SPATIAL DIFFERENCES IN FOOD CONSUMPTION BEHAVIOR IN UGANDA

by

GILBERT JOSHUA WEREMA

(Under the Direction of Jack E. Houston)

ABSTRACT

The purpose of this study was to analyze food demand patterns of Ugandan households and conduct econometrics analysis of food demand structure utilizing eleven different variables, namely: income levels, price, regional dummy, urbanization status of the household, production of food by household, border-effect as well as socio-demographic characteristics such as size of household, education status of head of household, sex of head of household, age of head of household.

The main objective was to conduct an econometric analysis of the structure of food demand in Uganda, examine the effect of borders and urbanization and their impact in determining household food demand, and to test the hypothesis as to whether consumers in poorer countries resort to greater substitution within food groups (i.e. cereals). The Working (1943) model was used to estimate aggregate expenditures and price elasticities for aggregate demand food and non-food commodities while the Linear Approximation of Almost Ideal Demand System (LA/AIDS), was tested econometrically for the five food sub-categories and 13 food commodities. To accomplish this, the 1996/1997 Uganda National Household Budget

Survey (UNHS) data from the Uganda Bureau of Statistics (UBOS) are used. In this study the Heckman's two-step model was used to correct for zero consumption.

The main conclusions were as follows. First, for low income households, price changes results in great consumer substitution within a particular food groups such as the starchy food group. Second, households that are located in border areas consume of matooke, sugar, oils, fruits and vegetables, dairy products, alcohol and pulses than the interior districts do. Households dwelling in urban settings differ from their rural counterparts only in the consumption of fruits and vegetables.. Third, the presence of young members in a Ugandan household had a positive effect in the demand for dairy products, meat, matooke, fats and oil, and fruits and vegetables. The presence of older household members has a positive effect in the demand for matooke and fats and oils and also that consumption of maize, cereal, rice, and beverage. Finally, food purchases for food producing households are more sensitive to price and income changes especially for matooke purchases.

INDEX WORDS: Food demand, Demand elasticities, Border effects,
Censored equations

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DEDICATION

Kwa wazazi wangu wapendwa Joshua Werema na Esther Bhoke Werema kwa kutusisitizia umuhimu wa elimu. Mlinihimiza mimi, kaka na dada zangu kuithamini elimu na kusoma hadi kiwango kilichowiana na uwezo wetu. Zenu zilikuwa sio hamasa za maneno tu, bali mlifuatilia kwa vitendo, kwa kujima, ili kuhakikisha tunatimiza malengo tuliokuwa tumejiwekea kielimu.

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Kwa wanangu Maissa na Babila kwa kutokuwa nanyi wakati. Mlipouliza, baba unakwenda wapi? Niliwajibu nakwenda Maktabani. Kwa sababu ya umri wenu mdogo, hamkuelewa niliziona nyuso zenu ndogo zikitafari na kuuliza, kulikoni Maktabani? Ni matarajio yangu kwamba manvyozidi kukuwa, na uwelewo wenu kuzidi kuimarika, mtaelewa nilichokuwa ninakisaka na kwamba juhudi zangu zitakuwa kichocheo kwenu kuithamini elimu.

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TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

Page

CHAPTER I

INTRODUCTION

Since 1985 Uganda has been going through a period of transition; a transition from the era of dictatorship under Idi Amin and the subsequent failed governments to the present government of the National Resistance Movement (NRM) led by President Yoweri Museveni. During this period, Uganda has experienced relative political calm and has also recorded high economic growth rates. According to the United Nations Statistics Division the economy of Uganda grew at the average rate of 6.2% between the year 1987 and 2003. These positive developments have in turn impacted consumption patterns of Uganda. Economists have identified income and prices as the main determinants for consumption patterns. Other determinants that have been identified include household demographics, changes in lifestyles, regional factors, urbanization, home-production and other events. In this study, in addition to the said variables, border-effect will be examined as a possible determinant for consumption patterns. Understanding these factors is very important for food demand analysis in Uganda.

In the early years of the NRM government, price levels were constantly rising but after the government instituted reforms, they have been steadily declining. For example, inflation stood at 240% in 1987 and slowed down to 42% in June 1992, 5.4% for fiscal year 1995-96, and 5.1% in 2003. While price has been on a steady decline, incomes have been increasing.

For example, average household incomes increased from USh 98,000 in 1997 to Ush 41, 000 in the year 2000[1]. This increase in incomes has helped to lower the poverty rates in Uganda. For example, the lowest income group, that is the group earning USh 50,000 and less, decreased from 46% to 28% in the same period. On the other hand, the highest income group, that is the group earning Ush 200,000 and more, increased by 6%. The rising incomes have played a role in the declining average monthly share of expenditures on food. The average monthly share of food expenditures declined from 56% in 1997 to 51% in 2000. This reflects fewer budgetary restrictions by households. The income and expenditure patterns also reveal that when different regions of the country are scrutinized the monthly share of food expenditures range from 35% in Kampala to 49%, 55%, 59%, and 55% in the Central, Eastern, Northern, and Western regions, respectively. This means that consumption and expenditure patterns differ by regions. The increasing incomes, however, have not reduced the income inequality gap between the higher and the lower income groups. As an example, in terms of expenditures, the poorest 20% households shared about 5% of the total expenditures compared to the richest 10% households who shared 40% of the total expenditures.

In addition to income, price, and its diverse regions, Uganda is characterized by rapid population growth. The population of Uganda, like any other developing nation, has been growing at a very fast pace. According to the census, between 1969 and 1980 the population grew at the rate of 2.7% before the growth declined slightly to 2.5% between 1980 and 1991. By the year 2002 the population was growing at the rate of 3.3%. In 2002 the Uganda had 24.4 million inhabitants having grown from 16.7 million in 1991. As

[1] These incomes are in nominal terms. USh is the abbreviation for the Ugandan currency, the Uganda shilling. According to the Bank of Uganda, as of the January 2007 the exchange rate was 1647.69 Ushs to 1 USD.

seen above, income growth has been occurring albeit from a very low income base. The growing population coupled with growing incomes likely will increase food demand substantially. The population of Uganda has not only been growing rapidly, but it also has been exhibiting another developing nation phenomena—rapidly becoming urbanized. According to the 2002 UNHABITAT, urbanization in Uganda is currently estimated to be 12% but is projected to reach 25% by 2025. This shift to urban areas will likely be accompanied by a shift in consumption patterns. Savadogo and Brandt (1988) showed that urbanization has a gradual impact on changing consumption habits.

Another characteristic of Uganda's consumption patterns is that home produced food products play a very important role in supplementing the nutritional intake of many households. For example, about half of food consumption expenditures in the rural areas comes from home produced food. Home food production takes place not only in rural areas but also in urban areas, where 10% of food consumption expenditures are derived from home produced food. To show how prevalent this practice is in Uganda, 33% of all households within a five-kilometer radius of Kampala city center engage in some agricultural activity (Maxwell & Levin, 1998). Streifler (2000) showed that there is a positive relationship between food production and nutritional intake. Weber and Weber (1975) attributed low calories per capita to low agricultural productivity.

Uganda's consumption and expenditure pattern will likely be affected by the events that are taking place in East Africa. In January 2001 Kenya, Uganda, and Tanzania formed a trading bloc called the East African Community (EAC). One of the aims of this new trade bloc is to promote free trade within the region. When trade is liberalized, the impact is usually first felt in a country's border markets. The most important impact is

usually on the distribution of commodity price. The open borders prices are determined by the international markets rather than by domestic supply and demand. As a country enters an integrated market, studies show that prices tend to shift down, especially for staple grains (Huang, Rozelle and Chang 2003). In the case of Uganda, the downward shift in prices at the border will likely affect consumption patterns between border districts and inland districts.

The purpose of this study was, therefore, to analyze food demand patterns of Ugandan households and conduct econometric analyses of food demand structure utilizing 11 different variables, namely: income levels, price, region, urbanization status of the household, production of food by household, and border effect as well as the socio-demographic characteristics size of household, education status of head of household, sex of head of household, and age of head of household.

Objectives

This study examines one primary objective and three secondary objectives. The main objective is to outline the food consumption patterns in Uganda and conduct an econometric analysis of the structure of food demand. The first two secondary objectives are to examine the effect of borders and their impact on determining household food demand and also to examine the effect of the urban/rural setting of the household and its impact on consumption patterns. The third secondary objective will be to test the hypothesis as to whether consumers in poorer countries resort to greater substitution within food groups (i.e. cereals). This research is expected to complement previous studies on food consumption behavior. A study of this nature is important because it

offers improved information to producers, wholesalers, retailers, and policy makers about food consumption patterns in Ugandan households. It will assist these stakeholders to anticipate such demand shifts and hence incorporate them in food demand projections. Since improving food and nutritional security is a major objective of the government of Uganda[2], this study will also assist policy planners to identify policies that ensure proper and adequate nutritional intake throughout Uganda and also in designing food subsidy programs that can be pursued by the government.

Methodology

To achieve these objectives, two specific food demand studies will be carried out to analyze food demand in Uganda. The first study involved analyzing aggregate demand for food and non-food commodities. The second study conducts a demand analysis for 14 food commodities. The Working (1943) model is used to estimate aggregate expenditures and price elasticities in the first study. This model is used because it has the advantage of assuming linear relationships between the budget share of each good and the logarithm of the total expenditure. The Linear Approximation of Almost Ideal Demand System (LA/AIDS), which is a quite flexible framework for estimating consumption structures, is tested econometrically for 14 food commodities in the second study. For an explanation of these consumption patterns, 11 different variables were used: income levels, price, size of household, education status of head of household, sex of head of household, age of

2 Uganda has the Plan for the Modernization of Agriculture (PMA), which is a cross-sectoral. Uganda also has a Food and Nutrition Policy that is implemented under the auspices of PMA, Tumusiime (2003). The overall goal of the Food and Nutrition Policy is "to ensure food security for and adequate nutrition of all the people of Uganda for their health as well as their social and economic wellbeing" NFNC (2002).

head of household, region, urban status of the household, production of food by household, and border effect.

To accomplish this, the 1996/1997 Uganda National Household Budget Survey (UNHS) data from the Uganda Bureau of Statistics (UBOS) are used. This study is unique as it is based on household level data. Therefore, these data were used to shed light as to whether consumers in poorer countries resort to greater substitution within food groups (i.e., cereals). Also, the large number of households in the household UNHS survey provided more degrees of freedom, which is important in estimating elasticity of important staple foods such as Maize and Matooke.

However, a problem arises when dealing with micro data from surveys and when some households report zero consumption during the survey. Survey data are usually insufficient to determine whether a zero value represents a household that never consumed an item, does not consume the item given the household's income, or consumes the item infrequently (Madalla, 1983). If zero observations are included, the corner solution interpretation is assumed. If the non-zero expenditure observations are used, then selectivity bias is introduced (Madalla, 1983). Failure to take into account the fact that the dependent variable is truncated and the sample is censored gives rise to biased estimators. In this study the Heckman's two-step model was used to correct zero consumption.

Contribution to the Literature

The main contribution to the literature will be to test the hypothesis that as a country enters an integrated market, prices, especially for staple grains, tend to shift down

(Huang, Rozelle and Chang 2003). In the case of Uganda the downward shift in prices at the borders will likely affect consumption patterns between border districts and inland districts. The second contribution to the literature will be to test the hypothesis as to whether poorer consumers resort to greater substitution within food groups (i.e., cereals) as income shifts. Regmi et al. (2001), in a cross-country analysis of food consumption patterns using highly aggregated data, found that adjustment to price and income change are not made uniformly across all food categories. They found that staple food consumption changes the least, while changes are greater for higher value foods, such as dairy and meat. They found that price changes in staple foods lead to similar responses in low- and middle-income countries. Their conclusion was that consumers in poorer countries might resort to greater substitutions within a food category.

Organization of the Dissertation

This dissertation is composed of six chapters. The first chapter discusses the introduction, the purpose of the study, the objectives, the methodology, and the overall organization of the study. The second chapter contains three sections. The first section presents a brief background about Uganda that covers the geography, including the topography, the climatic variations, the rainfall distribution, the crop zones, the population distributions and trends. This section also looks at the brief history of Uganda, the economy, a brief review of the agricultural development in Uganda, and trends in food consumption in Uganda. The second section reviews previous food demand studies, both cross-sectional and time series, that have been conducted in Africa. The third section discusses the neoclassical demand theory which underlies this food demand study.

This research focuses on demand analysis and therefore the first part of chapter three will sketch the concepts of the neoclassical consumer demand theory. The second part develops a specified model for food demand while the third part will discuss the estimation method employed. The fourth presents the data and survey used in the study. In addition basic descriptive sample statistics are presented. The fifth chapter presents the results and discussions. Chapter 6 includes a summary; conclusions are presented in part one, while part two discusses the shortcomings of the research.

CHAPTER 2

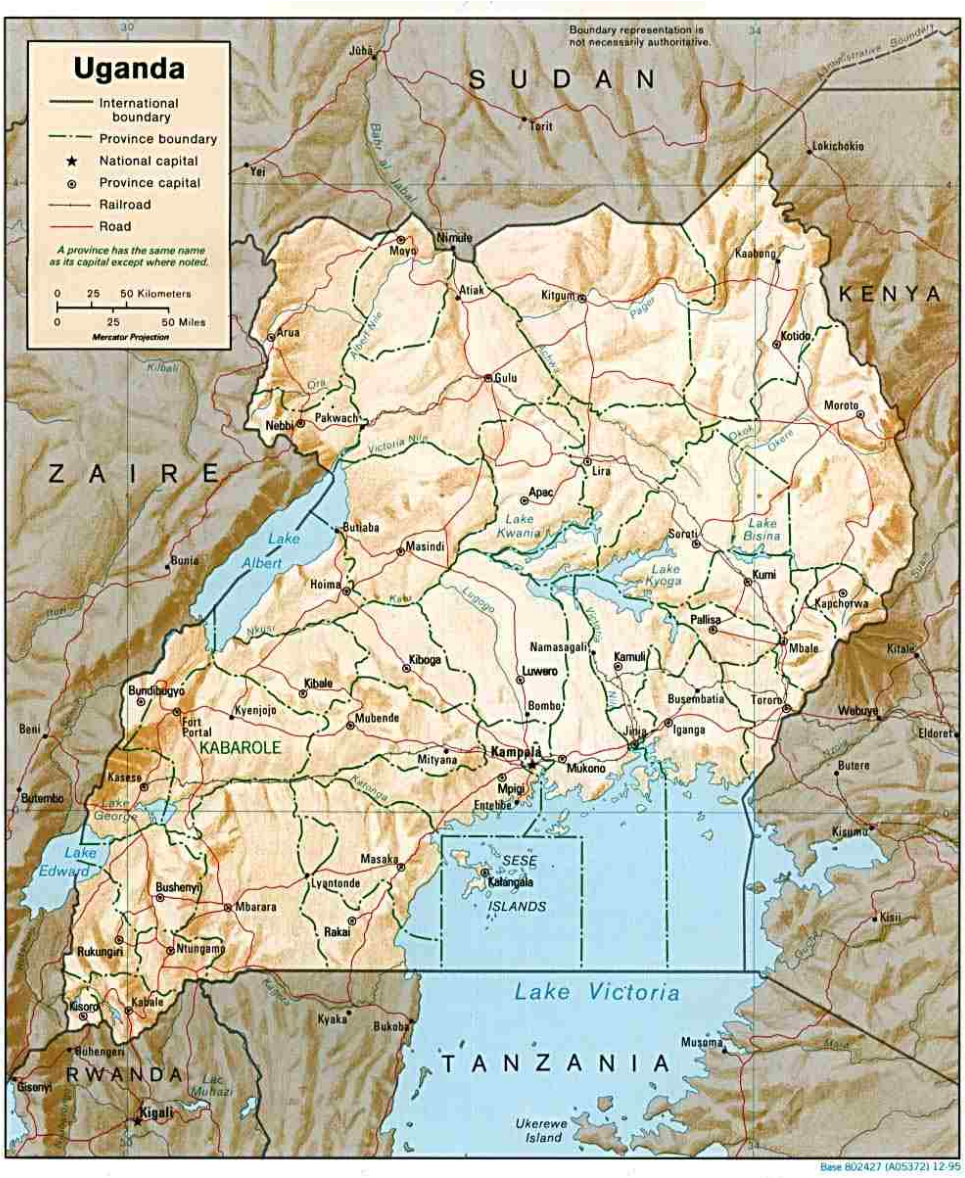
LITERATURE REVIEW

Chapter 2 contains three sections. The first section presents a brief background about Uganda that covers the geography, including the topography and the climatic variations, rainfall distribution, crop zones, and population distributions and trends. This section also, for contextual purposes, discusses a brief history of Uganda, its economy, a brief review of agricultural development in Uganda, and trends in food consumption in Uganda. The second section reviews previous food demand studies, both cross-sectional and time series, that have been conducted in Africa. The third section discusses the neoclassical demand theory that underlies this food demand study.

Uganda: A Brief Background

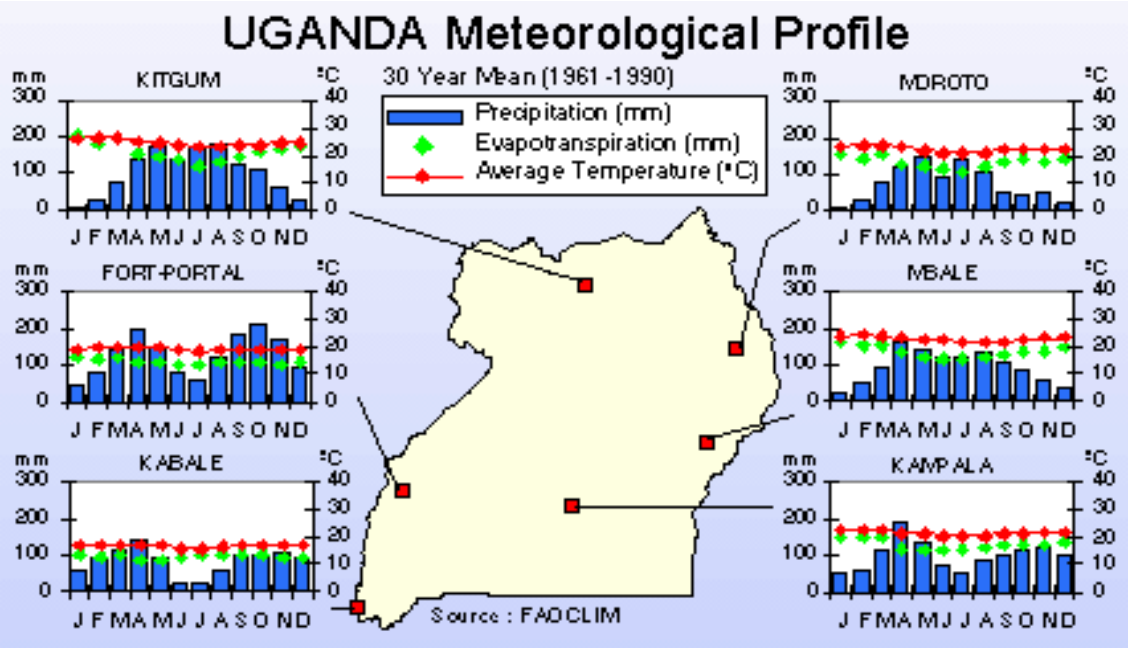
Geographically, Uganda borders Sudan to the North, the Democratic Republic of Congo to the west, Rwanda and Tanzania to the south, and Kenya to the east. It lies astride the equator, between 4^{o} latitude north and 1^{o} latitude south, and between 30^{o} longitude east and 35^{o} longitude to the east of the Greenwich meridian line. Uganda is slightly smaller than Oregon and covers an area of 242,554 square kilometers. Topographically, Uganda can be classified as a plateau, with extensive savannah plains. The country is cradled by Mount Elgon and Mount Moroto in the northeast, and, to the southwest, the Rwenzori Ranges rise to an altitude over 5000m. The lowest point in Uganda is Lake Albert, at 621 meters above sea level, and the highest point is Margherita Peak on Mount Stanley, at 5,110 meters above sea level.

Figure 2.1: Map of Uganda



Uganda is a well-watered country with close to 17% or 51,000 square kilometers of its area covered by swamp or open water. Much of the country lies between the so-called ‘greats lakes of Africa’. The country receives abundant rainfall, which mainly occurs between March to May and October to November. Figure 2.2 shows the rainfall distribution.

Figure 2.2: UGANDA: Meteorological Profile



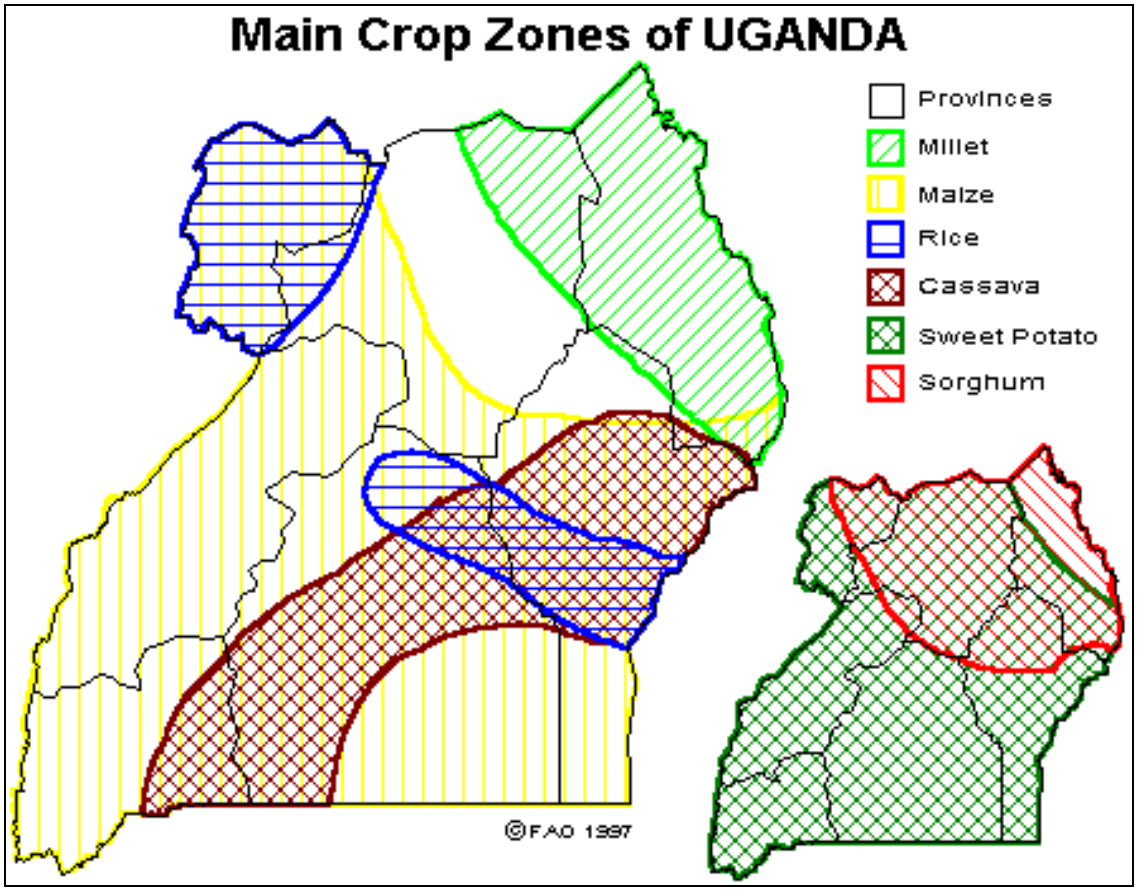
Source: FAO/CLIM

The rainfall pattern and soil characteristics have led to differing land uses in Uganda. Some 25% of the land is considered arable. However, although 25% of the land is arable, only 9% of the total land is covered with permanent crops. Permanent pastures cover another 9% of the land, while forests and woodland cover 28%. Other vegetation covers 29% of the total land area.

The rainfall patterns and soil characteristics in the arable land have led to different farming or agricultural production systems in Uganda. The World Bank (1993A, page 13) identified four farming systems/areas, namely Lake Victoria high rainfall system, eastern Uganda system, northern region system, and the northeastern Uganda system. In the Lake Victoria system that is characterized by high rainfall, bananas and Robusta coffee are grown. The second farming system has two rainy seasons and is suitable for growing millet, cassava and cotton. The third system, in the northern region, is characterized by

one season and the climatic conditions allow for growing cotton, maize and millet. The northeastern Uganda system of agriculture is characterized by low rainfall, around 80 mm per annum, and it is therefore suitable for drought-resistant crops, such as sorghum and millet. These farming systems are illustrated in Figure 2.3, which shows the main cropping zones of Uganda.

Figure 2.3: UGANDA: Crop Zones



Source: FAO

Central Region

The districts in this region are Kampala, Masaka, Luwero, Mpigi, Sese, Rakai, Mukono, Mubende and Kiboga. The region produces large quantities of banana, peas, groundnuts, potatoes, cassava, beans, maize, sorghum, and oil seeds. Banana production is an important activity in the Masaka district, while maize is mainly grown in Luwero District. Livestock numbers are high in the region, especially in the districts of Luwero, Mukono, Masaka, Mpigi and Rakai. Owing to these large numbers of livestock, the region produces large quantities of meat, milk, chicken and eggs. Despite the amount of food produced in this region, the region is not self-sufficient in food production. This is partly because Kampala, the capital city and the largest city in Uganda, is included in this region. Another reason for this food insufficiency is that farmers in this region grow cash crops, such as vegetables and coffee, and this reduces staple food production in some rural districts, such as Luwero.

Eastern Region

The Eastern Region is one of the most densely populated regions of Uganda. This region borders Kenya and is comprised of the districts of Jinja, Mbale, Iganga, Kamuli, Tororo, Kapchorwa, Kumi, Pallisa and Soroti. Most farmers here grow millet, cassava, maize, beans, bananas, and soy beans. The most productive districts are Iganga, Jinja, Tororo, and Mbale. According to WFP/FAO, the districts of Kumi, Soroti and Kamuli have marginal rains and fairly poor soils. These districts, therefore, produce drought resistant cereals and cassava.

The region receives an annual average rainfall varying from 800mm to 1 200mm and has a bi-modal rainfall pattern. This bi-modal rainfall pattern allows two crops to be grown each year. The favorable climatic conditions and the region's fertile soils mean that the Eastern region should be food secure and produce surplus food production. According to FAO/WFP, this potential is, however, highly under-utilized due to low levels of agricultural mechanization and poor agricultural technology.

Northern Region

The Northern Region is comprised of nine districts: Kotido and Moroto in the East, Kitgum, Apac, Lira, and Gulu in the center, and Moyo, Arua and Nebbi in the West. The crop patterns vary considerably within the Northern Region, with the mainly pastoralist Karamojong growing one major food crop, sorghum. Millet and sorghum are grown in Kitgum as food crops, and simsim[3] is grown as a cash crop.

The Northern Region has been plagued by insecurity and conflict, as rebels belonging to the Lords Resistance Army (LRA) continue to fight government forces. This insecurity and conflict in Kitgum, Gulu, Moyo and Arua have caused massive displacement of populations in these districts in the period since June, 1996, and this has led to a decline in crop production. In Kitgum, for example, the largest district in the country at 16 136 sq. km., a substantial displacement of people has occurred as a result of insecurity. According to FEWS NET Uganda, Lamwo County, the most fertile county in Kitgum District and the one most affected by insecurity, has suffered a serious drop in food production.

[3] Sesame seeds are called alizeti or simsim in Swahili

Western Region

The Western Region is comprised of the districts of Masindi, Bundibuio, Hoima, Kibaale, Kabarole, Kibaale, Kasese, Mbarara, Bushenyi, Ntungamo, Rukungiri, Kabale, and Kisoro. This region has a large livestock population, found mainly in the districts of Mbarara, Bushenyi and Ntungamo. Maize and beans are the major crops grown in the Kasese District. Cassava is mainly grown in the Masindi District.

This region has also been affected intermittently by insecurity caused by rebel elements in the Mount Rwenzori areas and other areas bordering the Democratic Republic of Congo (DRC). This insurgency activity has at times resulted in the displacement of large numbers of people. Uprooting of crops by insurgents, rustling of livestock and the general fear of being attacked have prevented farmers from preparing land as they would normally do. This has led to shortfalls in food crop production (FAO/WFP).

The Population

According to 1999 estimates, the population of Uganda was approximately 23 million people. The age structure is such that out of a population of 23 million, 14- year-old and under children constitute 51% of the population. Those aged between 15 and 64 account for 47% of the population, while those 65 years and over account for the remaining 2%. This population has been growing at the rate of 2.83% and has an average life expectancy of 43 years. The fertility rate reflects that 7.03 children are born to a Ugandan woman, on average.

When the population is divided into ethnic groups, the Baganda constitute 17% of the population, the Karamojong 12%, the Basogo 8%, the Iteso 8%, the Langi 6%, the Rwanda 6%, the Bagisu 5%, the Acholi 4%, the Lugbara 4%, the Bunyoro 3%, the Batobo 3%, the non-African (European, Asian, Arab) 1%, and other 23%. The geographical distribution of the population in (Table 2.1) shows that the four regions of the country have an almost uniform distribution of population. Figure 2.4, however, shows that population density is unevenly distributed in the various districts of Uganda. The majority of the population, 88% according to the 2002 census, lives in the rural areas.

The proportion of urban dwellers has increased from 6.6% in 1969 to 12% in 2002. The urban population is concentrated in a few areas. Kampala, with a population of 1.2 million people, is the main urban center in Uganda. However, the proportion of urban dwellers living in Kampala has declined from 56% in 1969 to 41% in 2002. The other important urban centers in Uganda are Gulu, with a population 113,000, Lira, about 90,000 people, and Jinja, 87,000 people. Amongst Uganda's 20 largest urban areas, Mukono showed the highest growth rate (15.9%) between 1991 and 2002, while Soroti showed the lowest growth rate.[4]

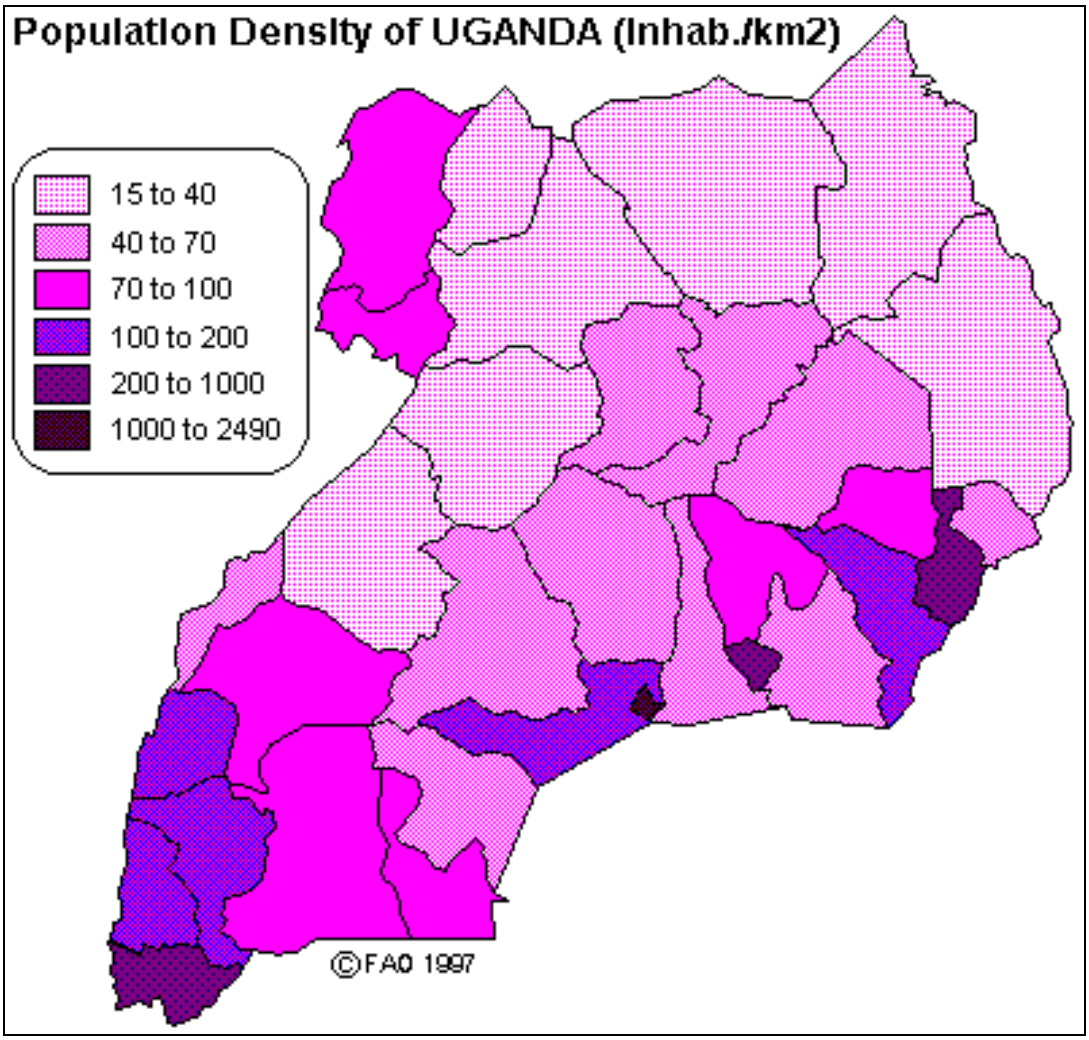
[4] The high growth rates in some urban areas, namely Kitgum (10.3%), Lira (10.1%), Gulu (9.3%), and Kasese (9.0%), are partly attributed to insecurity in the surrounding areas, which forced the population to move to urban centers that are relatively more secure.

Table 2.1: Population Per Region in Uganda

Table of population per region		
Region	**1991**	**2002**
Central	4,843,594	6,683,887
Eastern	4,128,469	6,301,677
Northern	3,151,955	5,345,964
Western	4,547,687	6,417,449
Total	**16,671,705**	**24,748,000**

Source: UBOS

Figure 2.4: Population Density of Uganda



Source: FAO / World Bank

A Brief History

In pre-colonial Uganda, several ethnic groups, such as the Banyoro, Baganda, Batoro, and the Banyankole, had their own Kingdoms that were ruled by the Bakama (Kings). When Uganda became a British Protectorate in 1894, the British administrators used these kings to assist them in administering the protectorate. Although this governance structure was annulled by Sir Andrew Cohen, Governor of Uganda between 1952 and 1956, some of these kings, most noticeably the Kabaka (king) of Buganda, had acquired so much power that they would have far-reaching consequences for the future cohesiveness of Uganda.

In 1953, Kabaka Mutesa II refused to have anything to do with the East African Federation and was consequently deported to England. At the same time, Ugandans were beginning to agitate for independence and political parties were forming. These events split the Bagandas along religious lines. The UNC party was predominantly Protestant, while the Democratic Party was Catholic-leaning. The third, traditionalist, party – the Kabaka Yekka (KY) -- was loyal to the Kabaka. With the powerful Banganda divided and in disarray, Uganda gained its independence on October 9th, 1962, with Apollo Milton Obote of the Uganda Peoples Union (UPC) as the first Prime Minister of Uganda.

Mr Obote, a non-muganda[5], but married to a muganda, had the support of Baganda. Obote's own political vision was to create a United Republic, the so-called "One Nation, One People, One Parliament." In creating a united republic, he abolished all kingdoms and this led to a huge population of Uganda being disenfranchised. The powerful Kabaka, Edward Mutesa II, fell out of favor with Obote and was exiled in

[5] Muganda is person of Baganda ethinicity.

England. This constitutional crisis lasted for about 10 years, before Milton Obote was ousted while attending a commonwealth summit in Malaysia in a military coupe led by General Idi Amin, who started to implement its own policies. Amin began to systematically massacre the members of Obote's Acholi and Langi tribesmen. Amin then expelled Ugandans of Asian origin that, at the time, controlled much of the country's wealth. This action and the action of trying to take revenge on the British ran the Ugandan economy aground.

Idi Amin was also fond of making territorial claims on neighboring countries. In 1978, he acted on his threat by invading the Kagera region of northwest Tanzania and occupied the area of Mutukula, which he promptly declared to be part of Uganda. His calculus was to try to boost the morale of his military and the people of Uganda. His experiment failed, as the Tanzanians, with the support of many exiled Ugandans, retaliated and swiftly advanced to Kampala. Kampala fell in April, 1979, when the Tanzania People Defense Forces and the Ugandan exiled fighters arrived there under the banner of the Uganda National Liberation Army (UNLA).

Idi Amin and his henchmen fled the country, leaving a leadership vacuum. The following years were characterized by successive governments that were short lived. First, it was Yusuf Lule, then Godfrey Binaisa, Paul Muwanga, and Milton Obote. Obote was removed from power by Major General Tito Okello. On 29th January, 1986, Yoweri Kaguta Museveni became president of Uganda and is still in power. Museveni established the rule of law, brought security back to the country, and started liberalizing the economy.

The Economy

The economic reforms that began in 1986 have begun to bear fruit. For example, in 1998 Uganda's Gross Domestic Product (GDP) in purchasing power parity (PPP) was $23 billion, and this increased to $32 billion in PPP by 2002**.** Inflation, which stood at 240% annually in 1987, was reduced to 5.1% in 2003. The GDP grew at an average rate of 5.5% between 1990 and 1998. As a result of this growth, average household incomes increased from USh 98,000 in 1997 to USh 141,000 in the year 2000. Uganda's labor force was estimated to be 8.4 million in 1993. Agriculture is the dominant sector of the economy; it employs over 80% of the work force and contributes to about 50% of the GDP. The main export of Uganda is coffee. Manufacturing employs 4% of the workforce, and the service sector employs 10%. The manufacturing industries, mainly light industries, process sugar, brewing, tobacco, cotton textiles, and cement. Between the years 2001/02, this sector grew at the rate of 7.4% contributing to 10% of the total GDP according to the African Development Bank (AfDB).

Trends in Food Consumption in Uganda

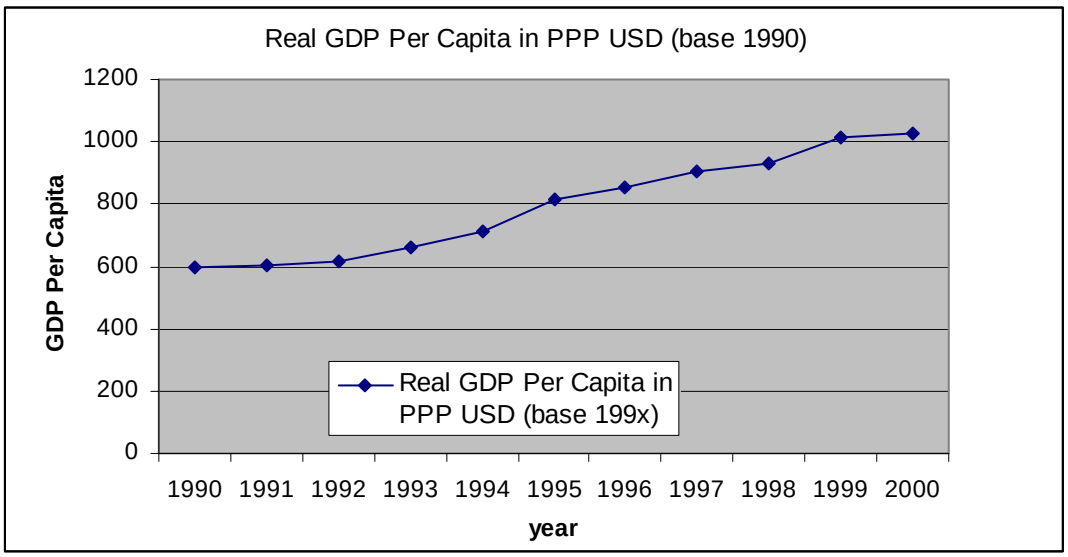
Income

Economic theory suggests that variations in real consumer income and in prices of complementary or substitute goods are widely accepted to be important determinants of food consumption differences. However, there are few other goods that can be considered substitutes for staple foods. In view of this fact, in the long run, real consumer income is considered the main determinant of long-run changes in per capita food consumption variation. In general, there is a positive correlation between income and consumption

such that countries that exhibit higher incomes also have higher consumption levels and vice versa. However, while this phenomenon may be observed, a minimum level of food must be obtained. This means that, at lower income levels, food consumption levels are very high; but, as income rises, food consumption increases at a lower rate. This increase in food consumption continues until it reaches a certain threshold, which cannot be surpassed due to physical limitations.

In the case of Uganda, GDP per capita uses PPP dollars as the measure of income. As the figures from FAO indicate, Uganda is characterized by low incomes. Since 1991, Uganda's per capita income has risen steadily from $596 in 1991 to $1017 in 1999 (see Figure 2.5).

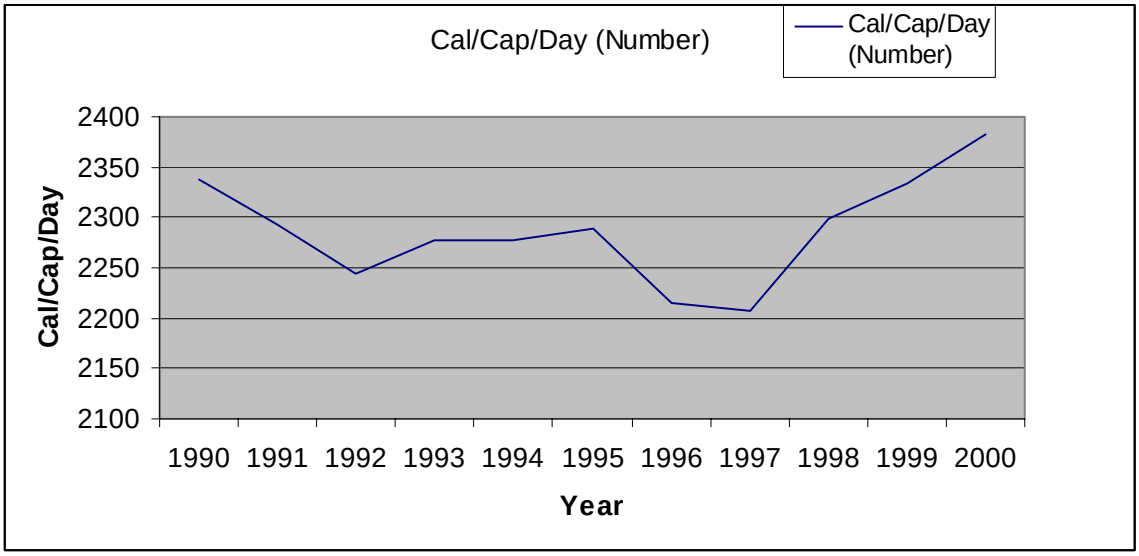
Figure 2.5. Real GDP Per Capita PPP (1990-2000)



Source of data: FAOSTAT (2003)

Calories per capita per day

Figure 2.6. Calories Per Capita (1990-2000)



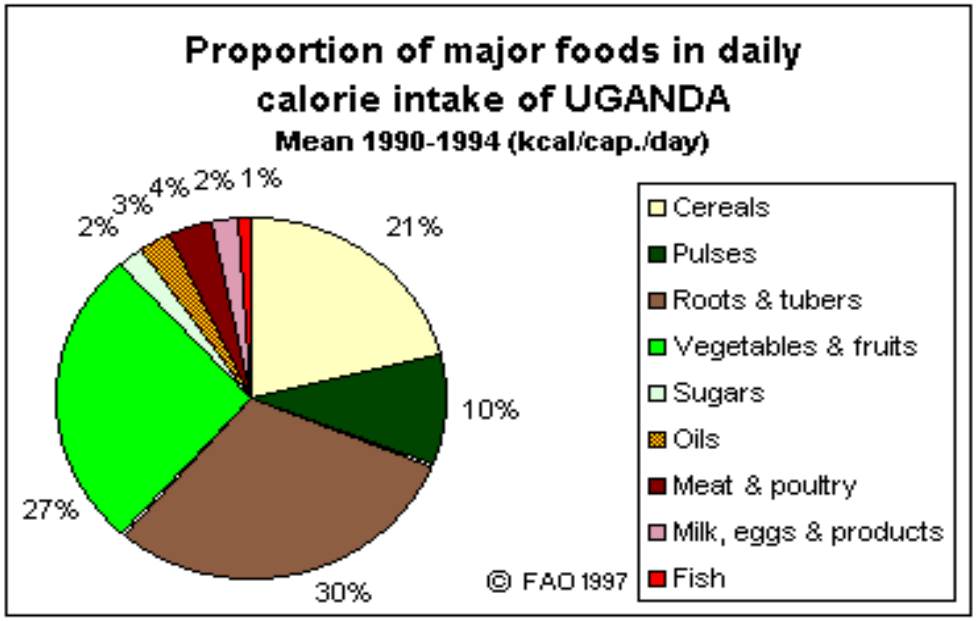
Source of data: FAOSTAT (2003)

As Figure 2.6 shows, caloric intake in Uganda declined between 1990 and 1997 but has been increasing ever since. In 1990 the per capita calorie intake stood at 2337 and fell to 2208 in 1997, before resuming an upward trend and reaching the mark of 2382 calories per person per day in the year 2000. The World Health Organization (WHO) caloric intake requirements for an adult male are 3000 kcal and 2100 kcal for an adult female. In Uganda, the daily caloric intake for the female adult has almost been achieved. The caloric intake for the male adult, however, is far from being achieved. Ugandan figures are low compared to developed countries, such as Sweden at 3030 and Belgium at 3901 calories per capita in the year 1986-1988. Weber and Weber (1975) attributed the low calories per capita to low agricultural productivity.

Starchy Staples in Uganda

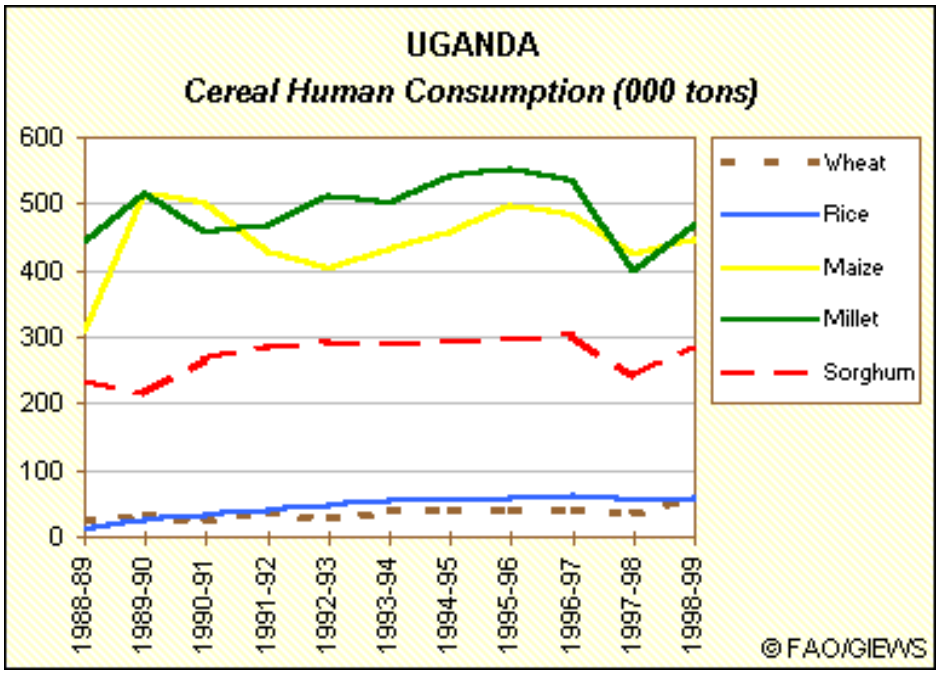
In many poor countries, cereals and roots provide two-thirds or more of the total calorie intake. Uganda, being a poor country, is no exception and exhibits this trend. According to Figure 2.7, which shows the share of food consumption between 1990 and 1994, 51% of the calorie intake in Uganda came from cereals and roots. Figure 2.8 confirms this high share of consumption of cereals by showing the highest consumed cereals in Uganda being millet, maize, sorghum, and rice, respectively. Teuteberg (1975) showed that, as incomes rose in Western Europe at the turn of this century, the proportions of calories from cereal and roots declined. This is a trend we are expecting to see in the case of Uganda.

Figure 2.7: UGANDA: Share of Food Consumption



Source: FAO/GIEWS

Figure 2.8: UGANDA: Evolution of Food Consumption

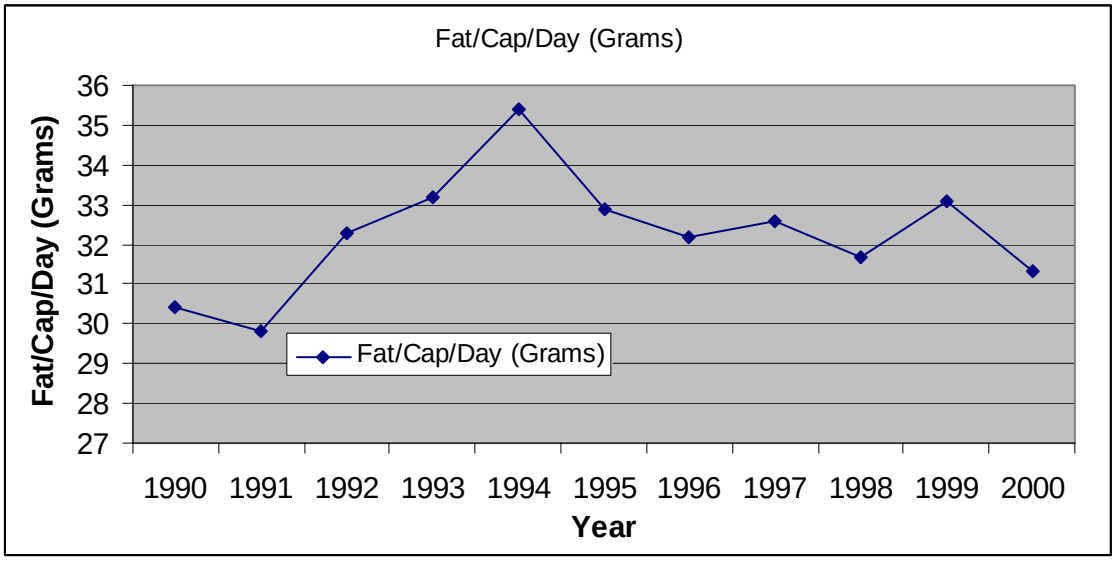


Source: FAO/GIEWS

Vegetable Oils and Animal Fats.

From the year 1990 to 2000, Ugandans consumed an average of 32.42 grams of fat per person per day. As illustrated by Figure 2.9, fat intake went from a low of 29.8 grams a day in 1991 to a high of 35.4 grams per day in 1994, and decreased to about 32 grams per person in subsequent years. Although the trend appears flat, it nevertheless is growing overall.

Figure 2.9: Per Capita Fat Intake (1990-2000)

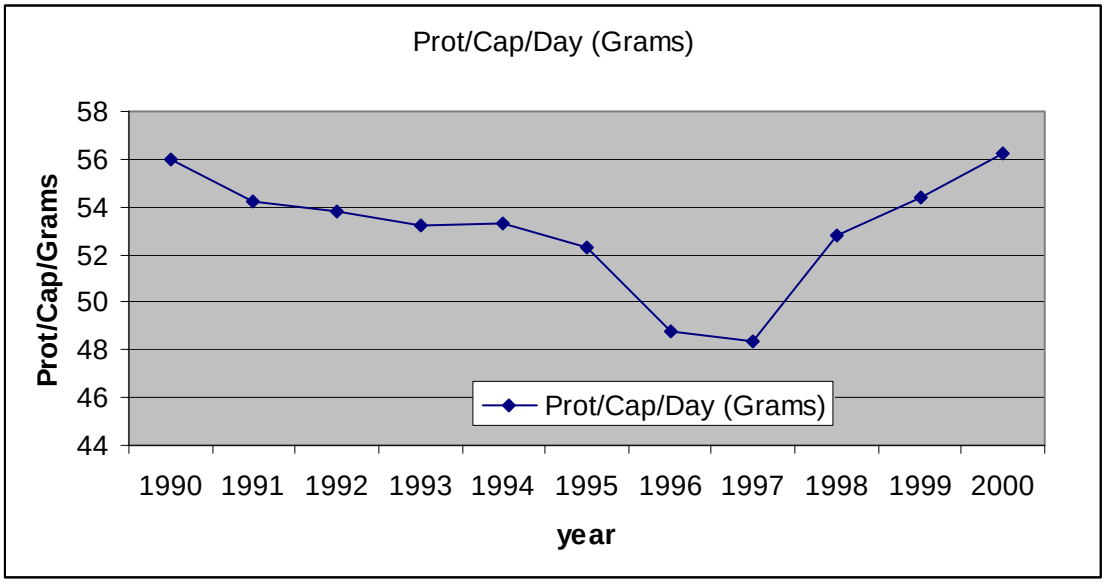


Source of data: FAOSTAT (2003)

Proteins

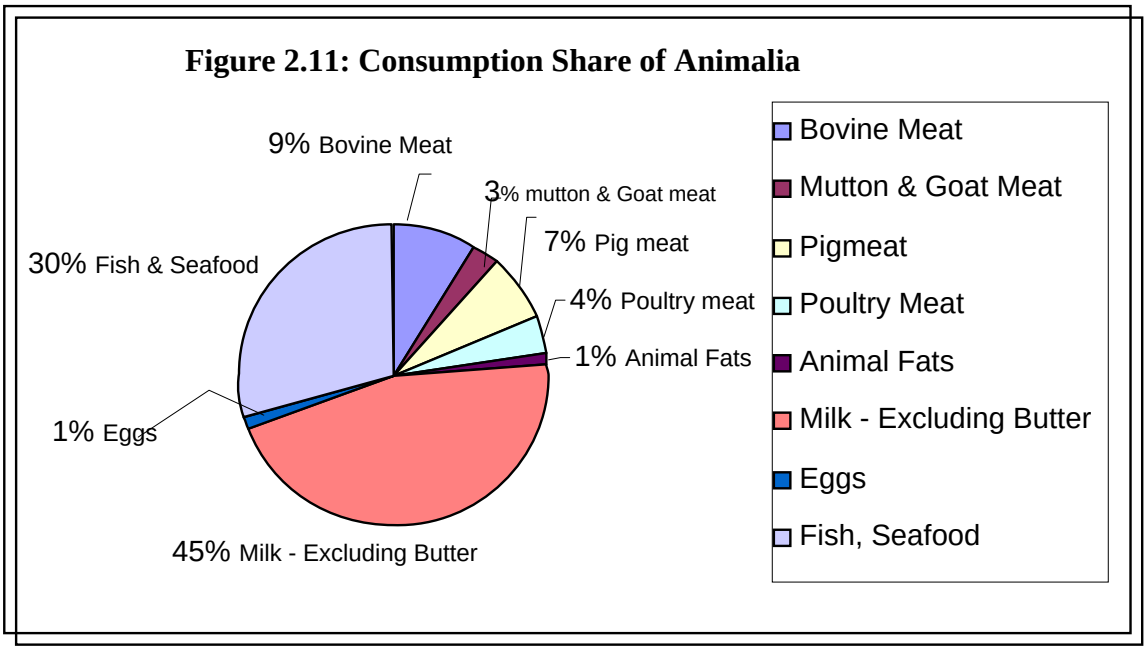
Demand theory suggests that as income in a country increases, it leads to a decrease in consumption of starchy staples and an increase in the intake of higher protein foods. According to FAO data, as illustrated in Figure 2.10, Ugandans consumed 56 grams of proteins per capita per day in 1990. This figure dropped slightly in the following years before resurging in the year 2000, when protein consumption rose back to 56 grams of protein per person per day. The main sources of protein are milk, which accounts for 45% of total consumption, fish and seafood at 30%, and bovine meat accounting for 9% (Figure 2.11) for the year 2000.

Figure 2.10: Proteins Per Capita per Day (Grams)



Source of data: FAOSTAT (2003)

Figure 2.11: Consumption of Animalia



Source of data: FAOSTAT (2003)

Literature Review of Food Demand in Africa

While there has been a proliferation of food demand studies elsewhere in the world, there is a very limited number of studies that have involved Africa. Most of the studies in Africa have been conducted using household level data and most of them have targeted specific geographical areas of the countries in question. This means that these studies have covered specific ethnic groups and the level of dissagregation of the food categories involved has been very high. However, very few studies covered whole countries.

Some of the first studies in this area were by Okunade (1988) and also Savadogo and Brandt (1988). Okunade estimated an inverse semi-log and double-log functional form for developing countries: the case of Africa. His model specification was a single equation using expenditure-income, as the main variable and utilized the official national data on household cash expenditures. His main finding showed that demand for food was income-inelastic and that the mean income elasticity for food was 0.57.

Savadogo and Brandt utilized the 1982-1983 survey of 65 households in Ouagadougou, Burkina Faso, and specified a demography-augmented LA/AIDS model, which had Engel aggregation restrictions imposed. The main results showed that two-thirds of the cereal budget was allocated to rice and wheat. Since the model had a demography component, the results showed that income, education, household demographic composition and length of residence were important determinants of food demand. Another important result was that the elasticities of domestic cereals decreased with rising incomes, while those for imported cereal tended to increase with increasing incomes.

These earlier studies were followed by several studies, notably by Delgado and Reardon (1991) and Rogers and Lowdermilk (1991). The former study utilized national data, the West African Semi-Arid Tropics (WASAT, 1966-1986) on cereal consumption, GDP per capital, and average consumer prices and employed the LA/AIDS model that imposed symmetry and homogeneity restrictions. Some of the major findings are that demand for cereals is price-inelastic and the price elasticity for coarse grain is low as compared to price elasticity of rice. The other major finding was that changes in cereal consumption patterns are driven by non-price factors such as household income, employment, and urbanization.

The former study, which is the study of Rogers and Lowdermilk (1991), estimated double Engel curves that also employed the Heckman's two-stage model to correct for zero consumption. That study covered 756 households in and around Bamako, Mali, in 1985 to 1986. The model was also specified to capture per capita quantity purchase equation for selected foods. In that study, they found that food expenditures as a percentage of total expenditures was an average of 54%. In the same study, the percentage of food budget allocated to cereals, roots and tubers was 40% for quartile 1 (Poor) and 34% for quartile 4 (Non-Poor) and 19% and 23% respectively for livestock products. The study also found that income had a positive influence on the purchase of rice and sorghum and millet while own price had a negative influence on the purchase of these products.

Reardon et al. (1992), using 1984 to 1985 survey data conducted amongst 125 households in Ouagadougou, Burkina Faso, also utilized the demography-augmented LA/AIDS model, with Engel aggregation restrictions imposed and estimated using

ITSUR method. The results showed that rice is the main urban staple food for both low- and high-income households. For example, the average expenditure on food as a percentage of total expenditure was 54%. The percentage of expenditure allocated to cereals, roots and tubers was 52% for tercile 1 (Poor) and 35% for tercile 3 (Non-Poor), so that sorghum and millet are the second most important staples for the poor. The results also show that although wheat and its products account for small percentage in budget share, this share increases with income.

Nweke et al. (1992), in a study that covered southeastern Nigeria, estimated, using an OLS-Instrumental Variables method, elasticities of demand for major food items in a root- and tuber-based food system. The data for this study were obtained from a panel survey of 60 households, and the model specification was the Working-Lesser[6]. The results showed that yam is the most important staple food in that part of Nigeria, with an average income elasticity of 1.3 and own-price elasticities that lie between 1.4 to 1.6. Cassava was found to be the next most important staple food, especially for low-income households. The cassava product (gari) is a normal good, and its consumption increases as income increases among high-income urban households. Gari (cassava), rice, and legumes were found to be gross substitutes for yam. The results also show that for imported rice, income elasticities decline with income. On the other side, however, expenditure elasticities for wheat increase with income level. For non-staples, such as legumes, vegetables, fruits, and fish, expenditure elasticities are higher for higher expenditure groups.

Arulpragasam (1994), with data from a survey of 1725 households in Conakry, Guinea, that took place in 1990 to 1992, used a demography-augmented LA/AIDS

[6] The Working-Leser model was originally discussed by Working (1943) and later by Leser (1963).

model. The method of estimation was 3SLS and had model restrictions imposed and also corrected for zero selectivity bias. The results showed that in terms of food as a percentage of total expenditure, among the poor it was 57% and 47% for the non-poor. The results show that consumption of imported rice was widespread; the share is higher among the poor. For example, rice accounted for 22% of the food share for the poor and 13% for the non-poor. Income elasticities of imported rice were shown to be –0.531 for the non-poor. Income and own-price elasticities for imported rice were lower than those for local rice. Imported rice and local rice were found to be net substitutes. Livestock products accounted for 27% of the food budget for the poor and 31% for the non-poor.

Dorosh et al. (1994) used a demography-augmented LA/AIDS model with symmetry and homogeneity restrictions imposed to test for food aid and poverty alleviation in Mozambique. They estimated income and price elasticities using survey data collected in the year 1991-1992 from 1816 households in the greater Maputo, Mozambique. The results from this study show that expenditure on food, as a percentage of income, was 80% for the poor and 65% for the non-poor. Yellow maize, which is imported as a form of food aid, had the largest share in the food budget for the poor and has negative income elasticity. Yellow maize has a low own-price elasticity and is a net substitute for white maize. Imported rice had a similar expenditure elasticity of 1.05 for both poor and non-poor.

Jayne and Argwings-Kodhek (1997) looked at how urban maize consumption and expenditure patterns have responded to the liberalization of the maize and maize meal markets in Kenya. They decomposed changes in maize meal prices attributable to changes in maize grain prices and maize milling margins. The method used for estimation

was OLS using data that was collected from two random household surveys conducted in Nairobi. The first survey was conducted before liberalization and the second one was done after liberalization. The main finding of the study is that maize market liberalization benefited urban consumers. Secondary finding were that the quantity of whole maize meal consumed is inversely related to household income while the quantity of sifted maize meal consumed increases with income.

Agbola (2003) investigated aggregate food demand patterns in South Africa using the demography-augmented LA/AIDS model. He utilized data from 1993 integrated national household survey which covered 9000 households. His results showed that demand for meat and fish, grains, dairy products, fruits, vegetables and other foods were, in general, price elastic. The expenditure elasticities indicated that meat and fish and grains are luxury products, while dairy products, fruits, vegetables and other foods are necessities in the household diet. The results also indicate that race, age, and gender of household head, urbanization and family size affect food demand in South Africa.

Welwita et al. (2003) used demography-augmented LA/AIDS model to analyze food demand patterns in Tanzania. The Heckman's two-stage estimation method was applied to correct for the zero consumption selectivity bias. They obtained income elasticities 0.885 for edible oils, 0.846 for cereals, -1.012 for milk.

Using 1996 ICP data, which covered expenditure and price data for 115 countries, over 10 broad consumption categories, and 22 sub-categories Regmi et al (2001) conducted a cross-country food consumption study. Their analysis employed a two-stage budgeting process. In the first stage they used the maximum likelihood estimation process to estimate parameters for the Working's Preference Independence model. This

yielded income and price elasticities for the 10 broad consumption groups. In the second stage for the estimation of parameter, the Working Slutsky model was utilized. Their results indicated that Low-income countries spend a greater portion of their budget on food and are more responsive to income and food price changes than middle- and high-income countries. Higher value food products undergo greater budget adjustments to price and income shocks, while budgets for staple food products such as cereal change the least. This study, although not based on Africa, its findings are important and may have important implications on food demand studies in low-income such as many African countries.

The literature reveals that most of the data used in studies carried out in Africa have been micro data. Most of these studies have included very limited geographical areas and therefore covering limited but specific ethnic groups. In fact, only one data set from the literature surveyed is truly national. This is the study by Welwita et al. covering Tanzania. A lot of the studies covered in the literature have been in West Africa. While studies covering East Africa are very scarce, none has been done on Uganda. Also, no work has been done on how borders affect consumption patterns.

Many of these studies including the one by (Regmi et. al 2001)have covered the consumption of staple foods and should help to shed light as to whether consumers in poorer countries may resort to greater substitutions within a food category**.** Roger and Lowdermilk (1991) concluded that changes in cereal consumption patterns are driven by non-price factors, such as household income, employment, and urbanization. Table 2.2 summarizes the main results from this literature review on demand estimations in Africa.

Table 2.2: Summary of main findings of literature review on African food demand

Author (year) Country (year)	Data source	Model specification	Method estimation	Main Findings
Okunade (1988)	Official national data on household cash expenditures	Single equation using expenditure-income	Estimated an inverse semi-log and double-log functional form for developing countries: the case of Africa.	Demand for food was income-inelastic and that the mean income elasticity for food was 0.57.
Savadogo and Brandt (1988). Ouagadougou, Burkina Faso (1982-1983)	Survey of 65 households	Demography augmented LA/AIDS model which had Engel aggregation restrictions imposed	Engel aggregation restriction imposed OLS	Elasticities for domestic cereals decrease with rising incomes while imported cereals rise with income.
Abdulai and Aubert (2004) Dar-es-salaam and Mbeya (July 1998-May 1999)	500 Households in Dar-es-salaam and Mbeya were surveyed in a two-stage random sampling procedure.	Demography augmented QUAIDS model	Engel aggregation restrictions imposed and estimated	Women's schooling is positively related to intake of food with nutritional value such as meat, fish, eggs, milk, fruit and vegetables. Own price elasticities close to one. Meat, fish, milk, eggs, and other foods most responsive to expenditure fluctuations.
Delgado and Reardon (1991) West African Semi-Arid Tropics (WASAT, 1966-1986)	National-level annual data on cereal consumption. GDP per capita, average consumer prices	LA/AIDS model that imposed symmetry and homogeneity restrictions.		Demand for cereals is price-inelastic . The price elasticity for coarse grain is low as compared to price elasticity of rice. Cereal consumption driven by non-price factors such as household income, employment, and urbanization.

Table 2.2: Summary of main findings of literature review on African food demand (Continued)

Author (year) Country (year)	Data source	Model specification	Method estimation	Main Findings
Rogers and Lowdermilk (1991). Bamako, Mali (1985 - 1986)	Three-round urban expenditure survey 1985 - 1986) Study covered 756 households	Per capita quantity purchase equation for selected foods	Estimated double Engel curves that also employed the Heckman's two-stage model to correct for zero consumption	Food expenditures as a percentage of total expenditures were an average of 54%.. Food budget allocated to cereals, roots and tubers was 40% for quartile 1 (Poor) and 34% for quartile 4 (Non-Poor) and 19% and 23%, respectively, for livestock products. Income had a positive influence on the purchase of rice and sorghum and millet.
Nweke et al. (1992) Southeastern Nigeria (1984 – 1985)	Panel survey of 60 households	Working-Lesser model Variables estimated were income, demographic variables, and price.	OLS	Yam is the most important staple in that part of Nigeria with an average elasticity of 1.3 and own price elasticities that lie between 1.4 to 1.6. Cassava the next most important staple food especially for low-income households. Gari is a normal good and its consumption increases as income increases among high-income urban households. Imported rice, income elasticities decline with income. Expenditure elasticities for wheat increase with income level.

Table 2.2: Summary of main findings of literature review on African food demand (Continued)

Author (year) Country (year)	Data source	Model specification	Method estimation	Main Findings
Dorosh et al (1994) Greater Maputo, Mozambique (1991-1992)	Data collected in the year 1991-1992 from 1816 households	Demography-augmented LA/AIDS model	Aggregation, Symmetry and homogeneity restrictions imposed.	Expenditure on food, as a percentage of income, was 80% for the poor and 65% for the non-poor. Yellow maize has largest share in the food budget for the poor and has negative income elasticity . Imported rice had similar expenditure elasticity of 1.05 for both poor and non-poor.
Arulpragasam (1994) Conakry, Guinea (1990-1991)	Households survey data from 1725 household in Conakry, Guinea	Demography augmented LA/AIDS model	3SLS with model restrictions imposed Also corrected for zero selectivity bias	Total expenditure, among the poor it was 57% and 47 for the non-poor. Consumption of imported rice is widespread and share is higher among the poor.
Weliwita et al (2003) Tanzania (1991-1992)	National household survey that covered 5328 households	Demography augmented LA/AIDS model	ITSUR Symmetry and homogeneity restrictions imposed Two step procedure by Heien and Wessells to correct for the zero expenditure problem	Found that rice, maize, other cereals, pulses sugar, and edible oils are price inelastic while milk and dairy products have unitary elasticity of demand. Household income and family size have significant effects on demand patterns.

Table 2.2: Summary of main findings of African literature review on food demand (Continued)

Author (year) Country (year)	Data source	Model specification	Method estimation	Main Findings
Delgado and Sil (1994) Ouagadougou, Burkina Faso (1984-1985)	1984-1985 rural household survey	LA/AIDS	Engel aggregation, symmetry, and homogeneity restrictions imposed Corrected for zero consumption selectivity bias ITSUR	Millet and Sorghum account for 52% of total expenditure in rural areas. Expenditure elasticity for millet and sorghum at the sample mean is 0.78. Maize and rice, relatively minor crops, have elastic demand. Demand is income-elastic for animal proteins and prepared foods. Demand for cereals is price-inelastic. Price elasticity is low for coarse grains as compared to rice. There is very little impact of rice prices on demand for coarse grains. Demand for rice is responsive to the price of coarse grains. Changes in cereal consumption patterns are demand-driven, but the factors driving such patterns are non-price factors (household income, employment, and urbanization).

Table 2.2: Summary of main findings of literature review on African food demand (Continued)

Author (year) Country (year)	Data source	Model specification	Method estimation	Main Findings
Agbola (2003) South Africa (1993)	Integrated National Household Survey (INHS) 1993 9,000 households surveyed	Demography-augmented LA/AIDS model	Engel aggregation restrictions imposed.	Meat, fish, and grains are luxury goods. Dairy, fruits, vegetables, and other foods are necessities. Race and urbanization, gender of household head, household size affect food demand.
Jayne and Argwings-Kodhek (1997) Nairobi, Kenya (1993-1995)	Two random household surveys in Nairobi conducted before and after liberalization First 344 households in Nairobi October 1993 Second 549 household in October 1995	Single equation using milling margins (MM) as the independent variable regressed against price of maize meal (PMEAL), procurements price of maize grain (PGR), and value of milling by product per kg (PBY)	OLS	Maize meal accounted for 60%o f staple grain consumption. Consumption of maize meal per AE[7] declines as income rises. Maize meal consumption ranged from 8.33 kg per Adult Equivalent (AE) among those in the lower income quintile, declining to 5.32 kg per AE among the highest income quintile. The quantity of whole meal consumed is inversely related to household income while the quantity of sifted maize meal consumed increases with income. Sifted maize meal continues to be the predominant form of maize meal consumed in Nairobi.

Adult Equivalent (AE)

Table 2.2: Summary of main findings of African literature review on food demand (Continued)

Author (year) Country (year)	Data source	Model specification	Method estimation	Main Findings
Reardon et al. (1992) Ouagadougou, Burkina Faso (1984 to 1985)	Survey data from 125 households in Ouagadougou, Burkina Faso	Demography augmented LA/AIDS model with	Engel aggregation restrictions imposed and estimated using ITSUR method.	Rice is the main urban staple food for both low and high-income households. Budget share for wheat and its products increases with income.
Regmi et al (2001) 115 countries (1996 ICP data)	1996 ICP[8] data, which covers expenditure and price data for 115 countries, over 10 broad consumption categories, and 22 sub-categories.	Working's Preference Independence model (Theil, Chung, and Seale 1989) estimated from the first stage of the analysis Second stage Working Slutsky model (Theil, Chung, and Seale, 1989)	Using the maximum likelihood estimation process	Low-income countries spend a greater portion of their budget on food and are more responsive to income and food price changes than middle- and high-income countries. Higher value food products undergo greater budget adjustments to price and income shocks, while budgets for staple food products such as cereal change the least.

[8] International Comparison Project (ICP)

CHAPTER 3

THEORY AND MODEL SPECIFICATION

Modeling Consumer Decisions

Consumer demand is the analysis of consumer preferences: how a consumer chooses to allocate his or her income among different products.

In modeling consumer decisions two approaches are widely discussed in the literature: the preference-based approach and the choice-based approach. The study of the individual decision problem starts with the idea that the individual decision maker has to choose from a set of mutually exclusive alternatives. The assumption is that consumers are rational decision makers and that the individual rational consumer will choose the most preferred bundle from a set of affordable alternatives.

Theory of Revealed Preferences

Samuelson (1938) developed the theory of revealed preferences as an alternative to neoclassical demand theory. In the revealed preference approach, choices that a consumer makes are observed and then inferences are drawn from observed relationships. If observed choices are consistent in a particular way, these choices can be represented as if consumers have maximized utility functions that satisfy six axioms, subject to budgetary constraints. If a consumer's choices obey two simple axioms of revealed preference, choices can be represented as if the consumer is maximizing a utility function that obeys the assumptions underlying the neoclassical economist's model of consumer behavior. The central idea of this theory is the weak axiom of revealed preference, or WARP.

The weak axiom of revealed preference states that if bundle A is revealed to be preferred to bundle B, then bundle B is never revealed to be preferred to bundle A. This theory simply shows that choices are never contradictory. This theory has the same properties as those derived from the neoclassical theory, including the integrability condition (Silberberg 1990).

Houthakker (1950) established the normal equivalence of choice-based and preference-based approaches by strengthening the concept of revealed preference to include the property that revealed preferences will not be intransitive. Through Houthakker, the strong axiom of revealed preference, or SARP was proposed. SARP states that if bundle A is revealed to be preferred to bundle B, and bundle B is revealed to be preferred to bundle C, then bundle C is never revealed to be preferred to bundle A. This axiom shows that choices are internally consistent, and that if a bundle is chosen from a feasible set, no other bundle will be chosen from within the set. This means that, since the most unique bundle is chosen, these choice functions could be derived by constrained maximization of a utility function. The major empirical contribution of the theory of revealed preference is that it provides a straight-forward method of testing whether consumers have a complete or partially complete preference ordering (Prato 1977). Prato (1977, p. 96), however, concludes that neoclassical theory continues to be the foundation that underlies much of modern demand analysis.

Neoclassical demand Theory

Neoclassical demand theory explains how an individual makes consumption decisions at a given point in time. According to Varian (1992), Prato (1977), and Capps and Havlicek (1987), a rational consumer will choose the most preferred consumption

bundle from a set of affordable alternatives, or bundles that satisfy consumers' budgetary constraints.

A number of axioms of consumer preference are required for a consumer to order his or her consumption bundles. The first three axioms are: completeness, reflexivity, and transitivity.

Axiom 1, *preferences are complete*. This means that for any two consumption bundles A and B, a consumer can make one the following comparisons:

1. **A** is preferred to **B** (denoted $A^P B$)
2. **B** is preferred to **A** (denoted $B^P A$)
3. **A** is indifferent to **B** (denoted $A^I B$

This axiom implies that the consumer makes this kind of decision for every consumption bundle he or she is faced with. This ranking of consumption bundles is referred to as preference ranking.

Axiom 2, *Preferences are reflexive*. If a consumer is presented with two consumption bundles A and B so that A = B in all respects, A is said to be indifferent to B. This means that A and B are the same, and they must be ranked equally by the consumer.

Axiom 3, *Preferences are intransitive*. If a consumer prefers bundle A to bundle B $\left(A^P B\right)$ and bundle B to bundle C $\left(B^P C\right)$, then this implies that the consumer also prefers bundle A to bundle C $\left(A^P C\right)$. Also if a consumer is indifferent between bundle A and bundle B $\left(A^I B\right)$ and he or she is indifferent between bundle B and bundle C $\left(B^I C\right)$, then this implies that the consumer is also indifferent between bundle A and bundle C $\left(A^I C\right)$. These first three axioms correspond to the fundamental properties of real numbers and

are necessary for any discussion about preference maximization. In general a person that obeys these axioms is said to rational.

Axiom 4, *preferences are continuous*. If a consumer prefers bundle A to bundle B $\left(A^P B\right)$ and bundle B is sufficiently close to bundle C (B is the limit of C), then this implies that the consumer also prefers bundle A to bundle C $\left(A^P C\right)$. Continuity in the preference relationships is a necessary assumption to rule out discontinuity in behavior. The continuity preference assumption, in addition to the first three axioms, allows for summarization of the consumer's behavior by way of an ordinal utility function.

Axiom 5, *preferences exhibit non-satiation*. Given two consumption bundles A and B, with the property that the X in A is equal to the X in B, and the Y in A is greater than the Y in B, then the conclusion is that the consumer will always prefer A to B. Similarly, if the Y in A is equal to the Y in B and the X in A is greater than the X in B, then the consumer will be said to prefer A to B.

Axiom 6, *Indifference curves exhibit diminishing rates of marginal substitution*. Finally, axiom 6 is sometimes invoked to restrict preferences so that calculus can be used to find a unique optimal solution to a consumer's choice that lies on the budget constraint (Mas-Colell, Whinston, and Green 1995). The consumer allocates his total expenditure, y, in a way that maximizes the utility. This can be expressed as:

$$\text{Max } u = \upsilon (q_1 \ldots q_n) \text{ subject to linear budget constraint } y = \sum p_i q_i \qquad (3.01)$$

where p_i is price per unit of the i^{th} good, q_i is the quantity of the i^{th} good, u is a utility function of the quantities of goods consumed, and y is total income. Total expenditure here is the disposable income. Solving the first order conditions yields the Marshallian demand function, or the uncompensated demand function results in:

$$q_i = g_i(y, P), \tag{3.02}$$

where P is the vector of commodity prices. This demand function is a utility maximization and is known as a Marshallian or uncompensated demand function. In the Marshallian function, the consumer's utility is maximized subject to a budget constraint and this is termed as the primal problem. The utility maximization problem can be expressed as:

$$V(p,y) = \max U(q) \text{ such that } p'q = y \tag{3.03}$$

where the function V(p,y), the maximum utility achievable given prices and income, is called the indirect utility function. From this indirect utility function, the Marshallian demand function can be recovered using Roy's identity so that:

$$q_i = g_i(p, y) = -\frac{\partial V(p, y)/\partial p_i}{\partial V(p, y)/\partial y}, \qquad \text{i =1,..., N.} \tag{3.04}$$

Alternatively, the consumer's problem can be expressed as one of cost or expenditure minimization subject to some utility level. This can be achieved by inverting the maximum utility function V(**p**, y) and using it to solve for y as a function of prices (p) and the level of utility (U). The resulting function is the cost or expenditure function e(**p**, U), and with it we get the cost minimization problem:

$$e(\mathbf{p}, U) = \min p'q \text{ such that } U(q) \geq U^0 \tag{3.05}$$

The Hicksian or compensated demand function can be expressed as **h**(**p**, U). The Hicksian demand function specifies a consumption bundle that enables us to achieve a certain utility level at a minimum expenditure or cost.

Duality theory

Some identities, as outlined by Varian (1992), summarize what has come to be known as the duality theory:

a. $e[p, V(p, y] \equiv y$

b. $V[p, e(p, U)] \equiv U$

c. $x_i(p, y) \equiv h_i[p, V(p, y)]$

d. $h_i(p, U) \equiv x_i[p, e(p, U)]$

The expressions c and d allow us to derive the value of q_i, as is required by the Hicksian demand function (3.05). The solution for the expenditure minimization problem and the Marshallian utility maximization problem are equal at an appropriate level of income. The problems stated in (3.03) and (3.05) are two ways of stating the same problem and are described as the "dual" problem – see Figure 3.1 below.

Maximize U = U (q) subject to pq = X *Primal problem* (3.06)

Minimize y = pq subject to U (q) = U *Dual problem* (3.07)

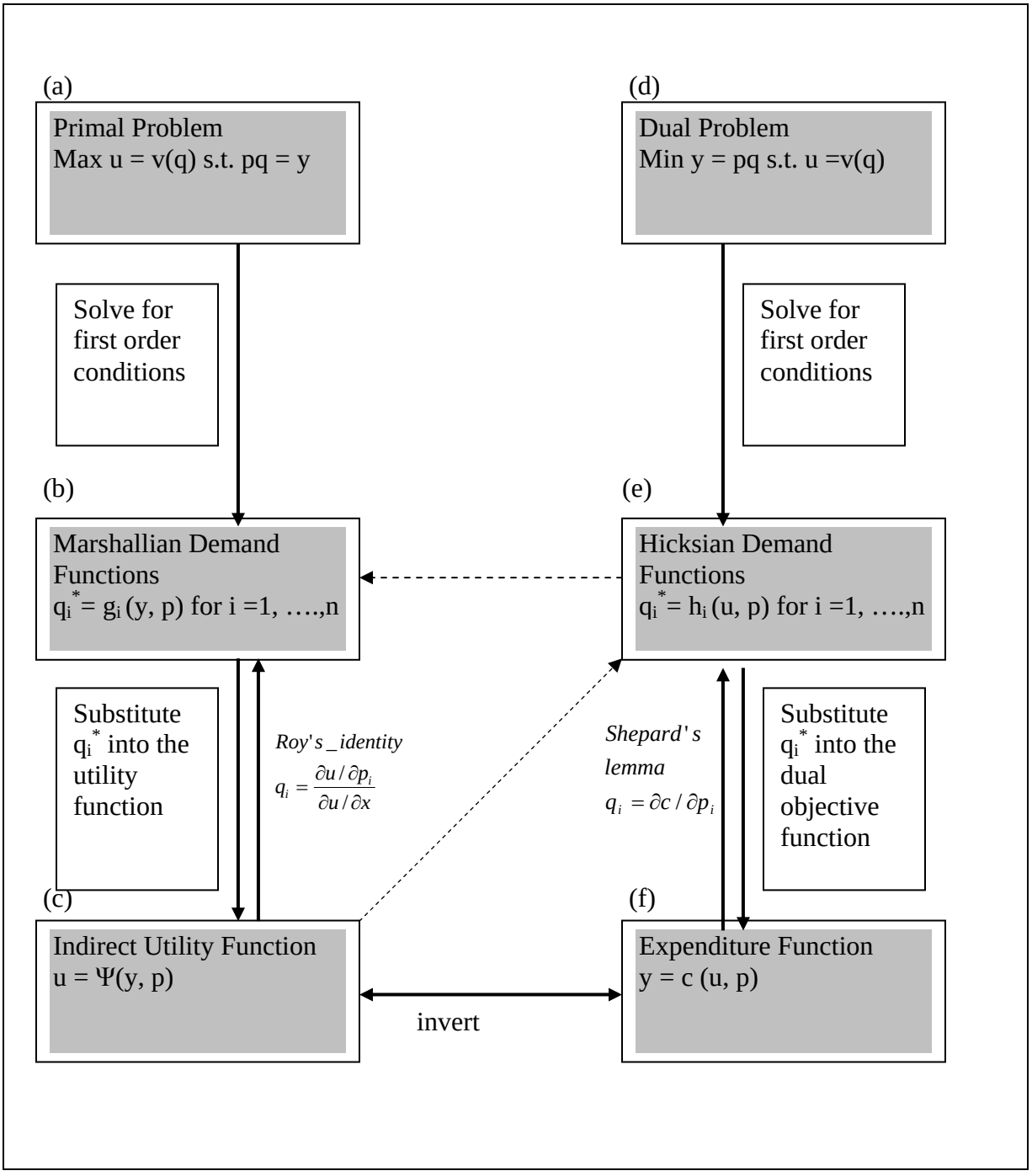
In both cases, the optimal values of q are being sought, and since the two solutions coincide, we have:

$$q_i = h_i(u, p) = g_i(x, p). \quad (3.08)$$

The duality problem is the Hicksian, or the income-compensated, demand functions. When substituted into the dual objective function, this yields the expenditure function, which is the minimum expenditure needed to reach a given level of utility with alternative prices. The duality approach is summarized in Figure 3.1. In part (a), the direct utility function is maximized subject to some budgetary constraint, and this leads to the Marshallian (uncompensated) demand functions in part (b). When the Marshallian

demand functions are substituted into the direct utility function, this yields the indirect utility function in part (c). The indirect utility function indicates the highest utility possible that can be obtained given different prices and income. The Marshallian demand functions can be derived by performing Roy's identity. In the dual problem, we try to minimize the expenditure needed to reach a given level of utility with alternative prices, shown in part (d). Part (d) leads to the Hicksian (compensated) demand functions as shown in part (e). After substituting these functions into the dual objective functions, we get the expenditure function in part (f). Part (f) shows the minimum expenditure needed to reach a given level of utility at various prices. Hicksian demand can be achieved similarly by using Shepard's lemma.

Figure: 3.1. Duality Consumer Theory



The Slutsky Equation

In the utility maximization problem (3.01), it is assumed that u* is the maximum level of utility which is attained when the vector of commodity $q= (q^*_1,..., q^*_n)$ is consumed. In the expenditure minimization problem, the minimum expenditure needed to achieve the specific utility level, u*, is calculated and this leads to an identical consumption bundle; that is, $q^*_n = h_i(u^*,p)=g_i(y,p)$, where p denotes the price vector $(p_1,….p_n)$. The expenditure function is then substituted into $q^*_n = h_i(u^*,p)=g_i(y,p)$ and the resulting identity is:

$$h_i (u^*,p)= g_i[c(u^*,p),p]. \tag{3.09}$$

When this identity is differentiated with respect to p_i it yields:

$$\frac{\partial h(u^*, p)}{\partial p_j} = \frac{\partial g_i(c(u^*, p), p}{\partial c(u^*, p)} \cdot \frac{\partial c(u^*, p)}{\partial p_j} + \frac{\partial g_i(c(u^*, p), p}{\partial p_j} \tag{3.10}$$

Using Shepard's lemma and rearranging the terms yields the relationship that is known as the Slutsky equation:

$$\frac{\partial q_i}{\partial p_j} = \frac{\partial h_i}{\partial p_j} - \frac{\partial q}{\partial x}.q_j, \qquad \text{i, j = 1, …..,n} \tag{3.11}$$

The Slutsky equation divides the total effect of a price change, $\frac{\partial q_i}{\partial p_j}$, into a substitution effect, $\frac{\partial h_i}{\partial p_j}$, which indicates how demand changes while utility is kept constant, and an income effect, $(\frac{\partial q_i}{\partial x})q_j$. The income effect means that a price change can cause purchasing power to change in such a way that it is reflected in the quantity demanded.

The Slutsky equation also helps us define the Hicksian substitute, $\frac{\partial h_i}{\partial p_j} > 0$, complement products, $\frac{\partial h_i}{\partial p_j} < 0$, gross substitutes, $\frac{\partial q_i}{\partial p_j} > 0$, and gross complements as $\frac{\partial q_i}{\partial p_j} < 0$.

Restrictions in Consumer Demand

A system of demand functions that is derived by maximizing some utility functions, subject to budgetary constraints, must satisfy some restrictions, such as adding up, homogeneity, negativity, and symmetry (Deaton and Muellbauer, 1993).

Adding Up

The consumer allocates his total expenditure, x, in a way that maximizes the utility. This can be expressed as:

Max u = υ ($q_1 \ldots q_n$) subject to linear budget constraint y = $\sum p_i q_i$ (3.13)

where p_i is price per unit of the i^{th} good, q_i is the quantity of the i^{th} good, u is a utility function of the quantities of goods consumed, and y is total income. Total expenditure here is the disposable income. Solving the first order conditions yields the Marshallian demand function, or the uncompensated demand function results in:

$$q_i = g_i(y, P), \tag{3.14}$$

where P is the vector of commodity prices. In the Marshallian function, the consumer's utility is maximized subject to a budget constraint and this is termed as the primal problem. Taking the derivative of the Langrangean function results in

$$d \log q_i = \eta_i d \log y + \sum_{j=1}^{n} \mu_{ij} d \log p_j, \tag{3.15}$$

where η_i is income elasticity and μ_{ij} are uncompensated price elasticities. For changes in prices and total expenditure to conform to the budget constraint in demand function, the following conditions on elasticities must hold,

$$\sum_{j=1}^{n} w_j \eta_j = 1 \qquad \textit{Engel aggregation} \qquad (3.16)$$

$$\sum_{j=1}^{n} w_j \mu_{ij} + w_j = 0, \qquad \textit{Cournot aggregation} \qquad (3.17)$$

where w is the budget share. These are Engel and Cournot aggregation, respectively, also referred to as the *adding up restrictions*. It should be noted that the restrictions (3.16) and (3.17) are impossible to estimate in many demand systems.

In addition to the adding-up restriction, the other restrictions can be expressed in terms of compensated price elasticities as follows:

Homogeneity: $\sum_{j=1}^{n} \varepsilon_{ij} = 0$ (3.18)

Symmetry: $\varepsilon_{ij} = \varepsilon_{ji}$ (3.19)

Negativity: $\sum_{i=1}^{n}\sum_{j=1}^{n} x_i w_j \varepsilon_{ij} x_j \prec 0$, for all x_i and x_j that are not constants. (3.20)

The homogeneity restriction implies that a proportionate change in income and prices of all goods will leave consumption of any good unchanged. The symmetry restriction means the increase in the price of good i will induce an increase in the compensated quantity demanded of good j equal to the increase of compensated quantity demanded of good i caused by an increase in the price of good j. Without this restriction, inconsistent choices could be made and there would be no substitute or complement products. The negativity restriction comes from the convexity of the utility

function, which is due to the fact that the utility is maximized in the Marshallian demand functions and costs minimized in the Hicksian demand function.

Separability and Two-Stage Budgeting

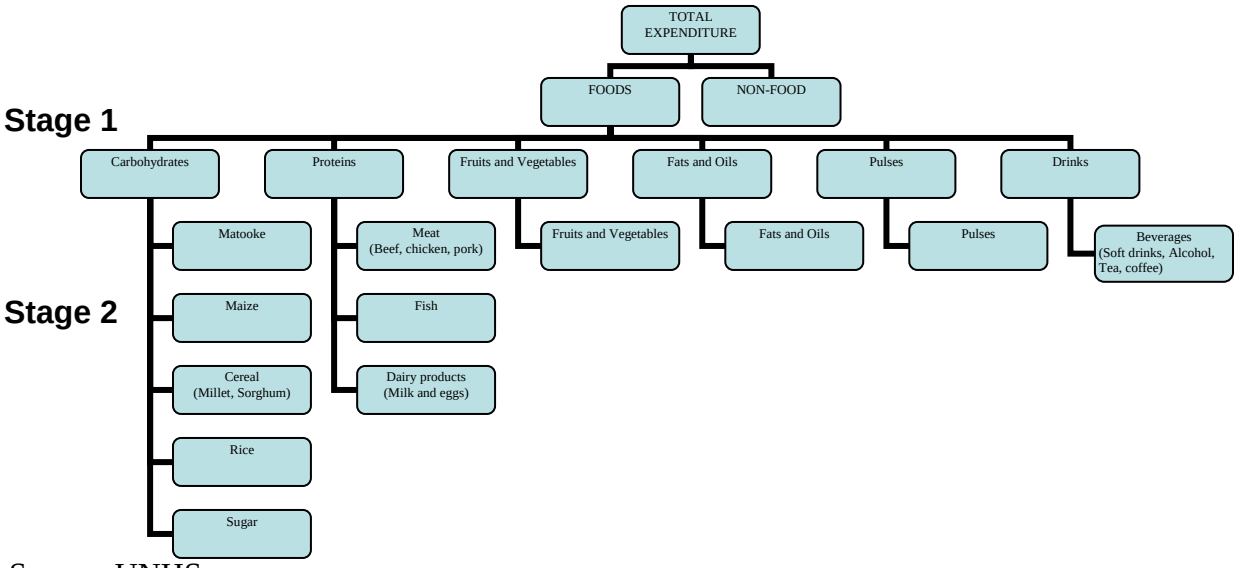
Researchers investigating consumption patterns are usually faced with a huge number of good and services available to the consumer. To analyze a complete demand system based on this reality is generally beyond the scope or resources of the researcher. To deal with this problem, researchers usually assume *a priori* some structure of consumer preference. This structure can be found in the concept of separability, a concept that was advanced by Leontif (1947) and Sono (1960), which assumes that a set of n commodities that are available to the consumer can be partitioned into s mutually exclusive subsets, $\{N_1, N_2,\ldots, N_s\}$. Each subset contains n_s (s = 1, 2, …, s) commodities where $n = \sum_{s=1}^{s} n_s$. Commodities within a particular subset are assumed to possess common characteristics.

This separability assumption is incorporated in the consumer allocation problem because it is assumed that the consumption decision process occurs in two stages (Strotz, 1957). First, the consumer is assumed to allocate his or her budget between subsets of commodities, $N_1, N_2,\ldots, N_s$. The second stage involves budget allocation within a subset of commodities. The most common assumption is one of weak separability.[9] This assumption is a necessary and sufficient condition for the second stage of the two stage budgeting process. Weak separability enables stepwise demand analysis, which assumes that consumers spend their income in stages. In the first stage, the consumer allocates

[9] Other types of separability that have been advanced are strong separability and Pearce separability.

his/her income on a broad category of goods, such as food, shelter, entertainment, etc. In the second stage, the consumer allocates his/her income on goods within these broad categories. This is the two-stage budgeting process, and it follows Gorman (1959), Pollack (1971) and Deaton and Mullbauer (1980a). Figure 3.2 depicts the budgeting procedure in this study.

Figure 3.2: Modeling Food Demand in Uganda



Source: UNHS

Choice of Demand Models

Much effort has been expended in trying to model a functional form that satisfies demand theory plausibly so that a researcher can be sure that a derived demand is from a utility-maximizing function. Imposing restrictions on functional forms has become the typical way to test demand theory. This approach results in the reduction in the number of parameters in the systems of demand equations, and it also tests whether the resulting functions satisfy the basic properties of demand functions. In considering a complete

system of demand equations, the problem of degrees of freedom can be reduced, restricting the parameters in an equation as outlined by consumer theory. This section reviews four demand functional forms: Linear Expenditure Systems (LES), the Rotterdam Model, the Indirect Translog Model, and the Almost Ideal Demand System (AIDS) Model. The first models are classified as linear functional forms, while the latter two are classified as flexible functional forms that do not require a particular functional form of utility function.

Linear Expenditure System (LES)

The LES was first estimated by Stone and has been widely applied to individual country data. LES is derived from the Klein-Rubin utility function, also referred to as the Stone Geary utility function, and it can be written as

$$u = \ln u = \sum_i \beta_i \ln(q_i - \gamma_i) \tag{3.31}$$

where q_i is the quantity of good i, $0<\beta_i<1$, $\sum_i \beta_i = 1$, $\gamma_i > 0$, and $q_i - \gamma_i > 0$.

Maximizing the utility function in (3.01) subject to budget constraint $\sum_i p_i q_i = x$ the demand function:

$$q_i = \gamma_i + \beta_i \left[(x - \sum_j p_j \gamma_j) / p_j \right] \quad \text{(i, j = 1,…..,n)} \tag{3.32}$$

The Engel expenditure function is derived by multiplying equation 3.32 by price p_i so that the equation obtained is

$$p_i q_i = p_i \gamma_i + \beta_i (x - \sum_j p_j \gamma_j) \quad \text{(i, j = 1,…..,n)} \tag{3.33}$$

where $0<\beta_i<1$, $\sum_i \beta_i = 1$, $q_i > \gamma_i$, and x is the total expenditure. Equation 3.33 is the Linear Expenditure System (LES) (Stone, 1954). LES is straight-foward to use. However,

it assumes additive preferences, severely restricting substitution possibilities and also ruling out inferior goods. Another major weakness is that budget shares are constant with income changes (homotheticity). Homotheticity can lead to estimations where income elasticity for necessities actually increases as incomes rise (Theil and Clement, 1987).

The Rotterdam Model

The Rotterdam model was first proposed by Barten (1964) and Theil (1965) and uses both Marshallian and Hicksian demand functions. The Rotterdam model is derived by totally differentiating a double-logarithmic demand function,

Ln $q_i = \alpha_i + \sum_k e_{ik} \ln p_k + e_i \ln x$, so that

$$\text{Dln } q_i = \sum_j \partial \ln q_i / \partial \ln p_j \cdot d \ln p_j + \partial \ln q_i / \partial \ln x \cdot d \ln x = \sum_j e_{ij}\, d \ln p_j + e_i d \ln x \quad (3.41)$$

where e_{ij} is uncompensated cross price elasticity, and e_i is total expenditure elasticity. The Slutsky equation can therefore be written as

$$e_{ij} = e^*_{ij} - e_i w_j \quad (3.42)$$

where e^*_{ij} is compensated cross-price elasticity, and w_j is the budget share of good j. Substituting 3.42 into 3.41 yields

$$d \ln q_i = e_i (d \ln x - \sum_j w_j d \ln p_j) + e^*_{ij} d \ln p_j \quad (3.43)$$

To impose symmetry restrictions, 3.43 is multiplied by the budget share so that the final equation is

$$w_i d \ln q_i = e_i w_i (d \ln x - \sum_j w_j d \ln p_j) + \sum_j e^*_{ij} w_i d \ln p_j \quad (3.44)$$

$$w_i d \ln q_i = b_i (d \ln x - \sum_j w_j d \ln p_j) + \sum_j c_{ij} d \ln p_j \quad \text{(i, j = 1,…,n).} \quad (3.45)$$

As a matter of practice, w_i is estimated by the mean of w_i, $\bar{w} = (w_{it} - w_{it-1})/2$. In the Rotterdam Model, restrictions are imposed and can be tested statistically. This is unlike the LES model, where restrictions are maintained or imposed algebraically within the model. Adding-up requires that $\sum_k b_k = 1$, and $\sum_k c_{kj} = 0$, where $b_i = w_i e_i$ is the marginal propensity to spend on good i, and c_{ij} is the net effect of price change. The homogeneity restriction is satisfied if $\sum_k c_{jk} = 0$ and symmetry is satisfied when $c_{ij} = c_{ji}$.

Unlike the LES model, the Rotterdam model allows for the estimation of substitutes and complements. Another advantage that it has over the LES Model is that it allows for the separability of preferences. This is a desirable property in demand analysis in that, if it holds, total expenditure can be partitioned into groups of goods, allowing for analysis of preferences in one group independent of quantities in other groups. The Rotterdam Model, however, has one very serious disadvantage in that, like LES, it produces constant marginal shares, leading to counterintuitive results, particularly with cross-country analysis, in terms of changes in income (Theil and Clement, 1987).

The Indirect Translog Model

An Indirect Translog Model is derived by first approximating an indirect utility function using the translog second-order Taylor approximation. The indirect utility function log u = f(log p_1, ……,log p, log x) approximated in the second order results in the following utility function:

$$\log = \alpha_0 + \sum_i \alpha_i \log(p_i/x) + \tfrac{1}{2} \sum_i \sum_j \beta_{ij} \log(p_i/x) \log(p_j/x) \qquad (3.51)$$

where α_0, α, and β are parameters. Equation 3.51 is the second order Taylor approximation to any arbitrary utility function, as developed by Christensen, Jorgenson, and Lau (1975). Applying Roy's Identity to equation 3.51, it leads to a system of demand equations

$$w_i = \frac{\alpha_i + \sum_j \beta_{ij} \log(\frac{p_i}{x})}{\sum_j \alpha_j + \sum_j \sum_i \beta_{ij} \log \frac{p_i}{x}} \qquad (i, j = 1,\ldots..,n) \qquad (3.52)$$

The indirect translog model imposes the additivity, homogeneity, and symmetry restrictions. Deaton and Muellbauer (1993) and Phlips (1983) found the major limitations of this model in estimating demand systems to be the number of structural parameters required, and the accuracy of approximation is at a particular value of x or p, not over an entire sampling period or entire sample.

Almost Ideal Demand System (AIDS) Model: A Complete Demand System

The AIDS Model, which is a popular Hicksian demand function, avoids the problem of constant budget shares. The AIDS Model can be estimated over broadly defined groups of commodities. Since budget shares are not constant, income elasticities change with income changes. Also, as Moschini (1998) pointed out, the AIDS model also automatically satisfies adding-up restrictions, and with simple parametric restrictions, homogeneity and symmetry can be imposed. The AIDS Model also has some shortcomings, with the main one being that parameters in the AIDS model are non-linear and thus difficult to estimate. To address this problem, Deaton and Muellbauer suggested a linear form of the model known as Linear Approximation of the Almost Ideal Demand

systems (LA/AIDS). Due to its simplicity, LA/AIDS has become popular amongst empirical researchers. This study will therefore apply AIDS and LA/AIDS models.

Model Specification

Basic Model: LA/AIDS

This study will apply the LA/AIDS model, which was developed by Deaton and Muellbauer (1980a, 1980b). To begin, an AIDS model for the 14 food commodities is estimated as follows:

$$w_i = \alpha_t + \sum_j \gamma_{ij} \ln(pj) + \beta_j \ln(\frac{x}{p}) + \mu_t \text{ , i = 1,…..14} \quad (3.53)$$

where w_i ($\geq$0) is the budget share of food product i, p_j is the price of food commodity j, x is the total expenditure on food commodity in question, μ_i's are random disturbances assumed with zero mean and constant variance, and P is a translog price index which is defined by:

$$\log P = \alpha_t + \sum_k \alpha_\kappa \ln p_k + \frac{1}{2} \sum_k \sum_l \gamma_{\kappa\lambda} \ln p_k \ln p_l \quad (3.54)$$

k = 1,….,14 i = 1,…….,14

The model defined by the Equations (3.53) to (3.54) is called the AIDS model. However, the price index in Equation (3.54) raises difficulties of estimation because of non-linearity in parameters. To avoid the non-linearity problem, Asche and Wessells (1997) suggested the application of the Stone index, which is widely used for LA/AIDS estimation. Moschini (1995) suggested the creation of a log-linear analog of the

Laspeyres price indexes as:

$$\ln(P^*) = \sum_j w_i \ln(p_i) \ , \qquad i=1,\ldots..,14 \qquad (3.55)$$

where w is the budget share among 14 commodities. The Stone index is an approximation proportional to the translog, which means that P = φP* where E (ln (φ)) = α_0. The LA/AIDS model with the Stone index is, therefore,

$$w_i = \alpha_\iota^* + \sum_j \gamma_{ij} \ln(p_j) + \beta_\iota \ln(\frac{x}{p^*}) + \mu_\iota^* \ , \qquad (3.56)$$

where $\alpha_i^* = \alpha_\iota - \beta_i \alpha_i$ and $\mu_i^* = \mu_i - \beta_i(\ln(\varphi) - E(\ln(\varphi))$.

According to Alston, Foster, and Green (1994), Asche and Wessells (1997), and Moschini (1995), prices will never be perfectly collinear. They found that applying the Stone index will introduce the units of measurement error. To overcome this measurement error problem, Moschini (1995) suggested the log-linear analogue of the Laspeyres price index be obtained by replacing w_i in Equation (3.55) with $\overline{w}_i$, which implies mean budget share. The Laspeyres price index, therefore, becomes a geometrically weighted average of prices:

$$\ln(P^L) = \sum_i \overline{w}_i \ln(P_i) \qquad (3.57)$$

When (3.57) is substituted into (3.56), it yields an LA/AIDS model with the Laspeyres price index as follows:

$$w_i = \alpha_i^{**} + \sum_j \gamma_{ij} \ln(p_j) + \beta_i(\ln(x) - \sum_j \overline{w}_j \ln(p_j)) + \mu_i^{**} \qquad (3.58)$$

where $w_i = \alpha_i^{**} = \alpha_i - \beta_i(\alpha_0 - \sum_j \overline{w}_j \ln(p_j))$

To conform to microeconomic theory, the adding-up, homogeneity, and symmetry properties of a demand function can be imposed on the LA/AIDS parameters. The adding-up restriction is satisfied with given $\sum_i w_i = 1$ for all j;

$$\sum_i \alpha_\iota = 1,\ \sum_i \beta_\iota = 0\text{, And } \sum_k \gamma_{kj} = 0 \tag{3.59}$$

The homogeneity restriction is satisfied for the LA/AIDS model, if for all j,

$$\sum_k \gamma_{jk} = 0 \tag{3.60}$$

Symmetry is satisfied by:

$$\gamma_{ij} = \gamma_{ji} \tag{3.61}$$

In this study, weak separability is assumed so as to allow a two-stage budget process. Food demand will be estimated by applying the Working (1993) model in stage one and LA/AIDS in stage two.

Introduction of Socio-demographic Characteristics

It is evident that demand for goods will differ across household, regions, and even countries because of differences in tastes. According to Heien and Wessells (1990) and Gao, Wailes, and Cramer (1997), the assumption is that taste differences are determined by household characteristics, referred to as socio-demographic characteristics in this dissertation. To include socio-demographic factors in this study, the basic LA/AIDS model that has been specified must be extended. This extension allows us to separate socio-demographic effects on demand from own-price, cross-price, and income effects of demand. To account for socio-demographic factors, this study follows Pollak and Wales

(1978, 1981). In their studies, Pollack and Wales modified the original cost function so that the constant term becomes

$$\alpha = \alpha + \sum_{j=1}^{n} p_j d_j$$

where d_j represents household characteristics. This method is known as a linear demographic translation and is used to preserve the linearity of the system. As a result, the derived system of share equations takes the form:

$$w_i = \alpha_i^{***} + d + \sum_j \gamma_{ij} \ln(p_j) + \beta_i (\ln(x) - \sum_j \overline{w}_j \ln(p_j) + \mu_i^{***} \tag{3.62}$$

where, for example,

$$\begin{aligned} d_i &= \rho_1 HHSIZE_i + \rho_2 HHHED_i + \rho_3 HHFEM_i + \rho_4 HHAGE_i \\ &+ \rho_5 PROD_i + \rho_6 URBAN_i + \rho_7 TCEXP1_i + \rho_8 TCEXP2_i \\ &+ \rho_{11} CENTRAL_i + \rho_{12} EASTERN_i + \rho_{13} NORTHERN_i \\ &+ \rho_{14} WESTERN_i \end{aligned} \tag{3.63}$$

where $\alpha_i^{***} = \alpha_i^{**} - \sum_k \rho_{ir} z_r$. The adding-up restriction requires

$$\sum_i \alpha^{***} = 1, \text{ and } \sum_i \rho_{ir} = 0, \text{ k = 1,…., m,} \tag{3.64}$$

where m is the number of socio-demographic variables.

Analysis of Unit Values

One problem associated with data collected by household surveys is that they do not include price data. This means that prices must be calculated by dividing expenditures by the corresponding quantities. Demand theory tells us that, at a given time, only one price exists for a particular good. If this is the case, this means that cross-sectional data

would show no variations at all. Price disparities, however, do exist and there are number of factors that cause them. Prais and Houthakker (1955) demonstrated that price variation is due to region, seasonal effect, price discrimination, and quality effects. In order to correctly interpret the effect of price in cross-sectional demand analysis, the causes of cross-sectional price variations have to be identified and only supply-related price variation should be used to estimate the demand functions. To assess the size of the demand related price effect, the unit value of the composite commodities was regressed on per capita food expenditure and selected demographic characteristics. The following price equation was estimated for the unit value of each commodity and sub-aggregate by linear regression including data from purchasing households.

$$\begin{aligned} uv_i &= b_1 + b_2 HHSIZE_i + b_3 HHHED_i + b_4 HHFEM_i \\ &+ b_5 HHAGE_i + b_6 PROD_i + b_7 URBAN_i + b_8 PCFEXP_i \\ &+ b_9 EASTERN_i + b_{10} NORTHERN_i + b_{11} WESTERN_i + \varepsilon_i \end{aligned} \tag{3.64}$$

where uv_i is unit value of commodity i and PCFEXP is per capita monthly expenditures on food; both are measured in thousands of Uganda shilling. HHSIZE is the size of the household, HHHED is the highest level of education obtained by the head of household, HHFEM is a female-headed household while HHAGE is the age of head of household. Eastern, Northern, Western, and Central are the administrative regions of Uganda[10]. URBAN represents a household located in an urban setting, and PROD is a variable that captures a household's engagement in home food production.

The unit value equation was estimated by OLS, and the parameter estimates are presented in Table 3.1 The unit values for the food groups are listed horizontally at the

[10] The Central Region is omitted because it is the reference region.

top of the table, and the independent variables are listed vertically on the left. The R-square coefficients range from 1.7% for eggs to 16% for alcohol. These R-squares are low but reasonable when analyzing cross-sectional household survey data.

The results of the estimated commodity unit values show that 54% of the estimated coefficients are significant at the 10% level. With respect to the signs of the coefficients, per capita food expenditure (PCFEXP) has a positive effect on the unit values of each food group except for sorghum, where it is negative but not significant. With the exception of ripe bananas, sorghum, maize, and eggs, the PCFEXP estimates are significant at the 5% level. The results confirm the hypothesis that the unit values of a commodity, which can be interpreted as an indicator of quality, increase with per capita expenditure on food.

The household size (HHSIZE) coefficient positively affects unit values in all cases, with the exception of soft drinks, which are significantly negative. The coefficients that are positive and significant are maize, matooke, rice, millet, bread, sugar, onions, tomatoes, cabbage, ripe bananas, fish, alcohol, cassava, and beef.

As expected, higher education status of the head of household (HHEDU) has a positive effect on unit values in 60% of the food categories. The unit values for matooke, other vegetables, fish, milk, alcohol, and beef are significantly higher, an indication that consumers with more education and higher incomes tend to consume food with higher unit values.

The age of head of household coefficient (HHAGE) has a significantly negative effect on consumption of rice, millet, and alcohol. Households that are headed by older household heads value matooke, bread, sorghum, sugar, onions, tomatoes, cabbage,

mangoes, oranges, ripe bananas, eggs and beef. This may be explained by the fact that older household heads tend to be more family oriented and hence will tend to consume food products that are of benefit to the family.

When a household is headed by a female (HHFEM), it increases the unit values of other vegetables and fruits, such as mangoes, oranges, and ripe bananas. It also increases the unit values of milk and beef. The increase in milk consumption for a female-headed household can be explained that women play the role of nurturing young children who need milk for proteins to enhance their growth. The HHFEM coefficient is negative for the unit values of maize, matooke, millet, sugar, tomatoes, cabbage, fish, eggs, cassava, and soft drinks. This negative effect can be explained by the fact that, in the case of Uganda, female-headed households tend to be relatively poor when compared to male-headed households.

As expected, the PROD coefficient (home production of food) has a negative effect in 13 out of 21 unit values. The unit values that are positive are maize, matooke, onions, tomatoes, sugar, fish, eggs, and soft drinks. Sugar and soft drinks are products that are normally not produced at home so the higher unit values are expected. The remaining products are, at times, produced for commercial purposes and this may explain the higher unit values.

As expected, location variables exhibit explanatory powers for unit values in approximately 66% of the cases. For the regions, however, the direction of influence of the unit values cannot be discerned. Considering only the statistically significant coefficients, unit values for maize are lower for western and northern regions compared to central, as expected. What is unexpected is that the eastern region has higher unit

values for maize compared to the central region. This is explained in that some of the maize produced in this region is exported to neighboring Kenya, according to the EAC. Exports tend to push prices higher in this region compared to the central region. The unit values for rice are lower in the eastern and northern region. This is as expected and it also reflects the availability of rice in the eastern region where it is grown. The unit values of sugar are significantly less in the eastern region, and again this reflects the availability of raw material for processing sugar. Sugarcane is grown and processed in the Jinja district of the eastern region.

The BORDER coefficient shows that over half of the food crops have higher unit values in border districts. This is expected, as the price at the border tends to be the international price, which tends to be lower compared to the interior of the country. The lower price tends to lead to higher consumption of a given good. Unit values of goods, such as bread, alcohol, and soft drinks are higher for the BORDER coefficient, because they are imported and exported across borders.

Households located in the urban areas (URBAN) value more quality choices of fish, milk, alcohol, and soft drinks than their counterparts in the rural areas. This may be because urban households tend to have higher incomes and also tend to be more health conscious than households located in the rural areas.

As shown above, the R-square coefficients range from 1.7% for eggs to 16% for alcohol. The rather low values show that a large portion of price variation is not explained by the model. Cox and Wohlgenant (1986) showed this residual variation reflects non-systematic factors related to supply. A small amount of variation can be attributed to demand factors and this should be taken into consideration by adjusting

prices so as to properly identify demand functions. Following Cox and Wohlgenant (1986), adjusted prices $\left(uv^{adj.}\right)$ that do not contain demand related effects could be derived from the price equations (3.64) so that:

$$uv^{adj.} = uv_i - \sum_{r=1}^{R} b_{ir} z_r = b_{i0} + \varepsilon_i \tag{3.65}$$

where $\sum_{r=1}^{R} b_{ir} z_r$ represents the estimated influence of household characteristics and expenditure in price equations (3.64). Equation (3.65) is used to generate adjusted unit values for each commodity and is derived by adding the estimated constant b_{i0} to the residuals derived from each commodity regression. This suggests that adjusted unit prices are made up of nonsystematic supply factors, represented by the residuals, and the price base. Adjusted prices can inversely be obtained by subtracting household specific influences on unit values from the observed unit values. This procedure will be done for each household to be able to account for the differential impact of influences of the different households in the survey.

Table 3.1: Parameter Estimates of Unit Values Analysis of Ugandan Households Food Purchases, 1999

Depended Variables														
Unit Values of food products		**Maize**		**Matooke**		**Rice**		**Bread**		**Millet**		**Sorghum**		**Sugar**
		1		**2**		**3**		**4**		**5**		**6**		**7**
Explaining Variables	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**
Intercept	0.439[a]	18.24	0.975[a]	12.32	0.904[a]	36.28	0.071[b]	3.71	0.342[a]	14.65	0.254[a]	8.19	1.031[a]	63.11
HIGH-EDU	-0.001[b]	-1.98	0.014[a]	6.47	-0.005	-0.53	-0.000	-0.19	0.000	0.52	-0.000	-0.48	-0.001	-1.49
HHSIZE	0.009[b]	3.25	0.051[a]	7.52	0.004[c]	1.89	0.006[c]	2.74	0.003[c]	1.81	0.002	0.84	0.004[b]	2.82
HHAGE	-0.000	-0.17	0.001	1.26	-0.001[c]	-1.95	0.000	0.25	-0.000[c]	-1.64	0.000	0.81	0.000	1.05
FEMHEAD	-0.006	-0.47	-0.041	-1.06	0.001	0.14	0.007	0.68	-0.003	-0.28	0.017	1.09	-0.009	-1.12
PCFEXP	0.004	0.75	0.049[a]	10.19	0.003[b]	3.14	0.003[a]	4.02	0.006[a]	4.87	-0.000	-0.04	0.005[a]	5.73
EASTERN	0.011[a]	7.70	-0.331[a]	-4.86	-0.124[a]	-6.8	0.068[a]	3.99	0.032[b]	2.33	-0.009	-0.61	-0.071[a]	-5.71
NORTHERN	-0.026[c]	-1.61	-0.733[b]	-3.27	-0.255[a]	-7.32	0.058	1.47	-0.078[b]	-2.98	0.008	0.26	-0.128[a]	-4.98
WESTERN	-0.161[a]	-3.89	0.083	1.09	-0.017	-0.68	0.018	0.68	-0.113[a]	-6.40	0.074[b]	3.02	0.025	1.32
BORDER	-0.042[b]	-2.12	0.043	0.86	-0.004	-0.23	0.095[a]	5.69	0.033[b]	2.69	0.184[a]	9.92	-0.007	-0.66
URBAN	-0.011	-0.84	0.073	1.41	0.008	0.59	-0.008	-0.74	0.053[b]	3.50	-0.003	-0.15	-0.012	-1.17
PROD	0.018	1.30	0.204[a]	3.88	-0.011	-0.82	-0.001	-0.16	-0.064[a]	-4.05	-0.067[b]	-3.66	0.034[b]	3.33
R^2	**0.0387**		**0.0577**		**0.0852**		**0.1856**		**0.0955**		**0.1196**		**0.0247**	
No.of HH included	**4431**		**4096**		**1431**		**521**		**2018**		**988**		**5122**	

Notes: Descriptions for socio-demographic characteristics and the products involved are found in Table 4.1 and Table 4.3.
Superscripts a, b and c indicate statistical significance at 99, 95 and 90 percent levels, respectively.
Data source: UNHS 1999/2000

Table 3.1: Parameter Estimates of Unit Values Analysis of Ugandan Households Food Purchases, 1999 (CONTINUED)

Depended Variables														
Unit Values of food products	**Onions**		**Tomatoes**		**Cabbage**		**Other vegetables**		**Ripe bananas**		**Mangoes**		**Oranges**	
	8		**9**		**10**		**11**		**12**		**13**		**14**	
Explaining Variables	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**
Intercept	0.106[a]	12.06	0.112[a]	17.79	0.244[a]	13.48	0.152[a]	20.23	0.179[a]	5.12	0.128[a]	4.20	0.144[b]	3.57
HIGH-EDU	0.000	1.32	0.000	1.46	-0.000	-0.79	0.000[c]	1.88	0.000	0.28	-0.000	-0.06	0.001	1.40
HHSIZE	0.005[a]	7.18	0.003[a]	5.68	0.003[b]	2.38	0.001	1.49	0.006[b]	2.08	0.002	1.06	0.003	0.81
HHAGE	0.000	0.11	0.000[b]	3.15	0.000	0.61	-0.000	-0.02	0.001[c]	1.61	0.000	0.73	0.000	0.25
FEMHEAD	0.002	0.46	-0.002	-0.81	-0.000	-0.02	0.011[b]	3.03	0.021	1.23	0.012	0.75	0.003	0.15
PCFEXP	0.006[a]	13.17	0.003[a]	9.86	0.003[a]	4.54	0.002[a]	5.03	0.005[b]	3.03	0.001	0.50	0.006[b]	2.83
EASTERN	-0.025[a]	-3.99	-0.015[b]	-3.34	0.018	1.43	-0.019[a]	-4.08	0.001	0.05	0.111[a]	7.34	-0.036[c]	-1.82
NORTHERN	-0.077[a]	-6.91	0.017[c]	1.88	0.063[b]	3.05	-0.079[a]	-10.89	-0.032	-0.75	-0.083	-1.84	-0.028	-0.63
WESTERN	-0.024[b]	-2.65	0.015[b]	2.14	-0.069[a]	-5.40	-0.043[a]	-5.79	-0.045	-1.33	0.014	0.39	0.053	0.52
BORDER	-0.018[b]	-3.16	0.014[b]	3.45	-0.014	-1.15	-0.009[b]	-2.13b	-0.045[b]	-2.07	-0.059[b]	-3.23	0.036	1.37
URBAN	0.013[b]	2.44	0.001	0.44	0.007	0.67	0.001	0.22	-0.055[b]	-2.55	-0.026	-1.16	0.007	0.29
PROD	0.008	1.50	0.001	0.31	-0.054[a]	-4.79	-0.004	-0.86	0.081[b]	3.68	-0.016	-0.81	-0.041	-1.52
R^2	**0.0560**		**0.0328**		**0.1310**		**0.0377**		**0.0642**		**0.1335**		**0.1082**	
No.of HH included	**5071**		**4795**		**994**		**5305**		**900**		**496**		**261**	

Notes: Descriptions for socio-demographic characteristics and the products involved are found in Table 4.1 and Table 4.3.
Superscripts a, b and c indicate statistical significance at 99, 95 and 90 percent levels, respectively.
Data source: UNHS 1999/2000

Table 3.1: Parameter Estimates of Unit Values Analysis of Ugandan Households Food Purchases, 1999 (CONTINUED)

Depended Variables														
Unit Values of food products		**15**		**16**		**17**		**18**		**19**		**20**		**21**
		Fish		**Eggs**		**Milk**		**Alcohol**		**Cassava**		**Beef**		**Soft drinks**
Explaining Variables														
Intercept	0.530[a]	15.96	0.091[a]	4.70	0.291[a]	22.50	0.292[a]	8.20	0.346[a]	10.10	1.539[a]	36.90	0.000[a]	6.98
HIGH-EDU	0.002[b]	2.92	-0.000	-0.37	0.001[b]	3.64	0.003[b]	2.82	-0.001[c]	-1.62	0.003[a]	2.96	0.013	0.46
HHSIZE	0.017[a]	5.55	0.002	1.43	0.001	0.69	0.019[a]	5.62	0.018[a]	6.10	-0.005	-0.99	-0.000[a]	6.50
HHAGE	-0.001[b]	-2.15	0.000	0.03	-0.000	-0.82	-0.001[b]	-2.61	-0.000	-0.03	0.001[c]	1.79	-0.004	-1.44
FEMHEAD	-0.009	-0.53	-0.005	-0.62	0.002	0.40	0.007	0.40	-0.024	-1.51	-0.035[c]	-1.58	-0.003	-0.49
PCFEXP	0.024[a]	11.81	0.001	1.40	0.004[a]	7.37	0.033[a]	15.49	0.012[a]	4.69	0.001	0.09	0.014	-0.87
EASTERN	-0.019	-0.81	-0.008	-0.62	-0.012	-1.32	-0.013	-0.56	0.039[c]	1.71	0.009[a]	4.45	-0.050[a]	14.77
NORTHERN	-0.184[a]	-5.07	0.017	0.52	0.039	0.87	0.042	0.70	0.293[a]	8.46	0.118[a]	4.88	-0.066[a]	-3.86
WESTERN	0.195[b]	3.45	-0.011	-0.66	-0.055[a]	-3.87	-0.026	-0.90	0.006	0.17	-0.123[a]	-2.82	0.042[a]	-3.42
BORDER	-0.126[a]	-5.13	0.002	0.22	-0.023[b]	-2.89	0.086[a]	3.95	-0.117[a]	-4.72	-0.010	-0.28	0.053[b]	2.21
URBAN	0.088[a]	3.99	0.010	0.94	0.041[a]	5.01	0.171[a]	6.95	-0.027	-1.16	-0.159[a]	-7.34	0.026[a]	4.52
PROD	0.065[b]	3.14	0.011	1.03	-0.057[a]	-6.94	-0.011	-0.50	0.157[a]	7.13	0.082[a]	3.49	0.011[b]	2.53
R^2	**0.0823**		**0.0107**		**0.1418**		**0.1682**		**0.0428**			**0.0742**		**0.0674**
No.of HH included	**3312**		**505**		**2366**		**2583**		**4580**			**1759**		**4859**

Notes: Descriptions for socio-demographic characteristics and the products involved are found in Table 4.1 and Table 4.3.
Superscripts a, b and c indicate statistical significance at 99, 95 and 90 percent levels, respectively.
Data source: UNHS 1999/2000

Treatment of Zero Expenditures

In the diary records method that was used to collect UNHS data, many zero expenditures are reported. There are different reasons why zero expenditures are reported. First, diaries were kept for a week, and it can be argued that if the survey had taken longer, then more food items would have been purchased. This is likely, especially for food items that are storable. Second, in low-income countries such as Uganda, some goods that are consumed are not purchased because they are home produced or have been received in-kind. Third, some food items may have been out of season during the survey period. Finally, some households may have failed to buy an item because they do not prefer the item.

The problem of zero expenditure has to be dealt with because if one includes zero observations in an econometric estimation without special treatment, this would lead to biased and inconsistent estimators (Intriligator et al., 1996). Likewise, as shown by Maddala (1977), including only dependent variables with values greater than zero would not lead to consistent estimators, because the expected residual value of estimators would not equal to zero.

Several methods have been proposed to deal with the zero expenditure problem. In this study, only the Generalized Heckman Procedure that was proposed by Heckman (1979) is applied. This approach follows a two-step estimation procedure that provides consistent and efficient parameter estimates. In step one, the probability that a given household would purchase a good is determined by a probit regression using all available observations. The probability is used to compute Mill's Ratios (λ) for each household and

food commodity. In step two, Mill's Ratios (λ) are used as the instrument that incorporates censoring latent variables in the demand function.

In this study, the probit regression is computed following Heien and Durham (1991) and Heien and Wessels (1990). The dependent variable I_{hi} is equal to one if the expenditure is greater than zero when household *h* purchases food commodity *i* and zero otherwise. The decision to buy is modeled as a dichotomous choice problem, where W_{hi} is vector of regressors that are related to the purchase decision I_{hi}.

$$I_{hi} = f(W_{hi}) \tag{3.66}$$

It is assumed that price (p), expenditure (x) as a proxy to income, and demographic factors (z) play a role in the decision to buy, similar to those variables in the traditional demand analysis (Heien and Durham, 1991). The purchase decision can therefore be written as:

$$I_{hi} = f(p, x, z) \tag{3.67}$$

The model chosen for probit analysis for each food commodity includes, as regressors, total per capita food expenditure and socio-demographic variables. This model is given below as:

$$\begin{aligned} I_{hi} &= \delta_0 + \delta_1 PCFEXP_i + \delta_3 HHSIZE_i + \delta_6 HHHED_i + \delta_7 URBAN_i \\ &+ \delta_8 CENTRAL_i + \delta_9 EASTERN_i + \delta_{10} NORTHERN_i + \delta_8 WESTERN_i + \varepsilon_i \end{aligned} \tag{3.68}$$

where PCFEXP is the per capita weekly expenditure on food; HHSIZE is the size of the household; HHHED is the highest level of education obtained by the head of household; while Eastern, Northern, Western, and Central are the administrative regions of Uganda. URBAN represents a household located in an urban setting. The equations to be estimated by probit regression will include data on purchasing and non-purchasing

households for the expenditure on each commodity in stage 2. The estimates of the inverse Mill's Ratio are derived as follows:

$$\lambda_{hi} = \frac{\phi(W_{hi}\ddot{a}_i)}{\Phi(W_{hi}\ddot{a}_i)} \qquad \text{For } I_{hi} = 1 \tag{3.69}$$

$$\lambda_{hi} = \frac{\phi(W_{hi}\ddot{a}_i)}{1-\Phi(W_{hi}\ddot{a}_i)} \qquad \text{For } I_{hi} = 0, \tag{3.70}$$

where ϕ is the standard normal distribution function evaluated at the value of the Probit function.

Engel Model at First Stage

For non-food items, UNHS data collected only expenditure information and did not collect quantity data. For this reason unit values cannot be calculated. Therefore food and non-food commodities aggregate expenditure and price elasticities will be estimated with an application of an Engel relationship. The model that will be used to estimate these elasticities will be the Working (1943) model. This model assumes a linear relationship between the budget shares of each good and the logarithm of total expenditures. It also satisfies the adding up constraint, since these result from the linearity of budget constraints if the model is estimated equation by equation using Ordinary Least Squares (OLS). This model allows for luxuries, necessities, and inferior goods (Deaton and Muellbauer, 1980b, pp. 19, 75). Since there are households exhibiting zero expenditures, the Heckman two-stage procedure described above will be applied to this model. This means that the inverse Mill's Ratio will be added to the Working model. This basic model is also extended to include household characteristics. The model formulated will thus be:

$$
\begin{aligned}
w_i &= \beta_{i0} + \beta_{i1} \ln PCFEXP + \beta_{i2} HHSIZE + \beta_{i3} HHHED \\
&+ \beta_{i4} HHFEM + \beta_{i5} HHAGE + \beta_{i6} PROD + \beta_{i7} URBAN \\
&+ \beta_{i8} TCEXP1 + \beta_{i9} TCEXP3 + \beta_{i12} CENTRAL + \beta_{i12} EASTERN \\
&+ \beta_{i13} WESTERN + \beta_{i14} NORTHERN + \beta_{i15} \lambda_i + \varepsilon_i
\end{aligned} \tag{3.71}
$$

where lnPCFEXP is the log of per capita weekly expenditures on food while $TCEXP_1$ and $TCEXP_3$ represent low income households and high income households, respectively. HHSIZE is the size of the household, HHHED is the highest level of education obtained by the head of household, HHFEM is a female headed household, and HHAGE is the age of head of household. Eastern, Northern, Western, and Central are the administrative regions of Uganda. URBAN represents a household located in an urban location and PROD is the variable that captures household engaged in home food production. The sign of β_i will determine whether a good is a necessary good or a luxury good. When $\beta_i > 0$, the good will be said to be a luxury good, and for $\beta_i < 0$, goods will be said to be necessities.

Estimation of LA/AIDS at Second Stage

In the second stage, the inverse Mills ratios are used as instruments to incorporate the latent variable into the estimation of the share equations. This means that the inverse Mill's Ratio is added to the model specified by equations (3.62) and (3.63). At this stage, all available observations are included: that is, zero and non-zero observations. The inclusion of inverse Mill's Ratio in this model means that the decision to purchase and the decision on the quantity to purchase are combined. This inclusion also permits the accounting for any biases resulting from zero values in the dependent variable. Therefore, each equation in the LA/AIDS will take the form:

$$w_i = \alpha_i^{***} + d + \sum_j \gamma_{ij} \ln(p_j) + \beta_i (\ln(x) - \sum_j \overline{w}_j \ln(p_j)) + \theta_i \lambda_i + \varepsilon_i \tag{3.72}$$

$$\begin{aligned} d_i &= \rho_1 HHSIZE_i + \rho_2 HHHED_i + \rho_3 HHFEM_i + \rho_4 HHAGE_i \\ &+ \rho_5 PROD_i + \rho_6 URBAN_i + \rho_7 TCEXP1_i + \rho_8 TCEXP3_i \\ &+ \rho_{11} CENTRAL_i + \rho_{12} EASTERN_i + \rho_{13} NORTHERN_i \\ &+ \rho_{14} WESTERN_i + \rho_{15} \lambda_i + \varepsilon_i \end{aligned} \tag{3.73}$$

To preserve the adding-up property, the restriction

$$\sum_i^k \theta_i \lambda_i = 0 \tag{3.75}$$

should be added to (3.59), (3.60), and (3.61).

The elasticity derivations for the AIDS and LA/AIDS models are widely investigated and well documented. Following Bues (1994) and Green and Alston (1990), taking the derivative of Equation (3.05) with respect to ln(x), we can obtain the expenditure elasticity e_i as follows:

$$e_i = 1 + \left(\frac{1}{w_i}\right)\left(\frac{\partial w_i}{\partial \ln(x)}\right) = 1 + \left(\frac{\beta_i}{w_i}\right) \tag{3.76}$$

Taking the derivative with respect to *ln(pj)*, uncompensated own ($j=i$) and cross ($j \neq i$) price elasticities $e_{ij}^{LA/AIDS}$ are calculated as follows:

$$e_i^{LA/AIDS} = -\delta_{ij} + \left(\frac{1}{w_i}\right)\left(\frac{\partial w_i}{\partial \ln(p_i)}\right) = -\delta + \left(\frac{\gamma_{ij}}{\overline{w}_i}\right) - \left(\frac{\beta_i}{\overline{w}_i}\right)\overline{w}_j \qquad \forall_i, j = 1,....,n \tag{3.77}$$

where δ_{ij} is the Kronecker delta that is unity if $i = j$ and zero otherwise. In this study, we use the sample mean for the point of normalization. We can derive the Hicksian compensated price elasticities for the AIDS and the LA/AIDS models. The compensated price elasticities, $s_{ij}^{LA/AIDS}$, at the point of normalization become:

$$s_{ij}^{LA/AIDS} = e_{ij} + e_i w_j = -\delta_{ij} + \left(\frac{\gamma_{ij}}{\overline{w}_j}\right) + \overline{w}_j \qquad \forall_i, j = 1,....,n \tag{3.78}$$

For the AIDS model, following Bues (1994), we apply Equation (3.76) for expenditure elasticity. Following Green and Alston (1990), uncompensated own ($j=i$) and cross ($j \neq i$) price elasticities, $e_{ij}^{LA/AIDS}$, become as follows:

$$e_{ij}^{LA/AIDS} = -\delta_{ij} + \frac{\gamma_{ij}}{\overline{w}_i} - \frac{\beta_i}{\overline{w}_i}\left(\alpha_j + \sum_{k=1}^{n} \gamma_{kj} \ln \overline{p}_k\right) \tag{3.79}$$

Compensated own ($j=i$) and cross ($j \neq i$) price elasticities, s_{ij}^{AIDS} become:

$$e_{ij}^{LA/AIDS} = -\delta_{ij} + \frac{\gamma_{ij}}{\overline{w}_i} - \frac{\beta_i}{\overline{w}_i}\left(\alpha_j + \sum_{k=1}^{n} \gamma_{kj} \ln \overline{p}_k - \overline{w}_j\right) \tag{3.80}$$

CHAPTER 4

DATA AND EMPIRICAL MODELS

Data for commodity groups described in this analysis were collected by the Uganda National Household Survey (UNHS) conducted nationally by the Uganda Bureau of Statistics (UBOS). The period covered by the survey is the fiscal year 1999-2000. A stratified, two-stage sampling design was applied in all districts, except the districts that lacked an Enumeration Area (EA) frame. In these districts, the sample was selected in three stages. For the districts with a two-sampling stage design, the first sampling unit was the EA of the 1991 population census in districts with the household as the second sampling unit. For each district with a three-stage sampling design, the first stage sampling unit was the parish, the second sampling unit was the LC-1 (village), and the third sampling unit was the household.

The survey included panel Enumerated Areas (EAs) and panel households from the 1992/93 Integrated Household Survey (IHS), as well as new EAs and new households. A total of 637 panel EAs and 763 EAs were allocated as sample design (1,400 first stage sampling units). The panel sample was selected on the basis of simple random sampling (SRS) from 1,018 EAs first stage sampling units covered during the 1992/1993 IHS. Conversely, the new sample was selected on the basis of Probability Proportional to Size (PPS) on the entire sample.

About 10,700 households were covered in the survey, encompassing all the districts except Kitgum, Gulu, Kasese, and Bundibugio. Three questionnaires were used to collect the data. The Community Survey Questionnaire (Appendix 1) was used to

gather information on household characteristics, such as household composition, and total annual income data were collected. The Socio-Economics Survey questionnaire (Appendix 2) was used to record household consumption expenditure in cash, in-kind or through barter and was recorded for the household level only. For bartered items, the value of the item was recorded, not the value one got in exchange. Goods and services entering the final consumption expenditures of households were divided into three groups – Parts A, B, and C – depending upon the frequency of purchases and/or consumption. Part A, Part B and Part C had 7 days, 30 days and 365 days as reference periods, respectively. The expenditure data were collected over a period of one year, from August 1999 to July 2000. During this period, households were visited twice: once at the end of the first season and once at the end of the second season.

The Socio-Economics Survey covered 11 expenditure groups: food, housing, education, clothing and footwear, furniture and furnishings, household appliances, education, health, transportation and communication, services, and non-durable and personal goods. Out of the 11 commodity groups available in the data, this study, which is on food demand analysis, only considers the food group. A third questionnaire, the Crop Survey Questionnaire, was used to collect information on crops.

The UNHS data were collected by UBOS in collaboration with the World Bank for the International Household Survey Network. To ensure that international standards and best practices for data documentation, dissemination and preservation were adhered to, the two institutions developed an online data documentation system for the survey. This was accomplished by using the Micro-data Management Toolkit. In using the tool

kit, UBOS was able to document UNHS in accordance with International metadata standards.

Household Characteristics

The average monthly per capita expenditure was Ushs 64,000 for those Ugandans living in the urban areas, while for those living in the rural areas, it was Ushs 21,500. In terms of budget shares, the food share dominated, as is generally the observed case with poor countries (Seale et al., 2003). The average budget share for food was 63%, but these shares were lower for the urban areas, where it was 48%. The lower food expenditure share in urban areas is due to higher non-food expenditures in these respective areas. The non-food expenditures may include expenditures on transportation or high housing rental costs. This is because incomes tend to be higher in the urban areas than in rural areas.

The food budget shares in Uganda are similar to other budget surveys done in Africa (Teklu, 1996). This evidence of the expenditures in the urban and rural areas shows that high-income and low-income households differ in the proportion of income they allocate in their food budgets. This comparison shows that low-income households spend over 60% of their income on food, while higher-income households spend slightly less than one-half of their income on food, as is the case for urban areas in Uganda. This confirms the hypothesis that households reduce the total budget share for food as incomes rise.

Household Expenditure

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Research Hypotheses

The model described in this chapter relates the budget shares as a function of total consumption expenditure, household size, household composition, age of the head of household, female head of household, level of education of the head of the household, household in an urban location, region of household location, household in a border

location, and home production of food variables. For the empirical estimation of the LA/AIDS model, research hypotheses are stated for each coefficient. It should be noted that *a priori* expectations cannot be formulated for all socio-demographic variables. In some cases, it is plausible that a socio-demographic variable may affect expenditure; however, the direction of this influence remains the question to be answered by this empirical study.

Relative Economic Status of Households

One way of capturing differences in food consumption is by analyzing the relative economic status of a household. This can be represented by either income or expenditure quintiles. It is a well-documented fact that household incomes in developing countries fluctuate more than expenditures in the short run and are often reported less accurately (Meyer & Sullivan, 2003). Consumption expenditures provide a more reliable measure of household income than income; it reduces reporting errors and smoothes out short-term fluctuations. Thus, the relative economic status of a household was represented by total consumption expenditure (TCEXP) as outlined in Table 4.1. This variable can be seen as a shift factor accounting for differences in food consumption behavior beyond the mere income effect captured by the expenditure variable. It has been shown that as incomes increase, African consumers shift from starchy staples to processed cereals and animal products. This pattern is consistent to other developing nations (Alderman, 1986; Pinstrup-Andersen, 1988; Waterfield, 1985). The hypothesis for the income coefficient was:

Hypothesis 1: *Ceteris paribus*, the budget share allocated to starchy grain staples will be greater in lower-income households than in higher-income households. The opposite will be true for the budget shares for processed cereals and animal products. The expectation, therefore, is that the expenditure coefficient will be negatively related to starchy grain staples and positively related to processed cereals and animal products.

Household Characteristics

Several variables have been chosen from previous studies to depict the characteristics of the household. One important variable is household size (HHSIZE). Rose and Charlton (2000) documented the importance of household size and suggested higher food poverty rates occur with increasing household size.[11] Sharon and Conlon (2004) showed that food poverty constrains food consumption in three ways: first, by affecting food affordability through the choice and quantity of food; second, by impacting accessibility to food through the retail options available; third, through psychosocial factors that determine food choice among socially disadvantaged groups. Earlier, Prais and Houthakker (1955) found total expenditure and household size to be positively correlated and exclusion of the latter could bias the result of consumption patterns. They also found that larger households tended to spend a higher proportion of their total expenditure on food than smaller households.

However, a coefficient of household size also captures the effect of economies of scale of larger households. Savadogo and Brandt (1988) indicated that, as household size increases, it leads to a less than proportionate increase in food consumption, indicating

[11] Food poverty can be defined as the inability to access a nutritionally adequate diet and the related impacts on health, culture and social participation.

there are economies of scale in consumption. They found that these economies of scale are larger for high-income groups. Houthakker (1957) found that the coefficient for the household size represents two effects: the specific effect and the income effect. The specific effect results from the increase in the need for various commodities when household size increases. The income effect, on the other hand, is the effect of the increase in household size making a household relatively poor. If the specific effect dominates the income effect, the coefficient for household size is positive; otherwise, it is negative. The hypothesis for the household size coefficient was:

Hypothesis 2: *Ceteris paribus*, the budget share allocated to food will be higher in larger households than in smaller households.

The expectation, therefore, is that the size coefficient will be positively related to food consumption.

Another effect of household size is that it induces the reallocation of food budget shares from food groups that are income-elastic to food groups that are income-inelastic. This was documented by Savadogo and Brandt (1988), who showed that an increase in household size had the effect of inducing households to shift consumption from income-elastic food groups, such as meats and vegetables, to starchy staples. This leads to another hypothesis:

Hypothesis 3: *Ceteris paribus*, the budget share allocated to income-inelastic food groups, such as starchy staples, will be higher in larger households than in smaller household.

The expectation, therefore, is that the size coefficient will be positively related to the consumption of starchy staples.

Substitution from income-elastic food groups to starchy staples depends on the stage of the lifecycle of the households. Alwang (1989) showed that a young household, which has a greater proportional need for body growth, consumes more coarse grains and high protein animal products than older households. He also concluded that, as the household gets older, there is the need for energy maintenance; hence, there is a shift in consumption to energy-rich food staples. The hypotheses for the household composition coefficient were:

Hypothesis 4: *Ceteris paribus*, the budget share allocated to coarse grains and high protein animal products foods will be higher in younger households than in older households.

Hypothesis 5: *Ceteris paribus*, the budget share allocated to high-energy food staples will be higher in older households than in younger household.

The expectation, therefore, is that the coefficient for household composition for younger households will be positive for the consumption of coarse grains and high protein animal product foods. Also, the coefficient for older households is expected to be positive for consumption of starchy staples.

Household Head Characteristics

Several variables were chosen from the literature to depict the characteristics of the household head. These variables include the age of the household head (HHAGE), the gender of the household head (HHFEM), and the education level attained by the head of household (HHEDU) and are outlined in Table 4.1. The age of the head of the household (HHAGE) corresponds to his or her age in years. In this study, this was a continuous

variable. Akbay et al. (2007) showed that households with older heads consumed more meat, fats and oils, vegetables, fruits and dairy products and less breads, cereals, non-alcoholic beverages than households with younger heads. The hypothesis for the household head age coefficient was:

Hypothesis 6: *Ceteris paribus*, the budget share allocated to meat, fats and oils, vegetables, fruits, and dairy products will be higher in households with older heads than in households headed by relatively younger household heads.

Hypothesis 7: *Ceteris paribus*, budget share allocated to breads, cereals, and non-alcoholic beverages will be lower in household headed by older individuals than in households headed by relatively younger people.

The expectation therefore is that the coefficient for age of the head of household will be positive when the household is headed by an older and negative when the household is headed by a younger individual when the food categories are meat, fats and oils, vegetables, fruits and dairy products. This coefficient is expected to be negative for a household headed by older individuals when the food categories are breads, cereals, and non-alcoholic beverages.

The sex of the head of household (HHFEM), who is responsible for food purchases, can influence food decisions, and therefore consumption, in a very significant way. The sex of the head of household is identified as a binary variable. The reference household is female and therefore will take the value of 1 if the person is female and 0 if the person is male. Alwang (1989) showed that demand patterns for food may vary across age and sex. He also showed that women had a greater propensity for food expenditure

than male consumers. The hypothesis for effect of the household headed by a woman was:

Hypothesis 8: *Ceteris paribus*, the budget share allocated to food will be higher in households headed by a female than in households headed by a male.

The expectation, therefore, is that the coefficient of household headed by a woman will be positive.

The social position of the household will be captured by the educational effect. The expectation is that the education level of a household will likely have an impact on the consumption pattern of the household. For example, Holcomb (1995) showed that age and education had a significant influence on reported food consumption and nutrient intakes. It is therefore expected that food expenditures for heads of households who have lower education and for those who have higher education will differ significantly. The education of the head of household (HHEDU) variable is identified as a binary variable with higher education taking the value one (1) while lower education takes the value zero (0). If a household head indicated that he or she has completed some secondary school education and beyond, he or she is considered to have higher education. If a household head indicated that he or she has no formal education or that he or she has some primary school education up to primary 7 then he or she is considered to have lower education. The hypothesis for the head of household education coefficient was:

Hypothesis 9: *Ceteris paribus*, the budget share allocated to food will be higher in households headed by individuals with higher education than in households headed by individuals with lower education.

The expectation, therefore, is that the coefficient for the education of head of household will be positive.

Location Factors

Three more variables were included in the study. These are termed as the location factors and they control for the differences in culture and lifestyles of the households that may occur between households residing in the urban or rural areas, border or inland districts, and different regions of the country.

The first variable, named URBAN, represents the urbanization status of the household. The work of Savadogo and Brandt (1988) showed that urbanization has an impact on consumption patterns. According to Huang and David (1993), empirical evidence shows that urbanization has considerable influence in explaining demand differences between rural and urban areas. In Africa, rapid urbanization is marked by a major shift from locally produced coarse grains (Millets, Sorghum) to imported wheat and rice (Delgado & Miller, 1985). The URBAN variable was a binary variable with the value one (1) representing households located in urban areas and zero (0) representing households in the rural areas. The hypothesis was:

Hypothesis 10: *Ceteris paribus,* households in urban areas will spend a higher proportion of their income on urban-oriented staples, such as wheat and rice, than households in rural areas. Households in rural areas will spend a higher proportion of their income on coarse staple grains than households in urban areas.

The expectation is that the coefficient of households in the urban areas will be positive for urban-oriented staples, such as wheat and rice, and negative for coarse staples, such as millet and sorghum.

The second variable is REGION, and it represents the region of Uganda in which the household resides. The regions of Uganda are documented in Table 4.1. REGION is a variable where *a priori* expectations could not be formulated and therefore, the direction of influence, how a given region will affect consumption expenditures, remains an empirical question whose answer is left to the empirical part of this study.

The third variable is BORDER, which represented the relative proximity to an international border for the household. The BORDER variable is a binary variable with the value one (1) representing households located in border districts and zero (0) representing other districts. Prices in the border districts are determined by the international markets rather than by domestic supply and demand. As a country enters an integrated market, studies show that prices tend to shift down, especially for staple grains (Huang, Rozelle & Chang, 2004). In the case of Uganda the downward shift in prices at the border will likely affect consumption patterns in the border districts but not in the inland districts. The hypothesis was:

Hypothesis 11: *Ceteris paribus,* the households residing in border districts will spend a higher proportion of their income on staple foods than households in the inland districts. The expectation is that the coefficient for households in the border districts will be positive for staples foods.

Home Production of Food

Home produced food products (PROD) play a very important role in supplementing the nutritional intake of many households. In Uganda, this importance is exemplified by the percentage of the population engaged in agriculture. For example, Table 4.7 shows that about 85% of rural households are engaged in crop farming as compared to 15% in the urban areas. Further, Table 4.8 shows that about one half of food consumption expenditures in the rural areas and 10% in the urban areas come from home produced food.[12] Home produced food products are likely to lower food expenditures for all relevant food items. It is also expected that food purchases for households engaged in home production of food will be more sensitive to price and income changes. This sensitivity to price and income changes is due to the fact that these food-producing households are able to substitute home produced food for purchased food and possibly even sell surplus food at higher prices. Also, several studies, including Streifler (2000), have shown that there is a positive relation between food production and nutritional intake. Weber and Weber (1975) attributed low calories per capita to low agricultural productivity.

Hypothesis 12: *Ceteris paribus*, households engaged in home food production will have lower food expenditures for all relevant food items than households not engaged in home food production

The expectation is that the coefficient for household involvement in home food production will be negative for all relevant food items.

[12] The items that are purchased in the market and those received free are valued at market prices, whereas those that consumed out of home production are valued at farm-gate prices.

Regmi et al (2001), in a cross-country analysis of food consumption patterns using highly aggregated data, found that price and income effects are not uniform across all food categories. They found that staple food consumption changes the least, while greater changes are made to higher valued foods, such as dairy and meat. Their conclusion was that consumers in poorer countries might resort to greater substitutions within a food category when prices are higher. The hypothesis for the income coefficient was:

Hypothesis 13: *Ceteris paribus,* a higher price will result in a significant substitution within a particular food group, such as the starchy food group, in lower income households compared to higher income households. The expectation, therefore, is that the cross-price elasticity of starchy foods, such as matooke, maize, rice, cereals, other foods (cassava, sweet potatoes, potatoes), will be positive, indicating that these foods are substitutes at lower-income levels.

Table 4.1: Socio-demographic variables used in the estimated models, all households, UNHS, 2000.

SOCIO-DEMOGRAPHIC FACTOR		**OPERATIONAL SOCIO-DEMOGRAPHIC VARIABLE**	NAME OF VARIABLE	TYPE
Relative economic status		Total per capita expenditure.		Dummy
			TCEXP1	Low income
			TCEXP2	Medium income
			TCEXP3	High income
Household size		Number of household members	HHSIZE	Discrete
Household composition		Age groups in number	HHCOMP N_1 Number of household members aged <6 N_2 Number of household members aged 7-12 N_3 Number of household members aged 13-19 N_4 Number of household members aged 20-54 N_5 Number of household members aged >55	Discrete
Age of head of household		Age of the head of household in years	HHAGE	Continuous
Sex of head of household		Variable indicating whether household is headed by a female (Reference household-NO)	HHFEM	Dummy (N-0, Y-1)
Social position of household	Head of household education	Numbers of years of schooling completed by the head of household.	HHHED	Dummy 1-high 0-low
Location	Urban status	Urbanization status of household dwelling (Reference household-rural)	URBAN	Dummy 1-urban 0-rural
	Region[13]	Region in which household dwells—Kampala are the reference households	CENTRAL EASTERN NORTHERN WESTERN	Dummy
	Border effect	Household dwelling relative to the border (Reference household—interior district)	BORDER	Dummy 1-border 0-interior
Household Production		Variable indicating whether household used land for production of plant products or kept livestock. (Reference household-NO)	PROD	Dummy 0-No 1-Yes

Source of data – UNHS.

[13] The regions of Uganda are Central, Eastern, Northern, and Western.

Table 4.2: Expenditure and price variables used in the estimation procedure, all households, UNHS, 2000.

Matooke	E1	Household's monthly expenditure on matooke
	P1	Price of matooke in Ushs per kg
Maize	E2	Household's monthly expenditure on maize
	P2	Price of maize in Ushs per kg
Rice	E3	Household's monthly expenditure on rice
	P3	Price of rice in Ushs per kg
Cereals[14]	E4	Household's monthly expenditure on Cereals
	P4	Price of cereals in Ushs per kg
Sugar & sweets	E5	Household's monthly expenditure on sugar/sweets
	P5	Price of sugar/sweet in Ushs per kg
Fruits and Vegetables[15]	E6	Household's monthly expenditure on fruits and vegetables
	P6	Price of fruits and vegetables in Ushs per kg
Meat[16]	E7	Household's monthly expenditure on meat
	P7	Price of meat in Ushs per kg
Fish[17]	E8	Household's monthly expenditure on Fish
	P8	Price of fish in Ushs per kg
Dairy[18]	E9	Household's monthly expenditure on Dairy
	P9	Price of dairy in Ushs per liter
Fats and oils[19]	E10	Household's monthly expenditure on Fats and oils
	P10	Price of fats and oils in Ushs per kg
Beverages[20]	E11	Household's monthly expenditure on beverages
	P11	Price of beverages in Ushs per kg
Alcoholic drinks[21]	E12	Household's monthly expenditure on alcoholic
	P12	Price of alcohol in Ushs per liter
Other foods[22]	E13	Household's monthly expenditure on other foods
	P13	Price of other foods in Ushs per kg
Pulses[23]	E14	Household's monthly expenditure on pulses
	P14	Price of pulses in Ushs per kg

[14] Cereals consist of wheat grain, wheat four, and prepared bread, sorghum, millet.
[15] Fruit and Vegetables include, Ripe bananas, oranges, mangoes, other vegetables, other fruits, onions cabbage, tomatoes
[16] Meat consists of bovine meat, pork, chicken
[17] Fish consists of fish and all fish products.
[18] Dairy consists of Milk, Eggs
[19] Fats and oils consists of butter, Other veg. oil and fats (o.v.o.&f), cooking fat, vegetable oils, lard
[20] Beverages consist of coffee, tea, soft drinks (sodas, fruit juices, and mineral water), alcoholic drinks
[21] Alcoholic drinks include all beers, wine, gin etc.
[22] Other foods consist of irish potatoes, sweet potatoes, cassava, FAFH
[23] Pulses include beans, peas,

Table 4.3: Food commodities considered in this study

STAGE 1		**STAGE 2**	
Aggregates	**Sub-Aggregates**	**Food commodities**	
FOOD	Carbohydrates	Matooke	Matooke
		Maize	Maize flour
			Maize grain
		Cereals	Wheat flour
			Sorghum
			Millet
		Sugar	Sugar
		Rice	Rice
	Fruits & Vegetables	Fruit and Vegetables	Onions
			Tomatoes
			Cabbage
			Other vegetables
			Mangoes
			Oranges
			Ripe bananas
			Other fruits
	Protein	Meat	Raw beef
			Raw pork
			Poultry
			Other meats
		Fish	Fish and Fish products
		Dairy products	Eggs
			Milk
	Oils and Fats	Fats and Oil	Butter
			Lard
			Veg. fats and oils
			Other oils and fats
	Beverages	Beverages	Coffee, tea
			Soft drinks
	Other foods	Other foods	Sweet potatoes
			Cassava
			Arrow root
			Potatoes
			FAFH
	Pulses	Pulses	Dry beans
			Dry peas
			Other pulses
	Alcoholic	Alcoholic beverages	
NON-FOOD			

Source: Own table, data by UNHS.

Table 4.4: Socio-Economic Household Statistics

BASIC STATISTICS		**UGANDA**
Number of households in the sample		10,700
Budget Shares (%)	**Rural**	**Urban**
Food Purchased	46	89
Food Not Purchased[24]	48	6
Food Share	63	48
Non-food Share	37	52
Mean expenditure per Capita (month)		
	21,500	64,000
Average number of persons Per household		
	5.4	4.4

Source of data: UNHS

Table 4.5: Characteristics of the Head of Household, Uganda, (1999/2000)

Basic Statistics			
Sex		**Rural**	**Urban**
Male		74	69
Female		26	31
Education (%)			**total**
None			30
Primary[25]			54
Secondary[26]			10
Post Secondary			6
Age of head of household (%)	**age**	**Male (%)**	**Female (%)**
	18-25	11	9
	26-49	60	51
	50+	29	40

Source of data: UNHS

[24] Food not purchased includes food produced for home consumption, received as payment in kind or gift.
[25] This data includes those who have completed form one to form four.

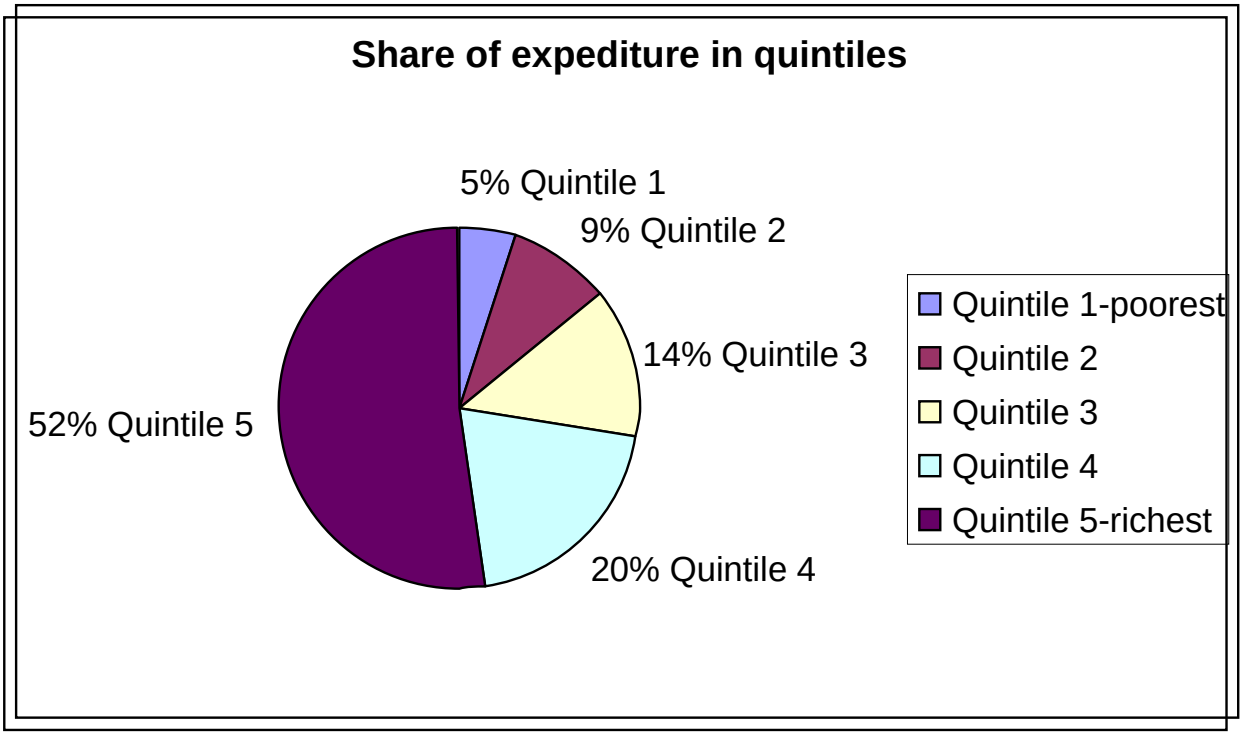
[26] This includes people who have completed form five or higher. It includes university education and other colleges after form five.

Table 4.6: Monthly Household Expenditure (%)

	1997			1999/00		
	Rural	Urban	Total	Rural	Urban	Total
Total (%)	100	100	100	100	100	100
Food, Drink, and Tobacco	63	48	59	56	38	51
Clothing and footwear	4	5	4	4	5	4
Rent, fuel, and power	12	18	13	15	21	17
Household appliances and equipment	6	7	6	6	7	6
Transport	2	5	3	4	8	5
Health and Medical care	5	3	4	5	3	4
Education	4	7	5	5	9	7
Other consumption expenditure	1	2	2	2	4	2
Non-consumption expenditure	4	5	4	3	5	4

Source: UNHS

Figure 4.1: Mean monthly expenditure per capita and their share by Quintiles



Source of data: UNHS

Table 4.7: Working Household Population (1999/2000)

		Rural		Urban
Industry	('000)	(%)	('000)	(%)
Total	**7,061**	**100**	**983**	**100**
Crop farming	5,968	84.5	146	14.8
Other Agriculture	265	3.8	18	1.8
Mining and Quarrying	30	0.4	3	0.3
Manufacturing	115	1.6	94	9.6
Electricity, gas and water supply	5	0.1	5	0.5
Construction	51	0.7	34	3.5
Trade, Hotels etc.	276	3.9	370	37.6
Transport Storage & comm.	47	0.7	72	7.3
All other services	304	4.3	242	24.6

Source: UBOS

Table 4.8: Food Consumption Expenditure by Source (1999/2000)

Region	**Purchased**	**Out of home produce**	**Free**
Central*			
Rural	46	49	**5**
Urban	82	11	7
Total	53	42	6
Kampala	93	2	5
Eastern			
Rural	50	42	7
Urban	89	7	4
Total	56	37	7
Northern			
Rural	56	35	9
Urban	91	5	4
Total	59	33	9
Western			
Rural	38	59	3
Urban	85	12	3
Total	43	54	3
Uganda			
Rural	46	48	6
Urban	89	6	5
Total	38	38	6

Source: UBOS
Note: * Central excludes Kampala District

CHAPTER 5

RESULTS AND DISCUSSION

This chapter presents and discusses the results from the descriptive statistics on table 5.1 and the probit regression model (equation 3.18), which includes data from purchasing and non-purchasing households. The regressors in the probit analysis for each commodity include total per capita food expenditure (PCFEXP) and a vector of selected socio-demographic characteristics. This chapter also discusses the results of the Working model, which estimates the food and non-food commodities in stage 1, and the LA/AIDS model estimates for matooke, maize, rice, sugar, dairy products, fats and oils, fruits and vegetables, meat, fish, pulses, beverages, other foods, and alcohol budget shares in the second stage.

Descriptive Statistics Results

Descriptive statistics of the variables are presented in Table 5.1. Among all food groups, meat accounts for the highest budget share and the mean expenditure reflecting the fact that meat, especially bovine meat, is the staple food among the pastoral communities of Northern, Eastern, and Western Uganda. The price of meat tends to be expensive in urban areas and this is evident in the unit prices. Meat is followed by fish, which has the second highest budget share. The high budget share of fish may be a reflection of both availability and preference. Uganda has plenty of lakes and rivers, which help, in the country having a steady supply of fish and its products. Maize has the third highest budget share. Maize is important because a typical Ugandan diet consists of ugali, a stiff maize porridge. Also, amongst the starchy cereals, maize is popular in urban

areas. Also popular in the Ugandan diet and especially in the Central region, is matooke. This is reflected in the fact that matooke has the fourth highest budget share. Matooke is usually eaten with groundnut stew and this may explain the reason why pulses, although highly aggregated, have a reasonably high share values. Rice, unlike maize that is grown in many regions of the country, is cultivated in limited areas. Local production of rice is normally unable to meet the domestic demand and therefore some rice is imported thus making it a bit more expensive than maize. The budget share for cereals is smaller than that for most food grains. This may be a reflection that consumer tastes are shifting away from coarse grains to more refined and processed food grains like maize and rice.

Probit Regression Results

The probit regression includes data from purchasing and non-purchasing households at stage two. The results, presented in Tables 5.2, show that 85.65% of the estimated coefficients are significant at 10%. With respect to the direction of the coefficients, per capita food expenditure (PCFEXP) exerts a positive influence in the probability of purchase of matooke, maize, rice, sugar, oils, cereals, fruits and vegetables, dairy and pulses. Regional variables exhibited explanatory powers for the probability of purchase in more than 70% of the cases of food types.

With reference to the Central Region, the probability of purchase of matooke is negative in the Eastern, Northern, and Western Regions. Households in Central Region traditionally consume more matooke (green bananas) than any other region. This relationship is reversed when maize is the food crop in question. With reference to the Central Region, the other regions consume more maize, and this is reflected in the fact

that the Eastern, Northern, and Western regions show a positive and significant probability for the consumption of maize. The Eastern Region is the only region to exhibit negative influence in the probability of the consumption of rice relative to the Central Region. This can be explained by availability of the product; rice is grown in this region and households here may hold more inventory of this product than other areas. All the other regions show a positive probability to purchase cereal in reference to the Central Region. This can be explained by the fact that sorghum and millet are the staple foods in the three regions. The inhabitants of these regions are also traditional cattle herders, and this may explain the fact that the Eastern and Northern regions exert a positive influence on the probability of meat consumption.

The Western Region shows a negative influence on the probability of alcohol purchase relative to the Central Region. The households situated in urban locations also appear to have a positive influence on the probability of alcohol purchase; but, to the contrary, urban households demonstrate a negative influence on the probability of most other food commodities. The negative influence may be puzzling, but can be explained by the fact that urban households tend to have higher incomes than their rural counterparts and the lower purchase probabilities may be due to the fact that they allocate less percentage of their food budget shares on many of the food groups. As expected, households located in the border districts have a positive influence on the probability of the purchase of alcohol, as well as rice, cereal, fruit and vegetables, matooke, meat, fish, and dairy. This is to be expected, since prices at the border tend to shift down, leading to higher consumption of these goods.

Households that produce some of the food they consume, as expected, have a negative influence in the probability of purchase on matooke, maize, fish, beverages, and other foods. Home production has positive influence on food groups that households may be unable to produce on their own, such as fruits and vegetables, meat, alcohol, and pulses. With higher education, there is a significant, higher probability that a Ugandan household will purchase all food groups, except for rice, sugar, oils, and dairy.

Parameter Estimates of the Working Model: Stage one

At the first stage, no Linear Approximation Almost Ideal Demand Systems (LA/AIDS) was estimated, because UNHS data contain only data on expenditures on food and non-food categories and no quantityies. This means that, at the first stage, no unit values could be calculated. The price and expenditure elasticities for food and non-food groups were calculated using an Engel relationship. The Engel relationship applied here was the Working (1943) model, and the results are presented in Table 5.3.

As expected, the expenditure coefficient of food is negative, indicating that food is a necessity. Food share is higher when a Ugandan household is headed by a woman or if the household is headed by a person who has a higher education. The same is the case if the household is located in the Eastern Region. Households residing the Central and Western regions demonstrate reduced food shares. Households in the border districts have higher food expenditure shares than their counterparts in the interior. This is expected, as the price at the border tends to be the international price, which tends to be lower compared to the interior of the country. Households residing in urban areas have higher food expenditures than do their rural counterparts. Contrary to expectations, food

expenditure share is lower in lower income households. However, when a household produces its own food, it is faced with lower food expenditure shares. Finally, the impact of inverse mills ratios (imr) is highly significant and thus supports the decision to include them.

Parameter Estimates of the LA/AIDS Model: Stage two

The Linear Approximation Almost Ideal Demand Systems (LA/AIDS) model including socio-demographic variables and augmented by the inverse mills ratios (IMR), as specified in equations (3.24), were next estimated by a linear ITSUR technique. Symmetry, homogeneity, and adding-up restrictions were imposed. To avoid singularity of the variance-covariance matrix, the last equation (other foods) was dropped. Parameter estimates of the demand system are given in Table 5.3. The relative fit of the model, as measured by the R^2, indicates a poor fit. The low fit is, however, not unusual for models estimated using cross sectional data. About 25% of the coefficients are significant at the 10% level.

In stage one, the expenditure coefficient for food is negative, implying that food is a necessity. The expenditure coefficients for maize, fat and oil, dairy, and pulses are negative, implying that these food categories are necessities. On the other hand, the expenditure coefficients for sugar, fish, cereal, fruit and vegetables, meat, and alcohol are positive, which implies that these foods are luxuries. Considering fish, sugar, and meat a luxury is not unusual for a low-income country, such as Uganda, since priority is given to starchy staples. Dairy products are mainly consumed in urban areas, where incomes tend

to be higher, and in pastoral communities, where these products are available as home-produced products.

To capture the relative economic status of the household, the study looked at the total consumption expenditure (TCEXP). It has been shown that, as incomes rise, African consumers tend to shift consumption from starchy staples to processed cereals and animal products (Waterfield 1985; Alderman 1986; and Pinsstrup-Andersen 1988). In this study, the results show that, at higher incomes (TCEXP3), Ugandans consume more rice, fruits and vegetables, and soft beverages than their low-income (TCEXP1) counterparts. Low-income households consumed food products, such as matooke, maize, and cereals, thereby supporting previous studies that show that higher income consumers tend to shift away from coarse grains like sorghum and millet.

To capture the effects of the location in which the household resides, urbanization (URBAN), the geographic region of the country (REGION), and border district (BORDER) variables were used. Delagado and Miller (1985) showed that, in Africa, rapid urbanization is marked by a shift from consumption of locally produced coarse grains to imported wheat and rice. In this study, we find a positive and significant correlation between households that located in urban areas and consumption of fruit and vegetables. There is also a strong and positive correlation between these households and the consumption of matooke, maize, sugar, cereal, fats and oil, fish, dairy products, and alcohol. Cereals, as illustrated on Table 4.3, include sorghum, millet, and bread. The cereal coefficient being positive may be an indication that the effect of bread consumption outweighs the effect of consuming sorghum and millet, and thus supports prior findings. Another explanation for the cereal coefficient being positive could the fact

that millet is used in processing alcohol; therefore, there is a possibility for derived demand for millet for alcohol processing. Contrary to the prior findings, the consumption of rice for households residing in urban settings is negative for Uganda.

The BORDER coefficients suggest that households that reside in the border districts consume significantly higher amounts of matooke, sugar, oils, fruits and vegetables, dairy products, alcohol and pulses than households in the interior districts. Matooke, maize, sugar, cereals, fats and oils, and fruits and vegetables are considered staples; thus, this result strongly supports hypothesis 11, which states that *ceteris paribus,* the households residing in border districts will spend a higher proportion of their income on staple foods than households in the inland districts. The expectation is that the coefficient for households in the border districts will be positive for staple foods, and the results support this. This is a strong indication that an economic integration framework, such as the one the East African Community is embarking on, is improving the welfare of consumers.

In examining the head of household characteristics, it is worthy to note that demand patterns tend to differ across age and sex of household head. In this study, as expected, age has a negative correlation on consumption of food, while education has a positive and significant correlation with the consumption of food. When the individual food groups are scrutinized, it can be noted that households with heads that possess a higher education consume a significantly higher amount of maize and consume higher amounts of alcohol. Education has a negative correlation with the consumption of matooke, rice, fruit and vegetables, and meat. The lower consumption of matooke can be partially explained by the fact that higher education is usually correlated with higher

incomes. Matooke is one of the starchy staples, which are usually consumed less as incomes rise. However, the negative correlation between education and the consumption of rice was unexpected. The negative correlation between education and the consumption of meat, although unexpected, can be due the amount of aggregation. With education comes health consciousness and consumer may choose not to consume certain meat products for health reasons.

As far as sex of household head is concerned, literature has shown that women have a greater propensity to food expenditures than men. In this study, the food coefficient for a household headed by a woman is negative, which is contrary to prior findings. This may be due to the fact that female-headed households tend to have lower incomes than male-headed households. The result here shows that female-headed households consumed more maize, rice, dairy products, sugar, fats and oils, beverages, and pulses but less maize matooke, cereals, oils, fish, and meats. The positive consumption of dairy products and/or maize can be explained by the fact that females in an African traditional setting tend to play the role of nurturing the children, hence the higher consumption of dairy products and maize[27].

Characteristics of the Household

The characteristics of the household demographic variables include household composition (HHCOMP) and the household size (HHSIZE), as illustrated in Table 4.1. The results here show that there is a positive and significant correlation between

[27] Maize is used to make porridge, which can be consumed on its own or mixed with milk.

households with children under the age 6 (N_1) and the consumption of dairy products, meat, matooke, fats and oil, and fruits and vegetables. In addition, there is a strong correlation between N_1 and the consumption of rice, maize, sugar, cereal, and soft beverages. This strong correlation can be explained by the fact that households with young children, who have greater need for growth, purchase more coarse grain and high protein animal products. The results also show that households with members aged 13 to 19 (N_3) and aged 20 to 55 (N_4) consume a significant amount of matooke and fats and oils, and also that consumption of maize, cereal, rice, and beverage is important to them. This group is comprised of the most active Ugandans and they need foods that will give them energy. The results show that, as expected, they consume high-energy food staples.

In this study, household size coefficient has a significant and positive correlation with the consumption of alcohol. The results also show that the size coefficient is important and positive in the consumption sugar and fish. This effect seems to be dominant in the consumption of these food categories. The Ugandan households seem to have found it necessary that, as the household grew larger, they would consume more sugar, fish, and alcohol. The household size coefficient is negative for the remaining food groups. In this respect, the income effect is dominating—as the household size increases, the household becomes relatively poorer and hence consumes less of a food category. This fact partly supports hypothesis 3, which states that, *ceteris paribus*, as the household size increases, households to shift consumption from income-elastic food groups, such as meats and vegetables, to starchy staples.

The coefficients of home food production (PROD) show that households that were engaged in household production of matooke and soft beverages experienced a

significant reduction in the consumption shares of these two food products relative to households that were not engaged in their production. The results also show the PROD coefficient is positive and significant for the consumption of rice, sugar, and meat. The explanation for this result is that sugar, and to some extent rice, are products that are not normally produced at home and households had to purchase them. The PROD coefficient in general is important and negative in the consumption of fish, fruits and vegetables, dairy products, maize, and fats and oils.

The quarter coefficient has explanatory power in the consumption of meat, fish, and sugar. This can be explained by the fact that, during holiday periods such as Christmas, Easter, and Ramadan, more fish beef, lamb, mutton, and chicken are consumed. Sugar is also in much demand during these periods of the year.

Demand Elasticities of the LA/AIDS Model

Tables 5.4, 5.5, 5.6, and 5.7 present the demand elasticities of the selected foood groups with respect to expenditures and prices. Mean prices and mean budget shares were used to calculate these elasticities.

Expenditure Elasticities

The expenditure elasticities for food and for all food groups are positive, implying that food is a normal good. This means that an increase in income will generally lead to an increase in food consumption. The expenditure elasticity for food is 1.48, which implies that a 10% increase in food expenditures will lead to a nearly 15% increase in food consumption.

The point estimates for matooke, maize, cereal, fish, meat, and pulses are greater than unity. This implies that for these food categories, an increase in total food expenditures will result in more than proportionate increase in expenditure shares. This is expected as far as meat and fish are concerned, because as consumers become wealthier, they consume more of higher quality foods such as meat and fish. On the other hand, estimates for rice, sugar, fruit and vegetables, meat, dairy products, and beverage are all less than unity. These results imply that an increase in future expenditure on food will result in less than proportionate increase in expenditure on rice, other cereals, fruit and vegetables, meat, dairy products, and beverage. The demand for matooke (1.389) and pulses (1.401) are the most expenditure elastic, while beverage (0.143) is expenditure inelastic.

Price Effects

The parameters of the LA/AIDS with demographic and seasonal dummies were estimated by dropping the other foods equation. Homogeneity and symmetry were imposed on the estimation and the iterative seemingly unrelated regression (ITSUR) procedure was applied in SAS for estimation. Tables 5.4, 5.5, 5.6, and 5.7 show results of elasticities estimated by the LA/AIDS model that includes inverse mills ratios to correct for households that had zero consumption. The results for marshallian (uncompensated) own-price, cross-price, and expenditure elasticities for the LA/AIDS with inverse mills ratio at stage two are presented in Table 5.4. The results for Hicksian (compensated) own-price and cross-price elasticities for the LA/AIDS with inverse mills ratio at stage two are presented in Table 5.5. Table 5.6 shows the results for uncompensated own-

price, cross-price, and expenditure elasticity for low-income consumers, while Table 5.7 illustrates the compensated own-price and cross-price elasticities results for low-income consumers.

Own-price (uncompensated) Effects

The uncompensated own-price food elasticity estimates for all food groups are shown on the diagonal sloping downward to the right in the price elasticities section of Table 5.5. As expected by theory, they all carry the negative sign. These estimates vary from maize (-0.417) to pulses (-1.440). The estimates for starchy staples vary from maize (-0.417) to cereal (-0.980). With the exception of pulses (-1.440), alcohol (-1.272), dairy (-1.045), fruits and vegetables (-1.290), and fats and oil (-1.022), all the other food categories are inelastic to price changes. The estimates for non-staples vary from fish (-0.857) to pulses (-1.440). The estimates indicate that a 10% increase in the price of alcohol, pulses, dairy, fruits and vegetables, and fats and oils decreases the consumption of these products by 12.7%, 14.4%, 10.5%, 12.9%, and 10.2%, respectively . Results also indicate that staples food products such as matooke, maize, rice, sugar, and cereals are inelastic to price changes. This means that a 10% increase in the price of matooke, maize, rice, sugar, and cereals would result in 6.2%, 4.2%, 4.35%, 7%, and 9.8% reductions in the consumption of these products, respectively. With the exception of pulses, alcohol, and dairy, all the other food categories are inelastic to own-price changes. The results show that, as expected, Ugandan consumers are insensitive to changes in the prices of staple food products. These results compare to results from other demand studies conducted in Africa. For example, the absolute own-price elasticities for rice range from -

0.46 in Conakry, Guinea (Arulpragasam 1994), to -0.67 for Maputo, Mozambique (Dorosh et al. 1994), to -0.74 for rural Sierra Leone (Straus 1984).

Cross-price (compensated) Effects

The results of the estimates for the compensated cross-price elasticities can be found in Table 5.5. These elasticities are fairly low, as compared to the uncompensated elasticities in almost all categories, but they do indicate that some food categories are gross complements, while others are gross substitutes. The cross-price elasticities of cereal demand with respect to the price for pulses[28], dairy, meat, oils, sugar, rice, and maize have positive signs, which imply that consumers view these products as substitutes. This result implies that an increase in the price of cereal will lead to Ugandan consumers increasing their demand for maize, rice, sugar, oils, meat, dairy, and pulses. This further indicates that a 10% increase in the price of cereal will lead to an 8.4%, 3.1%, 3.1%, 1%, 6.8%, 11.2%, and 10.7 % increase in the demand of maize, rice, sugar, oils, meat, dairy, and pulses, respectively. The cross-price elasticities of cereal demand with respect to the prices of fruits and vegetables, beverages, and alcohol are negative, which implies that these food products are complements. This means that a 10% increase in the price of rice will lead to a 2%, 1.4%, 1.7%, and 1.6% decrease in the demand for maize, sugar, fish, and beverages, respectively. Vegetables have negative signs vis-à-vis rice, cereal, meat, dairy, beverages, and pulses. This leads to the conclusion that Ugandan consumers view vegetables as a complement of rice, cereal, meat, dairy, beverages, and pulses. Another important result is that pulses have a negative relationship with the

[28] Pulses include beans, peas, and pulses which include groundnuts

consumption of meat, vegetables, and fish, indicating that pulses are considered complements of meat, vegetables, and fish.

Cross-price (compensated), Low Income Effects

Calculated price and expenditure elasticities for low-income household are presented in Table 5.7. In this table, only the cross-price elasticities are considered for discussion. Compensated cross-price elasticities for cereal demand with respect to the prices of matooke, maize, rice, sugar, dairy products, and pulses are all positive, implying that these foods are substitutes. This result confirms the hypothesis 13, which states that, *ceteris paribus*, at lower incomes, price changes may result in greater consumer substitution within particular food groups. At the mean expenditures, the substitution within the starchy foods only occurs within maize, rice, sugar, and pulses. However, at the lower expenditures, this occurs within the starchy food groups of matooke, maize, rice, sugar, and pulses.

CHAPTER 6

SUMMARY AND CONCLUSIONS

Summary

According to the United Nations Statistics Division the economy of Uganda grew at the average rate of 6.2% between the year 1987 and 2003. While the economy has been growing, inflation rates have been dropping from a high of 240% in 1987 to 5.1% in 2003. With prices stabilized and the economy growing, Uganda has witnessed a steady rise in income levels. For example, average household incomes increased from USh 98,000 in 1997 to USh 141,000 in the year 2000[29]. The rising incomes have played a role in the declining average monthly share of expenditures on food. The average monthly share of food expenditures declined from 56% in 1997 to 51% in 2000, according to Uganda Bureau of Statistics (UBOS).

The purpose of this study was to analyze food demand patterns of Ugandan households relative to 11 different variables, namely: income levels, price, region of household, urbanization status of the household, production of food by household and border-effects, as well as socio-demographic characteristics, such as size of household, education status of head of household, sex of head of household, and age of head of household. The main objective was to analyze the food consumption patterns in Uganda. Two secondary objectives included examining the effects of border areas on determining household food demand and examining the effects of the urban/rural setting of the household on consumption patterns.

[29] These incomes are in nominal terms. USh is the abbreviation for the Ugandan currency, the Uganda shilling. As of the year 2000, the exchange rate was 1644.474976 to 1 USD.

To achieve these objectives, two empirical food demand studies were carried out. The first involved analyzing aggregate demand for food and non-food commodities. The second study conducted a demand analysis for 14 food commodities. The Working (1943) model was used to estimate aggregate expenditures and price elasticities for the first study. The Linear Approximation of Almost Ideal Demand System (LA/AIDS) was used to empirically estimate consumption of the food groups in the second study. The 1999/2000 Uganda National Household Budget Survey data from the Uganda Bureau of Statistics were used.

Since problems arise when dealing with micro data from surveys or when some households report zero consumption during the surveys, this study used the Heckman two-step model to correct for zero consumption. In the first step, probit equations representing the decision to consume a positive amount of certain food groups were estimated. The estimated probit parameters were then used to construct correction factors, the Inverse Mills Ratios, that were used in the system of demand equations. Then, a system of demand equations was estimated by LA/AIDS in the second step.

Ugandan households spent 44% of their income of food. The breakdown of this food expenditure was as follows: the highest expenditure, 14.1%, was on meat products, followed by fish products at 10.1%, then alcohol at 9.6%. The expenditure on maize was 9.2 %, while 9.1% was spent on sugar products. Other expenditures were as follows: 8.1% on rice, 7.6% on other foods, 6.5% on dairy products, and 5.7% was spent on matooke and pulses, respectively. Finally, 4.4% of the expenditure was on cereals, 4.2% was spent on fats and oils, 4.1% was used to purchase fruits and vegetables, and 2.0% on soft beverages.

Regarding a household's decision to consume a particular item, per capita food expenditure exerts a positive influence on the probability of purchasing matooke, maize, rice, sugar, oils, cereals, fruits and vegetables, dairy and pulses. Using the Central Region as the reference region, the probability of purchase of matooke is negative in the Eastern, Northern, and Western Regions. This can be explained by the fact that households in Central Region traditionally consume more matooke than any other region. This relationship is reversed when maize is the food crop in question. Compared to the Central Region, Eastern, Northern, and Western Regions show a positive and significant probability for the consumption of maize.

The Eastern Region is the only region to exhibit a negative influence in the probability of the consumption of rice when compared to the Central Region. This can be explained by availability of the product -- rice is grown in this region. All other regions show a positive probability to purchase cereal compared to the Central Region. As expected, households located in the border districts have a positive influence on the probability of the purchase of alcohol, as well as rice, cereal, fruit and vegetables, matooke, meat, fish, and dairy.

Households that produce some of the food they consume have a negative relationship to the probability of purchase of matooke, maize, fish, beverages, and other foods. Home production has a positive influence on food groups that households may be unable to produce on their own, such as fruits and vegetables, meat, alcohol, and pulses, but there is a higher probability that a Ugandan household with higher education will purchase all food groups except for rice, sugar, oils, and dairy.

The expenditure coefficients for maize, fat and oil, dairy, and pulses are negative in the LA/AIDS estimations, implying that these food categories are necessities. On the other hand, the expenditure coefficient for sugar, fish, cereal, fruit and vegetables, meat, and alcohol are positive, which implies that these foods are luxuries. Results further showed that Ugandans with higher incomes consume more rice, fruits and vegetables, and soft beverages than their low-income counterparts. Low-income households consumed more food products, such as matooke, maize, and cereals.

In this study, there was a positive and significant correlation between households that located in urban areas and the consumption of fruit and vegetables. There was also a strong and positive correlation between these households and the consumption of matooke, maize, sugar, cereal, fats and oil, fish, dairy products, and alcohol. Households that reside in the border districts of Uganda consume significantly higher amounts of matooke, sugar, oils, fruits and vegetables, dairy products, alcohol and pulses than do households in the interior districts.

Education had a positive and significant correlation with food consumption. When the individual food groups are scrutinized, households with heads that possess a higher education consume significantly higher amounts of maize and alcohol. Female-headed households consumed more maize, rice, dairy products, sugar, beverages, and pulses, but less matooke, cereals, fats and oils, fish, and meats than male-headed households. There was also a positive and significant correlation between households with children under the age 6 (N_1) and the consumption of food products, such as dairy products, meat, matooke, fats and oil, and fruits and vegetables. Households with members aged 13 to 19 (N_3) and aged 20 to 55 (N_4) consumed significantly larger

amounts of matooke and fats and oils than their counterparts aged over 55 (N_5) and the consumption of maize, cereal, rice, and beverage is important to households with these age groups.

Households that were engaged in household production of matooke and soft beverages experienced significant, reduced consumption shares of these two food products relative to households that were not engaged in their production. Finally, the seasonal coefficients had significant explanatory power in the consumption of meat, fish, and sugar.

The expenditure elasticities for food and for all food groups are positive, implying that food is a normal good. The point estimates for matooke, maize, cereal, fish, meat, and pulses are greater than unity, implying that for these food categories, an increase in total food expenditures will result in more than proportionate increase in expenditure shares. On the other hand, estimates for rice, sugar, fruit and vegetables, meat, dairy products, and soft beverages are all less than unity, implying that an increase in future expenditures on food will result in less than proportionate increases in expenditures on these food groups.

Own-price elasticities for all food groups carried the expected negative sign. Own-price elasticities for alcohol, pulses, dairy, fruits and vegetables, and fats and oil are elastic, indicating that a 10% increase in their prices would accompany decreases in the consumption of these products by 12.7%, 14.4%, 10.5%, 12.9%, and 10.2% respectively . That is, Ugandan consumers are sensitive to changes in the prices of these products. The results also indicate that staple food products, such as matooke, maize, rice, sugar, and cereals, are inelastic to price changes. This means that a 10% increase in the prices of

matooke, maize, rice, sugar, and cereals would result in 6.2%, 4.2%, 4.35%, 7%, and 9.8% reductions in the consumption of these products, respectively.

Ugandan consumers consider pulses, dairy, meat, oils, sugar, rice, and maize as substitutes for cereals. However, cereal demand complements fruits and vegetables, soft beverages, and alcohol Ugandan consumers view vegetables as a complement of rice, cereals, meat, dairy, beverages, and pulses pulses complement meat, vegetables, and fish.

Conclusions

A number of conclusions can be drawn form the results of this study. The first conclusion is that Ugandans with higher incomes consume more rice, fruits and vegetables, and soft beverages than their low-income counterparts. Low-income households, on their part, consumed more matooke, maize, and cereals. This supports previous studies in Africa, because it shows higher income consumers shifting away from coarse grains, such as sorghum and millet, which comprise the largest percentage of starchy foods in cereals.

Secondly, in this study, positive and significant correlations were found between households that are located in border areas and the consumption of matooke, sugar, oils, fruits and vegetables, dairy products, alcohol and pulses compared to the interior districts. Households dwelling in urban settings differ significantly from their rural counterparts only in their consumption of fruits and vegetables.

Low-income Ugandan households appear to substitute consumption within particular food groups, such as the starchy food group. For example, at low incomes, households substituted between cereal, matooke, maize, sugar, and rice, whereas at mean

incomes, the substitution is between cereal, rice, sugar, and maize. The inclusion of matooke as a substitute for these starchy staples, especially for low-income consumers, leads us to conclude that there is greater substitution within the starchy food group.

The role played by socioeconomic and demographic characteristics is critical in this research. The age composition of the household appeared to be an important factor in determining the demand for various food groups. The presence of young members in a Ugandan household had a positive effect in the demand for dairy products, meat, matooke, fats and oil, and fruits and vegetables. This supports earlier studies, such as that by Alwang (1989), which showed that younger aged households purchase more coarse grain and high protein animal products. On the other hand, the presence of older household members has a positive effect on the demand for matooke and fats and oils, as well as for the consumption of maize, cereal, rice, and soft beverages. This conclusion also supports earlier work by Alwang (1989). Education also has a positive effect in the demand for all food groups, except for rice and cereal.

Food purchases for households producing food are more sensitive to price and income changes, especially as far as matooke is concerned. This sensitivity to price and income changes is due to the fact that these food-producing households are able to substitute home produced food for purchased food. As other studies have shown, home food production will lead to improved nutritional intake in Uganda.

Finally, the information presented here complements previous consumer demand studies, providing insights of food consumption behavior in Uganda. Additionally, spatial estimation of Ugandan consumption will contribute to the deeper understanding of food demand within the context of the dynamics of population structure and economic changes

that have occurred. The Uganda population is growing rapidly, and in turn this has fueled rapid urban population growth. The younger composition of Ugandan households has led to an increase in demand for certain food groups that enhance their growth. On the economic front, the Ugandan economy has continued to experience high growth rates and has joined the East African Community, an economic union with Kenya, Tanzania, and more recently Rwanda and Burundi. These changes may also have caused changes in food consumption behavior. These and other factors are important determinants of the demand for food in Uganda.

Implications

Understanding the consumer budget allocation and food demand patterns is important, because it offers improved information to producers, wholesalers, retailers, and policy makers about Ugandan households. The results in this study may be useful in assisting these stakeholders to anticipate such future demand shifts and hence incorporate them in their food demand projections. The results in this study may also assist policy planners to identify policies that ensure proper and adequate nutritional intake throughout Uganda and in designing food subsidy programs that can be pursued by the government.

In the present study, several economic and demographic variables related food consumption. Producers and marketers can better develop strategies for targeting their products. For example, when planning to market food to high-income groups in Uganda, the information obtained in this study showing higher income consumers shifting away from coarse grains like sorghum and millet can be valuable in developing marketing plans. Firms may wish to adjust their marketing mix variables such as product, price,

distribution, and promotion to meet the needs of this lucrative market while simultaneously benefiting from it. The government may use this information to ensure that nutritional intake is not compromised as the industry processes foods to meet the demand of the high-income consumers. The government can ensure that proper labeling is done so that consumers are aware of the ingredients in the foods they consume.

For low-income households in Uganda, cross-price elasticities for maize demand with respect to the prices of cereal, matooke, maize, sugar, and rice are all positive, implying that these foods are substitutes. This result indicates that price changes result in consumer substitution within these starchy food groups. This result can have important policy implications; stakeholders can use this information to anticipate demand shifts and hence incorporate them in food demand projections. If maize shortages are anticipated in a given region, consumers can be encouraged to consume millet or sorghum. If draught is anticipated and it can be projected that the maize supply will be unable to meet the demand, farmers can be encouraged to increase the production of draught resistant crops such as millet and sorghum.

The border effects suggest that people who reside in the border districts consume more of certain staple foods, such as matooke, sugar, oils, fruits and vegetables, dairy products, and soft beverages than do the households in the interior districts . During the regime of Idi Amin, the manufacturing industry was almost entirely wiped out. The Uganda sugar industry, which had been the most developed in East Africa, was almost decimated. Oil, sugar, and dairy products are now imported from relatively low-cost producers, such as Kenya, and thus the Ugandan consumers have benefited from importing foods. Empirical evidence obtained from this study suggests that as a country

enters an integrated market, prices decline. Therefore improving consumer welfare should be highlighted as reason to push for more economic integration of the East African countries.

The presence of young members in a Ugandan household has positive effects own the demand for matooke, rice, sugar, cereals, fish, dairy products, beverages, and other foods. On the other hand, the presence of older household members has positive effects on the consumption of maize, rice, sugar, and meat. These results can be used by policy makers to enhance the nutritional intake of these households by devising policies such as subsidizing such foods that benefit the two most vulnerable groups in Ugandan society.

Food purchases for food-producing households are more sensitive to price and income changes. This sensitivity to price and income changes is due to the fact that these food-producing households are able to substitute home produced food for purchased food. As other studies have shown, home food production will lead to improved nutritional intake in Uganda. The government of Uganda can use information in this study to encourage home production, because it leads to improved nutritional intake. In the urban areas, the government should encourage urban farming rather than discourage it. This study has shown that there is a strong correlation between urbanization and the consumption of fruits and vegetables. Knowing this, the government can encourage the planting of fruit trees that can serve to enhance the environment of the cities while increasing fruit availability for local and home consumption.

Limitations of the Study

East Africa, as is the case with other developing nations, has suffered from a relative scarcity of empirical demand studies. This can be explained by the fact that these countries lack the necessary expenditure data needed to allow sophisticated demand estimation. The situation, however, is changing in East Africa, where several comprehensive Household Budget Surveys have been conducted in Tanzania in 1991 and in 2001 and in Uganda in 1990 to 2002. Kenya conducted Welfare Monitoring Surveys in 1991/2, 1994, and 1997. The data are, however, not adequate to allow time series studies.

Table 5.1: Descriptive Statistics of the Variables

Variable	Mean	Std Dev	Minimum	Maximum
w1	0.057	0.106	0.0000000	0.9695652
w2	0.092	0.138	0.0000000	1.0000000
w3	0.081	0.073	0.0000000	0.9795652
w4	0.091	0.071	0.0000000	1.0000000
w5	0.044	0.095	0.0000000	1.0000000
w6	0.042	0.037	0.0000000	0.9666667
w7	0.043	0.056	0.0000000	1.0000000
w8	0.141	0.100	0.0000000	0.9990909
w9	0.102	0.091	0.0000000	0.9995652
w10	0.065	0.075	0.0000000	1.0000000
w11	0.020	0.039	0.0000000	1.0000000
w12	0.096	0.124	0.0000000	1.0000000
w13	0.056	0.085	0.0000000	0.9845455
w14	0.076	0.134	0.0000000	1.0000000
PF1	1.482	0.385	0.0010000	2.0000000
PF2	0.433	0.150	0.0002500	2.7000000
PF3	0.841	0.090	0.0010000	1.8000000
PF4	1.078	0.208	0.0010000	2.2000000
PF5	0.302	0.068	0.0010000	2.0000000
PF6	0.280	0.233	0.0010000	1.5000000
PF7	0.337	0.208	0.0005000	2.5000000
PF8	1.788	0.138	0.0400000	3.6000000
PF9	0.697	0.340	0.0020000	2.8000000
PF10	0.277	0.032	0.0010000	3.0000000
PF11	0.208	0.196	0.0010000	1.8000000
PF12	0.484	0.071	0.1100000	2.0000000
PF13	0.482	0.187	0.0010000	2.7000000
PF14	0.502	0.445	0.0004000	2.4000000

Data source: UNHS 1999/2000

Notes: w1 and PF1 = share and price of matooke in Ushs per kg,
W2 and PF2 = share and price of maize in Ushs per kg,
W3 and PF3 = share and price of rice in Ushs per kg,
W4 and PF4 = share and price of Cereals in Ushs per kg,
W5 and PF5 = share and price of sugar/sweet in Ushs per kg,
W6 and PF6 = share and price of fruits and vegetables in Ushs per kg,
W7 and PF7 = share and price of meat in Ushs per kg,
W8 and PF8 = share and price of Fish in Ushs per kg
W9 and PF9 = share and price of dairy in Ushs per liter,
W10 and PF10 = share and price of Fats and oils in Ushs per kg
W11 and PF11 = share and price of beverages in Ushs per kg,
W12 and PF12 = share and price of alcohol in Ushs per liter
W13 and PF13 = share and price of other foods in Ushs per kg,
W14 and PF14 = share and price of pulses in Ushs per kg

Table 5.2: Parameter Estimates of the Probit Analysis for the Ugandan Household Food Purchases, 1999

Dependent Variable:														Stage 2
Decision to Purchase:	MATOOKE 1		MAIZE 2		RICE 3		SUGAR 4		CEREAL 5		OILS 6		FRUIT & VEGE 7	
Explaining variables	coeff	t-stat	coeff	t-stat	coeff	t-stat	coeff	t-stat	coeff	t-stat	coeff	t-stat	coeff	t-stat
Intercept	0.371[a]	3.63	3.275[a]	9.17	1.684[a]	14.47	1.537[a]	9.82	-3.653[b]	-2.04	1.688[a]	11.67	-1.228	-1.82
EASTERN	0.500[a]	5.86	0.024[c]	1.85	-0.052[a]	-4.90	0.183[a]	8.65	0.608[b]	2.14	-0.017	-1.41	-0.096	-2.98
NORTHERN	-0.737[a]	-4.67	0.891[a]	6.53	0.214[a]	8.72	0.402[a]	9.99	0.603[b]	2.14	0.066[a]	3.95	-0.155	-3.21
WESTERN	0.079[a]	4.53	0.102[a]	5.01	0.042[a]	4.14	0.256[a]	9.32	0.317[b]	2.11	0.236[a]	8.58	-0.177[a]	-3.22
BORDER	0.265[a]	5.49	-0.795[a]	-6.31	0.006	0.64	-0.120[a]	-7.20	0.076[b]	2.16	-0.041[a]	-3.06	0.236[a]	3.18
PCFEXP	0.008[a]	4.91	0.024[a]	6.03	0.013[a]	5.80	0.015[a]	7.79	0.011[b]	2.20	0.015[a]	7.03	0.003[a]	2.48
PROD	0.156[a]	4.95	0.010	0.81	0.116[a]	7.33	-0.080[a]	-5.67	0.521[b]	2.13	-0.079[a]	-5.24	1.008[a]	2.99
URBAN	0.117[a]	4.65	-0.259[a]	-6.07	-0.278[a]	-7.80	-0.189[a]	-8.56	0.030[b]	2.10	-0.201[a]	-7.71	-0.241[a]	-2.87
HHHED	0.040[a]	3.41	0.030[b]	2.61	-0.069[a]	-5.57	-0.026[b]	-2.55	0.038[b]	2.10	-0.039[a]	-3.48	0.047[a]	2.72

Notes: Descriptions for socio-demographic characteristics and the products involved are found in Table 4.1 and Table 4.3.
Superscripts a, b and c indicate statistical significance at 99, 95 and 90 percent levels, respectively.
Data source: UNHS 1999/2000

Table 5.2: Parameter Estimates of the Probit Analysis for the Ugandan Household Food Purchases, 1999 (CONTD.)

Dependent Variable:														Stage 2
Decision to Purchase:	MEAT 8		FISH 9		DAIRY 10		BEVERAGES 11		ALCOHOL 12		OFOODS 13		PULSES 14	
Explaining variables	coeff	t-stat	coeff	t-stat	coeff	t-stat	coeff	t-stat	coeff	t-stat	coeff	t-stat	coeff	t-stat
Intercept	-1.221[c]	-1.80	1.222[a]	7.28	-3.691[b]	-1.99	1.455[a]	26.47	-2.646	-1.01	1.057[a]	7.21	-8.211[a]	-7.94
EASTERN	0.084[b]	2.26	-0.013	-0.95	-0.164[b]	-2.06	0.141[a]	6.59	0.165	1.05	0.014[b]	2.23	0.399[a]	8.39
NORTHERN	0.073[b]	2.16	-0.023	-1.05	0.143[b]	2.07	0.267[a]	7.36	0.366	1.06	-0.007	-1.21	1.482[a]	8.61
WESTERN	-0.057[b]	2.11	0.282[b]	2.28	0.297[b]	2.06	0.345[a]	7.81	-0.114	-1.04	-0.006	-1.17	0.118[a]	7.10
BORDER	0.062[b]	2.21	0.050[c]	1.80	0.160[b]	2.06	-0.001	-0.10	0.043	1.05	-0.001	-0.13	-0.234[a]	-8.21
PCFEXP	0.012[b]	2.35	-0.004	-1.41	0.019[b]	2.09	-0.012[a]	-6.32	-0.001	-0.98	0.001	1.59	0.025[a]	8.36
PROD	0.363[b]	2.07	-0.027	-1.32	0.456[b]	2.06	-0.084[a]	-5.36	0.278	1.05	-0.046[a]	-3.65	3.186[a]	8.38
URBAN	-0.031[b]	-2.00	-0.028	-1.42	-0.405[b]	-2.05	-0.167[a]	-6.91	0.071	1.06	0.007	1.29	-0.068[a]	-5.24
HHHED	-0.000	-0.10	-0.002	-0.22	-0.069[b]	-2.03	-0.031[a]	-2.94	0.001	0.59	0.003	0.69	0.104[a]	7.26

Notes: Descriptions for socio-demographic characteristics and the products involved are found in Table 4.1 and Table 4.3.
Superscripts a, b and c indicate statistical significance at 99, 95 and 90 percent levels, respectively.
Data source: UNHS 1999/2000

Table 5.3: Estimated Parameters of the Working Model and the LAAIDS model (1999/2000)

variable	Stage 1				Stage 2											
Budget share	**FOOD**		**NON- FOOD**		**Matooke**		**Maize**		**Rice**		**Sugar**		**Cereal**		**Fats & Oils**	
variable	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**
Intercep	0.406[a]	6.50	0.585[a]	8.68	-0.008	-0.09	-0.083[c]	-1.86	0.094[c]	1.91	0.032	0.74	-0.392[a]	-2.59	0.005	0.18
CENTRAL	-0.021[a]	-7.64	0.024[a]	8.48	0.020	0.44	-0.029	-1.22	0.018	0.70	-0.025	-1.03	0.009	0.20	0.014	0.90
EASTERN	0.009[a]	3.16	-0.003	-0.94	-0.049	-0.94	-0.039[c]	-1.67	-0.005	-0.19	-0.050[b]	-2.14	0.059	1.20	-0.003	-0.18
WESTERN	-0.012 [a]	-4.22	0.016[a]	5.18	-0.019	-0.43	0.011	0.43	0.010	0.36	-0.060[b]	-2.49	0.068	1.44	0.025	1.57
BORDER	0.002	0.81	-0.002	-0.67	0.092[b]	2.42	0.035[c]	1.88	0.001	0.03	0.042[b]	2.23	0.062[c]	1.81	0.032[a]	2.61
HHSIZE	0.001	1.32	-0.001	-1.10	-0.021[b]	2.09	-0.007	-1.19	-0.008	-1.34	0.002	0.38	-0.015	-1.52	-0.005	-1.37
HHAGE	-0.000	-0.98	0.000	0.89	0.001[b]	1.96	-0.000	-0.05	0.000	0.24	0.000	0.87	-0.000	0.00	0.000	0.06
HHFEM	0.005[c]	1.89	-0.005[c]	-1.83	-0.045[c]	-1.70	0.007	0.49	0.017	1.06	0.000	0.01	-0.027	-0.99	0.009	0.99
HHHMS	-0.002[b]	-1.97	0.002[b]	2.08	-0.004	-0.24	0.009	1.13	-0.014[c]	-1.70	0.004	0.49	-0.008	-0.53	-0.006	-1.22
N1	-0.004[a]	-2.65	0.004[a]	2.58	0.024[c]	1.70	0.004	0.55	0.012	1.42	0.001	0.12	0.012	0.88	0.008[c]	1.67
N2	-0.002	-1.53	0.002	1.23	0.019	1.16	0.012	1.35	0.004	0.38	-0.000	-0.04	0.017	1.04	0.003	0.21
N3	-0.002	-1.25	0.002	1.13	0.047[a]	3.02	0.008	0.96	0.010	1.08	-0.000	-0.06	0.017	1.09	0.005	0.82
N4	-0.001	-0.53	0.001	0.52	0.038[b]	2.08	0.013	1.40	0.000	0.02	-0.002	-0.21	0.029	1.61	0.013[c]	1.95
PROD	-0.039[a]	-7.26	0.044	1.34	-0.046[c]	-1.70	-0.003	-0.22	0.040[b]	2.33	0.027[c]	1.81	0.046	1.47	-0.011	-1.09
TCEXP1	-0.001[a]	-7.30	0.001[a]	7.34	0.001	0.54	0.002[c]	1.65	0.002[c]	1.89	0.000	0.22	0.001	0.26	0.000	0.27
TCEXP2	0.000[a]	5.68	-0.000 [a]	-5.62	-0.000[a]	-2.85	-0.000[c]	-1.63	0.000	0.05	-0.000	-1.21	-0.000	-0.54	-0.017	-0.62
URBAN	0.004[c]	1.67	-0.004	-1.52	0.001	0.05	0.012	1.17	-0.006	-0.58	0.004	0.37	0.010	0.53	0.006	0.89
QUARTER	-0.001	-0.30	0.001	0.41	-0.035	-0.98	-0.026	-1.41	0.003	0.15	0.011[c]	1.79	0.015	0.43	-0.006	-0.48
HHHED	0.004[b]	1.94	-0.005[b]	-2.11	-0.020[c]	-1.63	0.014[b]	2.12	-0.012[c]	-1.75	-0.010	-1.49	-0.017	-1.42	-0.003	-0.66
lTCEXPp	-0.055[a]	-6.86	0.055[a]	4.90	0.010	0.78	-0.014[b]	-1.98	-0.006	-0.74	0.001	0.15	0.010	0.79	-0.001	-0.15
lpmatook					0.060[b]	2.43	-0.000	-0.04	-0.001	-0.05	-0.000	-0.08	0.013	0.53	0.023[a]	2.65
lpmaize					0.068	1.27	0.026	0.89	0.030	0.96	0.040	1.38	0.010	0.20	0.032	1.68
lprice					-0.062	-1.03	0.018	0.58	-0.008	-0.23	-0.005	-0.16	0.061	1.05	-0.022	-1.00
lpsugar					-0.071[b]	-2.04	0.004	0.21	0.003	0.14	-0.006	-0.30	-0.017	-0.51	0.003	0.25
lpcereal					0.179[b]	2.51	-0.050	-1.32	0.014	0.34	-0.021	-0.55	0.015	0.21	0.005	0.18
lpfoil					-0.004	-0.31	-0.005	-0.71	0.006	0.83	-0.019[a]	-2.77	-0.007	-0.56	-0.002	-0.45
lpfeg					0.006	0.26	0.008	0.67	-0.013	-1.06	0.013	1.17	-0.001	-0.05	0.008	1.04
lpmeat					-0.298[a]	-2.82	-0.048	-0.85	-0.147[b]	-2.36	-0.098[c]	-1.74	-0.099	-0.95	-0.042	-1.12
lpfish					-0.016	-1.16	0.000	0.01	0.001	0.07	-0.002	-0.27	0.005	0.36	0.001	0.22
lpdairy					0.552[b]	2.06	0.098	0.72	0.384[b]	2.56	0.017	0.12	0.409[c]	1.66	0.213[b]	2.41
lpbev					0.002	0.24	-0.001	-0.45	0.003	0.84	-0.005	-1.47	-0.001	-0.15	-0.000	-0.11
lpalcohol					0.047	0.84	-0.037	-1.23	0.007	0.21	-0.037	-1.27	0.043	0.79	0.066[a]	3.39
lppulses					-0.001	-0.02	-0.008	-0.42	-0.042[b]	-2.04	-0.004	-0.20	0.033	0.98	-0.017	-1.41
MR	-0.061[a]	-5.73	0.950[a]	7.45	-0.008	-0.19	0.007	0.35	0.004	0.32	-0.006	-0.31	0.132[a]	2.78	0.024[b]	2.25

Notes: Descriptions for socio-demographic characteristics and the products involved are found in Table 4.1 and Table 4.3.
Superscripts a, b and c indicate statistical significance at 99, 95 and 90 percent levels, respectively.
Data source: UNHS 1999/2000

Table 5.3: Estimated Parameters of the Working Model and the LAAIDS model (1999/2000) (CONTINUED)

variable														Stage 2
Budget share	Fruit & veg			Meat		Fish		Dairy		Beverages		Alcohol		Pulses
variable	coeff	t-stat	coeff	t-stat		coeff		t-stat	coeff	t-stat	coeff	t-stat	coeff	t-stat
Intercep	0.169	1.53	-0.126	-0.67	-0.067	-1.17	-0.102	-1.21	0.080[a]	2.81	0.050	0.06	-0.034	-0.29
CENTRAL	-0.021	-0.66	-0.114	-1.51	0.027	0.90	0.039	1.48	-0.013	-0.83	-0.110	-1.52	0.031	1.24
EASTERN	-0.048	-1.49	-0.103	-1.35	0.010	0.32	-0.022	-0.83	-0.031[b]	-2.01	-0.112	-1.21	-0.007	-0.28
WESTERN	-0.007	-0.21	-0.056	-0.73	-0.030	-1.02	-0.007	-0.26	0.009	0.56	0.009	0.12	0.009	0.34
BORDER	0.063[b]	2.53	0.144[b]	2.46	0.027	1.21	0.078[a]	3.85	-0.006	-0.49	0.047	0.86	0.048[b]	2.56
HHSIZE	-0.007	-0.96	-0.014	-0.84	0.004	0.61	-0.003	-0.49	-0.006[c]	-1.69	0.044[a]	2.68	-0.010[c]	-1.69
HHAGE	-0.000	-0.85	0.001	0.63	0.000	0.34	-0.001[c]	-1.62	0.000[b]	1.97	-0.003[b]	-2.48	0.000	1.12
HHFEM	-0.003	-0.16	-0.032	-0.69	-0.023	-1.29	0.017	1.09	0.011	1.16	-0.034	-0.79	0.019	1.30
HHHMS	-0.009	-0.81	-0.024	-0.96	0.005	0.52	0.002	0.24	-0.006	-1.11	-0.015	-0.66	-0.000	-0.05
N1	0.025[b]	2.48	0.048[b]	2.04	-0.004	-0.46	0.020[b]	2.39	0.007	1.56	-0.015	-0.70	0.007	0.89
N2	0.004	0.31	0.023	0.82	0.006	0.51	-0.010	-0.98	-0.005	-0.91	-0.037	-1.37	0.003	0.35
N3	-0.005	-0.43	0.006	0.23	0.000	0.00	0.008	0.83	0.012[b]	2.23	-0.050[b]	-2.02	0.010	1.20
N4	0.012	0.92	0.015	0.50	0.003	0.30	0.003	0.27	0.008	1.34	-0.072[b]	-2.47	0.012	1.24
PROD	-0.042	-0.81	0.103[c]	1.93	-0.019	-1.04	-0.007	-0.41	0.021[b]	2.27	0.058	0.68	0.040	0.98
TCEXP1	0.001	0.78	0.001	0.17	-0.000	-0.08	-0.001	-0.70	0.001[c]	1.64	-0.000	-0.02	0.000	0.37
TCEXP2	0.000	0.18	-0.000	-1.35	-0.000[c]	-1.66	-0.000	-0.84	0.000[c]	1.75	-0.000	-1.03	0.000	0.28
URBAN	0.032[b]	2.22	-0.004	-0.14	0.003	0.24	0.002	0.15	-0.002	-0.32	0.010	0.29	-0.005	-0.46
QUARTER	-0.000	-0.00	0.033[c]	1.70	0.015	1.99[b]	0.020	0.96	0.018	1.45	0.028	0.50	-0.027	-1.39
HHHED	-0.002	-0.20	-0.044[b]	-2.18	-0.005	-0.65	-0.007	-1.01	-0.002	-0.50	0.017	0.88	-0.006	-0.87
ITCEXPp	0.000	0.05	0.019	0.90	0.004	0.49	-0.004	-0.51	-0.009[b]	-2.08	0.033	1.60	-0.005	-0.70
lpmatook	0.041[b]	2.25	0.037	0.87	-0.002	-0.16	0.049[a]	3.38	0.001	0.08	-0.069[c]	-1.73	0.026[c]	1.88
lpmaize	0.092[b]	2.37	0.055	0.60	-0.018	-0.49	-0.025	-0.77	0.022	1.18	-0.147[c]	-1.74	0.025	0.85
lprice	-0.035	-0.83	0.070	0.70	0.028	0.71	0.037	1.07	-0.011	-0.52	0.282[a]	3.03	-0.025	-0.76
lpsugar	-0.027	-1.12	-0.054	-0.95	0.006	0.27	0.012	0.59	-0.001	-0.12	-0.088	-1.57	-0.021	-1.11
lpcereal	0.009	0.18	0.081	0.68	-0.013	-0.28	0.040	0.94	-0.050[b]	-2.06	-0.123	-1.04	-0.038	-0.98
lpfoil	0.006	0.65	-0.015	-0.70	-0.013	-1.61	-0.008	-1.07	0.004	0.96	-0.037[c]	-1.82	0.009	1.22
lpfeg	0.005	0.31	-0.004	-0.12	0.010	0.72	0.026[c]	1.94	-0.025[a]	-3.39	0.014	0.40	-0.011	-0.89
lpmeat	-0.210[a]	-2.65	-0.313[c]	-1.77	-0.021	-0.30	-0.120[c]	-1.91	-0.064[c]	-1.77	0.294[c]	1.75	-0.146[b]	-2.51
lpfish	0.007	0.73	0.018	0.78	0.013	1.45	0.012	1.54	0.001	0.14	0.034	1.57	-0.003	-0.40
lpdairy	0.346[b]	1.99	0.817	1.87	0.109	0.65	0.305	2.06	-0.007	-0.08	0.057	0.15	0.1462	1.06
lpbev	-0.007	-1.54	0.006	0.59	0.005	1.24	-0.008[b]	-2.22	0.009[a]	4.32	0.007	0.73	0.001	0.19
lpalcohol	0.000	0.01	-0.050	-0.54	0.006	0.16	0.049	1.50	0.026	1.39	-0.091	-1.00	0.006	0.18
lppulses	-0.040	-1.61	-0.020	-0.34	0.013	0.56	0.014	0.71	0.012	0.99	0.030	0.56	0.016	0.83
MR	-0.053	-0.98	0.073	1.42	0.057[b]	2.43	0.073[b]	2.55	0.009	0.72	0.012	0.05	0.027	0.60

Notes: Descriptions for socio-demographic characteristics and the products involved are found in Table 4.1 and Table 4.3.
Superscripts a, b and c indicate statistical significance at 99, 95 and 90 percent levels, respectively.
Data source: UNHS 1999/2000

Table 5.4: Uncompensated Price and Expenditure Elasticities: LA/AIDS with Inverse Mills Ratio

Food Item		Uncompensated price elasticity													
	Mean budget share	mat	maize	rice	sugar	cereal	oil	veg	meat	fish	dairy	bev	alcoh	pulses	EXPEND. Elasticity
Food	**44%**														**1.48261**
Non-food	**56%**														**1.84623**
matooke	5.7%	-0.622	0.078	-0.197	-0.089	-0.168	0.315	0.459	0.069	-0.098	0.183	0.062	-0.547	0.212	**1.04914**
maize	9.2%	0.130	-0.417	-0.397	0.148	0.740	1.005	1.829	-0.249	0.014	0.180	-0.555	-1.999	0.726	**1.09070**
rice	8.1 %	-0.278	-0.358	-0.435	-0.105	0.229	-0.930	-0.765	0.399	-0.035	0.390	0.731	2.493	-4.846	**0.89568**
sugar	9.1%	-0.134	0.144	-0.113	-0.701	0.220	0.211	0.033	-0.038	0.255	0.499	0.588	-0.825	-0.470	**1.00623**
cereal	4.4%	-0.120	0.378	0.139	0.116	-0.980	0.070	-0.107	0.181	-0.196	0.759	-1.716	-0.995	0.867	**1.12345**
oil	4.2%	0.213	0.461	-0.481	0.096	0.059	-1.022	0.166	0.021	-0.104	-0.040	0.187	-0.257	-0.010	**0.96308**
veg	4.1%	0.306	0.846	-0.399	0.012	-0.109	0.167	-1.290	-0.095	0.022	-0.160	-0.594	0.054	-0.448	**0.85339**
meat	14.1%	0.135	-0.417	0.730	-0.068	0.532	0.073	-0.315	-0.968	0.341	-0.636	-0.788	3.064	-1.886	**0.91728**
fish	10.2%	-0.171	0.015	-0.043	0.306	-0.459	-0.268	0.064	0.261	-0.857	0.196	0.530	0.396	-1.822	**1.02392**
dairy	6.5%	0.199	0.128	0.315	0.358	1.055	-0.060	-0.240	-0.280	0.117	-1.045	-1.715	-1.750	1.077	**1.04017**
beverage	2.0%	0.003	-0.134	0.189	0.131	-0.787	0.090	-0.304	-0.124	0.099	-0.561	-0.488	0.065	1.003	**0.55063**
alcohol	9.6%	-0.906	-1.239	1.147	-0.921	-2.172	-0.617	0.151	2.158	0.370	-1.744	0.364	-1.272	1.488	**1.05323**
pulses	5.6%	0.197	0.423	-1.350	-0.290	1.015	0.003	-0.536	-1.251	-0.953	1.539	2.845	0.818	-1.440	**1.16824**

Data source: UNHS 1999/2000

Table 5.5: Compensated Price and Expenditure Elasticities: LA/AIDS with Inverse Mills Ratio

Food Item		Compensated price elasticity													
	Mean budget share	mat	maize	rice	sugar	cereal	oil	veg	meat	fish	dairy	bev	alcoh	pulses	EXPEND Elasticity
Food	**44%**														**1.48261**
Non Food	**56%**														**1.84623**
matooke	5.7%	-0.562	0.140	-0.145	-0.032	-0.104	0.370	0.508	0.122	-0.039	0.242	0.093	-0.486	0.279	**1.04914**
maize	9.2%	0.219	-0.324	-0.320	0.234	0.836	1.087	1.902	-0.170	0.102	0.269	-0.508	-1.909	0.826	**1.09070**
rice	8.1 %	-0.198	-0.275	-0.367	-0.028	0.314	-0.857	-0.701	0.468	0.042	0.469	0.772	2.573	-4.757	**0.89568**
sugar	9.1%	-0.045	0.237	-0.036	-0.615	0.316	0.293	0.106	0.039	0.342	0.588	0.635	-0.735	-0.371	**1.00623**
cereal	4.4%	-0.074	0.425	0.178	0.160	-0.830	0.113	-0.070	0.221	-0.151	0.804	-1.692	-0.948	0.918	**1.12345**
oil	4.2%	0.254	0.503	-0.446	0.136	0.103	-0.984	0.201	0.057	-0.064	0.001	0.208	-0.215	0.035	**0.96308**
veg	4.1%	0.347	0.890	-0.363	0.052	-0.064	0.205	-1.256	-0.059	0.063	-0.119	-0.572	0.096	-0.401	**0.85339**
meat	14.1%	0.278	-0.267	0.852	0.068	0.686	0.204	-0.198	-0.843	0.481	-0.495	-0.713	1.208	-1.726	**0.91728**
fish	10.2%	-0.064	0.127	0.047	0.409	-0.344	-0.171	0.151	0.354	-0.753	0.303	0.586	0.504	-1.702	**1.02392**
dairy	6.5%	0.263	0.195	0.370	0.419	1.123	-0.002	-0.188	-0.224	0.180	-1.028	-1.681	-1.686	1.148	**1.04017**
beverage	2.0%	0.024	-0.112	0.207	0.151	-0.764	0.109	-0.287	-0.105	0.120	-0.540	-0.477	0.086	1.026	**0.55063**
alcohol	9.6%	-0.806	-1.135	1.233	-0.825	-1.065	-0.525	0.233	1.245	0.468	-2.644	0.416	-1.072	1.600	**1.05323**
pulses	5.6%	0.253	0.481	-1.303	-0.237	1.075	0.054	-0.490	-1.203	-0.898	1.595	1.874	0.874	-1.202	**1.16824**

Data source: UNHS 1999/2000

Table 5.6: Uncompensated Price and Expenditure Elasticities: LA/AIDS with Inverse Mills Ratio (LOW INCOME)

Food Item		Uncompensated price elasticity													
	Mean budget share	mat	maize	rice	sugar	cereal	oil	veg	meat	fish	dairy	bev	alcoh	pulses	EXPEND. Elasticity
Food	**44%**														**1.48261**
Non-food	**56%**														**1.84623**
matooke	5.7%	-1.110	0.174	0.046	0.003	0.015	0.331	0.419	0.0182	0.041	0.303	0.025	0.021	-1.328	**1.38963**
maize	9.2%	0.270	-0.778	-0.130	-0.169	0.810	0.332	0.676	-0.395	-0.170	-0.032	-0.946	-0.539	1.089	**1.06968**
rice	8.1 %	-0.012	-0.121	-0.638	0.086	0.456	-0.312	0.228	0.563	0.085	0.453	0.5653	0.822	-1.587	**0.67178**
sugar	9.1%	-0.034	-0.174	0.115	-0.975	0.629	-0.153	-0.778	4.839	1.083	2.202	2.097	-1.881	-1.290	**0.93375**
cereal	4.4%	0.008	0.413	0.279	0.330	-1.404	-0.053	-0.962	-0.708	-0.224	0.513	-0.840	-0.059	1.399	**1.11284**
oil	4.2%	0.221	0.152	-0.160	-0.071	-0.050	-1.126	-0.349	0.147	-0.126	-0.089	0.108	-0.079	0.325	**0.95997**
veg	4.1%	0.258	0.310	0.137	-0.363	-0.8852	-0.352	-0.616	-0.148	0.171	0.211	-0.845	-0.061	0.548	**0.89534**
meat	14.1%	0.078	-0.633	1.051	7.769	-2.185	0.520	-0.460	-1.752	0.279	-0.498	-1.330	1.483	-1.480	**1.19698**
fish	10.2%	0.077	-0.203	0.117	1.299	-0.519	-0.325	0.444	0.209	-0.594	0.172	0.989	0.717	-1.848	**1.02799**
dairy	6.5%	0.342	-0.017	0.326	1.561	0.717	-0.144	0.301	-0.207	0.105	-0.155	-4.845	-1.126	-1.187	**0.86276**
beverage	2.0%	-0.063	-0.227	0.166	0.480	-0.405	0.054	-0.438	-0.219	0.189	-1.538	-0.444	0.122	1.586	**0.14338**
alcohol	9.6%	-0.193	-0.636	1.170	-2.093	-0.200	-0.179	-0.134	0.937	0.657	-1.665	0.881	-0.307	-0.012	**0.76373**
pulses	5.6%	-1.231	0.6704	-1.155	-1.741	1.909	0.448	0.776	-1.481	-1.524	-1.051	1.443	0.123	-1.385	**1.40059**

Data source: UNHS 1999/2000

Table 5.7: Compensated Price and Expenditure Elasticities: LA/AIDS with Inverse Mills Ratio (LOW INCOME)

Food Item		compensated price elasticity													
	Mean budget share	mat	maize	rice	sugar	cereal	oil	veg	meat	fish	dairy	bev	alcoh	pulses	EXPEND. Elasticity
Food	**44%**														**1.48261**
Non Food	**56%**														**1.84623**
matooke	5.7%	-1.030	0.235	0.085	0.056	0.079	0.386	0.470	0.086	0.099	0.353	0.033	0.0645	-1.248	**1.38963**
maize	9.2%	0.389	-0.686	-0.072	-0.089	0.905	0.414	0.752	-0.293	-0.082	0.041	-0.934	-0.474	1.029	**1.06968**
rice	8.1 %	0.092	-0.040	-0.587	0.157	0.541	-0.239	0.296	0.654	0.163	0.518	0.576	0.880	-1.448	**0.67178**
sugar	9.1%	0.084	-0.083	0.173	-1.055	0.723	-0.071	-0.702	1.941	1.170	2.276	2.109	-1.816	-1.171	**0.93375**
cereal	4.4%	0.068	0.460	0.309	0.371	-1.355	-0.011	-0.923	-0.655	-0.178	0.551	-0.833	-0.025	1.460	**1.11284**
oil	4.2%	0.275	0.194	-0.133	-0.034	-0.006	-1.089	-0.314	0.195	-0.085	-0.055	0.113	-0.049	0.380	**0.95997**
veg	4.1%	0.314	0.353	0.164	-0.326	-0.840	-0.314	-0.580	-0.100	0.212	0.246	-0.840	-0.030	0.604	**0.89534**
meat	14.1%	0.268	-0.487	1.143	7.896	-2.033	0.651	-0.338	-1.589	0.419	-0.381	-1.311	1.587	-1.289	**1.19698**
fish	10.2%	0.219	-0.093	0.186	1.394	-0.405	-0.227	0.535	0.331	-0.489	0.260	1.004	0.795	-1.705	**1.02799**
dairy	6.5%	0.427	0.048	0.367	1.618	0.785	-0.085	0.355	-0.134	0.168	-0.208	-4.837	-1.079	-1.102	**0.86276**
beverage	2.0%	-0.036	-0.206	0.179	0.499	-0.383	0.073	-0.420	-0.195	0.209	-1.521	-0.441	0.138	1.613	**0.14338**
alcohol	9.6%	-0.061	-0.534	1.234	-2.004	-0.094	-0.088	-0.048	1.051	0.755	-1.582	0.894	-0.234	0.121	**0.76373**
pulses	5.6%	-1.157	0.727	-1.119	-1.692	1.108	0.499	0.824	-2.418	-2.469	-1.005	1.451	0.164	-1.460	**1.40059**

Data source: UNHS 1999/2000

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APPENDIX 1

STRICTLY CONFIDENTIAL

UGANDA NATIONAL HOUSEHOLD SURVEY 1999/2000

SOCIO-ECONOMIC SURVEY QUESTIONNAIRE

SECTION 1A: HOUSEHOLD IDENTIFICATION PARTICULARS

1. STRATUM: _____
2. COUNTY: _____ 3. SUB-COUNTY: _____
4. PARISH: _____
5. EA/ LC1: _____
6. HOUSEHOLD SR. NO.: _____
7. SAMPLE NO.:
8. HOUSEHOLD CODE:
9. NAME OF HEAD: _____
10. LOCATION ADDRESS: _____

Codes for item 5 and 7 (first box)

Old EA/ LC1/household..... 1

New EA/LC1/household..... 2

11. G.P.S Coordinates **(Uganda lies between the following degrees 1 South and 4 North, 29 and 35 East)**

First reading: N/S ☐ ☐☐☐ o ☐☐ . ☐☐☐ '
E ☐☐☐ o ☐☐ . ☐☐☐ '

Second reading: N/S ☐ ☐☐☐ o ☐☐ . ☐☐☐ '
E ☐☐☐ o ☐☐ . ☐☐☐ '

Codes for North and South

North..... 1

South..... 2

12. LC1 Name and code _____ ☐

SECTION 1B: STAFF DETAILS AND SURVEY TIME

1. NAME OF ENUMERATOR _____
2. DATE OF INTERVIEW _____ DD ☐☐ MM ☐☐ YYYY ☐☐☐☐
3. NAME OF SUPERVISOR _____
4. NAME OF EDITOR/SCRUTINIZER _____
5. DATE(S) OF INSPECTION _____
6. STARTING TIME ☐☐☐☐ 7. STOPPING TIME ☐☐☐☐
8. RESPONSE CODE: ☐
9. DATA ENTRY OPERATOR _____

Response Details

Codes for Item 8 in Section2 :

1. Completed
2. No household memmber at home or no competent respondent at home at the time of visit
3. Entire household absent for extended period
4. Postponed
5. Refused
6. Dwelling vacant
7. Dwelling destroyed or not found
9. Others (specify)

SECTION 2: **HOUSEHC**

I D No	Name	Duration of stay in the household during the last 12 months **(In months)**	Relationship Head 1 Spouse 2 Cohabiting Partner 3 Child 4 Parent 5 Spouse's Parent 6 Other relatives 7 Servant 8 Others 9	Survival of parents Both father and mother alive 1 Only father alive 2 Only mother alive 3 None alive 4 Don't know 0	Sex Male 1 Female 2	Age	Marital Status Unmarried 1 Married 2 Cohabiting 3 Divorced/ separated 4 Widowed 5
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

Activity Status		
Usual (Main)	Secondary	Current (Main)
(9)	(10)	(11)

Activity status codes

Too young or old	01
Disabled	02
Student	03
Employer	04
Own account worker	05
Unpaid family worker	06
Govt employee	07
Private employee	08
Unemployed	09
Political, social	
Religious worker	10
Att. domestic duties	11
Others	19

Industry & occupation check on the right hand side of this page

Industry code

Not applicable	00
Crop farming	01
Livestock farming	02
Poultry farming	03
Fishing	04
Hunting	05
Mining & quarrying	06
Manufacturing	07
Electricity, gas and water	08
Construction	09
Sale, maintenance and repair of motor vehicles and motorcycles and parts	10
Wholesale and retail trade	11
Mechanical and Electrical workshops	12
Other repairs	13
Hotels and lodging, bars	
Restaurants & canteens	14
Transport, storage, & communications	15
Finance, Real Estates, Legal	
Accounting, Architecture etc	16
Photographic activities	17
Public service	18
Defence & related activities	19
Education	20
Health	21
Community service activities	22
Political/Social/Religious activities	23
Hair dressing and beauty clinics	24
Other activities n.e.c	29
(Please specify)	

Occupation

Not applicable	00
Professional, technical, etc	01
Administrative, managerial etc	02
Clerical & related workers	03
Sales workers	04
Service sector workers	05
Crop farmers & related wkrs	06
Cattle farmers, other livestock and related workers	07
Poultry	08
Forestry, fishing, etc	09
Production & transport wkrs	10
Unskilled labourers	19

SECTION 3: HOUSEHOLD MEMBER'S ED

I D No.	Education						
	Literacy Status	Current Schooling Status	Reason for Never Attending	Reason for Dropping out	Highest Level Attained/ Completed	Education of the father	Education of the mother
					Codes for these columns are on the right		
	Neither able to read nor write ..... 1 Able to read only ..... 2 Able to write only ..... 3 Able to read and write 4	Never attended ..... 00 Attended earlier ..... 01 Waiting for results ..... 02 Dropped out* ..... 03 **Attending:** Nursery ..... 04 Primary ..... 05 Post primary ..... 06 Secondary ..... 07 Post secondary** ..... 08 A diploma course ..... 09 University ..... 10 Apprenticeship 11	Young ..... 0 Sick ..... 1 Disabled ..... 2 Indifferent ..... 3 Need to work ..... 4 Cost ..... 5 School too far ..... 6 Orphaned ..... 7 Insecurity ..... 8 Others 9	Completed a desired level ..... 1 Need to work ..... 2 Domestic work ..... 3 Cost ..... 4 Transport ..... 5 Quality of school ..... 6 Sickness or Calamity in family ..... 7 Pregnancy ..... 8 Others 9			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

* This refers to those v

** This includes A-lev

	Major Illness				
Distance to the school (km)	Did ..[Name] fall sick or get injured during last 30 days	What sort of sickness/inj did ..[Name] suffer?	Days lost/ suffered due to sickness or injury	Type of medical attention	Distance to the clinic/ hospital (in Km)
	Yes ..... 1 No ..... 2 Don't know 3	Fever/malaria ..... 01 Diarrhea ..... 02 Accident ..... 03 Measles ..... 04 Aids ..... 05 Dental ..... 06 Respiratory ..... 07 Intestinal Infections ..... 08 Skin Infections ..... 09 Hyper - tension ..... 10 Ulcers ..... 11 Others 19		**Treatment:** None ..... 00 Home ..... 01 Hospital Govt. 1* ..... 02 Hospital private 1* ..... 03 Clinic ..... 04 Dispensary ..... 05 Health center ..... 06 Drug shop ..... 08 Pharmacy ..... 09 Traditional doctor ..... 10 Hospital govt. 2* ..... 11 Hospital private 2* ..... 12 Others 19	**If code 02 to 19 in col (13)**
(9)	(10)	(11)	(12)	(13)	(14)

	During last	
	Illness/ Injury	
Reason for not consulting	Major Illness/ Injury	Days lost due to major sickness or injury
Illness mild..... 1 Facilities are too far..... 2 Available facilities costly..... 3 Others..... 9	**Use codes in column (11)**	Less than a week..... 1 One to two weeks..... 2 Two to four weeks..... 3 More than a month..... 4
(15)	(16)	(17)

Code for highest level attained/ completed Columns (6, 7, & 8)

No schooling and No formal education	00
Some schooling but Not completed P.1	01
Completed P.1	11
Completed P.2	12
Completed P.3	13
Completed P.4	14
Completed P.5	15
Completed P.6	16
Completed P.7	17
Completed J.1	21
Completed J.2	22
Completed J.3	23
Completed S.1	31
Completed S.2	32
Completed S.3	33
Completed S.4	34
Completed S.5	35
Completed S.6	36
Completed Post primary Specialised training or Certificate	41
Completed Post secondary Specialised training or Diploma	51
Completed Degree and above	61
Don't know	99

SECTION 4 : CHARACTERISTICS OF DWELLING

(PART A) TYPE OF DWELLING

Type	Code	No. of Rooms
Independent House	1	
Tenement (Muzigo)	2	
Independent Flat/Apartment	3	
Sharing House/Flat/Apartment	4	
Boys Quarters	5	
Garage	6	
Hut	7	
Uniport	8	
Other (specify)	9	

(PART B) TYPE OF TENURE

Owned	1
Rented (Normal)	2
Rented (Subsidised)	3
Supplied free by Employer	4
Supplied free or rent paid by Relative or other person	5
Other (Specify)	9

(PART C) MATERIALS

ROOF		WALL		FLOOR	
Thatched	1	Thatched	1	Earth	1
Iron sheets	2	Mud and poles	2	Earth and Cow dung	2
Asbestos	3	Un-burnt Bricks	3	Cement	3
Tiles	4	Burnt Bricks with Mud	4	Mosaic or Tiles	4
Tin	5	Burnt Bricks with Cement	5	Bricks	5
Cement	6	Timber	6	Stone	6
Others	9	Cement Blocks	7	Wood	7
		Stone	8	Other	9
		Others	9		

(PART D) WATER SOURCE

1. What is the source of water for the members of your household ?	Drink	Other
Piped in Dwelling	1	1
Piped outside Dwelling	2	2
Public Tap	3	3
Bore-hole	4	4
Protected Well/Spring	5	5
Unprotected Well/Spring	6	6
Rain Water	7	7
Vendor/Tanker Truck	8	8
River/Lake/Stream & (Other Specify including neighbours)	9	9

2. Reasons for not using protected source [codes (6) and (9)] ☐

The queue at the protected source too long	1	Source used is okay	6
Have not contributed for maintenance	2	Excluded by social/cultural reasons	7
Protected source unreliable	3	Protected source not available	8
Protected source water taste not good	4	Others (specify)	9
Protected source is far	5		

3. Have you used the same source of water since 1992 Yes=1 No=2 ☐

If yes, fill in the information for the current period only and if no, fill in for both current and 1992

	Currently	In 1992
4. How far is the drinking water source from the dwelling (in km)?	☐☐.☐☐	☐☐.☐☐
5. How far is the other Water source from the dwelling (in km)?	☐☐.☐☐	☐☐.☐☐
6. How much water is collected/used by the household every day (in liters)?	☐☐☐	
7. Who normally collects water in this household (If source is outside house/compound)? (Record the I.D Nos. in order of frequency)	☐☐☐	

(PART E) TOILET FACILITY

What kind of toilet facilities does your household have ?

Flush Toilet (Owned)	1
Flush Toilet (Shared)	2
Flush Toilet (pour)	3
Pit Latrine (Covered)	4
Pit Latrine (Uncovered)	5
VIP	6
Pan/Bucket	7
Bush	8
Other	9

(PART F) TYPE OF LIGHTING AND FUEL

(a). What type of lighting is normally used in your household?

Electricity	1
Paraffin/Kerosene Lantern	2
Tadooba	3
Candle (Wax)	4
Firewood	5
Solar	6
Gas	7
Biogas	8
Other	9

(b). What type of cooking fuel is normally used in your household?

Fire wood	1
Charcoal	2
Paraffin/Kerosene	3
Electricity	4
Gas	5
Solar	6
Biogas	7
Other	9

PART G

If firewood is normally used, fill the following information.

1. Have you used the same source of firewoood since 1992 Yes=1 No=2

If yes, fill in the information for the current period only and if no, fill in for both current and 1992

	Currently	In 1992
2 How far is the source of firewood from the dwelling (if not bought) (in km)?	.	.
3 How many bundle(s) used a day?		
4 How much do you spend/ would you spend on firewood for a day?	Shs.	
5 Who normally collects firewood in this household (if not bought)?		
[I.D. Nos. in order of frequency]		

SECTION 5 : PAST EXPERIENCES OF THE HOUSEHOLD

Part A: MIGRATION HISTORY OF THE HOUSEHOLD HEAD

I.D. No.	Description of the person	Has..[NAME].. always lived in this village? Yes..... 1 No..... 2	If no, Year in which ..[NAME].. arrived	Place of Birth/Home District		
				Name of the District	Code (outside Uganda ... 500)	Area Rural..... 1 Urban..... 2
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Head of household					

Part B: INHERITANCES RECEIVED BY THE HOUSEHOLD

Has the household received any inheritances during the head's lifetime? Yes..... 1 No..... 2

If yes, fill the table below

Sr. No.	Type	Code	Value (Current)	Major year received
(1)	(2)	(3)	(4)	(5)
1	Land	01		
2	Building(s)	02		
3	Cattle	03		
4	Livestock (other than cattle)	04		
5	Agricultural Enterprise Assets	05		
6	Other Enterprise Assets	06		
9	Other Household Assets (Specify)	09		

Part C: MAJOR SHOCKS EXPERIENCED BY THE HOUSEHOLD DURING THE LAST 7 YEARS

Type of Shocks experienced	What year did it happen?	The 3 most important coping mechanisms			Who helped most?
Illness or Injury of 1 month or longer..... 1 Abandonment or Separation..... 2 Loss of permanent job..... 3 Loss of productive assets e.g Land, livestock, machinery, etc..... 4 Others..... 9	(yyyy)	Received help..... 1 Received gifts..... 2 Borrowed..... 3 Received formal credit..... 4 Sale of assets..... 5 No help..... 6 Others..... 9			Relatives inside the village..... 1 Relatives outside the village..... 2 Non-relative inside the village..... 3 Non-relative outside the village..... 4 No help received..... 5
(1)	(2)	(3)	(4)	(5)	(6)

SECTION 6 : HEALTH

(PART A) : HEALTH CARE AND VACCINATION (FOR WOMEN 12 YEARS AND ABOVE).

		During Last 12 months				FOR MOTHERS OF CHILDREN UNDER FIVE YEARS IN THE HOUSEHOLD											
						For cough and cold illnesses	Tetanus Vaccination										
		Pregnancy status	Ante-Natal Care	Intra-Natal Care	Post Natal Care		Did you receive a tetanus injection (TT) when you were pregnant with your last child ?		How many doses of TT did you receive during your last pregnancy ?	If less than 2 doses , did you receive any other dose(s) during the preceding pregnancy?	When was the last dose received?						
ID. No	Age	Pregnant..... 1 Not pregnant (delivered)..... 2 Not pregnant (aborted)..... 3 Never Been Pregnant..... 4	**(codes for Columns (4), (5) and (6))** Trained staff..... 1 TBA..... 2 No Care..... 3 Not Applicable..... 4 Govt. Unit..... 1 NGO..... 2 Private Unit..... 3 At Home..... 4 Not Applicable..... 5			When your child is sick with cough and/ or cold, what signs or symptoms will lead you to consult a doctor/health worker? Has a blocked nose..... 1 Has trouble with sleeping/eating..... 2 Has fever..... 3 Is breathing fast..... 4 Has difficulty in breathing..... 5 Is ill for a long time..... 6 Others..... 9 Don't know..... 0	**If no, go to col(11)** Yes..... 1 No..... 2	If yes, do you have a card? Yes..... 1 No..... 2		Yes = 1 No = 2	**(Record month and year).** **(mm/yyyy)**						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)						

SECTION 6 : HEALTH

(PART B) : VACCINATION, BREAST-FEEDING, DIARRHOEA, AND VITAMIN A FOR CHILDREN UNDER 5 YEARS (59 months and below)

ID No.	Age In Months	Vaccination and Source										Breast-feeding				Diarrhoea				Vitamin A		Response Code
		Card Status Yes and Card seen ..... 1 Yes but no Card seen ..... 2 No ..... 3 Don't know ..... 0 **Source** Don't know ..... 0 Govt. Hosp/ Clinic ..... 1 Private Hosp./Clinic ..... 2 Mobile Unit ..... 3 School ..... 4 Special Camp ..... 5 Not applicable ..... 8 Other (Specify) 9										Has [NAME] ever been Breast-fed? Yes ..... 1 No ..... 2 DK 0	Is he/ she still being Breast-fed? Yes ..... 1 No ..... 2 DK 0	For how long was the child breastfed exclusively (in months) **Not known=99**	Reason for stopping Child old ..... 1 No mother ..... 2 Mother working ..... 3 Breasts sick ..... 4 Mother became pregnant again ..... 5 Others 9	Has [NAME] had Diarrhoea in the last 2 weeks ? Yes ..... 1 No ..... 2 DK 0	If Yes,			Has [NAME] ever received a Vitamin A capsule like this one ? *(To be shown)* Yes ..... 1 No ..... 2 DK 0	**If yes,** How many months ago did [NAME] take the last capsule ?	Mother ..... 1 Other HH member ..... 2 Other person 3
		BCG	**DPT1**	**DPT2**	**DPT3**	**POLIO P0**	**POLIO P1**	**POLIO P2**	**POLIO P3**	**MEASLES**	**Polio (General)**						What kind of drink was given ? **(multiple codes in order of importance)** Nothing ..... 00 Breast milk ..... 01 Cereal-based gruel or gruel made from roots for soup ..... 02 Home fluids e.g. Sugar salt solution, Yoghurt drink ..... 03 ORS packet solution ..... 04 Other milk ..... 05 Water with feeding during some parts of the day ..... 06 Water alone ..... 07 Infant formula e.g. NAN Cerelac, etc ..... 08 Fluids like Alcohol, soda, and all artificial drinks ..... 09 Others 19	What amount of drink was taken ? Less than usual amount ... 1 Usual amount ..... 2 More than usual amount ... 3 Don't know 0	What amount of food was eaten ? None ..... 1 Less than usual ... 2 About the same as usual ..... 3 More than usual ..... 4 Don't know 0			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)

APPENDIX 2

SECTION 7 : HOUSEHOLD CONSUMPTION EXPENDITURE

(PART A) FOOD, BEVERAGES AND TOBACCO (During The Last 7 days)

On average, how many people were present in the last 7 days?

Adults				Children			
Male		Female		Male		Female	

Item Description	Code	Unit of Quantity	Purchases				Consumption out of Home Produce		Free		Market Price	Farm gate/ Producer Price
			Household		Away from home							
			Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value		
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]
Matooke	101											
Matooke	102											
Matooke	103											
Matooke	104											
Sweet Potatoes (Fresh)	105											
Sweet Potatoes (Dry)	106											
Cassava (Fresh)	107											
Cassava (Dry/Flour)	108											
Irish Potatoes	109											
Rice	110											
Maize (grains)	111											
Maize (cobs)	112											
Maize (flour)	113											
Bread	114											
Millet	115											
Sorghum	116											
Beef	117											
Pork	118											
Goat Meat	119											
Other Meat	120											
Chicken	121											
Fresh fish	122											
Dry/Smoked fish	123											
Eggs	124											
Fresh milk	125											
Infant Formula Foods	126											
Cooking oil/ghee	127											
Margarine, Butter, etc.	128											
Passion Fruits	129											
Sweet bananas	130											
Mangoes	131											
Oranges	132											
Onions	133											
Tomatoes	134											
Cabbages	135											
Dodo	136											
Other Vegetables	137											
Beans (fresh)	138											
Beans (dry)	139											
Groundnuts (In shell)	140											
Groundnuts (Shelled)	141											
Groundnuts (Pounded)	142											
Peas	143											
Sim sim	144											
Sugar	145											
Coffee	146											
Tea	147											
Salt	148											
Soda/juice	149											
Beer	150											
Other Alcoholic drinks	151											
Cigarettes	152											
Other Tobacco	153											
Expenditure in Restaurants etc.	154											
Other food, drinks etc.	159											

SECTION 7 : HOUSEHOLD CONSUMPTION EXPENDITURE

PART B: NON-DURABLE GOODS AND FREQUENTLY PURCHASED SERVICES (During Last 30 days)

Item Description	Code	Unit of Quantity	Purchases		Home Produced		Free		Unit Price
			Quantity	Value	Quantity	Value	Quantity	Value	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Rent of rented house/Fuel/Power									
Rent of Rented House	301								
Imputed rent of owned House	302								
Maintenance and Repair Expenses	303								
Water	304								
Electricity	305								
Paraffin (kerosene)	306								
Charcoal	307								
Firewood	308								
Others	309								
Non-durable and Personal goods									
Matches	451								
Washing soap	452								
Bathing soap	453								
Tooth paste	454								
Cosmetics	455								
Handbags, travel bags etc.	456								
Batteries	457								
Others	459								
Transport and communication expenses									
Tyres, Tubes, Spares etc.	461								
Petrol, diesel etc.	462								
Taxi, Bus and other fares paid	463								
Stamps, Telephones, etc.	464								
Others	469								
Health and Medical Care									
Consultation Fees	501								
Medicines etc.	502								
Hospital /Clinic Charges	503								
Traditional Doctors fees/medicines	504								
Others	509								
Other services									
Sports, theatres etc.	701								
Dry Cleaning and Laundry	702								
Houseboys/girls, Shamba boys etc.	703								
Barber and Beauty Shops	704								
Expenses in hotels, Lodging places etc.	705								

SECTION 7 : HOUSEHOLD CONSUMPTION EXPENDITURE

PART C: SEMI-DURABLE AND DURABLE GOODS AND SERVICES (During Last 365 days)

Item Description	Code	Purchases	Consumption out of household enterprise stock	Free
		Value	Value	Value
[1]	[2]	[3]	[4]	[5]
Clothing and Footwear				
Men's clothing	201			
Women's clothing	202			
Children's wear	203			
Other clothing and Clothing Materials	209			
Tailoring and Materials	210			
Men's' Footwear	221			
Women's Footwear	222			
Children's Footwear	223			
Other Footwear and Repairs	229			
Furniture, Carpet, Furnishings etc.				
Furniture Items	401			
Carpets, Mats, etc.	402			
Curtains, Bed sheets, etc.	403			
Bedding Mattresses	404			
Blankets	405			
Others and Repairs	409			
Household Appliances and Equipment				
Electric iron/Kettles etc.	421			
Charcoal and Kerosene stoves	422			
Electronic Equipment (TV. etc.)	423			
Bicycles	424			
Motorcar, Pick-ups, etc.	425			
Other equipment and repairs	429			
Jewelry, Watches etc.	430			
Glass/Table ware, Utensils & Electric goods				
Plastic Basins	441			
Plastic plates/tumblers	442			
Jerry cans and Plastic buckets	443			
Enamel and metallic utensils	444			
Switches, plugs, cables, etc.	445			
Others and repairs	449			
Education				
School fees including PTA	601			
Boarding and Lodging	602			
School uniform	603			
Books and supplies	604			
Other educational expenses	609			
Services Not Elsewhere Specified (N.E.S..)				
Expenditure on household functions	801			
Other services N.E.S	809			

SECTION 7 : (PART D) NON-CONSUMPTION EXPENDITURE		
Item Description	Code	Value during the last 12 months
(1)	(2)	(3)
Taxes and duties paid	901	
Pension and Social Security Contributions	902	
Remittances, Gifts and Other Transfers	903	
Contributions to Funerals and Other Functions	904	
Others (like subscriptions, interest to consumer debts, etc.)	909	

SECTION 8: ENTERPRISE PARTICULARS OF THE HOUSEHOLD

1. Does the household have a crop farming enterprise? Yes..... 1 No..... 2 [ ]
2. Does the household have any other enterprise? Yes..... 1 No..... 2 [ ]
3. If yes in 2 above, fill in the relevant information of the non-crop farming enterprise(s) code below.

Sr. No.	Description of Enterprise	Industry code (Codes below)	Year Started (yyyy)	Percentage of start up capital from own savings	Did you ever receive a formal credit for the Ent. Yes = 1 No = 2	Problems in running the Ent. (codes below)	Problems in expanding the Ent. (codes below)	ID No. of the person responsible	Labor during the last 12 months (In person - months)	
									Household members	Others
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1										
2										
3										
4										
5										

Industry codes

Livestock farming	02	Transport, storage, & communications	15
Poultry farming	03	Finance, Real Estates, Legal	
Fishing	04	Accounting, Architecture etc	16
Hunting	05	Photographic activities	17
Mining & quarrying	06	Public service	18
Manufacturing	07	Defence & related activities	19
Electricity, Gas, & Water supply	08	Education	20
Construction	09	Health	21
Sale, maintenance and repair of motor vehicles and motorcycles and parts	10	Community service activities	22
Wholesale and Retail trade	11	Political/Social activities	23
Mechanical and Electrical workshops	12	Hair dressing and beauty clinics	24
Other repairs	13	Other activities n.e.c. (Please specify)	29
Hotels and lodging, bars Restaurants & canteens	14		

Most important problem faced in running/expanding the enterprise

No difficulty	1
Supply problems	2
Demand related problems	3
Labour related problems	4
Technical problems (Machinery breakdown, spare parts, etc	5
Credit facilities	6
Govt. regulations	7
Not profitable	8
Not interested in expanding	9
Others (specify)	10

SECTION 9 : INCOMES FROM ENTERPRISE, EMPLOYMENT AND OTHER ACTIVITIES DURING LAST 12 MONTHS

Section 9A: Enterprise and Other Incomes

Sr. No.	Item Description	Cash	Kind (Value)
(1)	(2)	(3)	(4)
1	**Income from household enterprises**		
11	Crop Farming Enterprises		
12	Other Agricultural Enterprises (e.g Livestock, Poultry, etc.)		
13	Non- Agricultural Enterprises - Hh/Cottage		
14	Non-Agricultural Enterprises - Others		
2	**Property Income**		
21	Imputed rents of owner - occupied housing (net)		
22	Net actual rents received from building/h.hd. property		
23	Net rent received from Land		
24	Royalties		
25	Interest received		
26	Dividends		
3	**Current transfers and other benefits**		
31	Pension and life insurance annuity benefits		
32	Family allowances and other social security benefits		
33	Remittances and assistance received from others		
34	Other income {inheritance, alimony, scholarships and other unspecified income etc.}		

Section 9B: Employment Income

ID No.	Main Activity		Secondary Activity		Other Activities	Grand Total
	Cash	Kind (Value)	Cash	Kind (Value)	Total	
(1)	(2)	(3)	(4)	(5)	(6)	(7)

Section 10A: HOUSEHOLD AND ENTERPRISE ASSETS

Sr. No.	Asset	Code Asset	Available now		Available 1 year ago		In 1992
			Quantity	Value	Quantity	Value	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Household Assets						
1	House	001					
2	Other Buildings	002					
3	Furniture	003					
4	Furnishings e.g carpet, mat, matress,etc.	004					
5	Household Appliances e.g Kettle, Flat iron, etc.	005					
6	Electronic Equipment e.g TV., Radio, Cassette, etc.	006					
7	Bicycle	007					
8	Other Transport equipment	008					
9	Jewelry and Watches	009					
10	Other household assets 1	019					
11	2	019					
12	3	019					
	Livestock/Poultry						
13	Cows	101					
14	Bulls	102					
15	Oxen	103					
16	Pigs	104					
17	Goats	105					
18	Donkeys	106					
19	Chicken	107					
20	Other livestock/poultry 1	108					
21	2	108					
22	Structures for livestock rearing	109					
	Enterprise equipment						
23	Land	201					
24	Hoes	202					
25	Ploughs	203					
26	Pangas, slashers, etc.	204					
27	Wheelbarrows	205					
28	Other agricultural equipment	206					
29	Transport equipment for enterprise	207					
30	Enterprise equipment other than agriculture 1	209					
31	2	209					
32	3	209					

Rankings for 1992 column (8)

Much more..... 1
More..... 2
About equal..... 3
Less..... 4
Much less..... 5
None..... 6

SECTION 10B: OUTSTANDING LOANS AS ON DATE OF SURVEY AND LOANS FULLY REPAID DURING THE LAST 12 MONTHS

For Formal AND Informal credits [Adults only (18 years and above)]

(Loans longer than 1 month only)

ID No.	Did..[name] apply for a loan/credit?	If no, why?	Purpose	Source	How much did..[name] ask for?	How much did..[name] receive?	What was required as security?	Period of the loan in (months)	Outstanding amount as on date of survey	Have ..[name] ever received a loan?	Have ..[name] ever had any difficulty in meeting the repayment date
	Yes..... 1 No..... 2	Not needed..... 1 Does not know where to apply..... 2 No supply available locally (or too far)..... 3 Does not have security required... 4 Interest too high.... 5 Others (specify).... 9	Purchase of agricultural land..... 0 Purchase of livestock..... 1 Agricultural inputs..... 2 Setting up or expansion of enterprise..... 3 Housing..... 4 Education..... 5 Health..... 6 Household consumer goods & services..... 7 Ceremonies..... 8 Others..... 9	Bank..... 0 Cooperative credit societies..... 1 Government agency..... 2 Non Government Organisation..... 3 Commercial firm..... 4 Money lender..... 5 Employer..... 6 Relatives, friends, etc..... 7 Community funds..... 8 Others..... 9			None..... 1 Land..... 2 Livestock..... 3 House..... 4 Future harvest..... 5 Others (specify)..... 9			Yes.. 1 No.. 2	Yes.... 1 No.... 2
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)

Sr. No.	INDICATORS	Response	
		Currently	In 1992
(1)	(2)	(3)	(4)
1	Does everyone in the household have at least two sets of clothes? Yes... 1 No... 2		
2	Does anyone in the household own a radio? Yes... 1 No... 2		
3	Does every member of the household over one year old have a blanket each? Yes... 1 No... 2		
4	Does the household have a bicycle? Yes... 1 No... 2		
5	Does the household have any other transport equipment other than a bicycle? Yes... 1 No... 2		
6	Has your production of crops/ cattle or livestock rearing/ trading activities been harmed by civil strife over the last 12 months? Yes... 1 No... 2		
7	How long (in days) is it since anyone in the household traveled to the nearest town with modern amenities to do any of these: Deposit /Withdraw money from a Bank, Post a letter, make a Telephone call, Recreation (theatre, games, etc..).		
8	How often did the household eat meat or fish in the last week?		
9	How many incidents of theft of property has the household suffered in the last 12 months and in 1992?		
10	What was your reaction (household) to the theft? Went to police..... 1 Tried to solve with the help of local authorities..... 2 Tried to solve it with the help of local authorities and police..... 3 Tried to solve it with the help of neighbors..... 4 Tried to solve it on my own..... 5 Did nothing..... 6		
11	How many incidents of physical attack on members of the household have there been over the last 12 months and in 1992?		
12	What did you do when you last ran out of salt? Borrowed from neighbors..... 1 Bought..... 2 Did without..... 3		
13	What did your children below the age of 13 have for breakfast today? Tea/ drink with sugar only..... 1 Milk/ milk tea with sugar, etc..... 2 Tea/ drink with solid food..... 3 Tea/ drink without sugar with solid food..... 4 Porridge with solid food..... 5 Porridge with sugar only..... 4 Porridge without sugar only..... 5 Nothing..... 6 Not applicable..... 7 Others..... 9		
14	Does any member of the household participate in community organizations below? **Codes for Question 13** Does not participate..... 1 Participate if required..... 2 Participate actively..... 3 Item Description Church/Mosque Local government (elected) Local government (non - elected) Women groups Saving groups P.T.A Local development committee Sports club Professional organization e.g. farmers' groups, etc. Other Organizations		
15	Has the household benefited from any type of development project/program? e.g. food aid, productive development, legal assistance, employment program, etc. Yes..... 1 No..... 2		
16	If someone in the household had a serious problem which required you to get money immediately, how many people in the community could you ask for help?		

SECTION 12: CHANGES (REDUCTIONS) IN THE HOUSEHOLD SINCE 1992

Has there been any change (reductions) in composition of the household (e.g death, moving out of children or any other house hold member) since 1992? ☐

Yes.....1 No..... 2

If yes, fill in the necessary information in the table below

Sr. No.	Name	Relationship to the current head Husband 1 Spouse 2 Cohabiting Partner 3 Child 4 Parent 5 Spoure's Parent 6 Other relatives 7 Servant 8 Others 9	Sex Male 1 Female 2	Age	Year of change	Cause of the change Search of a job 1 Got a job 2 Set up a new hh 3 Married 4 Died 5 Others (Specify) 9
(1)	(2)	(3)	(4)	(5)	(6)	(7)

SECTION 13: ANTHROPOMETRICS AND TYPE OF FEEDING FOR CHILDREN 60 MONTHS AND BELOW

ID. No.	Name of Child	Sex Male 1 Female 2	Age in months **(60 months and below)**	Weight in kg	Height in cm	Reason for not measuring Child away from home on repeated visits 1 Permanent illness/ deformity 2 Temporary illness 3 Mother's illness 4 Refusal by the household 5 Others 9	Type of feeding BF* only 1 BF* supplemented with powdered/cow's milk 2 BF* with other milk/ other liquid & starch 3 No BF* but other milk 4 Other liquid & starch 5 Solid and liquid food with milk 6 Solid and liquid food without milk 7 Others 9	No. of times fed on the previous day
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

BF*= Breast-feeding

SECTION 14: REMARKS

REMARKS BY ENUMERATOR:

REMARKS BY SUPERVISOR: