INCOME AND BEAN CONSUMPTION PATTERNS IN ZAMBIA

by

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ABSTRACT

The literature shows that increases in incomes lead to changes in the allocation of income or expenditure shares to different food products. The purpose of this thesis is to identify the effect of income on expenditure share allocations among different food groups. The study was particularly interested in beans and how changes in incomes affect the share of bean expenditures.

We used data from the 2010 Zambia Living Conditions Monitoring Survey (LCMS). The LCMS covers the whole country and provides segmentation of the respondents, across the region and rural versus urban. It also provides detailed information on the income and expenditure distributions of respondent households. This allowed for the achievement of the overall objective of this thesis: understanding how beans and other food products responded to income changes as well as other demographic and socio-economic variables.

The food share is the proportion of total household income that was allocated to food. The results show that food averages about 40% of income but varied significantly across the four income groups. It was 92% for those earning less than ZMW300 per month and 37% for those earning between ZMW300 and ZMW750 per month. It was down to 22.6% for those earning between ZMW750 and ZMW2.1 million per month had a food share of total income of only 10.8%, similar to the average U.S. consumer. These averages were found to be statistically different across the income groups.

We found that Zambians allocated about 40% of their food expenditure to cereals compared to 5% to pulses and 3.5% to beans. They allocated a higher proportion of their food expenditure to fruits and vegetables than to beans and/or to pulses. This shows that legumes are very low on the food hierarchy in Zambia. However, across income categories, it was found that consumers in the second income group (ZMW300 and ZMW750 per month) allocated the most of their food expenditure to beans, about 3.9%, while those in the highest income group (ZMW750 and ZMW2.1 million per month) allocated the least, about 3%.

The biggest influencing demographic factor for pulses and beans' shares of food expenditure was locale, with urban consumers having about 1.1 and 0.8 percentage points higher share of food expenditures allocated to beans than rural consumers. The respective t-values were 15.58 and 16.96. All the demographic and socio-economic variables were statistically significant at or below the 5% level. There was no difference between the allocation of people in the highest income group and those in the lowest income group.

The results suggest that if the long-term objective is to reap the nutritional benefits of beans, there may be value in focusing on two principal policy variables: education and income enhancement. However, because education is correlated with income, the benefits of undertaking this policy initiative would more than benefit the bean consumption. It should unleash across the economy a more productive workforce that understands the health benefits of its food choices.

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CHAPTER I: INTRODUCTION

1.1 Background

Zambia is a relatively small land-locked country in southern Africa with a population of about 15.5 million (http://populationpyramid.net/zambia/2015/), and about 46% of them being under 15 years. It is classified as a lower middle-income country by the World Bank and had a Gross National Income (GNI) per capita of $502 in 2000 and $1,810 in 2013. Poverty headcount ratio at the national poverty line was 60.5% in 2010.[1] In its commitment to reduce poverty and increase nutrition, the Government of the Republic of Zambia and its development partners have been exploring policies that would improve consumption of nutritious food products, such as beans, legumes and pulses. Beans offer a variety of potential benefits to diets and incomes of smallholder producers. It has a high protein content of about 40% in addition to being a profitable cash crop. This means that consumption could also "contribute to improved nutritional status of rural households" (Raatz n.d.). For many poor families, beans are meat substitutes because of their high protein content (Beebe 2008). In Zambia, beans are usually served with cereals such as rice and maize. The expectation of the nutrition policy beyond improving the nutrition status of consumers is that increasing bean consumption can contribute to increasing its production as cash crops by smallholder farmers, who also tend to be among the poorest in the country.

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[1] All World Bank statistics available from http://data.worldbank.org/country/zambia. Accessed April 30, 2015.

It is important to recognize that because beans are perceived as a poor man's meat (Tharanathan and Mahadevamma 2003), its consumption may not be very attractive to those whose incomes are increasing. Indeed, it is expected that as incomes increase, people will reduce the share of their income devoted to bean consumption as they increase their consumption of animal products. This potential trend in consumption is predicted by Bennett's Law (Meenakshi, 1996) for cereals. However, in Zambia, where consumer perceptions about beans put them in the same inferior good category as cereals, beans may also be a victim of increasing incomes.

1.2 Problem Statement

People's preferences for different food products and the prices of those food products define the distribution of their expenditure. If government policies to enhance nutrition through the promotion of bean consumption are going to succeed in Zambia, then it is important to understand consumers' preference structure of beans. However, having noted that income influences distribution of expenditure, such an exploration must be done from the perspective of different income groups in Zambia.

The income effect on bean consumption in Zambia is currently unknown. Hence, this research is making an important contribution to an important emerging public policy. The research problem is providing empirical input to the policy-making process of improving nutrition through increased consumption of beans and, in the process, increasing the incomes of the smallholder farmers who produce beans. .

1.3 Objectives

The overall objective of the study is to address the gaps in knowledge about the effect of increasing incomes on the consumption of beans in Zambia. The specific objectives are as follows:

1. Estimate the relative position of beans share of food expenditures in Zambia
2. Estimate the response of bean share of food expenditure to income changes and compare it to the response of other food commodities in Zambia
3. Identify the income group with the most effective response to direct policy support to achieve the public policy objective of improving nutrition through enhancing bean consumption in Zambia.

1.4 Methods

The research employed a statistical and econometric approach to achieve the foregoing objectives. The statistical approach was used to estimate and compare the relative expenditures of the major food groups for statistical differences. We then employed an econometric method to determine the response of bean share of food expenditures to changes in consumer income. The results provided a foundation for contributing to the policy discourse on food security, nutrition enhancement and smallholder income improvement in Zambia. We used data from the 2010 Zambia Living Conditions Monitoring Survey (LCMS) for the study.

1.5 Outline of Thesis

The outline of the thesis is as follows. The next chapter is the review of the literature to provide a context of the research problem. Chapter III provides a thorough description of the data. We provide a description of the sampling approach used in the

LCMS and the modifications that were undertaken in order to address the specific objectives outlined above. Also in Chapter III, we discuss the estimation methods that were used to achieve the empirical estimates demanded by the study. The results are presented and discussed in Chapter IV. Also in Chapter IV, we present the summary and recommendations emanating from the research.

CHAPTER II: LITERATURE REVIEW

This chapter explores the application of the Engel curve economic model with particular attention on empirical studies. Subsection 1 reviews bean consumption and nutrition. Subsection 2 outlines studies that focus on budget share while Subsection 3 discusses expenditure shares, incomes and Engel's Law. Subsection 4 outlines factors influencing consumption behavior.

2.1 Bean Consumption and Nutrition

Birachi (2012) noted that beans are considered as a crop that can mitigate hunger in Malawi, Zambia and Tanzania. Hunger recurs every year given the annual cropping cycles, that is once a year in Malawi and Zambia. Families require stop-gap measures for food as they await the harvest of food crops such as maize. Beans play this role because they are considered a dependable and complete meal. Beans can be planted up to two to three times per annum and take a shorter time to mature than maize. They are cheaper than most crops of equivalent nutrition and have high consumption in certain communities in Zambia. For example, beans rank second after maize and third after maize and groundnuts in Zambia's Northwestern Province and Northern Province where they are consumed at least weekly or twice a week (Birachi 2012). Beans are used as both a relish and as a complete meal. Thus, beans increase consumer food security by mitigating hunger risks.

Some beans are sold while fresh as pods but they are mostly sold as dry grain. Birachi (2012) notes that the proportion beans sold in the pod is unknown but it is likely to be in the range of 5% to 10% of the total production. He opines that consumed

volumes are likely to increase by 30 to 40% in the future. While acknowledging that the consumption level of beans is low in Zambia (only between 5% and 10%), the prospects show that it can be increased by up to 50% with proper storage. This part of the bean product is usually considered a temporal product. Most beans are sold as dry beans (over 90%) in the Zambian markets with an expected increase of up to 40% in the coming years. Major users of the dry beans include schools, hospital and prisons and other security facilities in addition to the regular open markets (Birachi 2012).

Dry beans are nutrient-dense in that the amount of nutrients provided per calorie is particularly high. Increased intake provides nutritional benefits to the diet, and may help to reduce disease risk and enhance longevity. In a cross-cultural study on food habits among the elderly, show that the consumption of beans was the only dietary component positively related to longevity. They reported that for every 20g intake of legumes (including dry beans), the risk ratio of death were reduced by 6% in the people aged 70 and older (Raatz n.d.).

There are numerous varieties of dry beans. This variation is exhibited by flavor, size, color, and shape. Yet, the nutritional composition of these different bean varieties is very similar. They are low in fat and high in protein. They have the proper forms of carbohydrates, vitamins and minerals. Raatz reports that one half cup of cooked dry beans has about 115 calories and 8 g of protein as well as several phytochemicals. Dried beans are also low cost and healthy way to include into your everyday diet.

2.2 Budget Share by Social Economic Status

Mason and Jayne (2009) noted urban Zambian households' food budget share of income appears to be lower in 2007/8 (46-55%) than they were in 1991 (61%). This would seem to suggest that urban households, on average, might be experiencing increasing disposable income. Nevertheless, food budget shares among relatively poor households in Lusaka, Kitwe, Mansa, and Kasama remain high, somewhere between 60% and 73% of income (Mason and Jayne 2009). Mason and Jayne also show that the food group with the largest consumption expenditure share is meat and eggs, accounting for between 15% and 17% of total food expenditures in the four cities covered in the survey. The expenditure shares for other food groups are as follows: Vegetables (10.1% to 12.6%); Fish (7.1% to 11.6%); maize and maize products (7.6% to 11.1%); wheat products (5.9% to 10.5%); and sugar and cooking oil (6.7% to 8.4%). Although maize budget shares in 2007/8 exceeded those for other staple foods among relatively poor urban consumers, wheat was the most important carbohydrate in terms of expenditure share among urban consumers in Lusaka and Kitwe, and among the wealthiest consumers in Mansa and Kasama. This would suggest that maize is no longer the dominant staple food in urban Zambia, except among the poor. This is also the case in some urban areas in Mozambique, Kenya, and South Africa, where recent surveys have been conducted (Mason and Jayne 2009).

2.3 Expenditure Shares, Income and Engel's Law

Ernst Engel was a German statistician whose principal contribution to the literature was to establish the relationship between income and the share of income spent on food. In his seminal work (Engel, 1857), he notes that as income increases, people spend a decreasing proportion of that income on food. This would imply that they will spend an

increasing proportion of their increasing income on non-food luxury items. In operationalizing Engel's law, it is necessary to hold prices and preferences constant. This would suggest that cross-sectional data lend themselves to assessing the relationship between income and food share of total expenditure.

A well-known problem in the estimation of Engel curves is heteroscedasticity: the existence of unequal variability in expenditure share across income. Studies show that the Engel curve and other demand models fail to explain most of the observed variation in individual consumption (College and Lewbel 2006). As a result, many scholars acknowledge that influences other than current prices and current total expenditure must be systematically modeled if the pattern of demand is to be explained in a theoretically coherent and empirically robust way, (Deaton and Muellbauer 1980). As noted by Witt, 2001, (p. 23-36):

> "No established theory exists that can explain the observed shape of Engel curves and their associated income elasticity values. Ernst Engel himself argued that households possessed a hierarchy of wants that determined the shape of Engel curves. As household income rises, some motivations become more prominent in household expenditure as the more basic wants that dominate consumption patterns at low-income levels, such as hunger, eventually become satiated at higher income levels".

Not only does the quantity of food increase less than proportionally when income increases but the composition of food basket also changes as income increases. It has been observed that the consumption of starchy staple food declines with income, this is called Bennett's Law, which states that there is a negative correlation between income and proportion of income spent on cereals and a positive correlation between income and proportion of income spent on meat and other similar animal products (Timmer, Falcon and Pearson 1983).

Muyanga et al. (n.d.) show that while the volumes of staple carbohydrate consumption have declined, it is the poorest sections of urban populations in Zambia that has been affected the most. Also, on average, there has been a decline in consumption of maize products and rice. The poorest have experienced the greatest decline. Consumption of wheat products has grown significantly among all groups, but particularly among higher income groups. These results also indicate a significant shift in maize meal consumption patterns.

Regmi (n.d.) shows that global food consumption patterns have changed overtime. For example, per capita consumption of coffee, milk, eggs, and red meat in the U.S. has declined during the past 30 years while the consumption of cheese, soft drinks, and poultry has increased. Vegetables constitute a major component of Vietnamese cooking and Figure' (2003) shows that nearly 6 million tons of vegetables are consumed in Viet Nam per year. The increase results from population growth (about 2% per year) and increase in individual consumption (from 45.5 kg/capita/year in 1987 to 54 kg/capita/year in 2000). Figure' also reported that the value of consumed vegetables represents less than 5% of the total food consumption value and that the consumption of vegetables is higher for urban consumers than for rural consumers (+17%), and increases with household income. Figure's study also noted that cooking techniques are changing; especially in urban areas and that vegetables are increasingly being served with meat (which is also experiencing increasing consumption).

2.4 Factors Influencing Consumption Behavior

A number of factors that influence consumption are sex, age, education, marital status, urban-rural residence and household composition. When food security is assured, it

has been shown that life stage affects women's motives for consuming specific foods. These motives may be driven by health or social objectives (Devine and Olson 1991; Lichter and McLaughlin 1995). However, in the absence of food security, selection of food is driven principally by availability, accessibility and affordability.

Michael (1975) show that the level of formal schooling directly influences consumption independently of its effects on money income, and that the effect of education is not a random or erratic one but is systematically related to the changes in consumption patterns attributable to differences in levels of income. It has been suggested that as people age, their diets change (Wendt and Kinsey 2007). The sex of the household head influences food purchasing and would therefore influence the consumption decisions in a household. For example, women are generally more likely to prefer much more health-promoting behaviors towards food than men (Arganini, et al. 2012). Education influences food expenditure by shaping consumers' use of food quality, nutrition and other information (Binkley and Golub 2010). Whether the household resides in an urban or rural area may also influence food consumption decision, and hence food expenditure. Households in urban areas are exposed to a variety of food choices and purchasing locations while rural households do not have these options and often depend on their own production (Liu, et al. 2005). For example, According to the study by Hichaambwa (2012), the share of food budgets on livestock products increases with both household income and urbanization.

In summary, it seems changing income patterns in Zambia and developing countries such as Zambia are leading to changes in the share of expenditure being allocated to food. Additionally, these changes are leading to reallocation of the food budget

differently across the different food groups. How these changes are occurring in Zambia is the task that we estimate in the rest of the thesis.

CHAPTER III: METHODS AND PROCEDURES

This chapter discusses the model and its specification as well as the analyses that were conducted. This thesis uses the 2010 data from the Living Conditions Monitoring Survey (LCMS) conducted by the Central Statistics Office (CSO). The 2010 LCMS collected data on the living conditions of a sample of 16,717 of non-institutionalized private households in both rural and urban parts of the country. The survey was conducted between January and April 2010. In this chapter, we present a description of the data calculations. We also present the conceptual framework for the empirical model. This allows us to establish our hypotheses that would be tested.

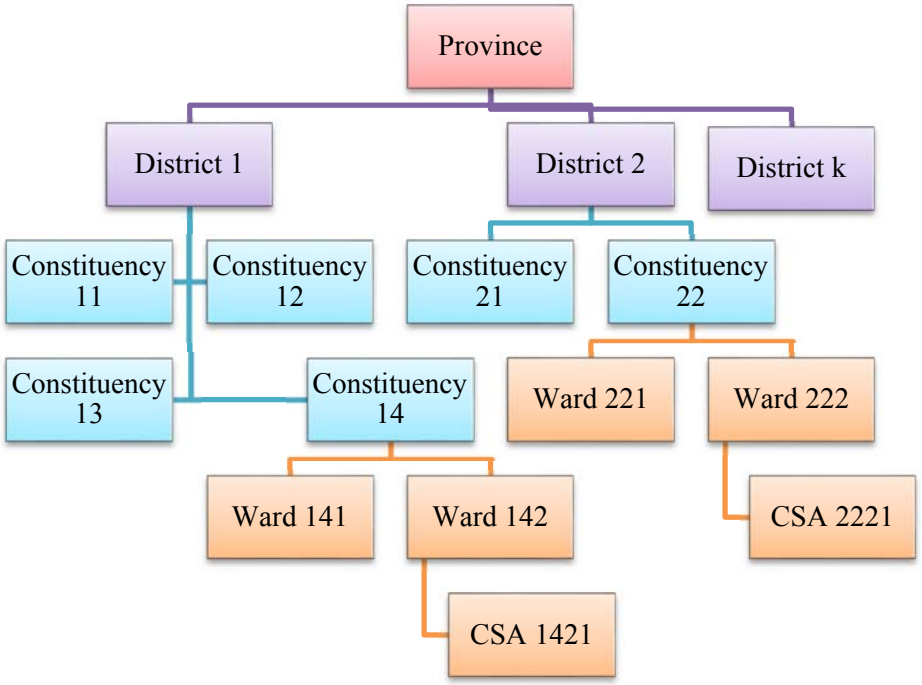
3.1 A Note on the LCMS

The Living Condition Monitoring Survey (LCMS) is a regular survey undertaken by the Government of Zambia to assess the state of Zambians' living conditions about every five years. The latest one was conducted in 2010. The survey's total sample size is about 20,000 households distributed across 1,000 standard enumeration areas (SEAs). The sampling process involves a two-stage cluster sampling procedure in which the first stage involved selection of primary sampling units (PSUs) or the SEAs using probability proportional to estimated size (PPES) from a national sampling frame. For the 2010 LCMS, the sampling frame used was the 2000 Census of Population and Housing. In the second stage, systematic sampling was used to select the sample households in the selected SEAs using a comprehensive listing exercise.

The national census organizes the country into its nine provinces, which are further divided into 72 districts. The districts subdivided into 150 constituencies, which are divided into wards. Wards are divided into Census Supervisory Areas (CSA), which comprise

Standard Enumeration Areas (SEAs). These SEAs constitute the Primary Sampling Units (PSUs) described above. To ensure proportional representation of rural and urban households in the sample, a probability proportional to size process is used in each district. The foregoing is illustrated in Figure 3.1.

Figure 3.1: Structure of the Sampling Frame



3.2 Conceptual Framework

There is often confusion about what legumes, pulses and beans are. Legumes include crops such as alfalfa, clover, peas, soybeans, peanuts or groundnuts and mixed beans. Pulses are a subset of the legume family and cover such products as dried edible beans of different colors, shapes and sizes, chickpeas or garbanzo beans and lentils. Our interest in this study is edible beans. The food products in the LCMS are organized into four broad categories – beans; cereals; meat and animal products; and fruits and vegetables. Beans – defined to cover dried edible beans of different colors, shapes and sizes – forms

the principal group in the pulses food group, with lima beans, peas and chickpeas comprising a small component of this category in Zambia.

Food expenditure share is the total expenditure on food divided by total household expenditure. From the discussion on Engel's Law, it is expected that increasing incomes would lead to declines in food share. We determined the share of food expenditure that was attributed to each of the food categories. Thus, there were two steps in the determination of expenditure shares. The first involved estimating the food share:

$$w_f = \frac{x_f}{X} \tag{3.1}$$

where w_f is the food share of total expenditure, x_f is expenditure on all food and X is total expenditure. When savings are zero, then X is also equivalent to income. The second involved estimating the share of the food categories of interest:

$$w_i = \frac{x_i}{x_f} \tag{3.2}$$

where w_i is the share of food category i in total food expenditure, x_f.

All food consumed were monetized using the implicit price of the food products in the particular locations. This allowed for the accounting of all consumption, whether it was produced by the household or received as a gift from a neighbor or donation from a non-governmental or charitable organization. The implicit price was the lowest price for the commodity available in the specified market. This was because it was assumed that people would not pay more than the lowest price for the commodity, were they to have purchased the product.

3.3 Conceptual Models

The primary objective of the research is to assess how expenditure share for beans changes with household income. Therefore, the left-hand side of the econometric model used is the beans' share of total food expenditure. This is represented in Equation 3.6 as follows:

$$\omega_b = \beta_0 + \beta_{ij} z_{ij} + \beta_y y_i + \beta_E x_i + \beta_x P_i + \varepsilon_i \quad (3.3)$$

where the $\beta's$ define the estimated coefficients and ε_i is the error term assumed to be independent and identically distributed, with a zero mean and a constant variance. The demographic and other characteristics of the household that are predicted to influence the food category share is defined by the vector, z_{ij}, for household *i* and demographic characteristic *j*. The income of Household *i* is defined by the variable y_i, whereas the total food expenditure of household *i* is defined by variable x_i. The cereal and animal products shares are defined by variable P_i for household *i*. It is traditional to structure y_i as a logarithm transformation. This allows its coefficient to be defined as the response in the dependent variable to a percentage change in the income variable; a very convenient trick to assess the effect of income on expenditure shares. The same approach was employed for expenditure, age and household size, i.e., use the logarithmic transformation of those variables in the regression.

Equation 3.3 was estimated four times, one for each income category. The independent variables were kept the same for all estimations, and they included the household head's age, sex (female = 0 and male = 1), number of years of formal education and marital status (0 = not married, i.e., single, separated, divorced, or widowed; married =

1). They also included the household's residential local (rural = 0; urban = 1), household size, total food expenditure and total household income.

Prior to estimating Equation 3.3, we investigated whether Engel's Law held in this sample. That is, we explored whether increasing incomes led to a decline in food share of total income. The model was structured as follows:

$$\omega_f = \alpha_0 + \alpha_{ij} z_{ij} + \alpha_y y_i + \alpha_E x_i + \alpha_x P_i + \varepsilon_i \quad (3.4)$$

where the alphas are the estimated coefficients and all other variables are as defined above. The income variable was categorized into four groups (Table 3.1) to explore the income bracket effect on the consumption expenditures.

There was significant variability in the data because it covered both urban and rural areas across the whole country. It covered various employment states, from unemployed household heads to fully employed professionals. To overcome this wide variability without discarding outliers, we estimated the regression equation specified in Equation 3.3 using the robust regression routine in Stata 13. The robust regression is an alternative to least squares regression when the data includes outliers or influential observations. By accounting for the flaws in the data through iterative weighting observations in the data, robust regression overcomes some of the biases that may be introduced as a result of the influential observations (Ho and Naugher 2002). One can either ignore these problems or accommodate them.

Table 3.1: Description of Income Categories

Category	Group Name	Observations	Household Income per Annum
Lowest Income	Income 1	3218	Less than ZMW 300
Low Income	Income 2	3738	ZMW 300 – ZMW 750
Lower-Middle Income	Income 3	3851	ZMW 750 – ZMW 2,100
Middle Income	Income 4	3771	Above ZMW 2,100

* The survey was conducted before the rebasing of the Zambian Kwacha and so the foregoing is the rebased values. The rebasing rate was ZMW = ZMK 1,000. As of the time of writing this paper, the exchange rate between the ZMW 1.00 = US$0.135.

The same set of demographic variables are used in estimating Equation 3.3 and Equation 3.4. Household head's age is hypothesized to have a positive effect on food expenditure share (Wendt and Kinsey 2007). This is because older household heads tend to have more social and community responsibilities, which force them to spend a larger share of their incomes on food to feed the people who depend on them. Education is hypothesized to have an ambiguous effect on food expenditure because despite being a proxy for nutritional knowledge, (Hogan and Berning 2012), its interactive effect with income and locale may affect its influence.

Females are the traditional food purchasers in households. It is expected, therefore, that they would focus on ensuring food security before much else. Female heads may be seen to have a positive impact on food share of total expenditure relative to males within a certain income range. Therefore, household head's sex is explored as an interaction with the income variable to determine if there is an effect of gender on food share given income level. Finally, the locale of the household is expected to have a negative impact on food share in that urban households are expected to spend a smaller share of their income on food compared to rural households, all things remaining equal. This is because rural households, on average, are expected to have lower incomes than urban ones.

CHAPTER IV: RESULTS AND ANALYSIS

This chapter presents and discusses the main findings of the study. The first section presents the descriptive statistics of the variables used in the study to provide a context for the results. The second section provides the results of the food share of total expenditure results. The final section presents the results for the different income categories of the beans share of total food expenditure. The outcome provides strategic insights into how policy may be structured to enhance bean consumption as a food and nutrition security initiative and through that indirectly enhance the incomes of smallholder bean producers in Zambia.

4.1 Summary Statistics

It was assumed in Chapter III that the study was interested in finding the effect of certain demographic and socio-economic variables on the shares of consumption expenditures for specific food products. The products were food – as a broad product category – and specific components of the food category: pulses; meat and animal products; fruits and vegetables; and cereal. There is a special interest in beans, which is a member of the pulses food group. As a result of this interest, the effect that socio-economic and demographic variables have on its share of total food expenditure is also explored.

Table 4.1 provides the summary statistics of the four income classes described in Table 3.1. It shows that the average total household income for the lowest income class is about ZMW144/month compared to about ZMW477/month for the low-income class. The middle income class averaged about ZMW7,774/month while the lower middle income class average was approximately ZMW1,287/month. This provides a context for the discussion of the changes in consumption expenditure shares with respect to income classes.

Table 4.1: Summary Statistics of Income Classes

Income Classes	Mean	S.E.	[95% Conf. Interval] Lower Bound	Upper Bound
< ZMW300 (Lowest)	143.52	1.24	141.10	145.95
ZMW300 - ZMW749 (Low)	477.28	2.03	473.30	481.26
ZMW750 - ZMW2,099 (Lower Middle)	1,287.42	6.25	1,275.16	1,299.69
≥ ZMW2,100 (Middle)	7,773.60	300.14	7,185.30	8,361.91
Total Household Income	2,444.97	79.72	2,288.71	2,601.23

Table 4.2 shows that while 79% of respondents were male, 72% of the respondents were married and 41% who had formal education beyond the 11th grade. About 66% of the respondents lived in urban locales and the average household was about five people. Average respondent age was about 41 years and the total household income averaged ZMW2,479 per month. Average food expenditure was about ZMW262 per month while food and beverage expenditure averaged approximately ZMW285/month. This implies that average beverage expenditure per household is about ZMW27/month. Average total monthly expenditures exceeded average total monthly income by about ZMW222. This is not surprising because people may live off credit or donations. When the case is donations of food and other relevant expenditures, they are monetized at the implicit market value, which can cause such results.

Table 4.2 shows that on average, the households in the sample spent about the same amount on cereals as they did on meat and animal products; ZMW97/month compared to ZMW89/month respectively. The difference was statistically significant at the 1% level (t = 15.74). Compared to cereal and meat and animal products, a relatively small amount is spent on pulses, only about ZMW12/month, and even smaller on beans, about ZMW8/month.

Table 4.2: Summary Statistics of Relevant Variables

Variables	Unit/Description	Mean	Std. Err.	[95% Conf. Interval] Lower Bound	Upper Bound
Marital Status	Not Married = 0; Married = 1	0.72	0.00	0.71	0.73
Locale	Rural = 0; Urban =1	0.66	0.00	0.65	0.67
Education	Less than High School = 0; High School or Higher = 1	0.41	0.01	0.39	0.43
Gender	Female = 0; Male = 1	0.79	0.00	0.78	0.80
Household size	Count	5.27	0.03	5.21	5.34
Age	Years	41.05	0.15	40.76	41.35
Total Income	ZMW/month	2,444.97	79.72	2,288.71	2,601.23
Cereals	ZMW/month	97.11	1.97	93.25	100.96
Pulses	ZMW/month	11.90	0.55	10.82	12.97
Fruits & Vegetables	ZMW/month	34.59	1.64	31.37	37.80
Animal Products	ZMW/month	89.08	2.74	83.71	94.45
Beans	ZMW/month	8.13	0.52	7.11	9.14
Food	ZMW/month	262.08	5.77	250.76	273.40
Food & Beverages	ZMW/month	284.53	6.45	271.87	297.19
Total Expenditure	ZMW/month	2,701.10	130.16	2,445.81	2,956.40

Table 4.3 presents the share of income spent on food and the share of total expenditure spent on cereal, animal and meat products, pulses, beans, and fruits and vegetables. It shows that on average, responding households spend about 42% of their total income on food and beverage compared to about 40% on food. About 40% of total food expenditure is spent on cereals on average compared to 30.3% on meat and animal products. Share of food expenditure spent on fruits and vegetables was estimated to average about 13.2%, but pulses' share was only about 5%. Beans accounted for about 70% of pulses' share at 3.5% of food expenditures. Despite its relatively small share of food expenditure, the share of beans was statistically different from zero (t = 65.80).

Table 4.3: Summary Statistics for Shares of Income Spent on Food and Shares of Food Expenditures Spent on Selected Food Categories

Variable	Share of . . .	Mean	Std. Err.	[95% Conf. Interval] Lower Bound	Upper Bound
Food & Beverage Share	Total Income	42.06%	1.88%	38.38%	45.74%
Food Share	Total Income	39.72%	1.84%	36.11%	43.33%
Cereal Share	Total Expenditure	40.07%	0.36%	39.37%	40.77%
Pulse Share	Total Expenditure	5.01%	0.10%	4.82%	5.20%
Fruits & Vegetable Share	Total Expenditure	13.19%	0.15%	12.89%	13.48%
Animal Share	Total Expenditure	30.30%	0.30%	29.72%	30.89%
Beans Share	Total Expenditure	3.46%	0.08%	3.31%	3.62%

4.2 Factors Defining Food Share of Total Household Income

Engel's theory suggests that increasing incomes would lead to a declining share of total income that is spent on food. Table 4.4 through Table 4.7 present results of the robust regression for the food expenditure share of total income as the endogenous variable and the following as the exogenous variables: marital status; locale; education; gender; log of income; log of expenditures; log of household size; and log of household head's age. The results are presented for each of the four household income categories described in Table 3.1.

Table 4.4 presents the regression results for the Lowest Income Category, i.e., Income less than ZMW300 income per month. The results show that marital status and gender were not statistically significant in explaining changes in the share of total income that is spent on food. This is not surprising since whether people are married or not and whether they are males or females do not technically affect their responsibility of ensuring their households are fed. The remaining variables were significant at the 1% level except education, which was significant at 5% level. Because the model is a double log, the coefficients produce the respective elasticities. Thus, the

results show that the household income elasticity of food share of income is 14.7%. This means that one percent increase in the household income of those in the lowest income category results in about 15% increase in the food share of income, holding all other things constant. This is expected and indicative of the food security situation of these households. The total expenditure elasticity of food share of income was about 56.3%, indicating that a percent increase in expenditure results in more than 56% increase in food share of income. This is another indicator of their food security challenge. They spend a large share of any increase in their expenditure on food. The model was statistically significant, with an F(8, 3,209) = 360.36 and Probability > F = 0.00.

Table 4.4: Regression Results for Food Share of Total Income for Lowest Income Category

Variables	Coefficient	Std. Err.	t	P>t	[95% Conf. Interval] Lower Bound	Upper Bound	Sig. Level
Marital Status (0=Not married; 1=Married)	-0.010	0.048	-0.210	0.831	-0.105	0.084	
Locale	0.413	0.031	13.420	0.000	0.353	0.473	***
Education	0.119	0.049	2.410	0.016	0.022	0.216	**
Gender	0.049	0.046	1.060	0.289	-0.042	0.139	
Total Expenditure	0.563	0.014	40.750	0.000	0.536	0.590	***
Household Size	-0.118	0.028	-4.300	0.000	-0.172	-0.064	***
Age of Household Head	-0.138	0.040	-3.420	0.001	-0.218	-0.059	***
Total Income	0.147	0.020	7.300	0.000	0.107	0.186	***
Intercept	2.707	0.304	8.910	0.000	2.111	3.303	

Table 4.5 presents results of food share for the Low Income category, that is, income between ZMW300 and ZMW749 per month. The results show a very similar response of allocation of total income to food as was observed for lowest income category. For example, marital status and gender are not statistically significant in explaining changes in the share of total income that is spent on food. Education and household size were statistically significant at 5% and the remaining variables were all significant at 1%. The results show that one percent increase in the

household income of those in the low-income category, *ceteris paribus*, results in about 10.8% increase in the food share of income. The total expenditure elasticity of food share of income was about 50%, indicating that a percent increase in expenditure results in 50% increase in food share of income. Just like in the lowest income category, this is indicative of food insecurity of the households. They spend a large share of any increase in their expenditure on food. However, this share is lower than what was observed for those in the lowest income category. The model was statistically significant, with an F(8, 3,729) = 430.19 and Probability > F = 0.00.

Table 4.5: Regression Results for Food Share of Total Income for Low Income Category

					[95% Conf. Interval]		
Variables	**Coefficient**	**Std. Err.**	**t**	**P>t**	**Lower Bound**	**Upper Bound**	**Sig. Level**
Marital Status (0=Not married; 1=Married)	0.038	0.033	1.140	0.256	-0.028	0.103	
Locale	0.306	0.020	14.910	0.000	0.265	0.346	***
Education	0.052	0.024	2.130	0.033	0.004	0.099	**
Gender	-0.030	0.034	-0.870	0.383	-0.096	0.037	
Total Expenditure	0.491	0.011	45.910	0.000	0.470	0.512	***
Household Size	-0.043	0.020	-2.190	0.029	-0.081	-0.004	**
Age of Household Head	-0.195	0.032	-6.170	0.000	-0.257	-0.133	***
Total Income	0.108	0.034	3.160	0.002	0.041	0.176	***
Intercept	4.387	0.463	9.480	0.000	3.480	5.294	

Table 4.6 presents regression results of food share for Low Middle income category, those with income between ZMW750 and ZMW2,099 per month. The results show that marital status and household size were not significant in explaining changes in the share of total income spent on food. Gender and age are statistically significant at 5% and the remaining variables were all significant at 1%. The results are similar to those in low income category and they show that a percent increase in the household income of those in the low middle income category, *ceteris*

paribus, results in about 19.7% increase in the food share of income, whereas the total expenditure elasticity of food share of income was about 36%. Again, the share allocation for this income group is lower than for the previous income group, indicating declining allocation to food as income increases. The control variables exhibited similar response of allocation of total income to food as observed for lowest and low-income categories. The model was statistically significant, with an F(8, 3,842) = 319.16 and Probability > F = 0.00.

Table 4.6: Regression Results for Food Share of Total Income for Lower-Middle Income Category

Variables	Coefficient	Std. Err.	t	P>t	[95% Conf. Interval] Lower Bound	Upper Bound	Sig. Level
Marital Status (0=Not married; 1=Married)	0.056	0.027	2.080	0.038	0.003	0.109	
Locale	0.305	0.020	15.070	0.000	0.265	0.345	***
Education	0.062	0.018	3.430	0.001	0.027	0.098	***
Gender	-0.058	0.028	-2.080	0.037	-0.112	-0.003	**
Total Expenditure	0.358	0.010	36.950	0.000	0.339	0.377	***
Household Size	0.018	0.018	1.040	0.297	-0.016	0.053	
Age of Household Head	-0.071	0.031	-2.240	0.025	-0.132	-0.009	**
Total Income	0.197	0.028	7.050	0.000	0.143	0.252	***
Intercept	4.488	0.398	11.280	0.000	3.708	5.268	

Table 4.7 presents results of food share for Middle Income category, i.e., those with income greater than ZMW2,100 per month. The results show that a percent increase in the household income elasticity of those in the middle-income category, results in about 6.4% increase in the food share of income, holding all things constant. Compared to the households in the lowest, low and low middle income categories, households in this income category will spend less on food, indicating that they are more food secure than those in the other income categories. The total expenditure elasticity of food share of income was about 28.8%, indicating that a percent increase

in expenditure results in 29% increase in food share of income. This implies that they spend a smaller share of any increase in their expenditures on food, and their allocation is much smaller than what was observed in the lower income categories. The model was statistically significant, with an F(8, 3,762) = 346.23 and Probability > F = 0.00.

Table 4.7: Regression Results for Food Share of Total Income for Middle Income Category

Variables	Coefficient	Std. Err.	t	P>t	[95% Conf. Interval] Lower Bound	Upper Bound	Sig. Level
Marital Status (0=Not married; 1=Married)	0.034	0.027	1.280	0.202	-0.019	0.087	
Locale	0.356	0.023	15.400	0.000	0.311	0.401	***
Education	0.163	0.021	7.660	0.000	0.121	0.205	***
Gender	-0.004	0.029	-0.150	0.877	-0.061	0.052	
Total Expenditure	0.288	0.008	34.500	0.000	0.271	0.304	***
Household Size	0.123	0.017	7.210	0.000	0.089	0.156	***
Age of Household Head	-0.005	0.034	-0.150	0.880	-0.071	0.061	
Total Income	0.064	0.011	5.600	0.000	0.042	0.086	***
Intercept	6.907	0.198	34.920	0.000	6.519	7.295	

As expected, the share of total household expenditure allocated to food decreases as one migrates from the lowest income households to low income, lower middle-income and middle-income households. This implies that the households in the first category are more food insecure compared to the second category and the households in the last (middle-income) category are less food insecure compared to the ones in the third category. This would seem to suggest that most of the responding households were poor and food insecure.

4.3 Factors Defining Selected Food Products' Share of Total Food Expenditure

In this section, we explore the principal factors that influence the share of food expenditure allocated to beans in the different income categories, and how beans share relates to meat and

animal products and cereals shares. Table 4.8 through Table 4.11 present results of the robust regression model for the beans share of total food expenditure as the endogenous variable and the following as the exogenous variables: marital status; locale; education; gender; log of income; log of expenditures; log of household size; log of household head's age; log of cereal share and log of animal share. The results are presented for each of the four household income categories described in Table 3.1.

Table 4.8 shows results of beans share in the Lowest-Income category. Marital status, gender and income are not statistically significant in explaining changes in the share of total food expenditure that is spent on beans. This implies that income for households in this income category does not have an effect on bean share of food expenditure. All the other variables are statistically significant at the 1% level, with the exception of age at 5% level. The total food expenditure elasticity of beans share was about -25.5%. It was interesting to note that a percentage change in cereals' share, *ceteris paribus,* would lead about 68.4% decline in bean share of total food expenditure while a percentage increase in animal products' share leads to nearly 150% decline in bean share. The model was statistically significant, with an $F(10, 1123) = 63.26$ and Probability > F = 0.00. The foregoing suggests that for consumers in this lowest-income category, there is a strong substitution effect between beans and animal products.

Table 4.8: Regression Results for Beans Expenditure Share of Total Food Expenditure for Lowest Income Category

Variables	Coefficient	Std. Err.	t	P>t	[95% Conf. Interval] Lower Bound	Upper Bound	Sig. Level
Marital Status (0=Not married; 1=Married)	-0.066	0.087	-0.770	0.444	-0.236	0.104	
Locale	-0.353	0.050	-7.010	0.000	-0.452	-0.254	***
Education	0.223	0.073	3.050	0.002	0.080	0.366	***
Gender	-0.002	0.084	-0.020	0.983	-0.166	0.163	
Total Expenditure	-0.255	0.028	-8.960	0.000	-0.310	-0.199	***
Household Size	0.130	0.049	2.640	0.008	0.034	0.227	***
Age of Household Head	0.169	0.073	2.330	0.020	0.027	0.312	**
Total Income	-0.010	0.038	-0.270	0.788	-0.084	0.064	
Cereal Share	-0.684	0.037	-18.730	0.000	-0.756	-0.612	***
Animal Share	-1.492	0.174	-8.590	0.000	-1.833	-1.152	***
Intercept	-0.427	0.596	-0.720	0.474	-1.596	0.743	

The results in Table 4.9 show beans share in the Low-Income category and they are not so different from the first income category described above. They show that marital status and gender are not statistically significant in explaining changes in the share of total food expenditure that is spent on beans. With the exception of education, household size and total income, the remaining variables were statistically significant at the 1% level. The results show that the household income elasticity of beans share of the low-income category is 13.5%. This means that one percent increase in the household income of those in the low-income category results in about 14% increase in the beans share of income, holding all other things constant. This is expected and indicative of the food security situation of these households. The total expenditure elasticity of food share of income was about -18%, indicating that a percent increase in expenditure results in 18% decline in beans share of income. A percentage increase in cereals and animal products, *ceteris paribus,* would lead about 80% and 226% decline in bean share of total food expenditure

respectively. The model was statistically significant, with an F(10, 2045) = 81.87 and Probability > F = 0.00.

Table 4.9: Regression Results for Beans Expenditure Share of Total Food Expenditure for Low Income Category

					[95% Conf. Interval]		
Variables	**Coefficient**	**Std. Err.**	**T**	**P>t**	**Lower Bound**	**Upper Bound**	**Sig. Level**
Marital Status (0=Not married; 1=Married)	-0.095	0.063	-1.510	0.132	-0.218	0.028	
Locale	-0.329	0.040	-8.140	0.000	-0.408	-0.250	***
Education	0.095	0.041	2.310	0.021	0.015	0.176	**
Gender	0.072	0.064	1.130	0.260	-0.053	0.196	
Total Expenditure	-0.180	0.022	-8.310	0.000	-0.223	-0.138	***
Household Size	0.093	0.038	2.450	0.014	0.018	0.167	**
Age of Household Head	0.216	0.061	3.530	0.000	0.096	0.336	***
Total Income	0.135	0.063	2.160	0.031	0.013	0.258	**
Cereal Share	-0.801	0.036	-22.350	0.000	-0.872	-0.731	***
Animal Share	-2.260	0.141	-16.080	0.000	-2.536	-1.985	***
Intercept	-3.354	0.841	-3.990	0.000	-5.004	-1.704	

Table 4.10 and Table 4.11 show results of beans share of households in the Low-Middle income and the Middle-Income categories respectively. The results are similar to the previous income categories except in magnitude of the coefficients. In Table 4.10, total expenditure elasticity of beans share of food expenditure was about -16%, but the income elasticity of bean share of food expenditure for households in the middle-income category was not statistically significant. However, for the middle-income households (Table 4.11), the income elasticity of bean share of food expenditure was about -6.8%. The total expenditure elasticity of beans share of food expenditure was about -12.8%. Similarly, a percentage increase in the share of total food expenditure allocated to cereals and animal products in households in Lower Middle Income category, *ceteris paribus,* would lead to about 71.1% and 231.9% decline in bean share of total

food expenditure respectively. For the middle-income category, a percentage increase in cereal share of total food expenditure would lead to 43.3% decline in bean share, holding all things constant, and a percentage increase in animal products' share of total food expenditure, *ceteris paribus,* would lead to about 173.1% decline in bean share of total food expenditure.

Table 4.10: Regression Results for Beans Expenditure Share of Total Food Expenditure for Lower Middle Income Category

					[95% Conf. Interval]		
Variables	**Coefficient**	**Std. Err.**	**t**	**P>t**	**Lower Bound**	**Upper Bound**	**Sig. Level**
Marital Status (0=Not married; 1=Married)	0.003	0.056	0.050	0.961	-0.107	0.113	
Locale	-0.350	0.046	-7.670	0.000	-0.439	-0.260	***
Education	0.138	0.036	3.880	0.000	0.068	0.207	***
Gender	-0.014	0.057	-0.240	0.809	-0.127	0.099	
Total Expenditure	-0.159	0.021	-7.680	0.000	-0.200	-0.118	***
Household Size	0.076	0.038	2.010	0.044	0.002	0.150	**
Age of Household Head	0.193	0.065	2.950	0.003	0.065	0.321	***
Total Income	0.084	0.055	1.530	0.127	-0.024	0.193	
Cereal Share	-0.711	0.039	-18.240	0.000	-0.787	-0.634	***
Animal Share	-2.319	0.148	-15.700	0.000	-2.609	-2.030	***
Intercept	-2.825	0.790	-3.580	0.000	-4.374	-1.276	

Table 4.11: Regression Results for Beans Expenditure Share of Total Food Expenditure for Middle Income Category

Variables	Coefficient	Std. Err.	t	P>t	[95% Conf. Interval] Lower Bound	Upper Bound	Sig. Level
Marital Status (0=Not married; 1=Married)	-0.112	0.051	-2.170	0.030	-0.212	-0.011	
Locale	-0.439	0.048	-9.160	0.000	-0.533	-0.345	***
Education	0.123	0.040	3.110	0.002	0.045	0.200	***
Gender	0.016	0.055	0.290	0.770	-0.092	0.124	
Total Expenditure	-0.128	0.016	-7.880	0.000	-0.160	-0.096	***
Household Size	0.125	0.035	3.600	0.000	0.057	0.193	***
Age of Household Head	0.190	0.064	2.960	0.003	0.064	0.316	***
Total Income	-0.068	0.022	-3.050	0.002	-0.111	-0.024	***
Cereal Share	-0.434	0.031	-14.140	0.000	-0.495	-0.374	***
Animal Share	-1.731	0.127	-13.670	0.000	-1.979	-1.482	***
Intercept	-0.888	0.382	-2.330	0.020	-1.636	-0.139	

CHAPTER V: CONCLUSION AND RECOMMENDATIONS

5.1 Summary and Recommendations

The objectives of this research were to identify the relative position of beans in Zambia, find out its consumption response to income in general and determine the income group that was most responsive to policy variables, such as income enhancement programs. The results showed that while 72% of respondents were married and 79% were male, 66% respondents lived in urban areas. This makes Zambia one of the most urbanized countries in Sub-Saharan Africa. The average age of respondents was about 41 years and only 41% of them had achieved 12th grade or higher education level. The average income across the sample was about ZMW2, 479.00, however about 24% of the respondents had average income of about ZMW143.52 per month. Another 25.6% had an average monthly income of about ZMW477.28 while another 25.3% had average income of ZMW7,773.60 per month. The remainder of the respondents had an average income of ZMW1,287.42 per month.

The results show that Zambians spend a relatively small proportion of their food expenditure on pulses, about 5%, and much smaller proportion – only about 3.5% – on mixed beans. This is equivalent to about 8.6% of what is allocated to cereals and 11.4% of what is allocated to meat and animal products such as fish, chicken and beef. It is even smaller than allocations to fruits and vegetables, accounting for only about 26.2%. Thus, even as a relish or stew, beans ranks very low on Zambians' totem pole of food products.

The preceding results offer some strategic actions that may be explored not only to increase incomes but education levels for many households in Zambia. We know that education and income are positively correlated in the data, as are education and total

expenditure. We also know that total income is positively correlated with total expenditure and food expenditure. Table 5.1 shows that increasing incomes is associated with increasing total expenditures and food expenditures and their correlation coefficients are all statistically significant at the 1% level. It shows that increasing the education level of the country must be followed aggressively because increasing education level leads to income augmentation.

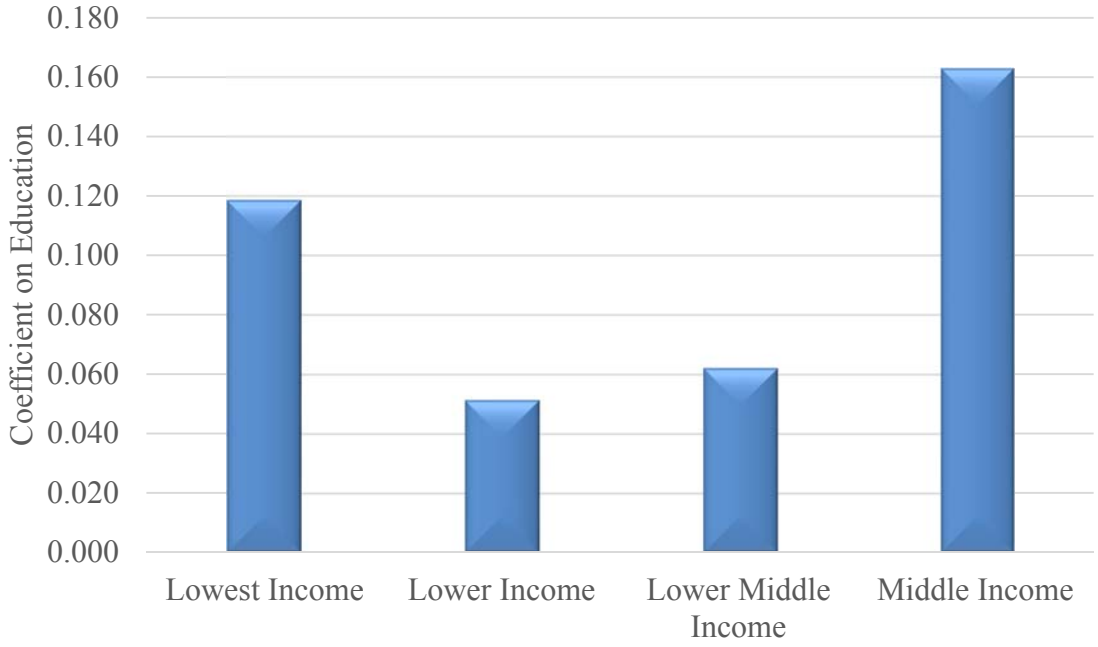
Table 5.1: Pairwise Correlation Table for Selected Policy Variables

Variables	Total Income	Education	Total Expenditure
Total Income	1.0000		
Education	0.1646*	1.0000	
Total Expenditure	0.1853*	0.2329*	1.0000
Food Expenditure	0.1745*	0.3060*	0.3137*

* 1% level of significance.

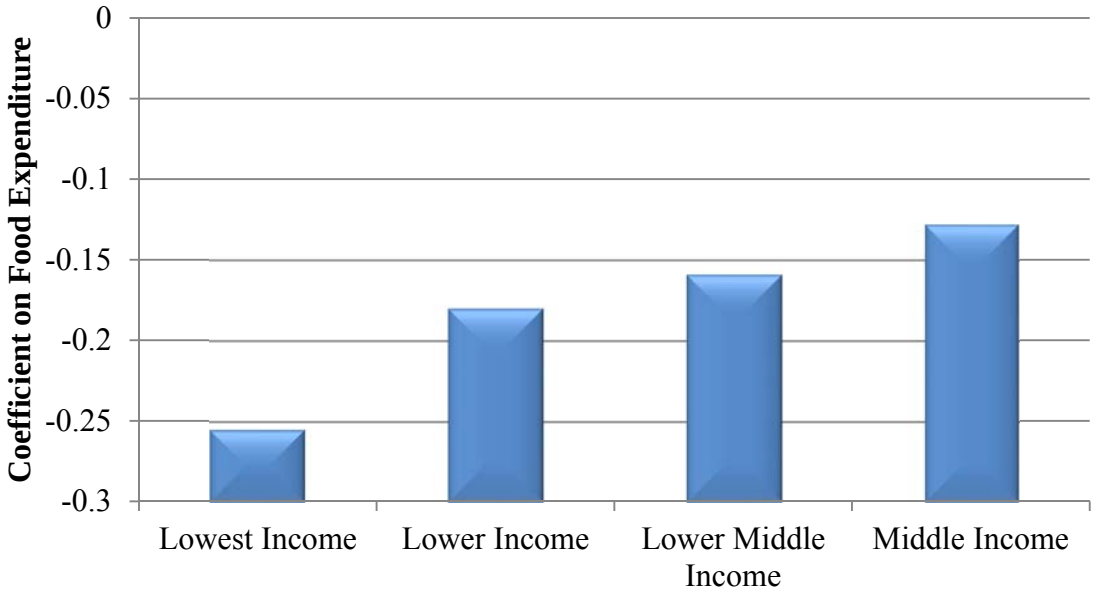
Additionally, Figure 5.1 shows that the regression coefficient on education in the middle-income class is 16 percentage points higher than in the lowest-income class, lower-income and lower-middle income classes. This suggests that people who are more educated may know more about nutrition and make their expenditure allocations accordingly.

Figure 5.2: Regression Coefficient on Education by Income Class



It was noted in Figure 5.2 that as total expenditure increases, bean share of food expenditure declines as one moves from lowest income category to low income, lower middle-income and middle-income households. This means that the more income a household has, the lower its share of expenditure on beans.

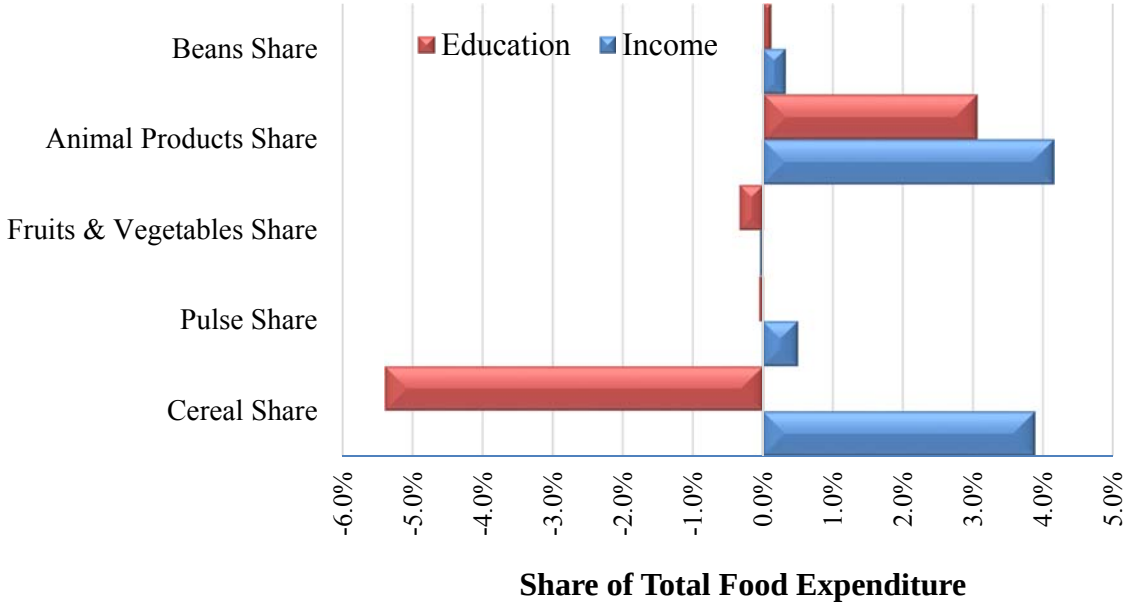
Figure 5.2: Regression Coefficient on Food Expenditure by Income Class



There is often a correlation between income and education. Figure 5.3 summarizes the responses of shares of the different food products to income and education from the foregoing econometric analyses. It shows that beans and animal products are the only food products that respond positively to both income and education enhancements even though beans' response is much small compared to animal products'. For example, the income elasticity of animal products' share of food expenditure is about 4.2% compared to 0.33% for beans. Likewise, the education elasticity of animal products' share of food expenditure is about 3.1% compared to about 0.1% for beans. However, the policy direction emanating from this research is targeted investment in education is more likely to have a positive effect on bean consumption since they both lead to improved food expenditure allocations. The fact that animal products' share responds more strongly to these variables is a good thing. It means the nutritional status of consumers will improve under the policy. Using

outreach and other initiatives to enhance consumer awareness about the nutritional value of beans could contribute to improving its share of food expenditure.

Figure 5.3: Comparative Responses of Allocations to Income and Education



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