values of each of these subutilities can be added to give total utility (Bopape, 2006). Weak separability allows us to express quantity demanded of a good as a function of its own price, the prices of goods within the group, and the total expenditures on the group if a good is "separable" from groups of other goods.

To limit the scope of analysis to particular commodities or food aggregates, or to use aggregate data when disaggregated data are unavailable or of poor quality, many studies have utilized the idea of separability in demand specification which opens up the possibility of multi-stage budgeting and decision making. Separability is imposed at the food level, implying that consumers modify their optimal food consumption bundle when relative prices of individual foods change, given an optimal allocation of expenditure to food. Due to separability, the marginal rate of substitution between any food items is independent of the changes in the non-food items. Hence, the individual food price changes influence non-food consumption expenditures only through their influence on the allocation of total expenditures to food and non-food. The advantage of separability lies in the fact that at each stage of budgeting, information appropriate to the stage is required (Haq *et al.*, 2011) and also Weak separability is both necessary and sufficient for the second stage oftwo-stage budgeting (Deaton and Muellbauer, 1980). A closely related concept is two-stage budgeting, which hypothesizes that consumers first allocate total expenditure to broad groups of goods (the first stage) and then allocate each group expenditure to the individual commodities in that group (thesecond stage).

2.7Review of empirical studies on estimation of food demand structure

A good number of relevant empirical studies were reviewed inorder to gain an insight into the approaches of food demand estimation. Adetunji and Rauf(2012) employed the Linear Approximate-Almost Ideal Demand Systems model in their study on Analysis of household demand for meat in southwest Nigeria in which they found that beef was mostly preferred in the study area and its budget share decreased with an increase in the price of chicken and vice versa, but increased with an increase in its price, the budget share of chevon, chicken and mutton increased with an increase in their own prices respectively. Ogunniyi (2011) in his study on Household Consumption of Cassava Products in Oyo State employed the Almost Ideal Demand Systems model in estimating the elasticiticies of demand for cassava products(gari, fufu and lafun).His result showed that demand for gari and fufu are elastic than demand for lafun meaning that lafun is a price inelastic cassava product and also expenditure elasticities of all the cassava products were found to be inelastic.Omonona*et al.* (2009) employed a two-stage Linear Approximate-Almost Ideal Demand Systems model to analyze micro level data on household consumption of four food groups(grains, roots/tubers vegetables/fruits and meat/fish) in their study on household food demand in semi-urban and rural households in south-west Nigeria. Their study showed that that aggregate food demand in the study area is inelastic to price changes with the exception of grain and aggregate expenditure elasticities also revealed that Meat/Fish are luxury foods while the others are necessities.

Ezedinma *et al.* (2006) in their study on Urban Household Demand for Meat and Meat Products in Nigeria employed the linear approximate Almost Ideal Demand System Analysisto a subset of the data on meat and meat products namely beef, mutton/goat, chicken, fish, eggs, and milk. Their results indicated that urban demand for meat products will

continue to increase as incomes improve, suggesting potential market opportunities especially for poultry.Olorunfemi and Ajibefun (2008) in their study on sample selection analysis of household food consumption in southwest Nigeria made use of ordinary least squares, heckman two-step sample selection estimator and maximum likelihood estimator in the estimation of food demand function. Their study revealed that the households budget share on rice was highest in the households food basket and the expenditure elasticity showed that rice and gari are normal goods in the region. Obayelu *et al.*(2009) in their study on Cross-sectional analysis of food demand in the North Central, Nigeria applied demand quadratic almost ideal demand system (QUAIDS) model to estimate price, and expenditure elasticities of six food groups(root and tubers, cereals, legumes, animal protein, fruits and vegetables, fats and oil) consumed in the North-Central, Nigeria, and the impact of the socio-economic variables on households' food demand. The result showed that all the six food groups analysed were price inelastic, income elasticity show that animal protein consumption is the most sensitive to income changes, while fats and oil is the least sensitive to income changes and the factors that positively and significantly affected demand for legumes, fats and oil, animal protein, cereals and roots and tubers were household size, level of education, primary occupation and access to credit.

Akinyele and Rahji (2007) in their study on Nutrient elasticities among Nigerian households differentiated by incomeemployed thelinear approximate almost ideal demand systems(LA-AIDS) to estimate the elasticities of six food items(rice, millet, guinea corn, yam, beans and maize) across low, average and high income earners.The findings showed that guinea corn is the food that would have the greatest implications for the nutrient status of low income households while millet, guinea corn and maize and rice, beans and maize respectively are the food items of note for the households whose heads earn average and high incomes. Jumah *et al.* (2008) in their study on La-aids Analysis of Cassava Food Products Demand in

Lagosused the linear approximate almost ideal demand system to analyse how consumers of cassava food products in the Lagos metropolitan area react to economic and demographic factors and their results established that demographic factors such as religion and residential area help to explain perceived variations in the consumption of cassava food products. Agboola (2003) in his study on estimation of food demand pattern in South Africa based on a survey of households employed the linear approximate almost ideal demand systems(LA/AIDS) modelling framework. His empirical results showed that the demand for meat and fish, grains, dairy products, fruits, vegetables and other foods were price elastic and the expenditure elasticities showed that grains, meat and fish were luxury products whereas dairy products, fruits, vegetables and other foods were necessities in the household diet. Haq *et al.* (2009) employed the Linear Approximate-Almost Ideal Demand Systems model(LA/AIDS) in the estimation of own and cross price compensated and uncompensated elasticities and expenditure elasticities in their study of food demand in the North West frontier province Pakistan. Their study showed all the food items were normal while rice, fruits, meat and other food products were found to be expenditure elastic as compared to wheat, vegetables, milk and cooking oil and also that Hicksian own and cross price elasticities closely followed the Marshallian elasticities. Heien and Wessells (1990) applied a censored regression approach that is computationally simple, consistent, and asymptotically efficient in their study on food demand systems estimation with microdata. According to them, the application of censored regression was necessary to resolve the estimation problem resulting from zero consumption of some food items during the survey period.

Weliwita *et al.* (2003) also applied the Linear Approximate-Almost Ideal Demand Systems (LA/AIDS) model in estimating price and food expenditure elasticities of demand for twelve food groups in their study on food demand in patterns in Tanzania. The findings of their study indicated that maize, rice, other cereals, pulses, sugar, edible oils, fish, starch, fruits and

vegetables, meat, and other foods were price inelastic while milk and dairy products had unitary elasticity of demand. The results also revealed that household income and family size had significant effects on food demand patterns. Salvez and Devoretz (1997) also utilized the Linear Approximate-Almost Ideal Demand Systems (LA/AIDS) model in their study on household demand for meat and fish product. The study tested for separability (and thus relevant substitutes/complements) by estimating different demand systems over different aggregation levels for fish and meat with an identical retail level household dataset for the Canadian market. Marufu and Marsh (2003) employed the Generalized Translog (GTL) expenditure system to assess the impact of subsistence consumption on food demand between rural and urban households in their study on analysis of household food expenditure systems in Tanzania. Their result indicated that subsistence consumption has significant effect on food demand in rural areas, but was less important in urban areas. Hence, ignoring differences between urban and rural regions can lead to incorrect inferences and policy recommendations. Bopape (2006) utilized the Quadratic Almost Ideal Demand System (QAIDS) to estimate demand functions for seven food groups(grains, meat and fish, fruits and vegetables, dairy, oils and fats, sugar, and other foods) in his study on the influence of demand model selection on householdwelfare estimates. His result showed that five of the seven food groups were found to be expenditure elastic, the exceptionsbeing meat and fish and other foods and that demand behaviour differs significantly between rural and urban households, as well as across income groups, implying that an accurate analysis of expenditure patterns in South Africa requires a disaggregated analysis that takes into account this heterogeneity in demand behaviour.

2.8 Theoretical framework

2.8.1Econometric models for estimation of food demand structure

Specifying the functional form of a system of demand equations is a central focus of empirical economic modelling. In general, econometric studies of demand include both single equations and systems of demand equations. In the single equation demand approach, the demand functions will be estimated in a pragmatic fashion without recourse to the economic theory(Grad and Karkout, 2008). Thus, the single equation models cannot represent preferences for all goods we buy, so the total expenditure function and utility based on the consumption of the complete basket cannot be derived. The parameters of the single equation demand model can be easily estimated by applying ordinary least squares (OLS) to cross-sectional or time series data. However, in order to maximize utility and satisfy the necessary restrictions, this model would require constant budget shares and constant elasticities, which is inconsistent with observations that budget shares change when income changes (Deaton and Muellbauer, 1984).However, such models can be implemented in the context of a welfare analysis where a great accuracy is not required like the one achieved by estimating a system of demand equations. The drawbacks of this approach can be summarized as follows:

1. The choice of functional forms for the demand equations and of the variables to be included is arbitrary (combination of common sense, interest in specific elasticities, computational convenience, and goodness of fit criteria).

2. The log functional form used above assumes constant elasticities over all values of the exogenous variables. This is true only over a short range of prices and income (because of switching between luxuries and necessities as income increases).

3. Predictions relying on this approach may not satisfy the budget constraint

According to Johnson *et al.* (1984), to estimate demand in the systems of equations demand approach, the approach uses a complete system of demand equations relying on the economic

theory. This system of equations aims at taking into account consistently the mutual interdependence of large numbers of commodities based on the structure of relative prices, real income, and a set of individual characteristics and demographic variables such as age, education, professional status, type of household, and rural versus urban population. The analysis of demand at the regional and national level is affected by both the average level of these variables in the unit of analysis and by their distribution across the population. The estimation results can be used to study behaviour (forecasting) and to conduct welfare analysis(Perali, 2003). The advantages and disadvantages of applying a demand systems approach can be summarized as follows:

1. It delivers more reliable estimates.
2. It uses the theory of demand as a guideline for the choice of functional forms and variables to be included.
3. It imposes constraints on demand parameters.
4. However, it requires data on individual consumer (which are not easily available).

In recent years, the academic literature on empirical demand analysis increasingly emphasized the use of flexible functional forms to estimate systems of demand equations that are consistent with demand theory (Alston *et al.*, 2002).These models havelargely displaced traditional, single-equation models formany purposes, such as testing the stability of preferences, but the common flexible forms are integrable only for subsetsof possible parameter values, and their flexibility is typically local, not global. Both Marshallian and Hicksian demand equations satisfy the restrictions imposed by demand theory. An example of a Marshallian demand equation is the Linear Expenditure System (LES), first estimated by Stone and widely applied using individual country data. Although easy to use, the LES assumes additive preferences, severely restricting substitution possibilities and it also rules out inferior goods. Another major weakness of the model is that marginal budget shares

obtained from estimation are constant with income changes. This property, known as "homotheticity," can lead to estimations where the income elasticity for necessities actually increases when income rises (Theil and Clements, 1987). Other limitations of LES such as proportional income and price elasticities, and ruling out of complementary relationship among goods opened doors to the development of other models.The Rotterdam model, first proposed by Barten (1964) and Theil (1965), uses both Marshallian and Hicksian demand functions. Unlike the LES, where restrictions are maintained or imposed algebraically within the model, restrictions must be imposed on the Rotterdam model and can be statistically tested. The Rotterdam model also allows the estimation of substitutes and complements. Moreover, the Rotterdam model allows for the separability of preferences, a desirable and useful property in demand analysis. If separability holds, total expenditure can be partitioned into groups of goods, making it possible to analyze the preferences in one group independent of the quantities in other groups. However, the Rotterdam model has a strong disadvantage in that it produces, like the LES model, constant marginal shares, leading to counterintuitive results, particularly with cross-country analysis, in terms of changes in income (Theil and Clements, 1987).Translog model of Christensen *et al.*(1975) corrected some of these shortcomings; but they introduced their own limitations and the major limitations of this model for estimating a demand system are the number of structural parameters required and the accuracy of the approximation only in the locality of some point. Although there are a number of system approaches available, the almost ideal demand system (AIDS), introduced by Deaton and Muellbauer (1980), has been the most commonly used method for analysing consumer behaviour. It is a flexible model that allows consistent aggregation of micro-level demands up to a market demand function, and does not require additive preferences (Eales and Unnevehr, 1988).By flexibility, it is usually meant that the model includes enough parameters so that, at a particular price vector, any set of elasticities could be obtained.

Alston and Chalfant (1993) indicated that, in a comparatively short time since the AIDS was introduced, it has been widely adopted by agricultural economists, to the point that it now appears to be the most popular of all demand systems. In the year following this statement, Buse (1994) supported their statement by saying that the model of Deaton and Meulbauer had become the model of choice for many applied demand analysts. The features of AIDS model include:

1. It gives an arbitrary first-order approximation to any demand system;
2. It satisfies the axioms of choice exactly;
3. It aggregates perfectly over consumers without invoking parallel linear Engel curves;
4. It has a functional form which is consistent with known household-budget data;
5. It is simple to estimate, largelyavoiding the need for non-linear estimation; and
6. It can be used to test the restriction of homogeneity and symmetry through linear restrictions on fixed parameters.

Many of these good attributes have contributed tremendously to the application of the model to demand equation estimations in many parts of the world.Since Deaton and Muellbauer (1980) proposed the AIDS model, it has been widely applied in many empirical studies of consumer behaviour using both cross-sectional and time series data. Hence, part of the reason for the popularity of this demand system is due to the considerable contentment with which it can be estimated and used for testing the predictions of consumer demand theory (Chambers and Nowman, 1997). Although many of these desirable properties are possessed by one or other of the Rotterdam or translog models, neither possesses all of them simultaneously.

The AIDS model is expressed as:

$$w_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \ln(p_i) + \beta_i \ln\left(\frac{x}{p^*}\right) + e_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where:

w_i = budget share of commodity ί

P_j = price of commodity j

x = total expenditure on the commodities within the system

p^* = price index

n = number of commodities

ln = natural logarithm

α_i = constant term in the i^{th} share equation

γ_{ij} = slope coefficient associated with the j^{th} commodity in the i^{th} share equation

β_i = expenditure coefficient ofi^{th} commodity in the i^{th} share equation

e_i = error term

Using the price index in equation (3) raises estimation difficulties caused by non-linearity of parameters. The use of stones price index as shown in equation (4) makes the model linear(Deaton and Muelbauer, 1980).

$$\ln(p) = \sum_{i=1}^{n} w_i \ln(p_i) \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots (4)$$

To capture the effects of demographic variables as intercept shifters on food demand function, the intercept in equation (1) is made to be a function of demographic variables through the translation method(Heien and Wessels, 1990). According to the translation method a_i is expressed as:

$$a_i = a_i^* + \sum_{j=1}^{n} \delta_{ij} Z_j \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots (5)$$

Where:

Z_j = the j^{th} demographic variables of which there are n in number

δ_{ij} = the vector of parameters

Incorporating equation (5) into equation (3) will yield

$$w_i = a_i^* + \sum_{j=1}^{n} \gamma_{ij} \ln(p_i) + \beta_i \ln\left(\frac{x}{p}\right) + \sum_{j=1}^{n} \delta_{ij} Z_j + e_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

The model in equation (6) is a Linear Approximate Almost Ideal Demand System(LA-AIDS) model which is a linear approximation to the intrinsically non-linear AIDS model in equation (3).

For the LA-AIDS model to be consistent with the theory of consumer demand; the conditions of adding up, homogeneity and symmetry must be satisfied.

Adding up:

$$\sum_{i}^{n} a_i^* = 1, \sum_{i}^{n} \gamma_{ij} = 0, \sum_{i}^{n} \beta_i = 0 \qquad \forall \ldots i \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Homogeneity:

$$\sum_{j}^{n} \gamma_{ij} = 0 \qquad \forall \ldots i \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

Symmetry:

$$\gamma_{ij} = \gamma_{ji} \forall\, i \neq j \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9)$$

The demand system in equation (4) is usually estimated using Seemingly Unrelated Regression (SUR) estimation method with homogeneity and symmetry restrictions imposed during estimation. The way this is achieved reflects the nature of these restrictions. Symmetry is a cross-equation restriction, whereas homogeneity is essentially a within-equation restriction(Tafere *et al.*, 2010). Since the sum of all expenditure shares in the LA-AIDS model is equal to unity, the residuals variance-covariance matrix is singular. To preserve the

adding-up restriction, one equation is omitted from the system. The coefficient of the omitted equation is obtained by imposing the adding-up restriction. The adding-up property of demand causes the error covariance matrix of system to be singular, so one of the expenditure share equations is dropped from the system to avoid singularity problems(Welinta *et al.,* 2003).

CHAPTER 3

METHODOLOGY

3.1 Description of the study area

The study was carried out in Sabon Gari, Kaduna South and Soba local government areas of Kaduna state. Kaduna state lies between latitudes 10^0 $21^1$and $10^0 33^1$North of the equator and longitudes $7^0 45^1$and 7^0 75^1 East of the Greenwich meridian and has 23 Local Government Areas. It occupies a total land mass of about 46, 053 km^2 and its population was put at 6, 066, 526 people in 2006(NPC, 2006) and had a projected population of 6, 903, 746 people in 2012 using an annual growth rate of 3.2%. The vegetation in the state is divided into Northern guinea savannah in the northern part of state and southern guinea savannah in the southern part of the state.The state experiences both wet and dry seasons with the wet season commencing in the month of April in the southern part of the state and between May and June in the northern part of the state. Rainfall is heaviest in the southern part of the state and decreases northwards with mean annual rainfall varying between 942mm and 1000mm. the rainfall lasts from May to October. The dry season sets in immediately after the rainy season and is characterized by harmattan period with a temperature ranging from 18^0C to 26^0C and the heat period with a temperature that ranges from 32^0C to 39^0C.

Sabon Gari Local Government Area is located in the northern part of Kaduna state with its headquarter in Dogarawa and had a projected population of 347, 319 people in 2012 from a population of 291, 375 people in 2006 using a population growth rate of 3.2%. It has six districts namely Hanwa, Muchia, Bassawa, Samaru, Bomo and Sabon Gari. Kaduna South Local Government Area is 950 $km^2$and had a projected population of 479, 649 people in 2012 from a population of 402,390 at the 2006 census. It is made up of seven districts namely Tudun Wada, Anguwan Mu' azu, Kurmin Mashi, Sabon Gari, Kakuri and Makera. Soba

Local Government Area has it's headquarter in Maigana and had a population of 293,270 at the 2006 census and a projected population of 349, 578 people in 2012. It is made up of eight districts namely Kwansanllo, Ricifa, Yakassai, Maigana, Soba, Turawa, Rahama and Damagira.

The climate of the state favours the production of crops such as rice, maize, beans, guinea corn, millet, cotton, yam, carrot, sugarcane, tomatoes, pepper, onions garden egg plant, lettuce, amaranthus and tobacco. Livestock reared in the state include poultry, sheep, goat, cattle and pig.

3.2 Sampling procedure and sample size

A multistage sampling technique was employed to select the households for the study. The first stage involved a random selection of 3 Local Government Areas in the study area namely Sabon Gari, Kaduna South and Soba Local Government Areas through the instrumentality of a computer random number generator. The second stage involved a random selection of two districts from Sabon Gari, Kaduna South and Soba Local Government Areas respectively through the use of a computer random number generator. The districts are Muchia and Hanwa in Sabon Gari Local Government Area, Kurmin Mashi and Kakuri in Kaduna South Local Government Area, Yakassai and Rahama in Soba local Government Area. The third stage involved a random selection of 5% of the households in the selected districts to give a sample size of 310 pooled from Muchia(48), Hanwa(56), Kurmin Mashi(52), Kakuri(56), Yakassai(54) and Rahama(44). The population of households in the study area was obtained from the National Population Commission.

3.3 Method of data collection

Primary data on household food consumption and expenditure patterns were used in this study. The primary data were elicited using well structured questionnairefrom heads of households or their representatives where the heads were not available. The data collected

were on the demographic characteristics of households such as sex, age and educational level of household heads, household size, household income, number of household income earners. Data were also collected on the households rice consumption with respect to the type, frequency, quantity, price and expenditure on rice consumed by the households during the sample period. Similarly, data on the quantities, prices and expenditure on other food items consumed by the households were collected.

3.4 Analytical techniques.

The tools of analysis that were employed in this study include descriptive and inferential statistics (LA-AIDS model, Logit model and Z statistic).

3.4.1 Descriptive Statistics: This involved the use of mean, frequency counts, standard deviation, percentages and coefficient of variation to achieve objectives 1 and 5 of the study.

3.4.2 Budget share index: this was used to achieve objective 2 and it is expressed as:

$$\boldsymbol{w_r = \sum_{i=1}^{n} \frac{\chi_{ri}}{X_i} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. (10)}$$

Where:

w_r = Budget share on rice by i[th]household

χ_r = Expenditure on rice by i[th] household (₦/month).

X_i =Expenditure on all food items consumed by i^{th} household(₦/month).

i = 1, 2, ………, n. (n = 310)

3.4.3 Linear Approximate Almost Ideal Demand Sytem (LA-AIDS) Model: this was used to achieve objectives 3 and 4 of the study. It is expressed as:

$$w_i = a_i^* + \sum_{j=1}^{n} \gamma_{ij} \ln(p_i) + \beta_i \ln\left(\frac{x}{p}\right) + \sum_{j=1}^{n} \delta_{ij} Z_i + e_i \ldots\ldots\ldots\ldots\ldots\ldots (11)$$

Where:

w_i = budget share of commodity ί

P_i = price of commodity i

x = total expenditure on the commodities within the system

n = number of commodities

ln = natural logarithm

a_i^* = constant term in the i^{th} share equation

p =stone's price index

γ_{ij} = slope coefficient associated with the j^{th} commodity in the i^{th} share equation

β_i = expenditure coefficient ofi^{th} commodity in the i^{th} share equation

Z_j = the j^{th} demographic variables of which there are n in number

δ_{ij} = the vector of parameters

e_i = error term

The explicit system of demand equations for rice and other food items(beans, maize, gari and yam) captured during the survey was estimated simultaneously using Seemingly Unrelated Regression(SUR) with homogeneity and symmetry restrictions imposed.The adding up property of demand was satisfied by deleting yam demand equation from the system and the parameters in the deleted equation werecalculated in accordance with the adding-up restrictions.Using matrix notation, the system of demand equations is expressed as:

$$\begin{bmatrix} w_R \\ w_B \\ w_M \\ w_G \\ w_Y \end{bmatrix} = \begin{bmatrix} a_1^* \\ a_2^* \\ a_3^* \\ a_4^* \\ a_5^* \end{bmatrix} + \begin{bmatrix} \ln P_R \\ \ln P_B \\ \ln P_M \\ \ln P_G \\ \ln P_Y \end{bmatrix} \begin{bmatrix} \gamma_{11} & \cdots & \gamma_{15} \\ \gamma_{21} & \cdots & \gamma_{25} \\ \gamma_{31} & \cdots & \gamma_{35} \\ \gamma_{41} & \cdots & \gamma_{45} \\ \gamma_{51} & \cdots & \gamma_{55} \end{bmatrix} + \begin{bmatrix} \ln\left(\frac{X}{P}\right) \\ \ln\left(\frac{X}{P}\right) \\ \ln\left(\frac{X}{P}\right) \\ \ln\left(\frac{X}{P}\right) \\ \ln\left(\frac{X}{P}\right) \end{bmatrix} \begin{bmatrix} \beta_1 \\ \beta_2 \\ \beta_3 \\ \beta_4 \\ \beta_5 \end{bmatrix} + \begin{bmatrix} Z_1 \\ Z_2 \\ Z_3 \\ Z_4 \\ Z_5 \end{bmatrix} \begin{bmatrix} \delta_{11} & \cdots & \delta_{15} \\ \delta_{21} & \cdots & \delta_{25} \\ \delta_{31} & \cdots & \delta_{35} \\ \delta_{41} & \cdots & \delta_{45} \\ \delta_{51} & \cdots & \delta_{55} \end{bmatrix} + \begin{bmatrix} e_1 \\ e_2 \\ e_3 \\ e_4 \\ e_5 \end{bmatrix} \ldots\ldots (12)$$

The explicit system of demand equations are as follows:

$$w_R = a_1^* + \gamma_{11}\ln P_R + \gamma_{12}\ln P_B + \gamma_{13}\ln P_M + \gamma_{14}\ln P_G + \gamma_{15}\ln P_Y + \beta_1 \ln\left(\frac{X}{P}\right) + \delta_{11}Z_1 + \delta_{12}Z_2 + \delta_{13}Z_3 + \delta_{14}Z_4 + \delta_{15}Z_5 + e_1 \quad \ldots\ldots \quad (13)$$

$$w_B = a_2^* + \gamma_{21}\ln P_B + \gamma_{22}\ln P_R + \gamma_{23}\ln P_M + \gamma_{24}\ln P_G + \gamma_{25}\ln P_Y + \beta_2 \ln\left(\frac{X}{P}\right) + \delta_{21}Z_1 + \delta_{22}Z_2 + \delta_{23}Z_3 + \delta_{24}Z_4 + \delta_{25}Z_5 + e_2 \quad \ldots\ldots \quad (14)$$

$$w_M = a_3^* + \gamma_{31}\ln P_M + \gamma_{32}\ln P_R + \gamma_{33}\ln P_B + \gamma_{34}\ln P_G + \gamma_{35}\ln P_Y + \beta_3 \ln\left(\frac{X}{P}\right) + \delta_{31}Z_1 + \delta_{32}Z_2 + \delta_{33}Z_3 + \delta_{34}Z_4 + \delta_{35}Z_5 + e_3 \quad \ldots\ldots \quad (15)$$

$$w_G = a_4^* + \gamma_{41}\ln P_G + \gamma_{42}\ln P_R + \gamma_{43}\ln P_B + \gamma_{44}\ln P_M + \gamma_{45}\ln P_Y + \beta_4 \ln\left(\frac{X}{P}\right) + \delta_{41}Z_1 + \delta_{42}Z_2 + \delta_{43}Z_3 + \delta_{44}Z_4 + \delta_{45}Z_5 + e_4 \quad \ldots\ldots \quad (16)$$

$$w_Y = a_5^* + \gamma_{51}\ln P_Y + \gamma_{52}\ln P_R + \gamma_{53}\ln P_B + \gamma_{54}\ln P_M + \gamma_{55}\ln P_G + \beta_5 \ln\left(\frac{X}{P}\right) + \delta_{51}Z_1 + \delta_{52}Z_2 + \delta_{53}Z_3 + \delta_{54}Z_4 + \delta_{55}Z_5 + e_5 \quad \ldots\ldots \quad (17)$$

Definition of Variables

w_R = household budget share on rice

w_B = household budget share on beans

w_M = household budget share on maize

w_G = household budget share on gari

w_Y = household budget share on yam

P_R = price of rice (₦/Kg)

P_B = price of beans (₦/Kg)

P_M = price of maize (₦/Kg)

P_G = price of gari (₦/Kg)

P_Y = price of yam (₦/Kg)

The quantity of yam in Kg was estimated from the number of large, medium and small sized tubers of yam consumed by the households in the last one month. On the average, large, medium and small sized tubers weigh 3, 2 and 1 kg respectively. Hence, the quantity of yam in Kg was estimated by multiplying the number of large, medium and small sized tubers of yam consumed by the households in the last one month by 3, 2 and 1 kg respectively.

Z_1 = age of household head (years)

Z_2 = educational level of household head (number of years of schooling)

Z_3 = household size (number of household members)

Z_4 = household income (₦/month)

Z_5 = number of household income earners

X = total household expenditure on all the food items within the system (₦)

P = stone's price index

$\gamma_{11} - \gamma_{55}$= price coefficients or the slope coefficientsin the share equations of rice, beans, maize, gari and yam respectively.

$\beta_1 - \beta_5$ = expenditure coefficients of rice, beans, maize, gari and yam respectively.

$a_1^* - a_5^*$ = constant terms in the share equations of rice, beans, maize, gari and yam respectively.

$e_1 - e_5$ = error terms in the share equations of rice, beans, maize, gari and yam respectively

$\delta_{11} - \delta_{55}$= coefficients of demographic variables in the share equations of rice, beans, maize, gari and yam respectively

The Marshallian(uncompensated) demand elasticities and the Hicksian(compensated) demand elasticities and expenditure elasticity of rice was determined from the estimated coefficients of the LA-AIDS model.

The Marshallian(uncompensated) own-price elasticity$\left(\varepsilon_{ii}^{M}\right)$and cross-price elasticities$\left(\varepsilon_{ij}^{M}\right)$of rice demand was computed as follows:

$$\varepsilon_{ii}^{M} = -1 + \frac{\gamma_{ii}}{w_i} - \beta_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (18)$$

$$\varepsilon_{ij}^{M} = \frac{\gamma_{ij}}{w_i} - \beta_i\left(\frac{w_j}{w_i}\right) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (19)$$

The Hicksian (compensated) own-price elasticity $\left(\varepsilon_{ii}^{H}\right)$and cross-price elasticities$\left(\varepsilon_{ij}^{H}\right)$of rice demand was computed as follows:

$$\varepsilon_{ii}^{H} = -1 + \frac{\gamma_{ii}}{w_i} + w_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (20)$$

$$\varepsilon_{ij}^{H} = \frac{\gamma_{ij}}{w_i} + w_j \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. (21)$$

The expenditure elasticity(ϵ_i) of rice demand was computed as follows:

$$\epsilon_i = 1 + \frac{\beta_i}{w_i} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (22)$$

Where:

ε_{ii}^{M} = Marshallian own-price elasticity of rice demand

ε_{ij}^{M} = Marshallian cross-price elasticites of rice demand

ε_{ii}^{H} = Hicksian own-price elasticity of rice demand

ε_{ij}^{H} = Hicksian cross-price elasticities of rice demand

ϵ_i= expenditure elasticity of rice demand

γ_{ii} = price coefficient of rice in its share equation

γ_{ij} = price coefficients of beans, maize, gari and yam in the share equation of rice

w_i = household budget share on i^{th} food item; where i = rice

w_j = household budget share on j^{th}food item; where j = beans, maize, gari and yam

3.4.4 Logit Model: this was used to achieve objective 6. The logit model is based on cumulative logistic probability function and it is computational tractable. The model assumes that the probability of households consumption preference for imported rice brand(P_i) is expressed as:

$$P_i = \frac{1}{1 + e^{-Z_i}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (23)$$

The probability of households consumption preference for locally produced rice brand($1 - P_i$) is expressed as:

$$1 - P_i = \frac{1}{1 + e^{Z_i}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (24)$$

P_i ranges between zero and one and it is non linearly related to Z_i .Z_i is the stimulus index which ranges from minus infinity to plus infinity and it is expressed as:

$$Z_i = \ln\left(\frac{P_i}{1 - P_i}\right) = \beta_o + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots\ldots + \beta_{11} X_{11} + u \ldots\ldots\ldots \quad (25)$$

To obtain the value of Z_i, the likelihood of observing the sample will be formed by introducing a dichotomous response variable. The explicit logit model is expressed as:

$$Y = \beta_o + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots\ldots\ldots + \beta_{11} X_{11} + u \ldots\ldots\ldots\ldots \quad (26)$$

Definition of Variables

Y = dichotomous response variable(1 for households consumption preference for imported rice and 0 for households consumption preference for locally produced rice)

X_1 = Age of household head(years)

X_2 = educational level of household head (number of years of schooling)

X_3 = household size (number of members of the household)

X_4 = household income(₦/month)

X_5 = frequency of rice consumption (number of times rice is consumed/month)

X_6 = food expenditure(₦/month)

X_7 = non-food expenditure(₦/month)

X_8 = price (dummy: 1 if household regards price as a factor for consumption preference between locally produced rice brand and imported rice brand and 0 otherwise)

X_9 = taste(dummy: 1 if household regards taste as a factor for consumption preference between locally produced rice brand and imported rice brand and 0 otherwise)

X_{10} = quality(dummy: 1 if household regards quality as a factor for consumption preference between locally produced rice brand and imported rice brand and 0 otherwise)

X_{11} = ease of preparation(dummy: 1 if household regards ease of preparation as a factor for consumption preference between locally produced rice brand and imported rice brand and 0 otherwise)

$\beta_1 - \beta_{11}$ = coefficients of stimulus variables

β_0 = constant term

u = error term

3.4.5 The Z-statistic: this was used to test the hypothesis which stated that there is no significant difference inthe income of households who preferredconsuming imported rice brand and locally produced rice brand. It wasexpressed as follows:

$$Z = \frac{\mu_1 - \mu_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}} \quad \ldots\ldots (27)$$

Where Z = calculated Z value

μ_1= Mean income of households that preferred consuming imported rice brand.

μ_2 = Mean income of households that preferred consuming local rice brand.

σ_1= Standard deviation of the households that preferred consuming imported rice brand.

σ_2 = Standard deviation of the households that preferred consuming local rice brand.

n_1= Sample size of households that preferred consuming imported rice brand.

n_2 = Sample size of households that preferred consuming local rice brand.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Socioeconomic characteristics of households

The socioeconomic characteristics of the sampled households in the study included gender of household heads, age, education, occupation, household size, number of income earning household members, household monthly income and frequency of rice consumption.

4.1.1 Gender distribution of household heads

The result in Table 4.1 shows that the sampled households in this study are largely male headed households with 83% of the household heads being males while 17% are females. This finding corroborates the finding of Erhabor and Ojogho (2011), who also found out in a similar study that rice consuming households are largely male headed with 89.3% of the household heads being males. Gender of household head could influence food consumption pattern of households and this was shown by Agboola (2003), who noted that gender was one of the socioeconomic characteristics that was significant in influencing grains demand, dairy products demand and vegetables demand in a study on estimation of food demand pattern in South Africa.

Table 4.1: Distribution of household heads based on gender

Gender	Frequency	Percentage
Male	256	83.00
Female	54	17.00
Total	310	100.00

4.1.2 Age distribution of household heads

The result as presented in Table 4.2 shows that larger proportions (31.61 %) of the sampled households belong to the age group of 41 – 50 years with the youngest household head found to be 24 years and the oldest household head found to be 75 years. The coefficient of variation(CV) of age was found to be 25% and this implies that there was low variation in the ages of the household heads. Age of household heads could influence food demand as indicated by Omonona *et al*.(2010), who revealed that age was significant in influencing demand for chicken, *ponmo*, yam flour and green leaves in their study on household food demand in semi-urban and rural households in south-west Nigeria

Table 4.2: Distribution of household heads based on age

Age group(years)	**Frequency**	**Percentage**
21 – 30	39	12.58
31 – 40	60	19.35
41 – 50	98	31.61
51 – 60	76	24.52
61 – 70	34	10.97
> 70	3	0.97
Total	310	100.00
Min.	24	
Max.	75	
Mean	48	
Standard deviation	0.12	
CV(%)	25	

4.1.3 Educational distribution of household heads

Majority(49.03%) of the household heads were found to have gained tertiary education with only 7.7 % of the households having no form of formal education as presented in Table 4.3. This could be attributed to the educational environment of the study area which makes the

state known as the centre of learning. This finding agrees with that of Okidim(2012), who revealed that household heads with tertiary education(34%) constituted a larger proportion of the rice consuming households in a similar study.Educational status of household heads could influence rice demand as well as the preference for imported or local rice types. As noted by Omonona *et al*.(2010), rice demand was significantly influenced by educational level of households heads in their study on household food demand. The mean years of schooling of the household heads is reported to be 13 years and this is higher than the national mean years of schooling of 5 years for Nigeria(UNDP, 2012).

Table 4.3: Distribution of household heads based on Education

EducationFrequency	**Percentage**	
No formal Education	24	7.74
Primary Education	45	14.52
Secondary Education	89	28.71
Tertiary Education	152	49.03
Total	310	100.00

4.1.4 Occupational distribution of household heads

The result in Table 4.4 shows thatthe larger proportion (59.35%) of the sampled heads of households were civil servants and this is not unconnected to the high educational attainment of majority of the household heads. This result suggests that there is a greater tendency for the households to rely on purchasing rice for household consumption rather than own production. This finding is in line with that of Kassali *et al*.(2010), who reported that majority(55 %) of the household heads were civil servants in a study of demand for rice in Osun state.

Table 4.4: Distribution of household heads based on their main occupation

Main OccupationFrequency	**Percentage**	
Agriculture	25	8.06

Civil service	184	59.35
Artisanship	36	11.61
Trading	48	15.48
Others	17	5.48
Total	310	100.00

4.1.5 Distribution of households according to their household size

The result presented in Table 4.5 shows clearly that majority of the households had a household size of 5 – 7 with a mean household size of 6 people. The coefficient of variation of household size was estimated to be 57% and this implies a wide variation in the sizes of the households which could influence the significance of household size on the demand for food by households. As reported by Omojola *et al.* (2006) and Haq *et al*. (2009), household size is an important determinant of food demand.

Table 4.5: Distribution of households based on their household size

Household SizeFrequency	**Percentage**	
2 – 4	108	34.84
5 – 7	134	43.23
8 – 10	49	15.81
> 10	19	6.13
Total	310	100.00
Min.	2	
Max.	23	
Mean	6	
Standard deviation	3.42	
CV(%)	57	

4.1.6 Distribution of households according to number of income earning members

The result as presented in Table 4.7 shows that majority(74.52%) of the sampled households had one to two numbers of income earning members with a mean of two household income earners. The estimated coefficient of variation of the number of household income earners was found to be 42% and this implies that there was a relatively low variation in the number of household income earners of the households sampled in this study. An increase in the number of income earning members of a household has the tendency of increasing the households income and therefore, this could influence the households food consumption.

Table 4.6: Distribution of households based on their number of income earners

Household Income Earners	**Frequency**	**Percentage**
1 – 2	231	74.52
3 – 4	78	25.16
> 4	1	0.32
Total	310	100.00
Min.	1	
Max.	5	
Mean	2	
Standard deviation	0.84	
CV(%)	42	

4.1.7Distribution of households according to their monthly income earning

The result in Table 4.7 shows that a larger proportion (27.42%) of the sampled households were in the ₦ 50, 000 – ₦ 99, 000 income bracket and 0.65 % having less than ₦ 10, 000 monthly household income. The average monthly household income was estimated to be ₦ 71, 304, 30. A coefficient of variation of 98% was estimated for the households monthly income and this indicates a high variation in the monthly income earnings of the households. The high variability of household income implies a wider variation in purchasing power of households and subsequently, the households demand for food. Empirical studies

(Onyemauwa *et al*., 2008; Okidim, 2012) have shown that household income influences food consumption.

Table 4.7: Distribution of households based on their monthly income earnings

Household Income(₦)	**Frequency**	**Percentage**
< 10, 000	2	0.65
10, 000 – 49, 000	67	21.61
50, 000 – 99, 000	85	27.42
100, 000 – 149, 000	72	23.22
150, 000 – 199, 000	51	16.45
200, 000 – 249, 000	27	8.71
> 249, 000	6	1.94
Total	310	100.00
Min.	7,000	
Max.	900,000	
Mean	71, 304, 30	
Standard deviation	63460.83	
CV(%)	89	

4.1.8 Distribution of households according to their frequency of monthly rice consumption

According to the result presented in Table 4.8, a larger proportion(58.34%) of the households consume rice (local and/ foreign) 16 – 30 times in a month and the least proportion(17.42%) consume rice 1 – 15 times in a month with an average monthly consumption of 21 times. This

suggests that rice is highly consumed by households in the study area. The coefficient of variation was estimated to be 47% and this implies that there was relatively low variation in the number of times rice is consumed by the sampled households in a month.

Table 4.8: Distribution of households according to their frequency of monthly rice consumption

Frequency of rice consumption	Frequency	Percentage
1 – 15	54	17.42
16 – 30	181	58.34
31 – 45	75	24.19
Total	310	100.00
Min.	10	
Max. 38		
Mean	21	
Standard deviation	9.87	
CV(%)	47	

4.2 Households share of expenditure on rice in the total food expenditure

The result presented in Table 4.9 shows that the households monthly budget share on rice (local and/ foreign) in Sabon gari, Kaduna south and Soba local government areas were 0.12, 0.14 and 0.19 respectively which implies that 12%, 14% and 19% of the households monthly food expenditure were spent on rice consumption. The households monthly budget share on rice for the aggregated households of the study was 0.14 which indicates that the aggregated households spent 14% of their monthly food expenditure on rice consumption. However, the 14% households monthly expenditure on rice was below that of North west geopolitical zone

and the nations average which were reported to be 28.39% and 30.63% respectively (Adeyeye, 2012).

Table 4.9: Share of households expenditure on rice in the total food expenditure

Households	Rice Expenditure(₦)	Total Food Budget(₦)	Rice Budget Share
Sabon Gari	147, 710	1, 248, 973	0.12
Kaduna South	131, 264	934, 487	0.14
Soba	87, 176	458, 290	0.19
Pooled Sample	366, 1502, 641, 750		0.14

4.2.1 Comparison of rice budget share with beans, maize, gari and yam budget shares

The result in Table 4.10 shows that the households average monthly expenditure on rice, beans, maize, gari and yam were ₦366, 150, ₦166, 060, ₦142, 080, ₦ 100, 650 and ₦ 78, 360 respectively and the households average total food expenditure was ₦2, 641, 750. The budget share on rice, beans, maize, yam and gari were estimated as 14%, 6%, 5%, 4% and 3% respectively and this clearly shows that rice constitutes a larger proportion of the households monthly food expenditure relative to beans, maize, gari and yam. This result lends credence to the growing trend in households rice consumption preference over other food items and therefore, the central position of rice in households food basket. The higher proportion of households expenditure on rice as shown explicitly in Table 4.9 conforms to the findings of Omonona *et al*.(2010) and Erhabor and Ojogho(2011) who also established that rice had the highest proportion of households monthly food expenditure relative to other food items in their studies respectively. The implication of this result is that sudden changes in households food expenditure would affect the households rice consumption.

Table 4.10:Share of households monthly expenditure on rice, beans, maize, gari and yam consumption

Households	Expenditure(₦)	Total Food Budget(₦)	Budget Share
Rice	366, 1502, 641, 750	0.14	
Beans	166, 0602, 641, 750		0.06

Maize	142, 0802, 641, 750	0.05
Gari	100, 650 2, 641, 750	0.04
Yam	78, 3602, 641, 750	0.03

4.3 Estimated Determinants of the Demand for Rice

The Generalized Least Squares(GLS) was employed to perform the seemingly unrelated regression of the linear approximate almost ideal demand system model for rice, beans, maize, gari and yam with rice as the focal food item and the other food items taken into consideration for comparative purpose and better comprehension of the nature of rice demand. With homogeneity and symmetry imposed at the point of estimation of the system of demand equations for rice, beans, maize, gari and yam, iterated seemingly unrelated regression estimates were calculated while dropping one equation (yam equation) to avoid singularity of the error covariance matrix and the parameters of yam demand equation were obtained by utilizing adding up theoretical restriction. The wald statistic of 97.3, 89.1, 94.3 and 102.9 for the results presented in Tables 4.11, 4.12, 4.13 and 4.14 respectively shows that the null hypothesis of the restrictions of valid homogeneity and symmetry for the system of demand equations are accepted at the 1 % significance level and this indicated that the data used were consistent with the consumer utility maximizing theory. The R-squared of the estimated rice demand equations in Tables 4.11, 4.12, 4.13 and 4.14 were 0.65, 0.47, 0.46 and 0.73 respectively with the rice demand equation of the estimated system of demand equations for the pooled sample having the highest R-squared value. The R-squared value of 0.73 inthe rice demand equation for the pooled sample indicates that 73% of the variability of households budget share on rice was explained by the explanatory variables included in the model. The F statistic of the estimated rice demand equations in Tables 4.11, 4.12, 4.13 and 4.14 were 22.16, 9.88, 11.14 and 19.12respectively with rice demand equation of the estimated system of demand equations for the sample drawn from Sabon Gari L.G.A having

the highest F statistic. The F statistics of the estimated rice equations were all significant at 1% significance level and this indicates the joint significance of the explanatory variables included in the models.

Price of rice($p<0.01$), price of beans($p<0.1$), price of yam($p<0.01$), food expenditure($p<0.01$), education($p<0.05$) and household size($p<0.01$) were the significant variables that influenced the proportion of households expenditure on rice in Sabon Gari L.G.A, price of rice($p<0.01$), price of maize($p<0.01$), food expenditure($p<0.01$) and household income($p<0.1$) were the significant variables that influenced the proportion of households expenditure on rice in Kaduna South L.G.A, price of rice($p<0.01$), price of beans($p<0.05$), price of maize($p<0.1$) and food expenditure($p<0.01$) were the significant variables that influenced the proportion of households expenditure on rice in Soba L.G.A. Although, the variables that influenced rice demand in the estimated system of demand equations for Sabon Gari, Kaduna South and Soba L.G.A's varied, price of rice and food expenditure were found to be significant in influencing rice demand in all the three L.G.As of the study.

The result for the pooled sample as presented in Table 4.14 shows that rice price, beans price, maize price, yam price, food expenditure, age of household head, household income and number of household income earners were all significant in influencing the households rice budget share. In the beans demand equation, beans price, rice price, maize price, yam price and food expenditure were the significant variables that influenced the proportion of households expenditure on beans. For the maize demand equation, rice price, beans price, maize price, yam price, food expenditure and household income significantly influenced the households maize budget share. The proportion of the households expenditure on gari was influenced significantly by the price of gari, the price of rice, the price of yam, household income and the number of household income earners. In the yam demand equation, the price of yam, price of beans, price of maize, price of gari, household size and household income

and the number of household income earners significantly influenced the households yam budget share.

The price of rice was found to be positive and statistically significant at 1% probability level and this implies that a unit increase in the price of rice will increase the proportion of households expenditure on rice by a unit of 0.0095 *ceteris paribus*. This finding does not agree with Omonona *et al*.(2010) who posited that the price of rice is negatively related to households expenditure on rice. The coefficient of beans was found to be negative and statistically significant at 10% probability level. This implies that a given unit increase in the price of beans will decrease the households proportion of expenditure on rice by a magnitude of 0.0103. The price of maize had a negative relationship with the households rice budget share and was significant at 1% probability level. This implies that a unit increase in the price of maize will decrease the households proportion of expenditure on rice by a magnitude of 0.0137. A plausible explanation for this is that an increase in the price of maize implies an increase in the expenditure on maize and hence, if the households must maintain its consumption level of maize, it means that the households food expenditure on other food items such as rice would decrease for the households to be able to maintain their level of consumption of maize. The coefficient of yam was statistically significant at 10% probability level and positively related to the households rice budget share. This implies that a unit increase in the price of yam will increase the households rice budget share by a unit of 0.01. Expenditure on food was found to be negative and statistically significant at 1% probability level. This implies that a unit increase in food expenditure will decrease the households proportion of expenditure on rice by a unit of 0.0434. This finding conforms to the finding of Erhabor and Ojogho (2011) who also found out that a percentage increase in total food expenditure will decrease the budget share of rice by 3.39%. Age had a negative relationship with the households rice budget share and was significant at 5% probability level. This

implies that a unit increase in the age of household heads will decrease the households rice budget share by a unit of 0.0014.

The coefficient of household size was found to be positive and statistically significant at 5% probability level. This implies that a unit increase in household size will increase the households rice budget share by a unit of 0.0075 and this could be attributed to the increase in the number of persons to be fed in the household. The monthly income of households had a positive relationship with the households proportion of expenditure on rice and statistically significant at 5% probability level. This implies that a given unit increase in the household income will increase the households proportion of expenditure on rice by a magnitude of 0.0252 and a plausible explanation for this is that an increase in household income leads to an increase in the purchasing power of the households. The coefficient of household income earners was found to be negative and statistically significant at 5% probability level. This implies that a unit increase in the number of household income earners will decrease the households rice budget share by a unit of 0.0205. This could be attributed to the shift in consumption of other food items as a result of the increase in household income from the increased number of household income earning members especially for households whose income have hitherto been low.

The price of rice was found to be statistically significant and negatively related to the households expenditure share on beans and maize but positively related to the households expenditure share on gari. Although, price of rice was found to be positively related to households expenditure share on yam, it was not significant.

Table 4.11: Seemingly unrelated regression estimates of LA-AIDS Model for Sabon Gari L.G.A

Variable	Rice	Beans	Maize	Gari	Yam
Intercept	0.3289	-0.0104	0.0640	0.5739	-0.0425
	(7.6090)	(-0.2480)	(1.4969)	(0.0226)	(-0.9237)
Log of rice price	-0.0928†	0.0007	-0.0085	0.0010††	0.0091
	(-12.5865)	(0.1030)	(-1.3017)	(2.4057)	(1.2050)
Log of beans price	0.0063†††	0.0006	-0.0051†††	-0.0002	0.0042
	(1.8603)	(0.1570)	(-1.6586)	(-0.8088)	(1.1426)
Log of maize price	0.0016	0.0036††	0.0002	-0.0001	0.0018†††
	(0.8401)	(2.0548)	(0.0806)	(-0.9985)	(1.9100)
Log of gari price	0.0003	-0.0048†††	0.0005	-0.0007†	-0.0023
	(0.0904)	(-1.8865)	(0.2009)	(-4.5467)	(-0.7685)
Log of yam price	0.0107†	0.0084†	0.0031	0.0004†	0.0025
	(4.3513)	(3.2109)	(1.4027)	(2.6225)	(0.8687)
Log of expenditure	1.9236†	1.6201†	1.9101†	1.3135†	1.9974†
	(52.2550)	(26.7783)	(26.6678)	(11.8936)	(41.8288)
Age	-0.0003	-0.0002	-0.9430E-4	-0.2015E-4	-0.00073†
	(-1.0970)	(-0.9545)	(-0.4115)	(-1.4103)	(-2.7200)
Education	0.0014††	-0.0004	0.0007	-0.0696	-0.0002
	(2.4180)	(-0.7016)	(1.3147)	(-0.2167)	(-0.2975)
Household size	0.0032†	0.0033†	0.0005	-0.1601	0.0001
	(3.2657)	(3.8477)	(0.5659)	(-0.2966)	(0.1176)

Household income	0.3829	-0.4188	-0.5485	0.1892	0.7044†††
	(0.9950)	(-0.1158)	(-1.5155)	(0.8626)	(1.6915)
Income earners	0.0065†††	-0.0038	-0.0024	0.0002	0.0094††
	(1.7478)	(-1.0479)	(-0.7102)	(0.7160)	(2.3176)

R-squared	0.65	0.50	0.38	0.49	0.58
F statistic	22.16	30.01	27.11	22.55	19.08
Wald test(χ^2)	97.345				

NB: Single, double and triple daggers (†) indicate statistical significance at 1, 5, and 10% levels respectively. Values in parentheses are the calculated t values.

Table 4.12: Seemingly unrelated regression estimates of LA-AIDS Model for Kaduna South L.G.A

Variable	**Rice**	**Beans**	**Maize**	**Gari**	**Yam**
Intercept	0.3076	-0.0449	-0.0436	0.0098	0.1111
	(5.1760)	(-1.1586)	(-1.5020)	(1.9033)	(1.0880)
Log of rice price	-0.0699†	0.0063	0.0090††	-0.0010	-0.0126
	(-6.3191)	(0.8355)	(2.3333)	(-1.0204)	(-0.6311)
Log of beans price	-0.0015	-0.0021†	-0.0012	-0.0002	-0.0015
	(-0.5013)	(-1.9376)	(1.5327)	(-0.5746)	(-0.2604)
Log of maize price	0.0013†	0.0014	0.0020	0.0002	0.0043
	(2.5870)	(0.9287)	(1.4641)	(1.2472)	(1.1074)
Log of gari price	-0.0040	-0.0004	-0.0019†	-0.0008†	0.0014
	(-0.2148)	(-0.2840)	(-1.8788)	(-4.3880)	(0.3876)
Log of yam price	0.0035	0.0051††	0.0005	-0.0007††	-0.0167†
	(1.0790)	(2.1190)	(0.2873)	(-2.2473)	(-2.7059)
Log of expenditure	2.0261†	1.6849†	1.7325†	1.6941†	1.7703†
	(45.0275)	(49.5286)	(53.9350)	(294.6213)	(40.1685)
Age	-0.0004	-0.7149E-04	0.6388E-04	0.5963†††	0.0013††

	(-1.2620)	(-0.2933)	(0.3441)	(1.8366)	(1.9971)
Education	0.0002	-0.0002	0.0002	0.2467	0.0004
	(0.3638)	(-0.6370)	(0.7503)	(0.5733)	(0.4238)
Household size	0.0018	0.0027††	0.0018††	-0.0003†	-0.0068††
	(1.0642)	(2.4412)	(2.1151)	(-1.9440)	(-2.2014)
Household income	0.3554†††	0.2193	-0.1601††	-0.1366	-0.1633
	(1.6831)	(0.1463)	(-2.4990)	(-0.7057)	(-0.4241)
Income earners	-0.0018	-0.0024	0.0022	0.0003	0.0080
	(-0.3340)	(-0.6387)	(0.8153)	(0.5159)	(0.8087)
R-squared	0.47	0.46	0.61	0.54	0.49
F statistic	9.88	7.54	13.97	6.28	9.84
Wald test(χ^2)	89.07				

NB: Single, double and triple daggers (†) indicate statistical significance at 1, 5, and 10% levels respectively. Values in parentheses are the calculated t values.

Table 4.13: Seemingly unrelated regression estimates of LA-AIDS Model for Soba L.G.A

Variable	**Rice**	**Beans**	**Maize**	**Gari**	**Yam**
Intercept	0.3928	0.0255	0.0302	0.0306	-0.1570
	(7.0126)	(0.5441)	(0.9960)	(0.4043)	(-0.3702)
Log of rice price	-0.0771†	-0.0071	-0.0039	-0.0082	0.0426††
	(-7.1580)	(-0.7475)	(-0.6322)	(-0.5426)	(2.5014)
Log of beans price	-0.0055††	-0.0020	-0.0010	0.0029†††	-0.0169
	(-2.0177)	(-0.8075)	(-0.6460)	(1.7450)	(-0.8053)
Log of maize price	0.0020†††	0.0032†††	0.0043†	0.0019	-0.0080
	(1.9841)	(1.7360)	(3.1511)	(0.6863)	(-0.5030)
Log of gari price	-0.0010	-0.0017	-0.0022††	0.0073†	-0.0474†
	(-0.4966)	(-1.0000)	(-2.0434)	(2.6950)	(-3.1369)
Log of yam price	-0.0019	0.0011	-0.0048†	-0.0264†	0.1561†
	(-0.6717)	(0.3970)	(-2.9177)	(-6.3722)	(6.7157)
Log of expenditure	1.8983†	1.7629†	1.6956†	0.3558†	12.3581†
	(44.5044)	(39.3763)	(54.3628)	(35.8687)	(75.4201)
Age	-0.9310E-04	0.0002	0.0004†††	0.0005	-0.0028

	(-0.2790)	(0.5547)	(1.9350)	(1.1158)	(-1.0470)
Education	0.0001	-0.0002	0.0001	0.0010	-0.0055
	(0.2744)	(-0.4400)	(0.4253)	(1.4484)	(-1.4501)
Household size	0.0015	0.0013	0.0011	-0.0015	0.0107†††
	(0.9173)	(0.9428)	(1.1610)	(-0.6444)	(1.8365)
Household income	0.2412	0.1538†††	-0.1744	-0.3955	0.2254
	(1.1431)	(1.8310)	(-1.4684)	(-1.3293)	(1.3504)
Income earners	-0.0007	-0.0031	-0.0005	0.0035	-0.0212
	(-0.1510)	(-0.7459)	(-0.1763)	(0.5182)	(-0.5683)
R-squared	0.46	0.40	0.64	0.49	0.61
F statistic	11.14	5.34	12.67	7.91	8.33
Wald test(χ^2)	94.33				

NB: Single, double and triple daggers (†) indicate statistical significance at 1, 5, and 10% levels respectively. Values in parentheses are the calculated t values.

Table 4.14: Seemingly unrelated regression estimates of LA-AIDS Model for the Pooled Sample

Variable	**Rice**	**Beans**	**Maize**	**Gari**	**Yam**
Intercept	0.3759	0.2329	0.4402	0.0324	0.1397
	(4.3887)	(2.1756)	(2.4463)	(2.1498)	(1.6771)
Log of rice price	0.0095†	-0.0103†††	-0.0137†	0.0045†††	0.0052
	(3.9860)	(-1.7414)	(-3.5170)	(1.8090)	(0.7248)
Log of beans price	-0.0103†††	0.0509†	-0.0166†	-0.0009	-0.0234†
	(-1.7414)	(8.5304)	(-5.1282)	(-0.1004)	(-4.7763)
Log of maize price	-0.0137†	-0.0166†	0.0490†	-0.3522E-04	-0.0105††
	(-3.5170)	(-5.1284)	(14.1394)	(-0.0263)	(-2.7637)
Log of gari price	0.0045	-0.0002	-0.3522E-04	0.0015†††	-0.0178†
	(1.6093)	(-0.1001)	(-0.0263)	(1.9332)	(-3.7260)
Log of yam price	0.0100†††	-0.0236†	-0.0187†	-0.0059†	0.0465†
	(1.6624)	(-5.0591)	(-5.1441)	(-3.1073)	(5.5439)
Log of expenditure	-0.0434†	-0.0009††	-0.0043†	0.5327E-06	0.1198E-04
	(-14.6392)	(-2.6470)	(-8.9190)	(0.6920)	(0.0268)

Age	-0.0014††	0.0005	0.0002	0.0002	0.0006
	(-2.0194)	(0.7942)	(0.4211)	(0.9154)	(0.5924)
Education	0.0015	-0.0005	-0.0006	0.0002	0.0004
	(1.1942)	(-0.4313)	(-0.6573)	(0.6108)	(0.2318)
Household size	0.0075††	0.0043	-0.0023	-0.0001	-0.0101††
	(2.5204)	(1.5201)	(-1.0371)	(-1.0947)	(-2.3700)
Household income	0.0252††	-0.0088	-0.0155††	-0.0040††	0.0063††
	(2.4323)	(-0.8904)	(-2.0240)	(-2.2520)	(2.4424)
Income earners	-0.0205††	-0.0112	-0.0050	0.0032†††	0.0243†††
	(-1.9294)	(-1.1224)	(-0.6344)	(1.9781)	(1.6636)
R-squared	0.73	0.56	0.69	0.54	0.67
F statistic	19.12	8.89	15.91	8.72	13.4
Wald test(χ^2)	102.93				

NB: Single, double and triple daggers (†) indicate statistical significance at 1, 5, and 10% levels respectively. Values in parentheses are the calculated t values.

4.4 Estimated uncompensated and compensated demand elasticities of rice

4.4.1 Uncompensated demand elasticities of rice

The result presented in Table 4.15 shows that the uncompensated own-price elasticity of rice(-0.8887) had the expected negative sign and was price inelastic. This implies that a unit increase in the price of rice will less than proportionately decrease the demand for rice by a unit of 0.8887 *ceteris paribus*. The uncompensated cross price elasticity of rice with respect to beans(-0.0552) and maize(-0.0824) were negative and this implies that they were complementary to rice consumption by the households with maize having a higher complementarity to rice than beans. The uncompensated cross price elasticity of rice with respect to gari(0.0446) and yam(0.2857) were positive and this implies that they were substitute to rice in the food basket of the households with yam having a higher substitutability to rice than gari. The absolute value of the own price elasticity of rice was higher than the absolute values of the cross price elasticities of rice and this implies that the

demand for rice is more responsive to its price than to the prices of beans, maize, gari and yam.

Table 4.15: Estimated uncompensated (Marshalian) own price and cross price elasticities of rice and other food items

	Rice	Beans	Maize	Gari	Yam
Rice	-0.8887	-0.1696	-0.2620	0.1125	0.1731
Beans	-0.0552	-0.1508	-0.3268	-0.0225	-0.7800
Maize	-0.0824	-0.2760	-0.0157	-0.0009	-0.3600
Gari	0.0446	-0.0027	0.0027	-0.9635	-0.5933
Yam	0.2857	-0.3929	-0.3574	-0.1475	0.5333

4.4.2 Compensated demand elasticities of rice

The estimated compensated own price and cross price elasticities of rice as shown in Table 4.16 are higher than the uncompensated own and cross price elasticities of rice. This finding is contrary to that of Erhabor and Ojogho(2011) who found out that the uncompensated elasticities of rice were higher than the compensated elasticities of rice. This implies that the income effect surpasses the substitution effect. The compensated own price elasticity of rice was similar to the uncompensated own price elasticity in being price inelastic and negative. This implies that a unit increase in the price of rice will less than proportionately decrease the demand for rice by a magnitude of 0.7921. The compensated cross price elasticities of rice with respect to beans and maize were negative and this implies that they exhibit complementarity with rice. The compensated cross price elasticities of rice with respect to gari and yam were positive and this suggests that they were substitutes to rice.

Table 4.16: Estimated compensated (Hicksian) own price and cross price elasticities of rice and other food items within the demand system

	Rice	Beans	Maize	Gari	Yam
Rice	-0.7921	-0.0317	-0.1340	0.2525	0.3133
Beans	-0.0136	-0.0917	-0.2720	0.0375	-0.7200
Maize	-0.0479	-0.2267	0.0030	0.0491	-0.3000

Gari	0.0721	0.0367	0.0039	-0.9225	-0.5533
Yam	0.1014	-0.3633	-0.3440	-0.1175	0.5800

4.4.3 Expenditure elasticity of rice

The expenditure elasticity of rice as presented in Table 4.17 indicates that rice is a normal good as shown by the positive sign of its expenditure elasticity and is expenditure inelastic as its expenditure elasticity lies between one and zero. This implies that rice is not a luxury in the households food basket but a necessityand a unit increase in the households income will less than proportionately increase the demand for rice by a magnitude of 0.69. This finding disagrees with that of Omonona *et al*.(2010) who posited that rice is an inferior good as indicated by the negative sign of its expenditure elasticity(-5.2837) and is an expenditure elastic food item. The status of rice as being a necessity in the households food basket is a pointer to the growing consumer preference for rice in Nigeria. The expenditure elasticities of beans, maize, gari and yam indicates that they were also normal goods like rice in the food basket of the households with beans and maize being expenditure inelastic just as rice but with gari and yam having unitary expenditure elasticity which implies that a proportional increase in the income of households will lead to a proportional increase in the households demand for gari and yam.

Table 4.17: Expenditure elasticity of rice and other food items within the demand system

	Expenditure Elasticity
Rice	0.6900
Beans	0.9850
Maize	0.9140
Gari	1.0000
Yam	1.0004

4.4.4 Test of hypothesis I of the study

From the estimated parameters of the rice demand equation for the pooled sample in Table 4.14, age of household head, household size, household income and number of income earners were found to be significant in influencing demand for rice by the households and therefore, the null hypothesis which stated that there is no significant relationship between the demand for rice and the socioeconomic characteristics of households is rejected and the alternative hypothesis is accepted.

4.5 Households consumption preference for foreign and local rice brands

From the result in Table 4.18, majority of the households in Sabon Gari(85%), Kaduna South(83%) and Soba(53%) local governments respectively preferred consuming foreign rice to local rice types with Sabon Gari having the highest households who preferred consuming foreign rice compared to Kaduna South and Soba. From the pooled sample of households, a larger proportion(75%) preferred consuming foreign rice brands to local rice brands. However, there was considerable local rice consumption preference by households(25%) and this in line with (Adeyeye, 2012) who opined that though the market for imported and locally produced rice in Nigeria appears segmented, consumption of locally produced rice is as well on the increase as that of imported rice. A plausible explanation for this is that local rice is perceived to be more palatable and nutritious than foreign rice.

Table 4.18: Result of consumer preference for foreign and local rice brands

Rice Brand	Frequency	Percentage
Sabon Gari		
Foreign Rice	85	82
Local Rice	19	18
Total	104	
Kaduna South		
Foreign Rice	83	77
Local Rice	25	23
Total	108	

Soba		
Foreign Rice	53	54
Local Rice	45	46
Total	98	
Pooled Sample		
Foreign Rice	232	75
Local Rice	78	25
Total	310	100

4.5.1 Test of hypothesis II of the study

The result of the Z test as presented in Table 4.19 shows that the calculated z value (3.40) is greater than the table z value of 1.64 at one tail and 1.96 at two tail respectively and it is significant at 1% probability level. This implies that there is a significant difference in the average monthly income of households who preferred consuming foreign rice to that of those who preferred consuming local rice and therefore, the null hypothesis is rejected and the alternative accepted. This suggests thathousehold income has contributed in the high consumer preference for foreign rice relative to local rice.

Table 4.19: Z test result for the test of significance between income of households who preferred consuming foreign rice and those who preferred local rice brands

	Foreign rice	**Local rice**
Mean	160968.25	75076.92
Known variance	34458934460	2391193846
Observations	232	78
Hypothesized mean difference	0	
Z	3.40	
P(Z<=z) one-tail	0.34E-3	
z Critical one-tail	1.64	
P(Z<=z) two-tail	0.68E-3	
z Critical two-tail	1.96	

4.6 Factors influencing households consumption preference for foreign and local rice brands

The maximum likelihood estimates of the parameters of the logistic regression of the factors influencing consumer preference for foreign and local rice brands in Sabon Gari, Kaduna South and Soba L.G.A's as well as the pooled sample are presented in Tables 4.20, 4.21, 4.22 and 4.23 respectively. The log-likelihood statistic of -30.14025, -31.32163, -20.90795 and -32.76064 for the results in Tables 4.20, 4.21, 4.22 and 4.23 respectively were all significant at 1% probability level and these indicated the joint significance of the independent variables included in the models. The overall percentage of the households rice consumption preference for foreign and local rice correctly predicted seems good at 78%, 77%, 86% and 83% for the result in Tables 4.20, 4.21, 4.22 and 4.23 respectively in comparison to the 100% predictions of a perfect model.

The factors found to be significant in influencing consumption preference for foreign and local rice were household size($p<0.05$), frequency of rice consumption($p<0.05$), price of rice($p<0.01$) and quality($p<0.1$) in Sabon Gari L.G.A, household size($p<0.1$), household income($p<0.01$), price of rice($p<0.01$) and quality($p<0.01$) in Kaduna South L.G.A and household size($p<0.05$), household income($p<0.1$), food expenditure($p<0.01$) and quality($p<0.01$) in Soba L.G.A. The results across the three L.G.A's have indicated a variation in the factors that influenced consumption preference for foreign and local rice with household size and quality as the only factors that influenced consumption preference for foreign and local rice in each of the L.G.A's.

Household size, household income, frequency of rice consumption, price of rice, quality and ease of preparation were the factors that significantly influenced the households consumption preference for foreign and local rice in the pooled sample. Household size was found to be negative and significant at 10% probability level with an odd ratio of 0.7277 which implies

that a unit increase in the size of the households would decrease the probability of households foreign rice consumption preference by a factor of 0.7277. This could be due to the inability of the households to increase purchase of foreign rice to meet the consumption need of its increasing household size.Household income was positively related to the households probability for foreign and local rice consumption preference and was significant at 5% probability level. The odd ratio of 1.1800 indicates that a unit increase in the households income will increase the probability of households rice consumption in favour of foreign rice preference by a magnitude of 1.1800. A plausible explanation for this is that as the income of households increases, their purchasing power also tend to increase. The households frequency of rice consumption was found to be negative and significant at 1% probability level with an odd ratio of 0.9344 which suggests that a unit increase in the frequency of rice consumption by households will decrease the probability of households foreign rice consumption preference. This could be attributed to the inability of the households to put up with the cost of purchasing additional quantity of foreign rice to meet their increasing rice demand. Price of rice was negative and significant at 1% probability level with an odd ratio of 0.0920which implies that that a unit increase in the price of rice will decrease the probability of households rice consumption in favour of foreign rice preference by a magnitude of 0.0920. This implies that as the prices of foreign rice increases, households tend to reduce their consumption of foreign rice by resorting to consumption of low priced local rice or other food items as substitute for foreign rice. This finding lends credence to that of Odusina (2008) who found out that the high price of imported rice is discouraging consumption of imported rice.The implication of this finding is that policy measures aimed at increasing production of local rice through the rice value chain of the agricultural transformation agenda (ATA) should be properly implemented to make local rice competitive and a better substitute for foreign rice.

Rice quality(cleanliness of grain, whiteness of grain, shape of grain and breakage of grain) was positively related to the households probability for foreign rice consumption preference and was significant at 10% probability level. The odd ratio of 3.5282 indicates that a unit increase in the quality of rice will increase the probability of households rice consumption in favour of foreign rice preference by a magnitude of 3.5282. This finding is consistent with Bamidele *et al*.(2010) who noted that households preferred imported rice to the local rice, because the imported rice is of a higher quality and grade(it has a better taste, it is polished, not broken and is free of stones and other debris). Kassali *et al*.(2010) also noted that the main reason imported rice is bought is as a result of the good quality as presumed by consumers. The significance of rice quality as a factor that favours foreign rice consumption implies that an improvement of the quality of local rice to attain the high quality desired by households would stimulate local rice consumption preference by households. This will stem the loss of earnings in the importation of foreign rice to bridge demand-supply gap and create opportunities for employment. This is in line with Bamba *et al*.(2010) who noted that increasing production of higher quality rice will reduce imports and strengthen food security. Ease of rice preparation was found to be positive and significant at 10% probability level with an odd ratio of 3.0836 which suggests that a unit increase in the frequency of rice consumption by households will increase the probability of households foreign rice consumption preference.

Table 4.20: Logit regression estimates of factors influencing consumer preference for foreign and local rice brands in Sabon-Gari L.G.A

Variable	**Coefficient**	**Standard Error**	**t-value**	**Exp.(β)**

Intercept	7.4758	2.74002.7284	1764.8130	
Age	-0.0025	0.0298 -0.0838		0.9975
Education	-0.0797	0.0610-1.3066		0.9234
Household size	-0.3829††	0.1894	-2.0216	0.6819
Household income	0.2854	0.4966 0.5747	1.3303	
Rice consumption	0.1992††	0.0840	2.3714	1.2204
Food expenditure	0.0457	0.03134	1.4582	1.0468
Non food expenditure	-0.2854	0.4967-0.5746		0.7517
Price	-3.3629†	1.1778	-2.8552	0.0346
Taste	-0.6262	0.6869	-0.9116	0.5346
Quality	-0.0630†††	0.0373	-1.6890	0.9389
Ease of preparation	-0.0253	0.1112	-0.2275	0.9750
log likelihood	-30.14025†			
Correct predictions	78%			
McFadden Pseudo R-squared	37%			

NB: Single, double and triple daggers (†) indicate statistical significance at 1, 5, and 10% levels respectively.

Table 4.21: Logit regression estimates of factors influencing consumer preference for foreign and local rice brands Kaduna South L.G.A

Variable	**Coefficient**	**Standard Error**	**t-value**	**Exp.(β)**

Intercept	5.9237	2.4486	2.4192	373.7922
Age	0.01160.0283	0.4099	1.0117	
Education	-0.0736	0.0604	-1.2185	0.9290
Household size	-0.3694†††	0.1948	-1.8963	0.6911
Household income	0.2164†	0.0808	2.6782	1.2416
Rice consumption	-0.2913	0.4987	-0.5841	0.7473
Food expenditure	-0.1679	0.2782	-0.6035	0.8454
Non food expenditure	-0.0601	0.1093	-0.5499	0.9417
Price	-3.2552†	1.1385	-2.8592	0.3857
Taste	-0.7347	0.6875	-1.0687	0.4796
Quality	2.0359†	0.6951	2.9289	7.6591
Ease of preparation	0.2819	0.1733	1.6266	1.3256
log likelihood	-31.32163†			
Correct predictions	77%			
McFadden Pseudo R-squared	35%			

NB: Single, double and triple daggers (†) indicate statistical significance at 1, 5, and 10% levels respectively.

Table 4.22: Logit regression estimates of factors influencing consumer preference for foreign and local rice brands in Soba L.G.A

Variable	Coefficient	Standard Error	t-value	Exp.(β)
Intercept	2.4903	2.9178	0.8256	12.0649
Age	0.0268	0.0429	0.6247	1.0272
Education	-0.0516	0.0755	-0.6834	0.9497
Household size	-0.5659††	0.2674	-2.1163	0.5678
Household income	0.2312†††	0.1219	1.8966	1.2601
Rice consumption	-1.3710	1.1075	-1.2379	0.2539
Food expenditure	-0.7477†††	0.9622	-1.7771	0.4735
Non food expenditure	-1.0229	1.0789	-0.9481	0.3596
Price	-0.0230	0.0458	-0.5021	0.9773
Taste	0.0317	0.3652	0.8680	1.0322
Quality	3.0165†	0.9614	3.1376	20.4197
Ease of preparation	-0.1174	0.1635	-0.7180	0.8892
log likelihood	-20.90795†			
Correct predictions	86%			
McFadden Pseudo R-squared	53%			

NB: Single, double and triple daggers (†) indicate statistical significance at 1, 5, and 10% levels respectively.

Table 4.23: Logit regression estimates of factors influencing consumer preference for foreign and local rice brands for the pooled sample

Variable	Coefficient	Standard Error	t-value	Exp.(β)
Intercept	5.1894	2.3426	2.2152179.3609	
Age	0.0033	0.0289	0.1142	1.0033
Education	-0.0535	0.0567	-0.9436	0.9471
Household size	-0.3178†††	0.1745	-1.8212	0.7277
Household income	0.1655††	0.0759	2.1805	1.1800
Rice consumption	-0.0678†††	0.0373	-1.8177	0.9344
Food expenditure	0.1235	0.2765	0.4467	1.1315
Non food expenditure	-0.0109	0.1166	-0.0935	0.9892
Price	-2.3862†	0.9104	-2.6210	0.0920
Taste	-0.5092	0.6642	-0.7666	0.6010
Quality	1.2608†††	0.7322	1.7219	3.5282
Ease of preparation	1.1261†††	0.6534	1.7234	3.0836
log likelihood	-32.76064†			
Correct predictions	83%			
McFadden Pseudo R-squared	55.2%			

NB: Single, double and triple daggers (†) indicate statistical significance at 1, 5, and 10% levels respectively.

CHAPTER 5

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

This research was undertaken with the broad objective of carrying out an analysis of households demand structure for rice consumption in Kaduna state. The specific objectives were to describe the socioeconomic characteristics of households in Kaduna State, estimate the share of expenditure on rice in the total food budget of households, examine the determinants of households demand for rice consumption, estimate the compensated and uncompensated rice demand elasticities of households, examine the households consumption preference between locally produced rice brand and imported rice brand and examine the factors that influence urban households consumption preference between locally produced rice brand and imported rice brand. A multistage sampling technique was employed in the selection of households for the study. A sample size of 310 households was sampled from three randomly selected local governments namely; Sabon Gari, Kaduna South and Soba local government areas of Kaduna state. Primary data on household food consumption and expenditure patterns through the instrumentality of structured questionnaire administered to household heads. Data on the households rice consumption with respect to the type, frequency, quantity, price and expenditure on rice consumed by the households during the sample period were obtained. Also, data on the quantities, prices and expenditure on beans, maize, gari and yam consumed by the households were collected. The data collected were analysed using descriptive statistics, budget share index, LA-AIDS model, logit model to achieve the objectives of the study and Z statistic to test hypothesis.

The result of the data analysis showed that majority(83%) of the household heads were males, a larger proportion (31.61 %) of the sampled households belonged to the age group of 41 – 50 years, 49.03% of the household heads were found to have gained tertiary education, majority(59.35%) of the household heads were civil servants, larger proportion(43.23%) of

the households had a household size of 5 – 7 people, 74.52% of the households had one to two numbers of income earning members, 27.42% of the households were in the ₦ 50, 000 – ₦ 99, 000 income bracket with an estimated average monthly household income of₦ 71, 304, 30 and a larger proportion 58.34% of the households consume rice 16 – 30 times in a month.The households monthly budget share on rice for the aggregated households of the study was 0.14 which indicates that the aggregated households spend 14% of their monthly food expenditure on rice consumption.This result lends credence to the growing trend in households rice consumption preference over other food items and therefore, the central position of rice in households food basket.

The factors that were significant in influencing rice demand by the pooled households of the study were found to be the price of rice($p<0.01$), beans price($p<0.1$), maize price($p<0.01$), yam price($p<0.1$), food expenditure($p<0.01$), age of household head($p<0.05$), household income($p<0.05$) and number of household income earner($p<0.01$).The uncompensated own-price elasticity of rice(-0.8887) had the expected negative sign and magnitude making it consistent with economic theory.The uncompensated cross price elasticities of rice with respect to beans, maize, gari and yam were found to be -0.0552, -0.0824, 0.0446 and 0.2857 respectively. The compensated own-price elasticity of rice was found to be -0.7921 while the cross price elasticities with respect to beans, maize, gari and yam were found to be -0.0136, -0.0479, 0.0721 and 0.1014 respectively. The expenditure elasticity of rice was found to be 0.69 which indicated that rice is a normal good and expenditure inelastic. Majority(75%) of the pooled sample of households were found to prefer consuming foreign rice than the available local rice brands.

The factors found to be significant in influencing the households consumption preference for foreign and local rice brands from the pooled sample of the study were household

size($p<0.10$), household income($p<0.05$), frequency of rice consumption($p<0.10$), price of rice($p<0.01$), quality of rice($p<0.10$) and ease of preparation of rice($p<0.10$).

5.2 Conclusion

It can be concluded from the findings of this research that rice with a budget share index of 0.14 constitutes a larger share of the households monthly food expenditure and therefore, assumes a vital position in the monthly food expenditure of households. Rice is a price and expenditure inelastic food item. It is a necessity and not a luxury food item for the households in the study area with a larger proportion of the households preferring to consume foreign rice than locally produced rice as a result of the perceived high quality of foreign rice amongst others. An improvement of the quality of local rice to attain the high quality desired by households would stimulate local rice consumption preference by households and save the nation from the colossal loss of foreign exchange incurred in the importation of foreign rice to meet local demand.

5.3 Recommendations

Based on the findings of this research, the following recommendations have been put forward:

1. Arising from the significant influence of households socioeconomic characteristics on rice demand, policy measures geared towards enhancing demand for riceby households should take into proper cognisance the demographic characteristics of the target households.

2. Adequate policy framework aimed at reducing the cost of production and increasing supply of local rice should be pursued as this will reduce the prices of local rice brands and invariably enhance demand for local rice by households as rice was estimated to be own-price inelastic.

3. Quality of rice was a major factor that influenced consumption preference for foreign and local rice and therefore,the rice value chain of Nigeria's Agricultural Transformation Agenda (ATA) should lay more emphasis on local rice processing so as to ensure that the quality of locally produced rice is improved to make local rice highly competitive with foreign rice and thereby encourage shift in consumer preference from imported rice to locally produced rice.

4. To stimulate increased local rice consumption and invariably production as well as income of rice farming households in line with the on-going rice subsector transformation under the umbrella of the Agricultural Transformation of Agenda (ATA) of Nigeria, well concerted policy measures aimed at ensuring stringent rice import duties and levies should be put in place and implemented to the latter to discourage foreign rice importation.

5. Mass sensitization campaigns should be launched to re-orientate households on the consumption of available high quality local rice brands so as to save the nation from continuous loss of huge foreign exchange in the importation of foreign rice to meet local demand.

5.4 Contributions to knowledge

The contributions of this study to the body of knowledge are:

1. The households monthly budget share on rice for the pooled households of the study was 0.14 which indicates that the pooled households spend 14% of their monthly food expenditure on rice consumption.

2. The expenditure elasticity of rice was found to be 0.69 and this implies that rice is not a luxury in the households food basket but a necessity and a unit increase in the households income will less than proportionately increase the demand for rice by a magnitude of 0.69.

3. The factors that were significant in influencing the households consumption preference for foreign and local rice brands from the pooled sample of the study were household size ($p<0.10$), household income ($p<0.05$), frequency of rice consumption ($p<0.10$), price of rice ($p<0.01$), quality of rice ($p<0.10$) and ease of preparation of rice ($p<0.10$).

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APPENDIX

DEPARTMENT OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY, AHMADU BELLO UNIVERSITY, ZAIRA.

FOOD CONSUMPTION RESEARCH QUESTIONNAIRE

TOPIC: HOUSEHOLD DEMAND STRUCTURE FOR RICE CONSUMPTION IN KADUNA STATE.

Dear Respondent,

This questionnaire will be used by a student in the above-named department. Please, provide the necessary information required in the questionnaire which will be treated with utmost confidentiality and used strictly for academic purpose.

Thank you for your cooperation.

(A) Administrative Information

(i) Local government. ……..

(ii) Ward.....

(iii) Date of interview.....

(iv) Questionnaire No. …….

(B) Socioeconomiccharacteristics of households

(1) Age of household head..... (years)

(2) Gender of household head

(i) Male ( ) (ii) Female ( )

(3a) Marital status of household head

(i) Married ( ) (ii) Single ( )

(3b)If single, tick the one that best describes your status

(i) Widow ( ) (ii) Widower ( ) (iii) Divorced ( )

(4) Educational qualificationof household head

(i) No formal education ( )

(ii) Primary ( ) .....(years spent)

(iii) Secondary ( ).....(years spent)

(iv) Tertiary ( ).....(years spent)

(v) Others, kindly specify .....

(5) Household size(i.e number of members of your household) ……..

(6) How many of your household members fall into the following age group

Age group (years)	Number of males	Number of females
0 - 10		
11- 20		
21- 30		
31- 40		
41-50		
51- 60		
60 and above		

(7) Primary occupation of household head

(i) Farming

(ii) Teaching

(iii) Trading

(iv) Civil service

(v) Artisanship

(vi) Others, kindly specify ……

(8) Number of income earners in the household (i.e income earning household members)

…….....

(9) Total household income per month(i.e income of all household members)

…… (₦/Month)

(C) Household food expenditure

(10) Kindly provide information on the following food items purchased in the last one month.

	Food items purchased by household per month	
	Quantity or unit purchased per month	Amount paid(₦)
Rice(grain)		
Rice flour		
Beans(grain)		
Beans flour		
Maize(grain)		
Maize flour		
Yam Number of large size tubers		
Number of medium size tubers		
Number of small size tubers		
Yam flour		
Gari		

Note: Unit refers to standard of measurements (e.g Mudu, Tiya, Basket, Bag) and Kilogramme (kg)

(11) Household food budget per month(i.e expenditure on all food items purchased in the last

one month) …… (₦/Month)

(D) Household rice consumption

(12) Frequency of rice consumption per month (i.e number of times rice was consumed in the last one month) ……..

(13) Do you prefer rice to other food items

(i) Yes ( ) (ii) No ( )

(14) Do you prefer local rice to foreign rice

(i) Yes ( ) (ii) No ( )

(15) Reason(s) for your rice consumption preference as indicated in (14) above.

(i) Price (a) Yes ( ) (b) No ( )

(ii) Nutritional quality (a) Yes ( ) (b) No ( )

(iii) Taste (a) Yes ( ) (b) No ( )

(iv) Ease of preparation (a) Yes ( ) (b) No ( )

(v) Grain shape (a) Yes ( ) (b) No ( )

(vi) Cleanliness (a) Yes ( ) (b) No ( )

(vii) Swelling capacity (a) Yes ( ) (b) No ( )

(vi) Others, kindly specify

a).....

b).....

c).....

(16) Kindly Provide Information on Your Household Non-Food Consumption Expenditure.

Item	Amount spent(₦/Month)
House rent	
Electricity/water bills	
School expenses(school fees, textbooks, writing materials e.t.c)	
Medical expenses	
Clothing expenses	
Communication expenses(G.S.M calls, recharge cards e.t.c)	

Transportation expenses	
Social expenses(wedding, naming ceremony e.t.c)	
Religion(offerings, contributions e.t.c)	
Remittances(monthly allowance to parents, relations or friends e.t.c)	
Monthly subscriptions(internet, D.S.T.V e.t.c)	
Others……..	