AN ANALYSIS OF URBAN HOUSEHOLD FOOD DEMAND IN NAIROBI, KENYA

BY

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DECLARATION AND RECOMMENDATION

DECLARATION

I hereby declare that this is my original work and has not been presented in this or any other university for the award of a degree.

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Sign: ----------

Date: 17/7/2008

RECOMMENDATION

This work has been submitted with our approval as University supervisors.

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DEDICATION

To my ever loving, motivating and emotionally supporting mum Dorothy Michael, my brothers and sisters, friends, and Eunice Williams.

You are all great.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Policies geared towards creating changes in food prices and incomes of the urban households coupled with the increasing urban population have led to changes in food consumption patterns in urban areas. The shift in demand for food experienced in urban areas of Kenya is accompanied by a shift in the ability to access food. The few existing studies of food demand patterns in Kenya are limited in both scope and analysis. There is no recent information on estimates encompassing price and expenditure elasticities and the effects of demographic effects on the patterns of food demand in the Nairobi urban area. This study investigated consumption response (the access to food) by the urban population of all income categories. The basis of ascertaining food consumption response to the policy interventions was through determining the price and expenditure elasticities of demand incorporating demographic characteristics. The aim of this study was to identify and quantify price and expenditure elasticities and the effects of demographic factors on food demand patterns for eleven categories of food (sifted flour, unsifted maize meal, dairy and dairy products, vegetables, fruits, beef and beef products, maize, poultry, sugar, wheat and wheat products and rice). In the study, Almost Ideal Demand System (AIDS) model giving attention to the presence of zero budgetary allocations was employed for analysis. The study utilizes data from an urban consumption survey conducted in the Nairobi metropolitan area by the Tegemeo Institute using Central Bureau of Statistics (CBS) sample frame towards the end of 2003. Results indicate that all the food categories were price elastic except for unsifted maize meal. Sifted flour, unsifted maize meal, dairy and dairy products, sugar, maize, wheat and wheat products were found to be necessities, while beef and beef products, vegetables, fruits, poultry and rice were found to have expenditure elasticities greater than one and thus are luxuries in the urban life. The findings indicate that simultaneous application of income and food price policies will be effective in influencing demand patterns of the urban households. The existence of identified and quantified effects of price and expenditures coupled with the effects of demographic factors provides an answer to the development policy which stimulates improved nutritional status, designing of food subsidy strategies and articulation of sectoral and macroeconomic policy analysis.

LIST OF ABBREVIATIONS

CBS	Central Bureau of Statistics
EAs	Enumeration Areas
GDP	Gross Domestic Products
RoK	Republic of Kenya
IFPRI	International Food Policy Research Institute
IMPACT	International Model for Policy Analysis of Agricultural Commodities and Trade
p.a	Per Annum
PSU	Primary Sampling Units
UHBS	Urban Household Budget Survey

CHAPTER ONE: INTRODUCTION

1.1 Background Information

The population of Sub Saharan African countries is rapidly growing leading to increased urban populations. This trend is being accompanied by a shift in the composition of food demand (Teklu, 1996) and is attributed to the urban dwellers shift to more convenient and processed foods. The shift in composition of food demand has steered food policy research in Sub Saharan Africa towards addressing the various ways in which food productivity can be increased. To address the issue, the agricultural sectors in most Sub-Saharan African countries have undergone a period of liberalization involving removal of price controls, removal of food subsidies, and removal of controls on movement of agricultural commodities (Kodhek 1998; Teklu 1996; Jayne and Rubey 1993) and liberalization of internal and external trade. These policies have induced adjustments in household budgets and changes in consumption patterns which have varied implications on the well being of the households (Teklu 1996). In the short run, these policies have increased food prices, induced a fall in real incomes especially among the poor households and created political unrest (Jayne and Rubey, 1993). In addition they have oriented agricultural productivity towards the market thereby increasing agricultural potential towards contribution to the economy (Tambi, 2001). Realizing this potential depends on the agricultural products and an increase in production. The extent to which producers respond to demand changes depends on how they perceive the demand for their products. Hence for producers to ensure a steady supply of agricultural commodities, a better understanding of the household consumption behaviour is needed (Tambi, 2001). This requires factors that influence demand for agricultural commodities be identified and their effects quantified.

The challenge to policy makers in this case is the prediction of the expected shifts in the composition of demand (Teklu, 1996) and to analyse individual consumer behaviour given the structure of relative prices faced, real income and a set of demographic characteristics. The paradigm to analyzing consumer behaviour is the determination of price and expenditure elasticities subject to government interventions through pricing policies and policies geared towards changing household incomes. The knowledge of consumer behaviour answers a wide range of development policy questions as it sets the basis of policy interventions geared towards

improvement of nutritional status, designing of food subsidy programs and conducting of sectoral and macroeconomic policy analysis (Sadoulet and Janvry, 1995).

Although a number of studies have been published on the subject of food demand patterns, much less effort has been made to understand food demand patterns in Africa (Weliwita *et.al*, 2003). For example Kenya, a country faced by a 2.1% p.a population growth rate, 2% p.a Gross Domestic Product (GDP) growth rate (RoK, 2004) has few studies that address food demand analysis. A report by Williamson and Shah (1981) used four cross-sectional expenditure surveys conducted in urban areas for Kenya in the analysis of urban household food consumption patterns. These surveys were the Nairobi African Middle Income workers Survey of 1963, the "Urban Household Budget Survey" of 1968- 69 for Nairobi and Mombasa, the 1974 Urban Household Budget Survey for Nairobi and the 1977 Urban Food Purchasing Survey for Nairobi, Mombasa, Kisumu and Nakuru. They confirmed that expenditure was in line with Engel's law that the share spent on food declined with income. For the lower income group the food budget was about 45% of the total expenditure, while for upper middle class it fell to about 30%. All groups spend a large share on cereals with this category accounting for about 25% of food expenditure on average, raging from 20.5 for the upper income group to 29% for the lower income group. Maize is the primary staple particularly among the poorer families where it accounts for two thirds of all expenditure on cereals.

According to RoK (2001), the 93/94 UHBS (urban household budget survey) solicited data on household demographic characteristics and expenditures. In addition data on incomes, housing conditions and educational characteristics of household members as well as employment profiles was collected. The annual urban household consumption expenditure was estimated at 81,246 million Kenyan shillings. Food constituted 42.4% of the total expenditure. Rent and other housing costs 24.1%, and alcohol and tobacco 1.1%. The mean annual household consumption was estimated to be 83,202 Kenyan shillings translating to a monthly equivalent expenditure of 6,934 Kenyan shillings.

Nairobi is the capital city of Kenya and habours an approximated population of about 2.2 million people (CBS 2003). Consumption expenditure by households in Nairobi accounted for 57.7% of the total, Mombassa 12.9%, Kisumu and Nakuru 2.7% and 2.5% respectively while the 'other urban' category comprising of 47 towns 18.5%. The total non-consumption expenditure

amounted to 14,200 million Kenyan shillings of which 50.8% was on loan repayment. The descriptive outcome showed that the mean household expenditure increased with household size and that the proportion of food expenditure increased with household size. The survey also showed that the expenditure share by food broad category in Nairobi was 38.8%. By the year 2000 the Kenyan population stood at an approximated 30.7 million, the population living in urban area in the same year raised to 33% from 24% in 1994, signifying a 79% increase (United Nations, 2001a). The Gross Domestic Product (GDP), according to the World Bank (2000), declined owing to the higher population growth hence the growth of per capita GDP was negative. The economic decline increased unemployment and in combination with inflation led to reduction in purchasing power of the urban households (Hilda Van.'t Riet 2002). In 1994 the absolute poverty level among the Nairobi urban households was 22%, this number doubled to 50% in 1997 (RoK, 2001).

According to Obudho, (1997), the majority of the households in Nairobi have low purchasing power prompted by the increasing poverty levels, fluctuations in employment availability, wage levels and commodity prices. These strongly influence the household food security which is pegged on purchasing power. Although food may be available in the city, it may not be affordable and accessible to the urban poor. The repercussions of this scenario are malnutrition and undernourishment, especially to the children under five years of age. The urban population is further characterized by differences in social classes prompted by differences in incomes, different religions, and different races and cultures, all of which culminate into different lifestyles. In addition, rapid changing and advancing media that is creating awareness to the city dwellers on the diversity and quality of various products and commodities face the city. For instance, according to Mukumbu and Jayne (1994), the perception of strong preferences for sifted meal has been reinforced by substantial advertising by large-scale milling firms portraying refined maize meal as a sign of sophistication and modernity.

All the above characteristics coupled with the substantial supply of products into the urban market have induced different food demand patterns within the urban area. It is presumed that the variation in preferences and tastes posed by the demographic and economic variables have effects on the food demand patterns. Previous studies have limited scope on demand analysis and are only limited to the estimation of income versus expenditure (Engel

relationships) due to the non-availability of micro-level data on expenditure and prices. In addition, these studies have fallen short of determining unbiased, consistent and efficient estimates of economic and demographic variables. In the absence of these estimates, policy formulation has been done through subjective judgment on the extent of the changes in price, expenditure and demographic factors. Demographic factors such as level of education, age gender, and religion have been found to have a significant influence on the level and pattern of food demand in a variety of studies such as Weliwita *et.al.*, (2003) in Tanzania; Abdulahi *et.al.*, (1999) in India and Tambi (1996) in Cameroon. There is no recent information on post reform price and expenditure elasticities and effects of demographic characteristics for the Nairobi urban area. It is more likely that a change in relative prices through these years either, caused by supply shifts, taste changes, marketing practices or changes in the pattern of income distribution and thus demand all driven by the reform programs, have altered the patterns of consumer spending.

Policy formulations based on price and expenditure elasticities of demand facilitate access to cheap food to the low-income groups in the urban area and contribute enormously to the improvement of their nutritional status. For instance, according to Mukumbu (1994), prior to liberalization of the maize markets, government articulated policies that favoured large-scale millers since maize movement was restricted in the urban areas. Thus the urban households could only access the expensive and less nutritious sifted maize meal. After liberalization traders could supply unsifted maize meal mills with maize leading to the unsifted maize meal millers increasing the output of whole meal, which is cheap and more nutritious, and preferred by the low-income groups. In Nairobi the response by the large-scale millers was to reduce prices so as to capture the lost market share. According to Williamson and Shah (1981), food budget shares skewed towards the lower income groups such as maize and to a lesser extent, dairy products were well suited as tools for nutritional policy.

This study attempted to elicit the urban household demand structure by estimating the price and expenditure elasticities and the effects of demographic characteristics on the household food budgetary allocation to the various food categories within the Nairobi urban area. The urban household demand structure is deemed important in making conclusive interventions that improve urban household food security.

1.2 Statement of the Problem

Reform programs such as market liberalization that have been implemented have in particular led to changes in income distribution, supply shifts and changes in the marketing practices. These outcomes coupled with taste changes have more likely led to a change in the commodity relative prices through the years. It is more likely that the change in food commodity relative prices has changed the urban household food demand behaviour (preference ordering) thus altering the pattern of consumer spending and consequently influencing their food security. The underlying food demand structure in Nairobi urban area remains unknown following the changes in prices and incomes that has taken place. Similarly the effects of the prices, incomes and demographic factors that influence food expenditure are unknown. This study investigated food consumption response patterns prompted by changes in food commodity relative prices, changes in urban household incomes and changes in urban household demographic factors.

1.3 Objectives of the Study

The primary objective of this study was to determine the price and expenditure elasticities and the effects of demographic characteristics on food demand patterns in the Nairobi urban area. The specific objectives are:

i. To determine urban household food consumption response to changes in own prices and relative prices of other food items.
ii. To determine food demand response to the changes in income allocated to the food category by urban household consumers
iii. To determine the effects of urban household demographic characteristics on food demand patterns.

1.4 Hypotheses

i. The urban household consumer food demand is not responsive to changes in own price and prices of other food items.
ii. The demand for a food is not responsive to the changes in urban household income allocated to food category.
iii. Urban household demographic characteristics have no effects on the food demand patterns of the urban household consumers.

1.5 Justification of the study

The few studies on urban food demand analysis in Kenya are limited in both scope and analysis since they do not determine the magnitude and direction of the effects of policies which lead to changes in food prices and household incomes to the consumer. Hence there is limited information on estimates of price and expenditure elasticities of food demand that encompass the effects of demographic factors in urban areas of Kenya. Due to the lack of recent information on urban food demand elasticities, the little empirical knowledge and limited debate on the effects of policy changes on food demand within households has been based on conventional wisdom and notions about household food demand. The result of this has been reliance by policy makers upon subjective judgment in policy formulation and planning for the urban areas thus making it difficult to evaluate how the prices and expenditure affect household food demand. This study was an attempt to fill this existing information gap. A micro dataset containing the information on the influence of household demographic factors (such as age, education and gender) on the food expenditure allocation yielded substantially greater precision in the estimation of the parameters than estimation based on the aggregate data. The knowledge of food demand elasticities obtained from separable food categories will be of importance in the formulation of policies aimed at food subsidy strategizing, nutritional improvement and the articulation of regional, sectoral and macroeconomic policies, all which culminate in ensuring that there is food and nutritional security across all income groups.

1.6 Scope and Limitations

This study covered the analysis of price and expenditure elasticities of eleven food categories in the urban area of Nairobi. Also determined were effects of household demographic factors on the patterns of food demand. The study utilized data from an urban consumption survey conducted in the Nairobi metropolitan area by Tegemeo Institute using Central Bureau of Statistics (CBS) sample frame towards the end of 2003. The survey involved administering a questionnaire during the month of November. Recall data for food expenditures for the month of June was also collected. The month of data collection (November & December) and the recalling for the month of June prompted low participation rate (proportion of households with nonzero expenditure on some categories of food), which was an indication of non-purchases due to non-

preference. Further data on 'other' food category was limiting and thus did not warrant inclusion for any significant analysis.

1.7 Definition of Terms

Household: A group of people who are generally bound together by ties or kinship or joint financial decision, who live together under a single roof or compound, are answerable to one person as the head and share the same eating arrangement. In this study urban household is used to define all the people who share the same eating arrangement within the urban area. This also includes the domestic workers such as house girls/boys, grounds men/ gatekeepers living in the same household and share the same meals with the family.

Opportunity set. The total expenditure/outlay by a consumer or household allocated over a choice set.

Choice set. The field or vector of alternatives or commodity quantities from which a consumer or household makes a choice to maximize his utility.

Separability Defines the conditional ordering of goods in a group where there is independence of goods outside the group.

Weak separability Defines a situation in which a commodity vector can be partitioned in to *n* groups.

Food security. Access by all people at all times to enough food for an active healthy life.

CHAPTER TWO: LITERATURE REVIEW

2.1 Socioeconomic, demographic factors and food demand

Empirical studies on food demand analysis in African countries are quite scant relative to other developing partners in Asia and Latin America (Weliwita *et.al.*, 2003). The few available studies are limited in terms of the rigour of analysis in which they fall short of estimating expenditure and price elasticities.

Studies by Williamson and Shah (1981), Bouis (1994), Mukumbu and Jayne (1994), Jayne and Kodhek (1997) in which they have tried to analyse food consumption patterns in Kenya cover some of the published literature. Williamson and Shah (1981) estimated elasticities of demand through the pragmatic approach, Linear Expenditure System (LES) and Almost Ideal Demand System (AIDS) (complete demand models) for both urban and rural areas in Kenya. They obtained results for both systems of analysis. From the results of the AIDS model they concluded that the expenditure estimates for urban areas indicated that all commodities except fruits and the non-food category were necessities, while poultry and eggs had an elasticity of one. Further they observed that the urban commodities with an elastic price response (negative parameter) are dairy products, vegetables and fish. In their analysis the hypothesis of cross-price symmetry of the Slutsky matrix was rejected. This could be attributed to the setting of many price parameters equal to zero. Using household expenditure survey conducted under the auspices of International Food Policy Research Institute (IFPRI), one in Kenya and another in Philippines, Bouis (1994) showed that differences in per capita calorie intake across income groups implied that those income groups were grossly inconsistent with observed differences in body weights. Mukumbu and Jayne (1994) used a logit to analyse the importance of factors likely to affect a Nairobi household's decision to consume unsifted maize meal meal. They found that household income, region, adult equivalent, region and full time working women in the household to significantly influence decision to consume unsifted maize meal meal. Jayne and Kodhek (1997), using data obtained through household survey in Nairobi, determined how urban household maize consumption and expenditure responded to the liberalization of maize and maize meal. They decomposed changes in maize grain prices and maize milling margins. Their results indicated that maize market liberalization conferred substantial benefits to urban consumers.

Several studies conducted outside Kenya but within Africa have demonstrated that demographic and socio economic factors are important explanatory factors in household consumption behaviour. A handful of the published studies include Weliwita *et.al.*, (2003) on Tanzania; Savadogo and Brandt (1988) on Burkina Faso; Tambi (2001, 1998, 1996); on Cameroon; Jayne and Rubey (1993) on Zimbabwe and Teklu 1996 on Sub Saharan Africa.

In Burkina Faso, Savadogo and Brandt (1988) used data from household survey to analyse food demand. Using AIDS model they found that food price, income and household composition, education and marital status and urbanization jointly influenced household expenditure. The study by Tambi (1996) employed static and dynamic demand models to estimate household demand for beef with specific concerns on the short run and long run price and income effects and the period of adjustment for habit information. Household incomes lagged consumption, own and cross prices were found jointly important in explaining beef consumption behaviour. Using a complete AIDS model incorporating habit information with and without homogeneity imposed on the system, Tambi, (1998), analysed the consumption patterns of meat, fish and dairy products in Cameroon. The results classified meat and dairy products as relative luxuries and fish as relative necessity. Tambi, (2001) uses a two-step Heckman procedure to analyse the household attitudes towards the purchase of livestock products. His results indicated that fish is a relative necessity in Cameroon concurring with his previous findings Tambi, (1998) study, and it is often a substitute for beef and chicken for households whose profiles include being of low income levels, having large household sizes, are of middle age and less educated. He further noted that the profiles of households likely to purchase beef include being married, middle aged, educated and of Muslim faith, whereas the profiles for households most likely to increase the purchase of chicken include being of high income level and are public sector employees. This concurred with Tambi's, (1996) study on the influence of income on the consumption behaviour.

The study by Weliwita *et.al.*, (2003), perhaps the most current study on food demand patterns in Africa as of now covers a set of food categories in Tanzania. Using a linearized AIDS model and paying attention to zero expenditure shares and demographic characteristics on food demand patterns, which result in two step analysis involving probit and a standard OLS, the results indicated that maize, rice, other cereals, pulses, sugar, edible oils, fish, starch, fruits and

vegetables, meat and other foods are price inelastic while milk and dairy products have unitary elasticity of demand. Most of food groups are income elastic. The results also reveal significant effects of household size and household income on food demand patterns.

In Zimbabwe, Jayne and Rubey (1993) assessed the maize milling market reform and urban food security. Their results indicated that the structure of Zimbabwe maize marketing system hurts both rural smallholder and urban consumers by forcing the bulk of surplus maize production be processed through the relatively high cost industrial milling system. While milling margins of small hammer mills ranged from 25%-45% of the large-scale industrial mills, the former was blocked by policy from procuring maize in the urban areas, such that consumers with preference for hammer milled meal were forced to purchase more costly industrially milled meal. Surveys of urban consumers suggest that whole meal flour would account for a much higher share of the urban maize meal market if it were available at a price discount. Evidence also shows that the poor are the main consumers of such meal when it is available.

Elsewhere outside Africa, in both developing and developed countries, studies on food demand analysis have been done. Some examples include, Abdulai *et.al.*, (1999) on India; Park *et.al.*, (1996); Park and Capps (1997); Gao and Spreen (1994); Gao *et.al.*, (1993) on the United States (U.S); Molina, (1994) on Spain; Balcombe *et.al.*, (1999) in Bulgaria and Tiffin and Tiffin, (1999) on Britain; Aguero and Gould, (2003) on Brazil; Thiele and Weiss (2003) on Germany; and Ishida *et.al.*, (2003) on Malaysia.

Using a linearized AIDS model in analyzing household demand for food in India, Abdulai *et.al.*, (1999), analysed price and expenditure elasticities estimates of the demographic variables on Indian food items in both rural and urban areas. The results indicate that for commodity groups (milk and milk products; cereals and pulses; edible oils; meat, fish and eggs; vegetables and fruits; other foods) demand is elastic only for milk an milk products in both rural and urban areas of India, which contrasts results by Tambi, (2001) in Cameroon and Weliwita *et.al.* (2003) in Tanzania all which show that milk and milk products are relative luxuries and unitary elastic respectively. However the three studies concur in ascertaining that demographic variables such as level of education, household size have significant influence on the household demand patterns.

Park and Capps (1997) used a two-step Heckman procedure to estimate the demand for prepared meals by U.S. households. They defined prepared meals as those ready to cook and those ready to eat. Their results pointed out that households headed by younger more educated and time constrained managers were more likely to purchase prepared meals. Income elasticities ranged from 0.07 to 0.13 while own-price elasticities ranged from -0.23 to -0.66.they gave evidence that prepared meals and food away from home are substitutes; the presence of teenagers in the household is positively associated with expenditure on prepared meals. On a similar study of food expenditure patterns for the Hispanic population in the US, Lafranco, *et.al.*, (2002), estimated Engel curves for food categories (Total Food (TF), Food eaten at home (FAH), Food eaten Away from Home (FAFH)). The estimated income elasticity of demand of food for the Hispanic households was 0.29 for TF, 0.21 for FAH and 0.49 for FAFH and household size elasticities were 0.32.0.4 and 0.07 respectively. The analysis indicated that Hispanic households devoted a higher proportion of their budget to FAH (25.8%the average American household while the proportion spent on FAFH was only 3.6%).

Park *et.al.*, (1996) estimated a demand system of food for US households segmented by income or poverty status. Using a US nationwide food consumption survey, they analysed twelve food commodity groups and obtained subsistence expenditures, own price elasticities, expenditure elasticities and income elasticities. Their results indicated own price elasticities were similar between the income groups for most commodities. However income elasticities were consistently higher for lower income group. Gao and Spreen (1994) analysed US demand. They estimated price and expenditure elasticities and also the effects of household demographic variables on the demand for six meat commodities (beef steak, roast beef, ground beef, pig meat, poultry and fish). Using a highbrid demand system combining a modified generalized addilog system, and a level version of Rotterdam demand system, they reported that the most significant household characteristics and socioeconomic variables were region, ethnic background, employment status and the proportion of food eaten away from home. Using a censored regression approach, Aguero and Gould (2003) analysed household composition and household food purchases for Brazilian families. They used estimated adult equivalence scale to evaluate an increase of household welfare represented by per adult equivalent food expenditure. It was found

that a significant shift in the distribution of per capita food distribution occurred when comparing member count versus per adult equivalent food distributions.

Estimates of food demand analysis for Britain were done by Tiffin and Tiffin (1999). Using the AIDS model and applying a Bayesian approach to impose curvature restrictions in the model, they obtained estimates of Hicksian, Marshallian and expenditure demand elasticities that were fully consistent with static optimization by consumers. Their overall results concurred with the expectations that aggregate food demand is both price and income elastic and individual food categories are mostly price and income elastic, with notable exceptions being meat, fish and chicken. Following AIDS model and time series data, Molina, (1994) analysed food expenditures aggregated in five categories, and also incorporated habit effects to capture the behaviour of the Spanish food consumer. Although the theoretical hypothesis of homogeneity and symmetry were rejected, the model provided plausible expenditure and price elasticities. Balcombe, *et.al.*, (1999) analysed consumer behaviour in Bulgaria when it was under transition and with a strongly contracting economy. He used the AIDS model and reported expenditure elasticities that were considerably higher than unity for foods. This was attributed to a substantial divergence between consumption and expenditure on food items.

Whereas a large number of empirical studies have concentrated on analyzing consumer demand for specific products, much less attention has been paid to the household demand for product variety (the number of products consumed in a specific period of time). Thiele and Weiss (2003) analysed consumer demand for food variety in Germany. The econometric result suggests significant increases in variety with an increase in income and the number of children between 7 and 17 being significantly higher if the family lives in a large city. The significance of household income on food variety is in line with the hypothesis that consumption evolves along a hierarchical order as income increases. That is, as income increases people as a rule and on average, increase their consumption.

2.2 Population growth, urbanization policy interventions and food demand

A number of studies have recognized the effects of population growth and urbanization on food demand pattern. Reardon (1993), Teklu (1996), Rae (1998), Delgado *et.al.*, (1999) and Ishida *et.al.*, (2003) all concur in ascertaining the influence of urbanization on food demand patterns. Reardon (1993), in his cross country evidence of consumption patterns and their

sensitivity to policy issues, asserted that, the trend towards rice consumption is a long term phenomenon linked to urbanization rather than to a short term price changes in the Sahel. He viewed the substitutability of maize or millet/sorghum as a pivotal point, which should serve to encourage development of maize to help assure food security in the Sahel. His observations are shared by Teklu (1996) who recognizes that rapid urbanization in sub Saharan Africa is marked by a significant shift in composition of food staples especially in Western African countries where there has been a major shift from locally produced coarse grain to imported wheat and rice. Delgado *et.al.*, (1999), asserts that population growth, urbanization and income growth are creating a huge demand for meat and milk in the developing countries. However he concludes that the anticipated increase by IFPRI and International Model for Policy Analysis of agricultural Commodities and Trade (IMPACT) of 38%and 68% for meat and milk respectively by 2020 will be supplied without dramatic price increases.

Urbanization has also been found to have significant effects in East Asian countries by Rae (1998). He reported positive urbanization elasticities indicating that the process of urbanization had a positive effect on the demand for food. In Malaysia, Ishida *et.al.*, (2003) explored the structural changes in food consumption expenditure after its food consumption diversified under rapid economic growth and urbanization. He estimated Engels' expenditure elasticities for food items using aggregate cross sectional data from a household expenditure survey. His results indicated that while expenditure elasticities of away from home food and elasticities of at home expenditure for meat, fruits and vegetables, milk and dairy products are relatively high, those of sugar, rice are low. This indicated that food expenditure structures in West Malaysia have diversified adding meat, fruits and vegetables, milk and dairy products to the most dominant food item, rice. Moreover, it is likely that the share of food away from home will increase with income enhancement and urbanization due mainly to economic growth. Gao *et.al.*, (1993) employed a latent variable logit to characterize consumer perception of orange juice in the US. His results indicate that urbanization, education, sex, race and household size are important determinants of consumer perceptions.

The effects of urbanization on food demand patterns are quite significant in a majority of studies. Particularly this is attributed to the employment opportunities concentrated in urban centers, which attract people and consequently increasing their income. Besides favouring the

growth of specialized firms (Fafchamps and Helms 1996), urbanization has influence on the lifestyles of many people in the developing world, which also change with production systems Zijpp and Van Der (1999).

Various studies that have exploited the effects of policy interventions on food demand include Atounga (1992), Holtzman (1998) on Cameroon; Akindes (1999) on Cote *d'Ivoire;* Diagana and Reardon (1999) on urban Senegal; Singare *et.al.*, (1999) on urban Mali; Savadogo and Kazianga (1999) on Burkina Faso and Diagana *et.al.*, (1999) on West African cross country comparisons.

While Holtzman's (1988) study of beef consumption in Cameroon focused on the effects of price distortions, Atounga's (1992) focused on the impact of import taxation on meat consumption under various scenarios of price changes. He concluded that for a 15% tax increase in the price of meat, budget shares allocated to meat decreased by 1.9% resulting into an annual per capita decrease in consumption of 3.4kg by each low-income household.

Diagana *et.al.*, (1999) summarizes the findings of four case studies (Burkina Faso, Mali, Senegal and Cote *d'Ivoire*) on the impacts of the 1994 CFA Frank devaluation in West Africa on urban food consumption. The research findings generally showed that, comparing food consumption patterns after the devaluation with those before, that, total cereal intake fell especially for the poor; the intake of imported rice held steadily which was attributed to the ease of preparation and convenience in processing; the intake of domestic coarse grains (millet, maize and sorghum) did not rise except for a maize intake rise in Burkina Faso and in Mali there was a significant shift to domestic rice. The intake of imported wheat fell; roots, tuber and plantain consumption did not rise; there was de-diversification of the diet characterized by the poor reduction in meat, and edible oils/fats consumption. In all the countries there was an increased importance of the informal restaurant sector as consumption pattern individualized. Such findings showed that there was a substantial opportunity to increase the production of local products in order to increase food security and alleviate poverty.

The weakness of most of the household consumption studies conducted in Kenya is that they are descriptive and do not evaluate the magnitude and direction of changes in food consumption response. In addition they do not take into account the effects of demographic characteristics of the population and the analysis does not depict preference ordering over the

various food items exhibited by the consumers since they consider only one category of food item. They have considered the estimation of expenditure-income relationships (Engel relationships), which do not take into consideration demographic effects. In Kenya, there is limited information on food demand analysis encompassing price and expenditure elasticities and the effects of demographic variables in urban areas.

This study will in particular take in to consideration price and expenditure factors and demographic factors which the previous studies have fallen short of capturing besides paying attention to zero expenditure shares which may arise in the survey data.

2.3 Theoretical framework

The basis of demand analysis is the theory of consumer behaviour, which is embedded in the neoclassical utility theory. The theory emphasizes the importance of supply and demand and the concept of marginal utility. The objective of the theory is to explain the behaviour of the consumer given a field of choice set and opportunity set (Sadoulet and Janvry, 1995). The rational consumer in this case is assumed to maximize utility when confronted with various prices and limited income. The empirical usefulness of the theory is to establish a set of constraints which demand parameters, must satisfy, thus reducing the number of independent parameters to be estimated and ensuring consistency on the results obtained.

This study takes in to consideration food items aggregated into eleven categories. Taking a consideration of a an individual consumer whose utility function is expressed as μ(q, d), where q. is a vector of quantities of food consumed from each of the eleven categories considered, and d. is a set of demographic characteristics. The objective of the rational consumer is to maximize utility subject to a constraining budget. This is expressed as

$$Max\mu(q,d) \text{ Subject to } p.q = y \quad \ldots\ldots (2.3.1)$$

The resulting Lagrangian equation for (1) appears as

$$Max\mu(p,q) + \lambda(y - p.q) \quad \ldots\ldots (2.3.2)$$

Where, λ is the Lagrangian multiplier.

Applying a dual approach to the primal equation (2), the dual programme resulting is represented as,

$$Min(p.q) + \lambda(\mu - f(q.d)) \quad \ldots\ldots (2.3.3).$$

The optimal solution to (2) and (3) above is a set of Marshallian and Hicksian (compensated) demand functions respectively. The solutions are substituted to their original respective objective functions to yield indirect utility $\psi(y,p)$ and cost functions $c(\mu,p)$.

i.e.

$$\psi(y,p) = Max[\mu(q,d); p.q = y] \quad \text{.....(2.3.4)}$$

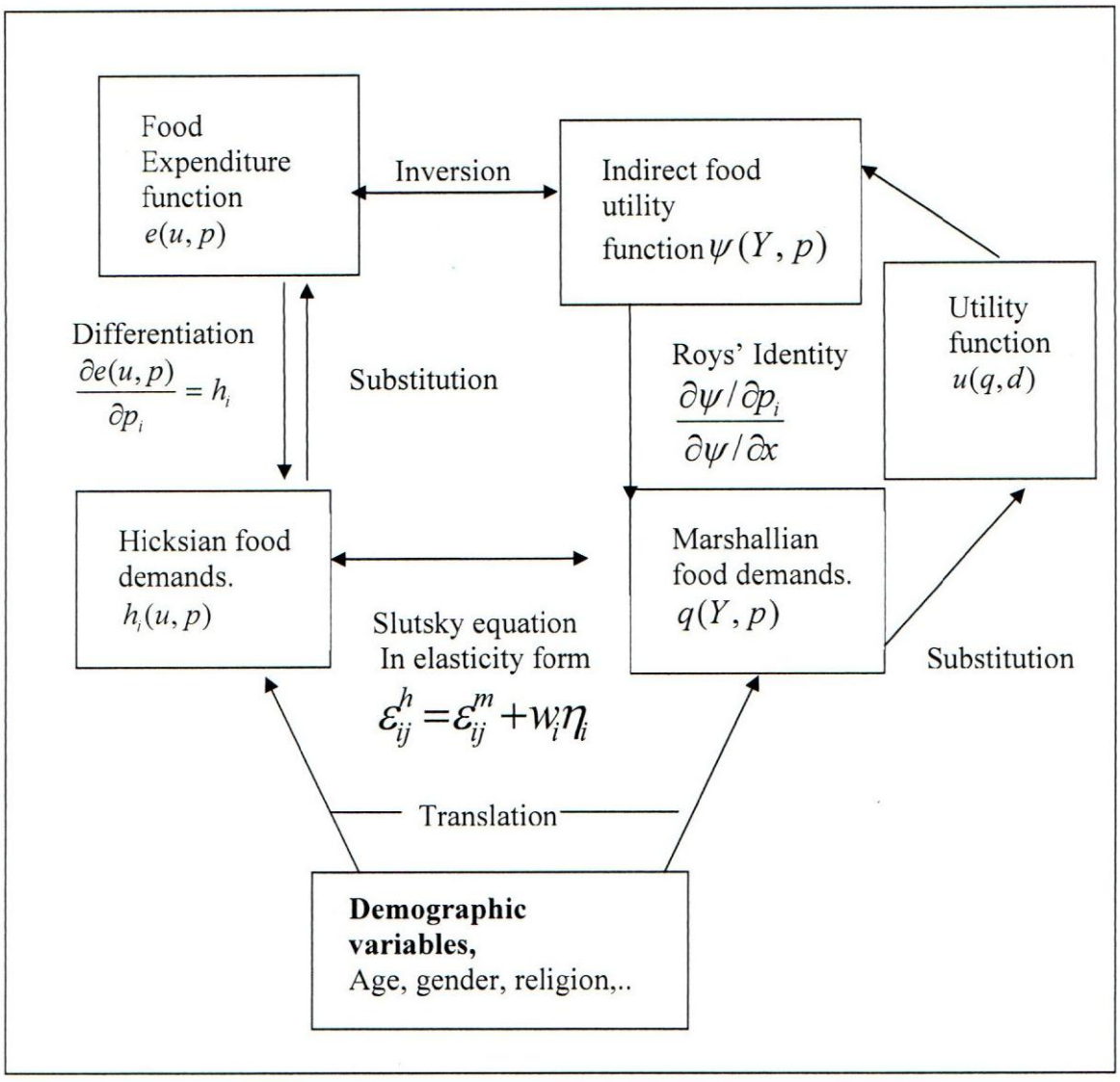
$$c(\mu,p) = Min[p.q; f(q,d) = \mu] \quad \text{.....(2.3.5)}$$

Where the function $\psi(y,p)$ is the maximum attainable utility given p and q, while $c(\mu,p)$ is the minimum cost of attaining utility μ at prices p. The two functions are related through inversion.

2.4 Conceptual Framework

A conceptual framework for this study is presented in Figure 1. A consumer is assumed to maximize a utility function subject to a budget constraint, the solution to this program is a set of Marshallian demand equations, which solve to n^2 Price slopes and n expenditure slopes and consequently to the respective price and expenditure elasticities. Substituting the Marshallian demands into the utility function $u(q,d)$ yields the indirect utility function $\psi(Y,p)$. The inversion of this indirect utility function yields an expenditure function $e(u,p)$, which through minimization subject to utility, yields the Hicksian demands, which on substitution yield the expenditure function. Demographic variables are incorporated into the demand functions through the translation approach, which involves setting the constant of the demand equations as a function of the characteristics. The Hicksian and Marshallian demand functions are linked through the Slutsky equations. The demographic factors are incorporated into the Hicksian and Marshallian demand functions through the translation approach that involves setting the constant as a function of the factors.

Figure 1. Conceptual framework adapted from Deaton and Muellbauer, 1980a.

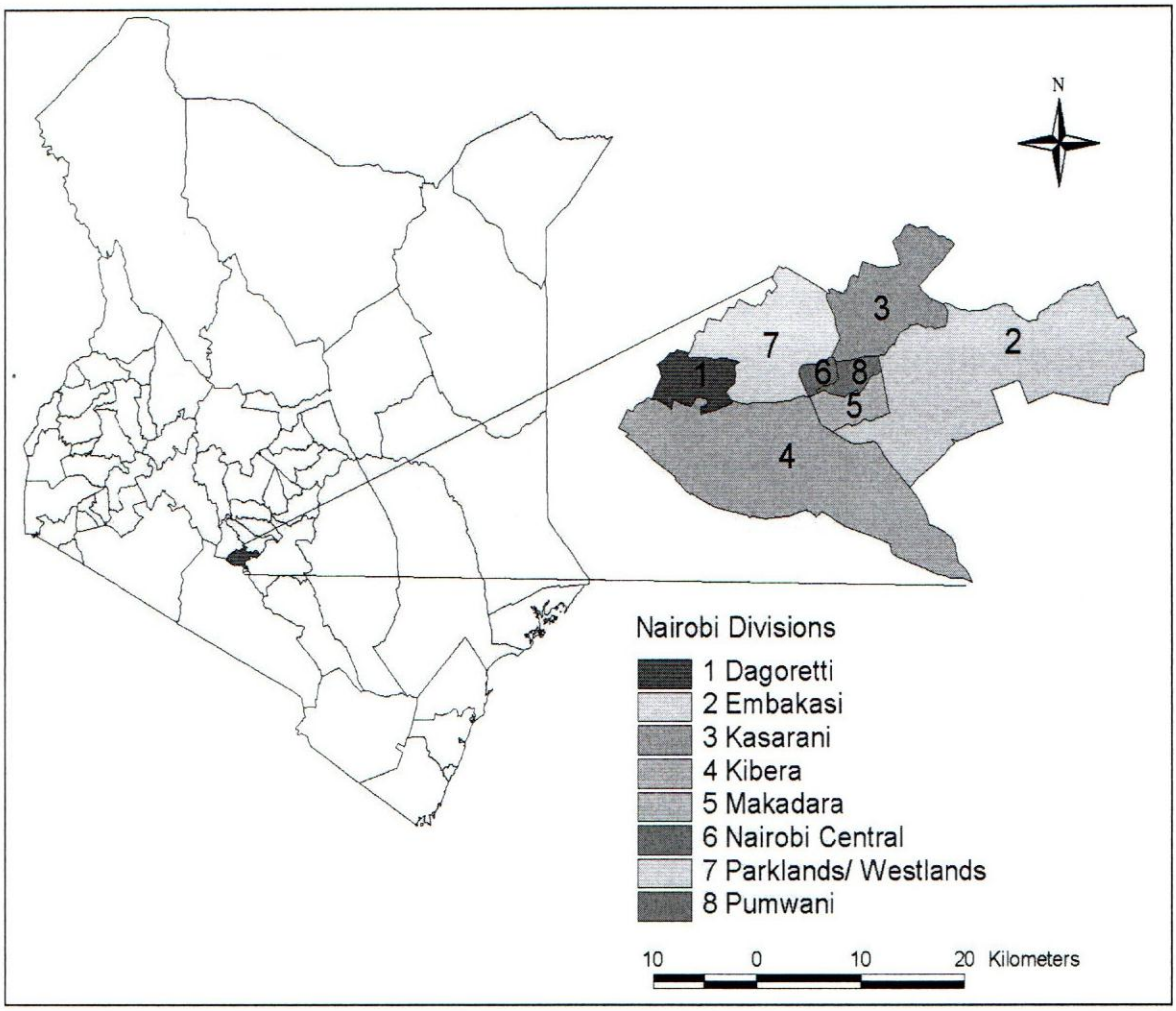


CHAPTER THREE: METHODOLOGY

3.1 Study Area

The survey was carried out in the Nairobi urban area (Figure 2) cutting across all income groups. Eight administrative divisions were considered in order to get a representative sample. The area was purposively selected due to its diversity in income groups and demographic characteristics, which lead to reliable information for analysis. It has also been covered more frequently by the CBS baseline survey that provides some socio-economic and consumer price variation data.

Figure 2: Nairobi Urban Area



Source: GIS Projection, 2004

3.2 Sampling

Tegemeo Institute in collaboration with the Central Bureau of Statistics (CBS) conducted an urban household survey covering the Nairobi metropolitan area between November and December 2003. The survey involved a sample of 600 households that was drawn according to the CBS sampling frame and corresponding clusters. The survey was undertaken within the current CBS's National Sample Survey Enumeration Program (NASSEP) IV frame established using the 1999 nationwide population and housing census database. Census Enumeration Areas (EAs) were used as the primary sampling units (PSUs). The first step in developing the frame involved allocating the PSUs to the districts considered as the strata. This was followed by selection of the PSUs using probability proportional to size (PPS). Due to socio-economic diversity in the urban centers, Nairobi was stratified into five income classes (strata): upper, lower-upper, middle, lower-middle and lower. In Nairobi, a total of 108 (Table 1) primary sampling units were selected to cover the whole urban area out of the 1800 units in the national frame. These were then optimally sampled over the five strata and the PSUs selected with probability proportional to size (*pps*). The idea of *pps* ensures that larger values are overrepresented and contribute more to enhancing the efficiency of the. The allocation of PSUs among the five strata was as follows;

Table 1 Urban household Income Stratification and strata selection

Strata (*a*)	**PSUs (*b*)**	**Probability of Cluster selection (π) (*c*)**	**Distribution of *pps* selected clusters (*d*)**
Upper	28	0.26	8
Lower Upper	12	0.11	3
Middle	16	0.15	4
Lower Middle	36	0.33	10
Lower	16	0.15	4
Total	**108**	**1**	**30**

Source: Egerton University Tegemeo Urban Household Survey 2004

For the purpose of the household consumption survey, 30 clusters were selected in Nairobi using systematic random sampling with distribution as shown in table 1 column (d). For each of the 30 clusters, 20 households were then systematically selected, giving a total of 600 households covered in the city. Data weighting procedure was applied as illustrated in the data weighting

procedure is illustrated in Appendix 1. Because of missing information on some surveys and other sources of attrition, the final sample size for analysis was reduced to 541 households.

3.3 Data and estimation procedure

A total of 40 food items were aggregated into eleven food categories: sifted flour, unsifted maize meal, dairy and dairy products, vegetables, fruits, maize, sugar, beef and beef products, wheat, rice and poultry. The data for the analysis was taken from Tegemeo Institute, Egerton University Urban Household Survey conducted between June 2003 and January 2004.In the urban survey household food allocation, purchases within the previous month and demographic characteristics were collected. The following demographic variables were included in the analysis: gender of the household head (a dummy variable taking value 1 for the male and 0 for the females), age of the household head, income category (in this study low income category refers to those having an aggregate income from both salary labour and business activities of less than 10,000 per month Kenya shillings (CBS,2004), otherwise high income category) of the household head (a dummy variable taking value 1 if in the low category and 0 for the high). Household income was derived as the sum of proceeds from employment and business earned by household members in the previous month. Number of household members between the ages of 0-10, male members between 11-20 and 21-50 years of age, number of household female members between the ages of 11-20 and 21-50,and number of household members >50. Others include household head engagement in salaried labour (dummy variable taking a value of 1 if engaged and 0 otherwise), household head engagement in business activities (dummy variable taking value of 1 if engaged, otherwise zero), religion of the household head (dummy variable of 1 if Christian and 0 otherwise) and the household size.

Food item expenditures were not collected in the survey but actual market prices and item quantities were collected in the survey. This necessitated the use of actual market prices in the estimation. Prices for the categories were calculated by summing the prices of the items in a category and were weighted by the category budget shares (Abdulai *et.ai.*, 1999, Weliwita *et.ai.*, 2003).

The demand system specification in this study was done with the assumption that consumers allocate their expenditures in two-stages: separability and stepwise budgeting. The postulation of the idea of separability is that the commodities which interact closely in yielding

utility can be grouped together while those which interact only in a general way through the budget constraint are kept in a separate group (Sadoulet and Janvry, 1995). In the first stage, consumers decide on how much to spend on broad categories of goods and services such as food, housing, clothing, transportation and entertainment with budgetary allocation to individual groups being dependent on consumer total income and the groups' price indexes (Weliwita *et.al.*, 2003). In the second stage, the groups' expenditure is allocated among various commodities in that group depending on the prices of individual commodities and the expenditure allocated to that group in the first stage. Weak separability of the utility function is assumed over the broad categories of food categories in this stage. It is also intuitively appealing to note that the idea of separability and stepwise budgeting implies independence of the marginal rates of substitution between items in the food category and items in the non-food category. Further an intuitive appealing and plausible assumption made in this study is that the expenditure on 'other' food category which includes foods eaten away from home beverages and alcoholic drinks and other types of foods not in the categories does not affect the allocation to the specified categories. This is because most of the urban household consumers make their purchases which almost last to the other pay or income interval period or 'consumption regime'. This category is thus eliminated from the analysis. The concern of this study is in the second stage of budgetary allocation in which the consumer allocates his expenditure among the eleven categories of food under consideration.

A widely employed model in demand analysis is that developed by Deaton and Muellbauer (1980a, 1980b) that has been used in a number of studies such as Abdulai *et.al.*, (1999) Weliwita *et.al.*, (2003) among others. The Almost Ideal Demand System (AIDS) model is linear, flexible and satisfies the axioms of demand theory. That is, it is derived from a well-behaved utility theory hence consistent with demand theory. If the system of equations is complete then the budget shares will sum to one, a satisfaction of the adding up condition and that it is easier to impose and test the symmetry restriction in the cross-price terms. The AIDS model budget shares are derived from an expenditure function that is obtained after inverting an indirect utility function. The translog expenditure function is represented as follows,

$$\ell ne(u,p) = \alpha_0 + \sum_i \alpha_i \ell np_i + 0.5 \sum_i \sum_j \beta_{ij} \ell np_i \ell np_j + \sum_i \gamma_i \ell nY \ell np_i \quad \text{.....(3.3.1)}$$ Where

$\ell ne(u,p)$ is the expenditure function for utility u and price vector p. applying Shephard's Lemma, the expenditure function yields the budget share equation as follows;

$$w_i = \alpha_i + \sum_j \beta_{ij} \ell np_j + \gamma_i \ell n(\frac{Y}{P^*}) \quad \text{.....(3.3.2). Where}$$

w_i =The i^{th} food budget share. This is derived as $\frac{\partial \ell ne(u,p)}{\partial \ell np_i} = \frac{p_i x_i}{e} = w_i$.

Pj = food prices.

Y= the total expenditure on all food commodities

γ_i =The expenditure coefficient

β_{ij} =Price coefficients.

P*= the price index as defined by Stone i.e. $\sum w_i \ell np_i$.

The theoretical properties of adding-up, homogeneity in prices and expenditure, and symmetry in cross effects of demand imply the following parametric restrictions on the budget share equation;

Adding-up, $\sum_{i=1}^{n} \alpha_i = 1; \sum_{i=1}^{n} \beta_{ij} = 0; \text{and} \sum_{i=1}^{n} \gamma_i = 0$.

Homogeneity $\sum_j \beta_{ij} = 0$.

Symmetry $\beta_{ij} = \beta_{ji}$

The AIDS model with the Stones price index is referred to as the Linear Approximate Almost Ideal Demand System (LA/AIDS).

Demand for food is influenced by demographic variables e.g. age, education of the population among other variables. The effects of demographic variables on food demand patterns will be captured through translation approach (Sadoulet and Janvry 1995; Weliwita *et.al.*, 2003). This involves letting the constant in the share equation (3.3.2) to be a function of the demographic variables i.e.

$$\alpha_i = \rho_{i0} + \sum_{k=1}^{S} \rho_{ik} d_k \qquad \text{(k=1...S)} \qquad \text{(3.3.3)}$$

Incorporating (6) into (5) will yield

$$w_i = \rho_{i0} + \sum_{k=1}^{S} \rho_{ik} d_k + \sum_j \beta_{ij} \ell n p_j + \gamma_i \ell n(\frac{Y}{P^*}) \qquad (3.3.4)$$

With the demographic variables the adding-up requirement, requires that

$$\sum_k^S \rho_{i0} = 1; and \sum_k^S \rho_{ik} = 0.$$

The Marshallian (3.3.5 and 3.3.6) and Hicksian (3.3.7 and 3.3.8) demand elasticities will be computed as in (Hayes *et.al.*, 1990) using the estimated LA/AIDS parameters, i.e.,

$$\varepsilon_{ii} = -1 + \frac{\beta_{ii}}{w_i} - \gamma_i \qquad (3.3.5)$$

$$\varepsilon_{ij} = \frac{\beta_{ij}}{w_i} - \gamma_i \frac{w_j}{w_i} \qquad (3.3.6)$$

$$\delta_{ii} = -1 + \frac{\beta_{ii}}{w_i} + w_i \qquad (3.3.7)$$

$$\delta_{ij} = \frac{\beta_{ij}}{w_i} + w_j \qquad (3.3.8)$$

The expenditure elasticities are computed as follows,

$$\eta_i = 1 + \frac{\gamma_i}{w_i} \qquad (3.3.9)$$

The Marshallian and Hicksian demands for cross-price elasticities can be linked through the Slutsky equation as in Friedman (1984) as follows,

$\delta_{ij}^h = \varepsilon_{ij}^m + w_j \eta_i$, and for own-price elasticities as $\delta_{ij}^h = \varepsilon_{ij}^m + w_i \eta_i$

The expenditures for some households were found to be zero for some food items. Prices for these items could not be calculated. The zero prices for the food items and food categories were replaced by the cluster averages for the non-zero prices. The participation rate was estimated as the proportion of the total sample for those with nonzero expenditure for a particular food category. Low participation rates mean a high presence of a large number of zeros for the dependent variables (budget shares). These cause the error terms associated with the dependent variables to have a nonzero mean that is $\mu \neq 0$. This violates the assumption of zero mean and

constant variance. The use of standard estimation techniques (OLS) results into biased and inconsistent estimates since these methods do not take into account the nonzero mean of the error terms (Maddala, 1983). The logarithmic model can only be used to describe the behaviour of those households with positive purchase amounts. Restricting analysis to those with positive purchases can eliminate a large fraction of the sample especially in a multi-equation model. The fundamental issue was to model demand conditional on making purchases. Since zero expenditures are a common occurrence in household budget survey data (Weliwita *et.ai.*, 2003), and that the factors that influence the decision to purchase are similar to those that influence the amount purchased, then a selection model had to be used. In this study a two-step procedure adopted by (Heien and Wessells 1990, and Weliwita *et.ai.*, 2003) was used to deal with zero expenditure. This method involves censoring the dependent variable such that the zero expenditure is modeled as a two stage process. The amount consumed by a household which is a second stage decision is conditional on the decision to purchase items in a particular category which is the first stage decision. Thus, the dichotomous decision for the dependent variables take the value of 1 if the household expenditure is nonzero, otherwise 0. In the first stage of the two-stage procedure, estimation of a probit regression for each of the eleven food categories was done. The estimates from the probit regressions were then used in computation of the Inverse Mill's Ratio (IMR) for each household for each food category. The IMR links the participation and expenditure decisions steps. The probit regressions take the form

$$p_{ih} = f(\sum_{j=1}^{m} \beta_j p_{ij} + \gamma_i Y + \sum_{d=1}^{s} \delta_d D_{id}) \text{ or } \quad p_{ih} = f(Z) \qquad (3.3.10)$$

Where p_{ih} is equal to 1 if the household has a nonzero purchase, otherwise 0, Z defines all the independent variables. The maximum likelihood estimates from the above equation were then used to construct the inverse Mill's ratio (IMR) or non-selection hazard for each household for each food category. The IMR is derived from the standard normal density (pdf) and the cumulative density function (cdf). The IMR (Φ) for a nonzero budget share household was derived as;

$$\Phi_{ih} = \frac{\theta(Z)}{\Theta(Z)}, \qquad (3.3.11)$$

While for the zero budget households was derived as;

$$\Phi_{ih} = \frac{\theta(Z)}{1-\Theta(Z)}, \qquad (3.3.12)$$

Where θ and Θ are the standard normal density (pdf) and cumulative density (cdf) as defined by the probit independent variables. The Inverse Mill's Ratio was then used in the second stage as an instrument in the respective equation of the system. The estimation model (3.3.4) was thus;

$$w_i = \rho_{i0} + \sum_{k=1}^{S} \rho_{ik} d_k + \sum_j \beta_{ij} \ell n p_j + \gamma_i \ell n(\frac{Y}{P^*}) + \omega_i \Phi_{ih} + \varepsilon_i \qquad (3.3.13)$$

Price index was estimated as a linear approximation of budget shares and natural logarithm of the estimated category prices. The eleven budget share equations are related in that the error terms across the equations are correlated by the fact that the budget shares (dependent variables) need satisfy the budget constraint, that is, budget shares should sum to one. This means that the vector of constant terms in (3.3.13) should sum to one. To ensure consistency with demand theory 82 restrictions (symmetry, adding up and homogeneity restrictions) were imposed into the system of demand equations. Although an OLS estimate of the system of budget share equations will provide consistent and unbiased estimates, Zellner's Seemingly Unrelated Regression (SURE) estimation provide more efficient estimates (Sadoulet and Janvry, 1995). An iterative seemingly unrelated regression (ITSUR) which provides estimates which are invariant to the dropped equation, incase of singularity, was used in the estimation of the eleven budget share equations dropping the unsifted maize meal equation(second equation). The dropped equation was re-estimated as per the imposed demand restrictions

3.4. Empirical Model

The model that was used to analyze consumer expenditure on food in the Nairobi urban area was specified from the relationship that food budget expenditure is a function of the weighted food category relative prices, the income allocated to the food category and household demographic factors and the respective inverse Mills' ratio as in Eq (3.3.13). Household decomposition by age and sex has been included since studies such as Weliwita *et.al.*, 2003 have shown that households with members of different age groups influence budgetary allocation to

some and specific food items. This relationship was expanded to the following empirical model incorporating all the variables under consideration.

$$Expenditure\ share\ (w_i) = \rho_0 + \rho_1 ha + \rho_2 hl + \rho_3 hb + \rho_4 rel + \rho_5 hs + \rho_6 hg + \rho_7 mf_1 + \rho_8 f_2 + \rho_9 f_3 + \rho_{10} m_2 + \rho_{11} m_3 + \rho_{12} Mf_4 + \rho_{13} ic + \sum_{j=1}^{11} \beta_{ij} \Pr_j + \gamma_1 \ell nRfdexp + \varepsilon_i \ldots (3.4.1)^T$$

able 2 presents the definition and measurement of all the variables included in the equation (3.4.1).

Table 2 **Variable description**

Variable Name	**Description**	**Measurement**	**Expected sign**
ha,	Years of the household head	Age in years	?
hs	household head engagement in salaried labour	Dummy 1 if engaged, otherwise 0	+
hb	Engagement in business or informal labour	Dummy 1 if engaged otherwise 0	+
rel	The religion of the household head	Dummy 1 Christian, 0 others	?
hs.	Household size	Number of house members	+
hg	Gender of the household head	Male 1, female 0	?
Mf1	Household members below 10 years of age	Number of people	?
f2, M2	Age between 10-20 for female and males	Number of people	?
f3 , M3	Age between 20-50 for female and males	Number of people	?
Mf4	Household members above 50 years of age.	Number of people	?
Ic	Income category	Dummy variables, 1=low income category <10,000 ,0 otherwise	+
w_i	Budget share of the jth food category	Share of total expenditure	
Pj_j	Price of the jth food category.	Weighted food category prices	-
lnRfdexp	Real food expenditure allocated to category	Price deflated income	?

$\rho_{ik}, \beta_{ij}, \gamma_i$, Are associated parameters to be estimated.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Descriptive results

Demographic variables used in the analysis are shown in Table 3, and included age, gender, income category, religion, and engagement in salaried labour, engagement in business activities of the household head and household size. Household size was also decomposed by gender and age.

Table 3 **Household demographic profile**

Characteristic	General population (percentages)		Income Category (percentages)	
			upper	lower
Income category	high	57		
	low	43		
household head gender	male	82	81	83
	female	18	19	17
Engagement in salaried employment	yes	58	61	54
	no	42	39	46
Engagement in business	yes	43	41	45
	no	57	59	55
Household head age	Mean (yrs)	39	42	36
Household size	mean	5	5	4

Source: Authors estimations, 2006

From the study 57% of the urban houselds was found to be in the high income category while 43% in the low income category based on (CBS, 2004) classification. The implication here is that there are less urban households who are food poor compared to those who are food secure under income-consumption hypothesis. These results compare favourably with the outcome of Central Bureau of Statistics Integrated Household Budget Survey in 2005 which concluded that urban food poverty increased from 38.8% in 1997 to 40.5% in 2005. However, the observed difference between the of 43% in 2004 and 40.5% in 2005 arise due to time difference as to when data was collected, sampling and sample differences and the hypothesis of using income versus consumption in poverty measures. Mean household size in the urban area was 4 members in the low income category and 5 in the high income category. This is attributable to the fact that

the well to do families can maintain a bigger number of family members since they can afford facilities such as bigger housing. High income category households can also afford to employ workers and thus increasing the number of members within the household. Slightly larger households are headed by females 19% in the high income categories than in the low income categories 17%. This indicates the independence of the urban females as they climb up the income ladder.

While only 58% of the urban population engaged in salaried labour, 43% engaged in businesses and other informal activities to generate income. Out of the population that engaged in salaried labour 61% was from the high income category while 54% was from low income category households. Among those who engaged in businesses and informal activities, 41% and 45% came from the high and low income households respectively. These results indicate that the higher income category households depend more on their employment than the low income households. The low income engages in business and informal activities to supplement their incomes in the city. The average age of the household head in the urban area was 39 years. In the high income category it was 42 years and 36 years for the low income categories. This can be attributed to that the high income category households are expected to have spent more time on their education. This encourages late marriages unlike in the low income households who perhaps may drop out of school to look for job and is thus prompted to marry early so as to aggregate their income to enable them live comfortably in the city. Real food expenditure increases as income increases. The mean food expenditure obtained from the data for the high income category is 1103.30 Kenya Shillings and for the low income category is 626.10 Kenya shillings.

The household expenditure and participation profile is presented in Table 4. Descriptive outcome of the data indicate that, nearly all the food categories: dairy items, vegetables, fruits, sugar, wheat and wheat products and rice categories had participation rates above 90% except for the sifted flour (sifted meal 1 (*hostess*) and sifted meal 2 (*Jogoo, Ndovu, Pembe*)), maize, beef and beef products, poultry which had less than 90% participation while unsifted maize meal maize flour (unsifted maize meal dehulled no. 1 and unsifted maize meal straight run no. 2) was very poor with a participation rate of 5.7%. This can be attributed to the few hand milling machines which are used to mill these types of unsifted maize meal meals hence they are not

available to the urban consumers or either they are highly non-preferenced. Among the food categories dairy and dairy products accounts for the highest budget share 0.185, highest mean expenditure of 1179.90 Kenya shillings and but a participation rate of 95.6% which is lower than that of sugar, wheat and wheat products and vegetables. This reflects that although dairy items make the major budgetary item in the urban diet, a larger number of households consume more of wheat and wheat products, sugar and vegetables as compared to the dairy items. This contradicts the findings obtained by (Weliwita, *et.ai.*, 2003) in Tanzania though the study combined both rural and urban areas who found that cereals were the staple food in Tanzania. Maize had a participation rate of 63.3% and a budget share of 0.023. This can be attributed to the fact that maize related meals such as *githeri* are less valued by the urban people and that a lot of time and energy is used in preparation of these maize related meals.

Table 4 Household expenditure

Expenditure category	Mean budget shares	Category mean Expenditure (Ksh)	Participation rate (%)
Sifted flour (sp)	.073	444.00	82.5
Unsifted maize meal (sm)	.004	15.50	5.7
Dairy & products(sd)	.185	1179.90	95.2
Vegetables (sv)	.168	975.40	98.3
Fruits (sf)	.091	804.10	93.9
Maize (sz)	.023	98.90	63.3
Sugar (ss)	.056	301.90	96.1
Beef & products(sb)	.153	1015.20	89.1
Poultry (sc)	.068	502.80	83.2
Wheat and products(sw)	.121	791.70	95.8
Rice (sr)	.060	389.20	91.5

Source: Authors Estimations, 2006

Further, the urban people have a wide range of alternatives which are energy and time saving and are perceived to be of higher value than maize. The meals during which maize related meals can be consumed are also optional hence reducing the quantities of maize taken implying that although a necessity, the proportions consumed are relatively low in the urban areas. Vegetables had a participation rate of 98.3% indicating that a majority of the urban population consume vegetables as an accompaniment to the main dish. The wheat and dairy categories had nearly

equal participation rates of 95.8% and 95.2% but dairy took a higher budget share (0.185) and thus expenditure than (0.121) budget share of wheat and wheat products. The direct implication here is that these are highly consumed foods in the urban areas. This is attributed to that dairy items such as milk which is consumed directly by children or used in making tea foods is widely and frequently accompanied mostly by a wheat product especially as breakfast or light lunch. Further there is a high perception on the value of these two categories in addition to that there are limited options for these categories for the urban people and that the consumption of the products of these two categories mostly takes place during breakfast and/or supper which are least optional. There is slightly higher preference for dairy and dairy related products to wheat and wheat products within the urban population implying that incase of the availability of these two products, urban people will be better off with dairy and dairy products than wheat and wheat products.

The model fit of the eleven equations is reported in Table 5, while the estimated price and expenditure effects are reported in Table 6. The model fit is measured by the R^2. Though all the models are significant, a poor fit usually results from survey data. The poor fit of the unsifted maize meal results from the poor category participation rate which amounted only to 5.7%.

Table 5 Model fit

Expenditure share	R^2	Chi^2	p-value
Sifted flour (sp)	0.5616	745.97	0.0000
Unsifted maize meal (sm)	0.0283	55.30	0.0004
Dairy & products(sd)	0.5204	750.83	0.0000
Vegetables (sv)	0.5507	718.20	0.0000
Fruits (sf)	0.4546	469.37	0.0000
Sugar (ss)	0.4167	437.18	0.0000
Maize (sz)	0.3985	451.90	0.0000
Poultry (sc)	0.5641	791.67	0.0000
Beef & products(sb)	0.6251	1040.95	0.0000
Wheat and products(sw)	0.6406	1077.89	0.0000
Rice (sr)	0.5160	615.04	0.0000

Source: Authors Estimations, 2006

Table 6 **Price and Expenditure coefficients of the AIDS Model**

Expenditure category	Constant term	Sifted flour Price	Unsifted maize meal price	Dairy price	Veget. price	Fruits price	Sugar price	Maize price	Poultry price	Beef price	Wheat price	Rice price	Real food exp
Sifted flour (sp)	.1297[a]	**-.0625[a]**	.000013	.0148	.0083	.0052	.0037	.0030	.0070	.0057	.0092	.0056	-.0100[a]
	(0.000)	**(0.000)**	0.975	0.000	0.001	0.008	0.026	0.011	0.000	0.009	0.000	0.001	(0.036)
Unsifted maize meal (sm)	.0340[a]	.000013	**.000075**	-.0004	-.0003	.0005	-.0003	.0007	.0007	.0002	-.0010	-.0003	-.0032[a]
	(0.000)	(0.975)	**(0.564)**	0.442	0.586	0.208	0.480	0.028	0.082	0.671	0.021	0.530	(0.000)
Dairy & products(sd)	.3304[a]	.0148[a]	-.0004	**-.0802[a]**	.0184	.0131	.0004	-.0049	.0021	.0118	.0198	.0050	-.0025
	(0.000)	(0.000)	(0.442)	**(0.000)**	0.000	0.000	0.798	0.000	0.312	0.000	0.000	0.005	(0.706)
Vegetables (sv)	.1192[a]	.0083[a]	-.0003	.0184[a]	**-.1098[a]**	.0099	.0091	.0023	.0123	.0264	.0124	.0110	.0021
	(0.006)	(0.001)	(0.586)	(0.000)	**(0.000)**	0.000	0.000	0.152	0.000	0.000	0.000	0.000	(0.719)
Fruits (sf)	-.0693[c]	.0052[a]	.0005	.0131[a]	.0099[a]	**-.0558[a]**	.0053	-.0010	.0048	.0088	.0058	.0034	.0194[a]
	(0.091)	(0.008)	(0.208)	(0.000)	(0.000)	**(0.000)**	0.001	0.395	0.010	0.000	0.002	0.037	(0.000)
Sugar (ss)	.0531[b]	.0037[b]	-.0003	.0004	.0091[a]	.0053[a]	**-.0449[a]**	.0007	.0075	.0060	.0032	.0093	-.0040
	(0.031)	(0.026)	(0.480)	(0.798)	(0.000)	(0.001)	**(0.000)**	0.512	0.000	0.001	0.093	0.000	(0.230)
Maize (sz)	.1184[a]	.0030[b]	.0007[b]	-.0049[a]	.0023	-.0010	.0007	**-.0174[a]**	.0002	.0102	.0058	-.0004	-.0150[a]
	(0.000)	(0.011)	(0.028)	(0.001)	(0.152)	(0.395)	(0.512)	**(0.000)**	0.859	0.000	0.000	0.714	(0.000)
Poultry (sc)	.0050	.0070[a]	.0007[c]	.0021	.0123[a]	.0048[a]	.0075[a]	.0002	**-.0610[a]**	.0115	.0078	.0071	.0130[a]
	(0.885)	(0.000)	(0.082)	(0.312)	(0.000)	(0.010)	(0.000)	(0.859)	**(0.000)**	0.000	0.000	0.000	(0.005)
Beef & products(sb)	.1075[b]	.0057[a]	.0002	.0118[a]	.0264[a]	.0088[a]	.0060[a]	.0102[a]	.0115[a]	**-.1036[a]**	.0176	.0054	.0015
	(0.015)	(0.009)	(0.671)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	**(0.000)**	0.000	0.005	(0.801)
Wheat and products(sw)	.1562[a]	.0092[a]	-.0010[b]	.0198[a]	.0124[a]	.0058[a]	.0032[b]	.0058[a]	.0078[a]	.0176[a]	**-.0881[a]**	.0074	-.0035
	(0.000)	(0.000)	(0.021)	(0.000)	(0.000)	(0.002)	(0.098)	(0.000)	(0.000)	(0.000)	**(0.000)**	0.000	(0.388)
Rice (sr)	.0145	.0056[a]	-.0003	.0050[a]	.0110[a]	.0034[b]	.0093[a]	-.0004	.0071[a]	.0054[a]	.0074[a]	**-.0543[a]**	.0021
	(0.577)	(0.001)	(0.530)	(0.005)	(0.000)	(0.037)	(0.000)	(0.714)	(0.000)	(0.005)	(0.000)	**(0.000)**	(0.556)

Source: Authors Estimations, 2006

[a] significance at 1%, [b] significance at 5% and [c] significance at 10% α -level. Values in the parenthesis are *p*-values

The price matrix (Slutsky matrix) of estimates satisfies global concavity restrictions since the matrix is symmetrical and negative semi-definite (quadratic expansion of the Slutsky matrix sums to <=0). Out of the 110 symmetry constrained price estimates, 51 are significant. All the own price coefficients carry the expected negative sign and are significant at 99%level except for the unsifted maize meal category which carry a positive sign but is not significant. This indicates that as the price increases the purchasing within this category remains unchanged. The expenditure coefficients for sifted flour, unsifted maize meal, fruits, maize and poultry significantly influence budgetary allocation. The expenditure coefficients for sifted flour, unsifted maize meal, dairy and dairy products, sugar, maize and wheat and wheat products were negative while they were positive for vegetables, fruits, poultry beef and beef products and rice. This pattern is consistent with Bennett's Law that as income rises, consumers reallocate their food budget away from starchy staples, such as maize, that are inexpensive sources of calories, towards higher-cost sources of vitamins and proteins such as fruits, vegetables, and animal products.

4.2. Household demographic effects

The effects of demographic variables reported in Table 7 shows that 39 estimates are significant. The income category (1 for lower and 0 for the high) indicates that those in the low income category consume significantly more maize while those with high income consume significantly more dairy and dairy products and unsifted maize meal. Although sifted flour, vegetables, wheat and wheat products and rice are consumed by the higher income category households while fruits, sugar, poultry and beef and beef products by the low income category households the coefficients are not significant. The household head gender has no significant effect on the consumption patterns but indicates that male headed households consume more of fruits, sugar, maize, wheat and wheat products and rice while the female headed one consume more of sifted flours, unsifted maize meal, dairy and dairy products, vegetables, poultry and beef and beef products. The decomposed household variable on age and gender however has significant effects on consumption of some food items. The number of household members at the age of 10 years and below has significant effects on sifted flour, dairy and dairy products and sugar.

Table 7 **Demographic Effects**

Expenditure category	rel	lc	hg	hl	hb	ha	Hs	f2	f3	M2	M3	Mf4	Mfl	Mills ratio
Sifted flour (sp)	-.0052	-.0033	-.0056	-.0023	-.0081	.0001	.0913[b]	-.0914[b]	-.0853[b]	-.0906[b]	-.0904[b]	-.0975[b]	-.0935[b]	.0016
	(0.596)	(0.568)	(0.413)	(0.764)	(0.293)	(0.817)	(0.032)	(0.033)	(0.045)	(0.035)	(0.037)	(0.023)	(0.029)	(0.468)
Unsifted maize meal (sm)	-.0078[a]	-.0027[a]	-.0004	-.0024	-.0009	.00004	.0204	-.0200	-.0207	-.0209	-.0207	-.0212	-.0204	-.0009[c]
	(0.002)	(0.002)	(0.726)	(0.039)	(0.479)	(0.433)	(0.112)	(0.121)	(0.111)	(0.104)	(0.110)	(0.097)	(0.117)	(0.091)
Dairy & products(sd)	-.1164[a]	-.0141[c]	-.0007	.0155	-.0068	.0003	-.1513[b]	.1424[b]	.1599[a]	.1393[b]	.1463[b]	.1603[a]	.1455[b]	.0034
	(0.000)	(0.082)	(0.945)	(0.164)	(0.535)	(0.468)	(0.013)	(0.020)	(0.008)	(0.023)	(0.017)	(0.009)	(0.017)	(0.267)
Vegetables (sv)	.0249[b]	-.0040	-.0060	-.0084	-.0042	-.0001	.0165	-.0171	-.0219	-.0123	-.0144	-.0183	-.0173	-.0125[a]
	(0.039)	(0.569)	(0.475)	(0.381)	(0.653)	(0.890)	(0.752)	(0.744)	(0.674)	(0.815)	(0.786)	(0.727)	(0.742)	(0.002)
Fruits (sf)	.0166	.0065	.0063	-.0038	.0110	-.0003	-.0057	.0130	.0028	-.0001	.0012	.0123	.0006	-.0067
	(0.152)	(0.329)	(0.435)	(0.681)	(0.225)	(0.378)	(0.910)	(0.796)	(0.955)	(0.999)	(0.981)	(0.806)	(0.991)	(0.150)
Sugar (ss)	.0004	.0018	.0033	-.0001	.0007	1.9e-07	.0548[c]	-.0507[c]	-.0583[b]	-.0554[c]	-.0532[c]	-.0543[c]	-.0510[c]	.0065[b]
	(0.954)	(0.653)	(0.474)	(0.986)	(0.895)	(0.999)	(0.059)	(0.082)	(0.044)	(0.058)	(0.070)	(0.062)	(0.079)	(0.041)
Maize (sz)	.0101[c]	.0077[b]	.0007	-.0100[b]	-.0082[c]	-.0001	-.0246	.0267	.0264	.0329	.0274	.0279	.0310	.0058[a]
	(0.082)	(0.022)	(0.870)	(0.031)	(0.070)	(0.446)	(0.385)	(0.347)	(0.352)	(0.248)	(0.339)	(0.324)	(0.275)	(0.009)
Poultry (sc)	.0552[a]	.0004	-.0077	.0027	.0016	.0002	-.0171	.0151	.0137	.0159	.0177	.0130	.0170	.0140[a]
	(0.000)	(0.942)	(0.241)	(0.715)	(0.828)	(0.563)	(0.676)	(0.714)	(0.736)	(0.700)	(0.668)	(0.751)	(0.679)	(0.000)
Beef & products(sb)	.0447[a]	.0117	-.0016	.0087	.0133	.0001	.0551	-.0587	-.0576	-.0454	-.0526	-.0682	-.0543	-.0096[b]
	(0.000)	(0.103)	(0.850)	(0.374)	(0.170)	(0.880)	(0.302)	(0.275)	(0.281)	(0.399)	(0.331)	(0.203)	(0.311)	(0.016)
Wheat and products(sw)	-.0178[b]	-.0013	.0069	.0037	.0061	-.0002	-.0079	.0069	.0095	.0088	.0063	.0071	.0101	-.0051
	(0.033)	(0.787)	(0.235)	(0.580)	(0.347)	(0.471)	(0.826)	(0.850)	(0.792)	(0.807)	(0.863)	(0.845)	(0.780)	(0.182)
Rice (sr)	-.0046	-.0028	.0048	-.0037	-.0045	.00004	-.0315	.0339	.0316	.0277	.0324	.0388	.0322	.0034
	(0.524)	(0.507)	(0.331)	(0.521)	(0.419)	(0.854)	(0.310)	(0.277)	(0.308)	(0.374)	(0.302)	(0.212)	(0.301)	(0.253)

Source: Authors Estimations, 2006

[a] significance at 1%, [b] significance at 5% and [c] significance at 10% α -level. Values in the parenthesis are *p*-values

The effects are negative on sifted flour and sugar while it is positive in dairy and dairy items. This indicates that the families with a high number of members within this category spend heavily on milk and related products for the children. However they spend less on sugar and sifted flour. As the number of household members above the age of 50 years increases, a similar trend is observed in both the significance and direction but with increased significance in dairy and dairy products. The food demand behaviour for both of these age categories is consistently similar in direction and significance. The numbers of male and female household members between the ages of 11-20 and 21-50 have negative but significant effects on sifted flour and sugar and positive effects on the consumption of dairy and dairy products. Though not significant the numbers of household members between these ages and in all sexes have a negative effect for beef and beef products and positive for maize, fruits and poultry. The household head age has a negative influence on the consumption of vegetables, fruits, maize and wheat and wheat products. However, as age increases the consumption of dairy and dairy products, beef and beef products, rice, sifted flour and unsifted maize meal increases. These effects are however not significant. The effects of household size show that as the household size increase there is a significant increased consumption of sifted flour and sugar and decrease in dairy and dairy products. The 'expectation' variables that is, the variables of engagement in labour and business also have effects although only negative significant effect on maize consumption was found all the others are insignificant. The negative effect observed in the consumption of maize indicates a shift away from maize consumption as income increases. Household engagement in labour indicates positive effect on the consumption of dairy and dairy products, poultry, beef and beef products and wheat and wheat products but negative on all the other categories. Although it is not obvious that those engaged in salaried labour have higher incomes than those engaged in business, it may be obvious for the salaried to consistently consume these relatively expensive items because of their income certainty. On the other hand, those engaged in business have a higher consumption of fruits, sugar, poultry, beef and beef products and wheat and wheat products and negative on all the other categories.

The Inverse Mills' Ratio is significant in the unsifted maize meal, vegetable, sugar, maize, poultry, beef and beef and beef products equations confirming that the non consumers in these equations cannot be ignored in the estimation as it will result into biased and inconsistent

estimates. However it is not significant in the equations of sifted flour, dairy and dairy products, fruits, wheat and wheat products and rice equations.

4.3. Price elasticities

The Hicksian (compensated) and Marshallian (uncompensated) elasticities are reported in Table 8. The elasticity results were interpreted according to the goods categorization as non-giffen if elasticity <0 (elastic <-1, inelastic>-1) and giffen if elasticity >0. Generally all food categories are more responsive to their own prices than to cross-prices. The food demand response to relative food prices satisfies the alternative hypothesis that there is a price response in this study. Since food expenditure was used in the estimation of the elasticities rather than the total expenditure, the estimated elasticities are conditional. The Marshallian (uncompensated own-price elasticities) estimates carry the expected sign as expected from the concavity or negativity constraint from utility theory implying that all the food categories are non-giffen. The uncompensated own-price elasticities for all the categories except for unsifted maize meal are elastic and range from -1.9101 to -1.4310. The own-price elasticity for the unsifted maize meal -0.99501 indicates that this category is inelastic implying that as the price of the items within this category increases, the consumers have no option but still continue to purchase the items. The consumers who purchase the items of this category come from both the categories of income levels 4.2% and 7.7% from the high income and low income respectively. These consumers monthly mean real food expenditure of 629.20 Kenya shillings falls below the overall monthly mean of real food expenditure 884.80 Kenya shillings. The fact that the category is inelastic indicates that the consumers' field of choice is constrained by their opportunity set and that few substitutes exist. The Marshallian cross-price elasticities indicate that several food categories are gross substitutes while others are gross complements. The results indicate that dairy and dairy products and maize are complements.

A better measure of the substitution effects between two food categories are the Hicksian (compensated) price elasticities as they measure only substitution effects leaving the income effects. All the compensated own-price elasticities are negative and

Table 8 Price Elasticities of Demand (Marshallian and Hicksian)

Expenditure category	Sifted flour price	Unsifted maize meal price	Dairy price	Veget. price	Fruits price	Sugar price	Maize price	Poultry price	Beef price	Wheat price	Rice price
Sifted flour(sp)	**-1.84616**	0.005932	0.228082	0.136712	0.083699	0.058356	0.044247	0.105205	0.098904	0.142603	0.084932
	(-1.78316)	(0.042178)	(0.38774)	(0.281699)	(0.162233)	(0.106685)	(0.064096)	(0.16389)	(0.230082)	(0.247027)	(0.136712)
Unsifted maize meal (sm)	0.0058714	**-0.99501**	0.004571	0.005657	0.018838	-0.00288	0.018419	0.021848	0.016343	-0.01459	-0.00257
	(0.0733095)	**(-0.95621)**	(0.175476)	(0.160857)	(0.102905)	(0.048857)	(0.039667)	(0.084667)	(0.156762)	(0.09719)	(0.052857)
Dairy & products(sd)	0.0809865	-0.00159	**-1.43101**	0.10173	0.072041	0.002919	-0.02618	0.01227	0.065838	0.108662	0.027838
	(0.153)	(0.039838)	**(-1.24851)**	(0.267459)	(0.161811)	(0.058162)	(-0.00349)	(0.079351)	(0.215784)	(0.228027)	(0.087027)
Vegetables (sv)	0.0484923	-0.00231	0.107211	**-1.65567**	0.057791	0.053467	0.013403	0.072364	0.155243	0.072297	0.064726
	(0.12240)	(0.040214)	(0.294524)	**(-1.48557)**	(0.149929)	(0.110167)	(0.03669)	(0.141214)	(0.309143)	(0.19481)	(0.125476)
Fruits (sf)	0.0415802	-0.00346	0.104516	0.072976	**-1.63259**	0.046303	-0.01589	0.038251	0.064299	0.037941	0.024571
	(0.1301429)	(0.047495)	(0.328956)	(0.276791)	**(-1.52219)**	(0.114242)	(0.012011)	(0.120747)	(0.248703)	(0.184736)	(0.097363)
Sugar (ss)	0.0712857	-0.00236	0.020357	0.1745	0.101143	**-1.79779**	0.014143	0.138786	0.118	0.065786	0.170357
	(0.1390714)	(0.036643)	(0.192143)	(0.3305)	(0.185643)	**(-1.74579)**	(0.0355)	(0.201929)	(0.259143)	(0.17814)	(0.226071)
Maize (sz)	0.1780435	0.057826	-0.09239	0.209565	0.01587	0.066957	**-1.74152**	0.053043	0.542609	0.331087	0.021739
	(0.2034348)	(0.072435)	(-0.02804)	(0.268)	(0.047522)	(0.086435)	**(-1.73352)**	(0.076696)	(0.595478)	(0.373174	(0.042609)
Poultry (sc)	0.0889853	0.002265	-0.00449	0.148765	0.053191	0.099588	-0.00146	**-1.91006**	0.140059	0.091574	0.092941
	(0.1759412)	(0.052294)	(0.215882)	(0.348882)	(0.161588)	(0.166294)	(0.025941)	**(-1.82906)**	(0.321118)	(0.235706)	(0.164412)
Beef & products(sb)	0.0367796	0.000901	0.075806	0.172026	0.056997	0.038921	0.066878	0.074987	**-1.68308**	0.114595	0.034934
	(0.1105)	(0.043316)	(0.262632)	(0.341684)	(0.148895)	(0.095474)	(0.090105)	(0.143658)	**(-1.52958)**	(0.236789)	(0.095526)
Wheat and products(sw)	0.0781446	-0.00705	0.168988	0.107339	0.050566	0.028066	0.048599	0.06643	0.149851	**-1.7246**	0.062893
	(0.1490331)	(0.033736)	(0.348636)	(0.270479)	(0.138934)	(0.082446)	(0.070934)	(0.132463)	(0.297455)	**(-1.6071)**	(0.121157)
Rice (sr)	0.0907783	-0.00647	0.076858	0.177453	0.053482	0.15304	-0.00747	0.115953	0.08468	0.119098	**-1.9071**
	(0.16633)	(0.037)	(0.268333)	(0.351333)	(0.147667)	(0.211)	(0.016333)	(0.186333)	(0.242)	(0.244333)	**(-1.845)**

Source: Authors Estimations, 2006

Hickisian (compensated elasticities) are presented in the parenthesis

smaller in magnitude than the uncompensated own-price elasticities. Except for maize and dairy and dairy products all the compensated cross-price for the food categories indicate substitutable relationships. In several cases, the compensated cross-price elasticity is positive while the uncompensated is negative. This implies that the income effect in this case outweighs the substitution effect. Since the price elasticities all the food commodities are non-giffen, then the case in which the income effect predominates between two food commodities indicates that one is inferior but not giffen. For instance the marshallian cross price between unsifted maize meal and sugar indicate complement (<0) relationship, while the hicksian (>0) indicate that they are substitutes. In this case the income effect predominates hence the marshallian elasticity is negative. Positive substitution elasticity is associated with a price reduction and by drawing an analogy the opposite holds. Thus, purchasing power from real income increase implied by a sugar price decline leads to increased sugar purchase. The cross price elasticities between dairy and poultry, that is, the response of poultry purchase as the price of dairy and dairy products change (-0.00449) marshallian and (0.215882) hicksian, and the opposite that is, the response of dairy and dairy items as the price of poultry change (0.01227) marshallian and (0.079351) hicksian. The former has an income effect that predominates unlike the latter. This indicates that real income increase resulting from dairy and dairy products price decline will lead to purchase of more dairy and dairy products than would a price decline associated with poultry would lead to purchase of poultry. This implies that a comparison between poultry and dairy and dairy products renders poultry as inferior but not giffen to dairy and dairy products.

4.4. Expenditure elasticity and marginal shares

Expenditure elasticities and marginal expenditure shares are reported in Table 9. The marginal expenditure shares as in many studies were calculated as the product of expenditure elasticity and the budget share ($\omega_i \eta_i$).The null hypothesis that food demand is not responsive to income allocated (food expenditure) is rejected in this study. The expenditure elasticities for all food categories are positive implying that all food categories are normal and that an increase in income will lead to higher consumption. From the expenditure elasticities sifted flour, unsifted maize meal, dairy and dairy products, sugar, wheat and wheat products and maize were found to be necessities, while beef and beef products, fruits, vegetables, poultry and rice were greater than

one hence luxuries. This is partly consistent with Tambi's, (1998), analysis on consumption patterns of meat, fish and dairy products in Cameroon, where meat and dairy products were found to be relative luxuries. However it is inconsistent with the findings from Weliwita, *et.ai.*, (2003) study in Tanzania in which beef items are classified as necessities. Dairy and dairy products, wheat and wheat products are necessities owing to their high participation rates. This implies that the urban people cannot do without these. This supports the previous argument that these are consumed in the least optional meals such as breakfast and/or supper and that at these meals the field of choice is limited. Vegetables, rice and beef and beef products have expenditure elasticities which are slightly above unitary. Although vegetables are perceived to be a necessity, have a highest participation rate and receives a relatively high budget share they are a luxury.

Table 9 Expenditure Elasticities and Marginal Shares

Expenditure category	**Expenditure elasticity**	**Marginal shares**
Sifted flour (sp)	0.863	0.063
Unsifted maize meal (sm)	0.924	0.039
Dairy& products(sd)	0.986	0.183
Vegetables (sv)	1.013	0.170
Fruits (sf)	1.213	0.110
Sugar (ss)	0.929	0.052
Maize (sz)	0.348	0.008
Poultry (sc)	1.191	0.081
Beef & products(sb)	1.010	0.154
Wheat and products(sw)	0.971	0.118
Rice (sr)	1.035	0.062

Source: Authors Estimations, 2006

This implies that the sensitivity of vegetables to real income changes is high but despite this the category receives the highest relative expenditure share at all income levels. Further in the few meals in which vegetables are consumed, the consumption takes place in large quantities relative to the high valued alternatives such as beef. The fact that these categories' elasticities are declining towards the necessity range indicates the growth of the economy over time as supported by the liberalisation policies such as the removal of price controls, removal of food subsidies, and removal of controls on movement of agricultural commodities and liberalization

of internal and external trade. As a result of increased incomes, the majority of the urban household can access vegetables and fruits and beef and beef products as indicated by the participation rate. These findings suggest that as income increases urban consumers tend to spend proportionately less on sifted flour, unsifted maize meal and maize.

The marginal expenditure shares indicate that an increase in the households' income will slightly lead to a general increase in all the category allocations. The results indicate that for any increase future expenditures the largest allocation 18.3% will go to dairy and dairy products, vegetables 17% while beef and beef products will take 15.4%. The allocation to maize is likely to decline in future from the current budgetary allocation. The results indicate that allocation to beef and beef products and dairy and dairy products and vegetables will remain consistent to the current trend while sifted flour, unsifted maize meal are likely to decline. In the short run, holding economic growth constant such that the household incomes vary proportionally to commodity prices, a shift in reallocation in food budgetary shares is expected to be consistent with these findings. However, in the long run, a shift consistent with Bennett's Law is expected.

From Williamson and Shah's (1981) study, the expenditure elasticity trend of several items which constitute the cereals category in the current study tended not to change and thus the overall category in the current remained inelastic. However, vegetables have changed from being a necessity in the previous study to being a luxury as indicated in the current study. This can be attributed to the rising prices of vegetables owing to the relatively declining production overtime. Various items that constituted the category of animal protein were inelastic; however the beef category in the current study has an expenditure elasticity that is greater than one indicating that beef has become a luxury. The reason for this trend stems from the declining livestock production hence limiting the supply of beef items to the consumers. The dairy category has however maintained its trend as a necessity within the household indicating its importance as a source of nutrients to the members overtime irrespective of the changing production and price regimes.

CHAPTER FIVE: CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

5.1 Conclusions

The overall objective of this study was to determine urban household food demand under changing incomes and prices and under changing demographic characteristics. Specificallmy the objectives were threefold; *i)* to determine household response to price changes, *ii)* to determine the household food demand response to changes in income and , *iii*) to determine the effects of demographic characteristics. The total response to a price change occurs in a two-step hypothesis resulting to substitution and income response. Understanding the two step hypothesis is important for predicting the effects of a policy change. The study utilized data from an urban consumption survey conducted in the Nairobi metropolitan area by Tegemeo Institute using a Central Bureau of Statistics (CBS) sample frame towards the end of 2003. The study utilized a flexible translog model which satisfies the axioms of demand theory and imposed adding up, symmetry and homogeneity restrictions as implied by the theory.

Several points which are relevant to policy makers, consumers and the traders can be made from the results. First, food demand pattern is responsive to prices, second, food is responsive to income changes and, third, demographic characteristics cause a shift in the demand structure and are thus important in explaining the patterns of food demand.

All the food commodities are elastic to their own prices except unsifted maize meal (unsifted maize meal) which is inelastic. The Marshallian (uncompemsated) elasticities all carry the expected negative sign indicating that all the categories are non Giffen. This implies that a decline in price will create a high demand for all the food categories except unsifted maize meal and will increase the quantities consumed. The inelastic behaviour of unsifted maize meal implies that even with a price change, the consumption is unlikely to change. All the food categories imply a substitution relationship as indicated by the compensated own price elasticities. Price elasticities also imply that there are complementary relationships.

Food demand patterns are responsive to expenditure allocation changes. The most expenditure responsive food categories are poultry, rice, beef and beef products, vegetables and fruits. This means that these categories will have the highest demand increase incase of income increase that translates to increase in food expenditure allocation. Other food categories like sifted floor, sugar, wheat and wheat products, dairy and dairy products and unsifted maize meal

have expenditure elasticities less than unity hence they are necessities. This means that they will have the lowest response and their demands will least change even with increase in income. Holding income levels and relative food prices constant, it is evident from the marginal expenditure shares that there will be increased allocation on cereals and beef items, this should be used to predict the increase in demand for the items in these categories and the indirect implied production response in the short run. However if the economy grows and the income levels of the households increase, a shift is expected from the expenditure inelastic categories; sifted flour, unsifted maize meal, dairy and dairy products, maize, sugar, wheat and wheat products of food to the more elastic food categories such as vegetables, beef, rice and fruits.

Household demographic characteristics are important in explaining the shifts and changes in urban household food demand pattern. Household characteristics such as income levels explain the consumption patterns and are important in forecasting food demand shifts on changing incomes. For instance, in the study, while dairy and dairy products are very crucial in terms of nutritional value, they are mostly consumed by the high income level households. This implies that the poor households are nutritionally disadvantaged

5.2 Implications

The urban population is increasing and consequently negatively influencing the food security of the urban households. Urbanisation is further making the people loose the ability to produce their own food and rely heavily on food purchases (Ruel, et. al., 1999). This situation only prompts increased poverty and undernutrition in the city and poor economic growth. Elimination of hunger and economic development can only be guaranteed if there is a trade-off between food and nutritional intake and the expenditure elasticity. The achievement of this trade-off is only through sound food and nutrition policy.

The study results imply several points for the urban consumers, food crops producers and processors, and the policy makers. From the results of the study, access and availability of food without consideration of the quality can be guaranteed on the basis of the price and/or expenditure responses. The issue of availability and access to enough and quality food rests on the articulation of price and/or income policies. While increases in food commodity prices shifts food away from the consumers, a decline in the prices will bring food closer to consumers through directly increased purchases and real income increase. In this case decline in relative

food prices and increase in household income lead to increased set of alternatives guaranteeing preference ordering and substitution and hence food security. Alternatively to achieve food security indirect policies that will address price decline and real income increment can be pursued. However, sharp contrasts may arise from the nutritional point of view since high elasticities do not directly translate to high nutritional elasticities. For instance, the prevalence of stunting in children in 1994 according to RoK/Unicef (1998) was 30.2% and it is likely that this has increased owing to the poverty levels. Iron deficiency anaemia and vitamin A deficiency are thought to be prevalent in Kenya and the magnitude and distribution of the problem is unclear due to the limited surveys in urban areas. The justification of improved quality or delivery on milk and vegetables which are likely to lead to reduction on prices perhaps find appreciation from nutritionists. This avails and makes milk and vegetables accessible to the low income category. However this is unlikely to be accepted by economic advisors since the price elasticities of these two categories are large (elastic) indicating that the consumers' field of choice is wide and will not be hurt if the prices of milk and vegetables is maintained or increased.

The consumers of unsifted maize meal have a limited opportunity set for substitution as indicated by the price and income elasticity. They are thus not cushioned from the effects of price increases. Any increase in prices in this category hurts the consumers more than any other price increase since there are no alternatives. The consumers of this categories expenditure and the price of the category preferences and tastes, they cannot sustainably shift to the use of any other substitute or complement. The marginal expenditure shares predict the short run demand response *certeris-paribus* the economic growth. The expenditure reallocation generally shows an increase which is consistent with the current allocation. However in the long run and if there is growth of the economy leading to an increase in incomes and price variations a shift in consumption from income inelastic categories to more elastic categories as the proportionate allocation to necessities declines relative to the luxuries. The shift seems to be in favour of the tremendous growing horticultural industry in the country.

The producers of food commodities and products should infer from the marginal shares in to forecast on their future production. The demand structure is the main determinant of the observed prices in the market since the production structure is relatively inflexible in the very

short run. Therefore the final demand structure is important for determining consumption levels, price formations, trade flows, income levels and government fiscal revenues which lead to a production response inference. Under a growing economy like Kenya, the increase in income is likely to translate to a relative increase in food expenditure allocation. This will shift the demand from the necessities to the implied luxuries. Within the Nairobi urban and other urban areas, the consumption of more elastic food categories such as vegetables, beef, rice and fruits is expected to rise. This implies that in the long run the production of beef, fruits and vegetable should be emphasized if the economy grows. These findings are consistent with the current trend of growth of the horticultural industry in which the production of fruits and vegetables has significantly increased.

5.3 Recommendations

Simultaneous implementation of both the food and nutritional policy is incorrect and logically flawed. Therefore the achievement of food security should be prior to the implementation of any nutritional program. The achievement of nutritional security is conditional on availability and access to enough and quality food. The objective of any intervention should thus be geared towards availing food to the urban people, but putting into consideration their consumption behaviour as influenced by income and food commodity relative prices before considering any idea of optimization of the nutritional levels.

From the study, dairy and dairy products, wheat and wheat products are necessities and owing to the persistent malnutrition in the urban area, the food policy should address ways in which these items should be availed without increase in prices. Pricing policies are recommended if only they will lead to increased purchasing power and thus consumption of the items of these categories. For the categories which are price and income elastic both pricing and income policies are applicable in increasing the purchasing power of the households.

The focus should thus be on addressing the factors that lead to reduction of food prices such as proper physical infrastructure, efficient production systems and marketing channels. On the other hand policies such as tax cuts are necessary to widen the opportunity sets of the households. Further availing of alternatives for the categories which are inelastic in both income and prices such as unsifted maize meal is important to avoid constraining the consumers of these categories more. The emphasis of the current food policy is on adequate supply of nutritionally

balanced foods to all at the lowest cost (RoK 1994). One means to achieving adequate food supply is through increased production in the country.

Increased food production can only be guaranteed if the appropriate production technologies are adopted by the farmers. Owing to the increasing population leading to pressure on land resources, future food security can only be assured from intensive rather than extensive technologies. Although the government intervention to ensure food and nutritional security is through equitable distribution of income, raising the household purchasing power and promoting consumption of nutritious foods, these may fall short of satisfying the food and nutritional requirement, especially where food production and markets are inefficient. Therefore intensive urban agriculture on nutritious foods can be encouraged if space is available to supplement food and nutritional requirements where the purchasing power falls short of satisfying nutritional requirement.

This study is not exhaustive, further studies on the implied welfare and nutrition of the urban households under the changing food and income scenario will be important in policy formulation. Further, studies on the urban-rural linkage as a safety net to the urban food insecurity will stimulate simultaneous development of the rural and urban areas. A major urban factor not considered in the study is the environmental aspect of the urban area. Urban households especially slum dwellers are known to live in unconducive environment in terms of water sewage and even road infrastructure. The cost of mitigating the effects of such environment is high and this trickles to limit food budgetary allocation and consequently influence the demand structure. Such is not assessed in this study.

APPENDIX 1: Data Weighting Procedure

Tegemeo Institute in collaboration with the Central Bureau of Statistics (CBS) conducted an urban household survey covering the Nairobi metropolitan area between November and December 2003. The survey involved a sample of 600 households that was drawn according to the CBS sampling frame and corresponding clusters. The survey was undertaken within the current CBS's National Sample Survey Enumeration Program (NASSEP) IV frame established using the 1999 nationwide population and housing census database. Census Enumeration Areas (EAs) were used as the primary sampling units (PSUs). The Enumeration Area (EAs) were segmented into clusters of 100 households with each block being a Measure of Size (MoS). One segment was then selected at random to form the selected cluster in that EA. For EAs with a measure of one, no segmentation was done and the whole EA was adopted as the sample cluster. The selected clusters formed the urban frame. For Nairobi, a sub-sampling was carried out using the income variable and the population segmented into five strata. In addition a geographical representation of the 8 administrative divisions was taken into account to obtain a representative sample. Out of the 108 clusters selected for Nairobi, 30 clusters were selected through probability proportional to size. In each cluster 20 respondents were selected using systematic random sampling procedure with a random start. This resulted in an equal probability sample where the sampled households were proportional to the total number of households in the cluster. The weights were adjusted accordingly to cater for the cluster sample reduction. The weighting of the data from the household consumption survey takes into account the sampling procedures at each stage of selection and non-responses. Weights for each cluster were calculated based on their selection probabilities. Household weights were also calculated based on their probabilities of selection. In cases where some selected households did not respond, the weights were adjusted by the following factor:

$$w_i = \frac{k_i}{n_i}$$

Where k_i = Number of selected clusters in the ith cluster n_i = Number of clusters that responded in the *ith* cluster.

Thus the overall household weights were calculated as follows;

$$W_{ci} = D_{ij} * \frac{H_{si}}{H_{ri}} * \frac{k_i}{n_i}$$

Where D_{ij}, is the sample weight of the *jth* household in the *ith* cluster, H_{si} is the number of selected households in the ith cluster and H_{ri} is the number of households that responded in the *ith* cluster.

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