ILLUSTRATING THE RISE IN FOOD PRICES IN ZAMBIA:

Household Expenditure Shares and Price Indexes, 2006 and 2010

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CONTENTS

1 INTRODUCTION

Between 2006 and 2008, the world witnessed an unprecedented rise in food prices. This was triggered by a combination of, inter alia, sustained increases in global demand for food, biofuels and adverse weather conditions. Within these three years, the FAO food price index rose by 63 percent (FAO, 2012). The rise in food prices sparked riots in countries like Mozambique, Haiti, Kenya and Somalia (Camillo, 2010).

Zambia faced a similar price shock. Refined maize flour (locally known as breakfast *mealiemeal*) prices increased by 46.3 per cent between 2006 and 2010[1] while the price of less refined maize flour (locally known as *rollermeal*) increased by 40.6 per cent. Dramatic increases were observed in commodities such as kapenta[2] and rice, which doubled in price during the same time period.

A pertinent question to ask after an experience of a covariate food price shock is, what happens to the welfare of households? Answering this question requires consideration of complex processes as multiple factors, which make households vulnerable and resilient to shocks have to be taken into account. This paper examines a narrow aspect of welfare effects, household consumption patterns. It does this by analysing the change in the share of the household budget allocated to food between 2006 and 2010 and estimating the changes in district level food price indexes, using the fisher index, over the same period.

The paper also integrates information from a unique three-round panel of a few households collected through the IDS/ Oxfam food price volatility project using a qualitative and participatory approach. The research was conducted in two sites (urban and rural) in Zambia between 2009 and 2012. The urban site, Kabwata, is situated in a medium density area of Lusaka Province while the rural site, Chikwanda, is located in the Northern Province.

Household consumption is used in this paper as a measure of welfare. A number of authors (see for example, D'Souza & Jolliffe, 2010; Glewwe & Hall, 1998; Jensen & Miller, 2008) used consumption to estimate the effects of rising food prices on household welfare.

Food consumption and subsequently household welfare are sensitive to changes in food prices. This is especially so among poorer households who can spend up to three quarters of their income on food (Cranfield, Preckel, & Hertel, 2007). Following the neoclassical economic theory on the effects of price change, an increase in prices of food will have two consequences; first, it would lead to a reduction in purchasing power of poor households and second, it would induce households to substitute away from expensive foods (Perloff, 2011). As argued by the author, "a doubling of the price of all goods the consumer buys is equivalent to a drop in the consumer's income to half its original level. Even a rise in the price of only one good reduces a consumer's ability to buy the same amount of all goods previously purchased." (p. 111).

However, households (particularly those in rural areas) are not just consumers but producers. As such, the impact of rising food prices on poor households in developing countries is also dependent on the net selling position of the household. This observation of rural households being both producers and consumers had been made earlier by others such as Deaton (1989) through an empirical exercise in Thailand. Theoretically, Singh, Squire and Strauss's (1986) advanced a similar argument that traditional economic theory had dealt with household

[1] Calculated by author using monthly retail price data collected by the Zambian Government's Central Statistics

[2] Small sardine-like fish

consumption and production as separate units when their interdependence is of crucial importance in developing economies where most households depend on agriculture.

Therefore, given the nature of economic activities in developing countries, the impact largely depends on whether a household is a net producer or net consumer of the commodity facing a price spike. Robles and Keefe (2011) and McCulloch and Grover (2010) found significant negative effects on urban households. This suggests that urban households are on average net food consumers and hence would suffer a welfare loss while rural households are net food producers and would gain from a rise in food prices. On the other hand, Ivanic and Martin (2012) argued that if price spikes are short lived, even the poor producers are negatively affected as they do not have time to increase their output in response to a price change. As summarised by Minot and Goletti (2000), it is almost always certain that urban households would suffer a welfare loss from rising food prices but the impact on rural households is uncertain.

Therefore, the hypothesis guiding this paper is that households, predominantly those in urban areas, will reduce expenditure on animal-source protein and other micro-nutrients as they substitute protein-rich foods for energy-rich foods.

This paper first provides empirical information on the evolution of household consumption using the share of the budget devoted towards a particular commodity before and after the 2007/8 food crisis. The information provides an initial glimpse of whether there was a change in the consumption pattern between 2006 and 2010. While this is not the formal way of assessing substitution within and across groups, the results provide an indication of whether households adjusted consumption patterns within and across food groups across the two years.

The rest of the paper is organised as follows: section 1.1 describes the data used in this paper. Section 2.0 estimates the household food expenditures and discusses the results. Section 3.0 provides details on various price indexes and the justification for selecting one to be used in this paper. The rationale for estimating the price index in the current paper is to show the variation in prices across space and time in Zambia. This information is informative for identifying the locations that were more affected by price effects. Section 4.0 concludes the paper.

Data

To calculate the household food budget shares, the paper mainly uses nation-wide data collected through the Living Conditions Monitoring Survey (LCMS) by the Central Statistics Office (CSO) of Zambia. Two LCMSs (2006 and 2010) are used to estimate the evolution of household food budget shares in the wake of the 2007/8 price spike. These two cross section surveys have been selected for a number of reasons:

i. They are the latest available household surveys.

ii. The surveys just precede (2006) and follow (2010) the 2007/8 global food crisis. Furthermore, the expectation is that households would have adapted to high prices by 2010 and the effects on adjustments in consumption patterns would be observable.

iii. The survey has appropriate modules to estimate welfare effects. These include household characteristics, agricultural production and expenditure.

Ideally, long panel data are the best in assessing the effects of a shock on household welfare (Chaudhuri & Jalan, 2002; Christiaensen & Subbarao, 2005). However, most developing countries, including Zambia lack consistent and adequate data to assess welfare effects. This

dearth in repeated panels might be because their collection is costly, time-consuming, and logistically more complicated than cross section collection. As such, most developing countries only rely on cross section data or at best very short panels, with only two waves. A few examples of articles using lengthy panel data exist in developing countries. For instance, Alem and Söderbom (2012) in Ethiopia used a 3 wave panel to assess the "before" and "after" effects of food prices on household welfare.

However, one major advantage of the LCMS survey is that it has a large number of observations and also covers broad welfare topics. Each of the surveys covered approximately 20,000 households across the country. Another advantage is that each of these surveys was conducted around the same calendar month, December for the 2006 survey and December and January for the 2010 survey. Therefore, observed differences are unlikely to be influenced by seasonal variations.

The main LCMS module used in this paper is the expenditure module, which provides details of household expenditure during a defined recall period. For almost all the food products, the questionnaire asked questions using two reference periods, "usual month" and "two weeks". Therefore, there was a choice to use either one of these reference periods. When faced with this choice, Deaton (2002) suggests that it is best to use the "usual month" measure as it is a better welfare measure than what actually happened in the last two weeks, which could have been unusual for any number of reasons. Therefore, in this research, all the food sub-aggregates were converted to a uniform reference period, a month.

Like most household surveys, the LCMS questionnaire collects consumption data on purchased food, own-produce and gifts. Using a straight forward aggregation exercise, I combine food items from the three sources to construct a food consumption sub-aggregate. Deaton and Zaidi (2002) advise that when computing a measure of total food consumption to include as part of the aggregate welfare measure, it is important to incorporate food consumed by the households from all possible sources.

Specifically, the questionnaire was designed as follows: a respondent was asked whether they had purchased a specific item (for example maize grain) during a specified reference period (two weeks or one month). If it was the case, the respondent was then requested to provide information on the total value purchased. The subsequent question was about whether the respondent had consumed maize grain from own-produce. If so, information on the unit consumed, quantity consumed and estimated market value was collected. The final question was about whether the respondent had consumed maize received as a gift or other sources such as food for work. If yes, then information on units consumed, quantity and the value was sourced. The respondent was then asked about the next food commodity until all the items on the list were exhausted.

The process for selecting the food items used to calculate the shares and price indexes involved making the food items consistent across the 2006 and 2010 survey rounds. More specifically, the 2010 LCMS survey questionnaire featured more food items (112) in comparison to only 39 food items in 2006. One reason why the food items in 2006 seem fewer is that some products such as different types of vegetables, fruits and non-alcoholic drinks were combined in the questionnaire. In 2010 however, the products were more disaggregated as each type of vegetable, fruit and non-alcoholic drink was asked in turn.

Due to the importance of these items in the Zambian diet, particularly vegetables, I amalgamated the relevant food items from the 2010 date to make the list of food items comparable to that of 2006. The alternative would have been to drop the commodities. This procedure reduced the initial list from 112 to 51 commodities. Some items from the 2010 LCMS were excluded because they were not part of the 2006 LCMS. These included: alcoholic

beverages; confectioneries such as sweets and cocoa; foods labelled as "other", such as "other meat", "other cereal" and "other poultry". The final list was made up of 36 food commodities[3]. In a study on Indonesia, Friedman and Levinsohn (2002) conducted a similar exercise.

A further challenging issue that emerged with the 2006 LCMS questionnaire was that prices or units could not be calculated from the data. This was because, under the 'purchased' category, the questions on units and quantity consumed were omitted. Instead, households were only asked to provide information on the total amount spent. This omission was rectified in the 2010 questionnaire. Following Attanasio, et al., (2013; p.140), computing a unit value requires both the expenditure and the quantity of a given item purchased. As quantities cannot be directly estimated from the expenditure section, calculating prices using this data would be prone to measurement error. In the absence of adequate food price data, the procedure followed here, as suggested originally by Deaton (1997; p.283), consists of merging regional price data with the household survey data. This line of thinking is extended in Deaton and Zaidi (2002; p.40), where they argue that ancillary data sources such as government price surveys is typically a last resort, but that it was better to use such data than make no price correction at all.

For the purpose of this research, I merged the monthly price data collected by the CSO in various districts with the LCMS consumption data. I then estimated the quantities of individual food commodities in 2006 and 2010 by dividing the total household monthly expenditure on a particular commodity with the monthly price of the same commodity. This exercise revealed that of the 36 common food items in the 2006 and 2010 LCMS, only 29 had price observations (*part A of Table 1*). These were the final food items included in my estimation for quantities of food consumed and shares, for example. The advantage of this list is that it features all the commodities included in the list for estimating the official poverty line for Zambia (see GRZ, 2011). Furthermore, the items include some of the most consumed food items in the country as will be evidenced in *section 2* on household food expenditure shares. In relation to the price index, five non-food commodities (charcoal, water, candles, electricity and paraffin) were also included in the estimation due to their importance in the preparation of food (*part B of Table 1*).

Another challenge faced with the data is that during the reference period, the CSO only collected price data from 38 of the 72 districts. However, for 3 (Ndola, Kabwe and Lusaka) of these 38 districts, two sets of price data existed, rural prices and urban prices. For purposes of estimating the price indexes, I reallocated these 'rural prices' to neighbouring (and predominantly rural districts) but within the same province. Therefore, prices collected in Ndola Rural were reallocated to Mpongwe district, Kabwe Rural was reallocated to Chibombo district, and Lusaka Rural was reallocated to Chongwe district. This increased the number of districts with price data to 41. It is these 41 districts that are used to estimate the price indexes.

[3] Three items were excluded from both the 2006 and 2010 list: alcoholic beverages, cigarettes and processed baby foods.

Table 1: List of Commodities Used to Calculate the Indexes

Part A: Food Items		Part B: Non-Food Items
Maize grain	Chicken	Water
Refined maize flour	Beef	Electricity
Less-refined maize flour	Pork	Charcoal
Millet	Beans	Paraffin
Sorghum	Sugar	Candles
Rice	Eggs	
Bread/ Bread rolls	Butter	
Sweet potatoes	Tea leaves/ tea bags	
Irish potatoes	Groundnuts	
Cassava	Cooking Oil	
Milk (fresh)	Vegetables	
Milk (powdered excluding baby milk)	Tomatoes	
Fruits	Onions	
Kapenta (small dried fish)	Salt	
Bream fish (tilapia)		

Source of Data: LCMS raw data

Prior to performing any analytical work, consistency checks were conducted to ensure the data was ready for analysis. As suggested by Deaton and Zaidi (2002; p.123), every analytical exercise with household surveys reveals new problems with data and is very data intensive. Therefore, data cleaning and setting up of various datasets formed a significant aspect of this exercise

2 HOUSEHOLD FOOD EXPENDITURE SHARES

To assess the effect of rising food prices on household welfare in Zambia, I start the analysis by estimating the changes in the share of the food budget that households spent on individual food commodities. Equation (i) shows the budget share, which is calculated as expenditure (x) that a household devoted towards commodity i in year $t \epsilon (2006, 2010)$ divided by the total household expenditure (X).

$$w_{it}^{h} = x_{it}/X_{t}^{h} \qquad \text{(i)}$$

In his seminal work, Engel (cited in Deaton, 1997; p. 254 - 255) showed that the food share is an inverse indicator of welfare, as the share of expenditure on food in the household budget declines as income or total outlay increases. Engel's Law also indicates that different households have different food income demand elasticities according to their levels of income, and as income grows within households, income demand elasticities tend to decrease over time (Cirera & Masset, 2010). An analysis by the CSO using the LCMS data reveal that the share of household expenditure on food increased between 2006 and 2010. Specifically, the CSO shows that households spent 42 per cent of their income on food in 2006, in comparison to 49.2 per cent in 2010. Once disaggregated by rural and urban areas, a higher share of household expenditure in rural areas is spent on food than non-food while the reverse is observed in urban areas (GRZ, 2011; p. 163). The report specifically finds that food expenditure in rural areas accounted for 58.7 per cent of overall expenditure in 2006 and increased to 64.6 per cent. The share of household expenditure on food in urban areas was only 32.4 per cent in 2006 and 39.1 per cent in 2010. Following Engel's argument, this implies that Zambian households in 2010 were worse off in comparison to 2006. The results also imply that rural households are poorer as they devote a higher proportion of their budget towards food needs than do urban households.

Evolution of expenditure shares (2006-2010)

The results in *Table 2* indicate that the share of the household budget allocated to some individual items evolved between 2006 and 2010. The changes include a 3 percentage points reduction in the share of the budget devoted to refined maize flour while there was a commensurate increase (3 percentage points) in expenditure on less-refined maize flour. Significant variations in expenditure patterns are observed in vegetables where the share doubled during the reference period. Furthermore, households allocated a much lower share of their food expenditure towards some items such as chicken, bream fish[4] and cooking oil in 2010 than in 2006. In all these instances, the expenditure shares are statistically different from zero at 1 per cent level.

In Zambia, the main food, *nshima,* is usually eaten with different types of relishes or accompaniments such as vegetables, beans, meat and fish. On average, the results on budget shares suggest that the change in consumption is from more expensive cereals (e.g. refined maize flour and rice) to less expensive cereals (less-refined maize flour and maize grain). *Table 2* further shows that households in 2010 significantly increased the expenditure on vegetables while the share of the budget allocated towards animal-source foods such as beef, chicken and fish declined slightly. Among the animal-source foods, the highest decline was observed in bream fish at about 2.3 percentage points. The most significant changes in the budget share were however observed between refined and less-refined maize flour.

This finding is similar to observations made by authors such as Ruel, et al., (2010) that to minimize the impacts of rising food prices on welfare, households may among others decide to switch to cheaper, often less preferred or lower quality staples to protect energy intake.

[4] Bream fish is similar in appearance to tilapia fish and is normally sold in large sizes.

Table 2: Expenditure share of food Items between 2006 and 2010

Commodity	2006	2010	Difference
Maize grain	0.090(0.157)	0.099(0.157)	-0.009***
Refined maize flour	0.053(0.115)	0.022(0.077)	0.031***
Less-refined maize flour	0.021(0.089)	0.054(0.094)	-0.033***
Hammermill maize flour	0.016(0.076)	0.026(0.083)	-0.010***
Rice	0.031(0.050)	0.027(0.055)	0.004***
Cassava	0.035(0.107)	0.041(0.120)	-0.006***
Millet	0.005(0.039)	0.005(0.036)	-0.000
Sorghum	0.004(0.034)	0.002(0.025)	0.002***
Bread	0.052(0.068)	0.057(0.078)	-0.005***
Sweet Potatoes	0.002(0.016)	0.011(0.035)	-0.009***
Irish Potatoes	0.010 (0.024)	0.009(0.027)	0.001***
Chicken	0.080(0.088)	0.065(0.086)	0.015***
Other poultry	0.002(0.014)	0.001(0.015)	-0.001
Beef	0.043(0.065)	0.032(0.061)	0.010***
Pork	0.012(0.043)	0.008(0.030)	0.004***
Goat meat	0.013(0.046)	0.009(0.039)	0.004***
Mutton	0.001(0.012)	0.000(0.000)	0.001
Game meat	0.008(0.038)	0.007(0.034)	0.001***
Bream fish	0.068(0.086)	0.045(0.070)	0.023***
Kapenta	0.053(0.064)	0.039(0.056)	0.014***
Vegetables	0.047(0.062)	0.103(0.100)	-0.056***
Beans	0.035(0.048)	0.031(0.048)	0.004***
Onion	0.017(0.025)	0.018(0.025)	-0.001*
Tomatoes	0.040(0.437)	0.033(0.032)	0.007***
Eggs	0.019(0.032)	0.020(0.035)	-0.001*
Cooking Oil	0.078(0.073)	0.047(0.048)	0.031***
Groundnuts	0.021(0.049)	0.015(0.036)	0.006***
Butter	0.007(0.016)	0.006(0.017)	0.001***
Sugar	0.062(0.062)	0.045(0.051)	0.017***
Honey	0.002(0.021)	0.001(0.015)	0.001***
Tea/ coffee	0.008(0.017)	0.006(0.018)	0.002***
Fresh milk	0.016(0.035)	0.015(0.036)	0.001***
Powdered milk	0.003(0.014)	0.002(0.013)	0.001***
Salt	0.029(0.055)	0.013(0.013)	0.016***
Fruits	0.006(0.019)	0.030(0.049)	-0.024***
Non alcoholic drink	0.012(0.031)	0.008(0.032)	0.004***
Total	1.00	1.00	

Source of Data: Estimated from LCMS raw data

*Notes: Standard deviations in parenthesis. Significance of the difference in means based on a t-test for continuous variables. ***p<0.01, **p<0.05, *p<0.1*

A parallel analysis in quantity terms (*Table 3*) confirms that households have drastically reduced the consumption of refined maize flour by about 32kilograms on average, i.e. by 53 percent. Less-refined maize flour also declined but it is only statistically significant at the 0.1 per cent level. In contrast, consumption of maize grain almost doubled between 2006 and 2010. Consumption of vegetables and sweet potatoes also increased significantly. While these estimates should be treated as suggestive rather than definitive due to the quantities being subject to errors, the findings confirm that households adjusted consumption within food groups for cereals but the observation does not hold for proteins. The rest of the analysis however is based on results from shares.

Table 3: Average quantities consumed (in kilogrammes)

Commodities	2006	2010	Difference
Maize grain	27.36(36.20)	56.03(92.52)	-28.68***
Refined maize flour	60.32(276.50)	28.37(19.13)	31.96***
Less-refined maize flour	61.19(123.76)	55.25(93.76)	5.94*
Rice	5.01 (7.36)	7.70(8.24)	-2.69***
Cassava	24.28 (47.34)	25.73(50.36)	-1.45
Millet	15.79(18.70)	37.91(73.80)	-22.12***
Sorghum	26.87(35.45)	19.64(15.91)	7.22**
Bread	8.96(12.32)	11.23(16.25)	-2.28***
Sweet Potatoes	8.71(18.44)	17.50(44.21)	-8.79***
Irish Potatoes	6.50(7.78)	9.76(12.21)	-3.26***
Chicken	2.96(4.01)	5.04(5.93)	-2.09***
Beef	2.91(3.93)	3.47(5.50)	-0.57***
Pork	0.93(1.57)	1.64(2.76)	-0.71***
Bream fish	0.74(1.08)	0.92(0.89)	-0.18***
Kapenta	0.61(0.93)	0.55(0.86)	0.58***
Vegetables	12.20(14.58)	18.62(56.58)	-6.42***
Beans	2.16(2.22)	2.96(3.94)	-0.80***
Onion	2.45(3.47)	2.81(4.64)	-0.36***
Tomatoes	6.81(9.34)	6.38(59.84)	0.43
Eggs	1.43(2.26)	2.03(14.11)	-0.60***
Cooking Oil	2.81(2.64)	2.66(46.91)	0.15
Groundnuts	1.94(3.04)	3.01(4.53)	-1.07***
Butter	0.44(0.79)	0.49(1.09)	-0.05***
Sugar	4.13(5.40)	4.39(6.08)	-0.27***
Tea/ coffee	0.65(1.03)	0.57(2.18)	0.08***
Fresh milk	5.02(7.38)	4.67(7.49)	0.35***
Powdered milk	0.92 (0.87)	1.19(1.09)	-2.27***
Salt	1.68(2.38)	1.12(5.09)	0.56***
Fruits	4.02(7.72)	7.02(53.59)	-2.99***

Source: authors' calculations based on 2006 and 2010 LCMS raw data and Central Statistical Office district price data

*Notes: Standard deviations in parenthesis. Significance of the difference in means based on a t-test for continuous variables. ***p<0.01, **p<0.05, *p<0.1*

Evolution of expenditure shares by geographical location and year

The following analysis disaggregates the household budget shares by geographical location and by quintiles. It is clear from *Tables 4 to 6* that the average results in *Table 2* obscure important spatial, temporal and income-distribution differences. In rural areas (*Table 4)*, the top five shares in 2006 were diverse in terms of types of food items. These included: cereal (maize grain), fat (cooking oil), protein (chicken and bream fish) and sugar. In 2010 however, the top five expenditure shares changed and comprised only of cereal (maize grain, cassava flour and hammermill maize flour/ pounded maize), protein (chicken) and vegetables. Therefore, the top five expenditure shares in 2010 had less protein and more cereal.

Another observation in rural areas is that the share of the budget that households devoted to cereal products remained relatively unchanged between 2006 and 2010. This could be a result of households already consuming primarily less expensive staples in the pre-crisis period. The same is true for animal source foods such as beef. This finding is similar to that of Jensen and Miller (2008) in China where the poor were already consuming the cheapest variety of grains leaving them with little room to substitute in an effort to mitigate the nutritional impacts of price changes. The share of the household budget allocated towards chicken, bream fish and kapenta was however significantly lower in 2010 relative to 2006 for the Zambian case.

In urban areas, the top five commodities in 2006 were refined maize flour, chicken and beef (protein), bread (carbohydrate), cooking oil (fat) and vegetables. When comparing consumption levels between 2006 and 2010 in urban areas, less-refined maize flour displaced refined maize flour among the five commodities claiming the highest shares in 2010. In percentage terms, refined maize flour declined by about 7 percentage points (9.4 to 2.2 percentage points) during the reference years. On the other hand, household food budgets devoted towards less-refined maize flour increased from 3 to 8 percentage points. In 2010, the refined maize flour was displaced by less-refined maize flour in the top five list. Furthermore, while households maintained the budget share devoted to chicken and bream fish, the budget share towards beef declined. These results suggest that in 2010, urban households substituted the more expensive cereals (refined maize flour) for cheaper cereals (less-refined maize flour) but maintained the consumption of some protein-rich foods such as bream fish and kapenta.

Given the mixed results evidenced in this paper, I am unable to confirm the hypothesis that households, particularly those in urban areas, will respond to higher food prices by reducing expenditure on protein as they substitute animal-source protein for energy-rich foods such as maize. The results suggest that there was a more evident decline in animal-source foods in rural households than there was in urban areas. Within the maize group however, there was a stronger budget share adjustment in urban areas.

Table 4: Expenditure share by region and year

Commodity	Rural			Urban		
	2006	2010	Difference	2006	2010	Difference
Maize grain	0.152(0.187)	0.164(0.190)	-0.012***	0.031(0.087)	0.049(0.099)	-0.018***
Refined maize flour	0.011(0.067)	0.022(0.084)	-0.011***	0.094(0.136)	0.022(0.072)	0.072***
Less-refined maize flour	0.011(0.069)	0.018(0.066)	-0.008***	0.031(0.104)	0.082(0.102)	-0.052***
Hammermill maize flour	0.021(0.090)	0.044(0.110)	-0.023***	0.011(0.067)	0.012(0.050)	-0.001*
Rice	0.026(0.057	0.016(0.015)	0.009***	0.035(0.042)	0.040(0.058)	-0.001
Cassava	0.062(0.139)	0.078(0.161)	-0.016***	0.009(0.049)	0.013(0.060)	-0.004***
Millet	0.010(0.054)	0.010(0.050)	-0.000	0.001(0.012)	0.001(0.016)	-0.000**
Sorghum	0.006(0.047)	0.004(0.036)	0.002***	0.001(0.015)	0.001(0.010)	0.001***
Bread	0.030(0.054)	0.031(0.062)	-0.001	0.073(0.073)	0.078(0.083)	-0.005***
Sweet Potatoes	0.003(0.021)	0.012(0.042)	-0.009***	0.002(0.011)	0.010(0.029)	-0.009***
Irish Potatoes	0.004(0.020)	0.004(0.020)	0.000	0.016(0.026)	0.013(0.031)	0.003***
Chicken	0.080(0.104)	0.050(0.086)	0.030***	0.080(0.070)	0.076(0.084)	0.004***
Other poultry	0.002(0.016)	0.001(0.013)	0.001***	0.001(0.012)	0.002(0.001)	-0.001
Beef	0.025(0.061)	0.016(0.053)	0.009***	0.060(0.064)	0.045(0.065)	0.015***
Pork	0.015(0.054)	0.007(0.033)	0.008***	0.010(0.030)	0.009(0.029)	0.001***
Goat meat	0.019(0.058)	0.012(0.048)	0.007***	0.008(0.027)	0.007(0.030)	0.000
Mutton	0.001(0.016)	0.001(0.010)	0.000	0.000(0.007)	0.000(0.009)	-0.000
Game meat	0.011(0.047)	0.008(0.040)	0.003	0.006(0.026)	0.006(0.028)	0.000
Bream fish	0.078(0.104)	0.029(0.066)	0.049***	0.058(0.061)	0.058(0.070)	0.000
Kapenta	0.059(0.075)	0.034(0.059)	0.024***	0.048(0.050)	0.042(0.053)	0.006***
Vegetables	0.032(0.059)	0.132(0.121)	-0.100***	0.061(0.060)	0.080(0.074)	-0.020***
Beans	0.035(0.057)	0.029(0.054)	0.006***	0.035(0.037)	0.033(0.044)	0.002***
Onion	0.012(0.025)	0.012(0.022)	-0.000	0.022(0.024)	0.023(0.027)	-0.001
Tomatoes	0.033(0.046)	0.025(0.037)	0.008***	0.047(0.041)	0.039(0.035)	0.008***
Eggs	0.010(0.028)	0.010(0.029)	-0.001	0.027(0.032)	0.027(0.038)	0.001
Cooking Oil	0.085(0.088)	0.044(0.050)	0.042***	0.071(0.053)	0.050(0.046)	0.021***
Groundnuts	0.027(0.061)	0.017(0.044)	0.010***	0.014(0.033)	0.013(0.028)	0.002***
Butter	0.002(0.011)	0.001(0.008)	0.001***	0.011(0.018)	0.009(0.021)	0.002***
Sugar	0.067(0.073)	0.042(0.059)	0.025***	0.057(0.047)	0.048(0.044)	0.009***
Honey	0.003(0.028)	0.001(0.016)	0.002***	0.001(0.010)	0.001(0.013)	0.000***
Tea / coffee	0.004(0.014)	0.003(0.011)	0.001***	0.012(0.018)	0.009(0.021)	0.003***
Fresh milk	0.011(0.034)	0.011(0.035)	0.000	0.021(0.036)	0.018(0.036)	0.003***
Powdered milk	0.001(0.010)	0.001(0.010)	0.000	0.004(0.016)	0.003(0.015)	0.001***
Salt	0.044(0.072)	0.017(0.032)	0.028***	0.014(0.024)	0.010(0.023)	0.004***
Fruits	0.002(0.013)	0.027(0.055)	-0.025***	0.010(0.022)	0.032(0.044)	-0.022***
Non-alcoholic drink	0.008(0.029)	0.012(0.042)	-0.005***	0.017(0.033)	0.005(0.020)	0.012***
Total	1.00	1.00		1.00	1.00	

Source of Data: Estimated from LCMS raw data

*Notes: Standard deviations in parenthesis. Significance of the difference in means based on a t-test for continuous variables. ***p<0.01, **p<0.05, *p<0.1*

These quantitative findings further confirm the evidence from the household interviews conducted by IDS and Oxfam (field interview, IDS/ Oxfam project, 2008 - 2009). Respondents in both the rural (Chikwanda) and urban (Kabwata) sites of Zambia reported that they had reduced the quality and diversity of food consumed. In the rural site, when asked about some of their coping strategies in relation to high food prices, respondents revealed that some households substituted the more expensive, bream fish and Kapenta, for beans. During focus group discussions in the urban site, participants indicated that they normally have 2 to 3 meals a day. According to the participants, these meals primarily consist of the staple food *nshima* and relish such as vegetables (field interview, IDS/ Oxfam project, 2008).

In an interview, the Chief of Chikwanda community observed that availability of food was a major challenge in general but that community members also relied on wild foods. He further observed that the households' reliance on wild foods was more important than usual for the reference period (2008-2009). An illustration of household consumption pattern could be further highlighted through the story of Mrs. M, a widow with 4 children. In a day, Mrs. M has 1 to 2 meals. Breakfast and lunch are often skipped or eaten alternately. Her household members usually eats nshima (made from maize flour), vegetables, beans or Kapenta. On rare occasions she would eat rice with beef (field interview, IDS/ Oxfam project, 2009).

Similarly, using the IDS/ Oxfam qualitative data for six countries[5], Hossain and McGregor (2011) found that household responses to the food price shock included spending a larger share on food; changing food shopping habits by buying smaller quantities more often and from cheaper sources; and a reduction in the quality and diversity of food. These choices have significant bearing on the nutrition status of a household. Campbell, et al., (2010) suggest that because dietary diversity and animal-source foods are recognised as key components of high quality diets, rising food prices can lead to a reduction in the quality of the diet. The authors further argue that reduced quality of the diet would in turn adversely affect both nutrition and health over time.

Evolution of expenditure shares by quintiles

The expenditure shares were further divided into quintiles to assess the variation across household income. *Tables 5* and *6* compare the commodity expenditure shares for rural and urban areas in 2006 and 2010 respectively. For purposes of presentation, only two quintiles are represented per region (the richest 20 per cent and the poorest 20 per cent).

It is interesting to note that the households in the highest quintile in rural areas in both 2006 and 2010 devote a higher budget share towards products that are typically consumed in urban areas such as bread and rice. Indeed, four of the five top commodities among the richest households in rural and urban areas in 2006 are the same (bream fish, refined maize flour, chicken and beef). This suggests that in a normal period (non-price peak), the wealthiest households in rural areas have similar standards of living to households in urban areas.

The results in *Table 6* show that in 2010 in rural areas, beef and rice featured among the commodities that claimed higher expenditure shares in the highest quintile but not the lowest quintile. For the poorer households, this finding confirms the earlier suggestion that they were already consuming less expensive staples. One inconsistent factor here is that poorer households allocate some of their household budget (3 per cent) towards the more expensive and refined maize flour. Instead, households in the top quintile devoted hardly any of the income towards refined maize flour.

[5] These six countries are: Bangladesh, Indonesia, Jamaica, Kenya Yemen and Zambia.

Even among top commodities that featured in both quintiles, the shares varied. In the 2006 rural category, a significant difference is notable in maize grain (20.6 and 4.9 per cent for the lowest and highest quintile respectively). Similarly, poorer households spent a higher portion of their budget on cassava, hammermill flour (a cheaper source of maize flour) and vegetables. To the contrary, richer households spent less of their total budget on cereals and instead reallocated their budget share to other commodities such as animal-source proteins (for example 6.2 per cent towards beef in comparison to only 1.8 per cent among poorer households). Therefore, among the households in the sample, there is a tendency for poorer households to maintain consumption of calorie-rich foods and spend less on animal-source proteins.

Food consumption patterns vary even more starkly in urban areas. The results in *Table 5* reveal that in 2006, the poorest households allocated a higher percentage of their budget towards the staple crop, maize grain, while the richer households spent a higher budget share on the more expensive starchy foods such as rice and refined maize flour. The variation in consumption patterns is further demonstrated for animal-source proteins. While the richer households devoted 8 per cent of their food budget share towards beef, poorer households only allocated 1 per cent. In relation to chicken, richer households allocated a much higher budget share (9 per cent) in comparison to only 2 per cent among poorer households. Instead, the poorer households allocated about 7 per cent each towards bream fish and kapenta. In 2010 (*Table 6*), the pattern of allocation of the budget share towards animal-source proteins is similar to 2006. The variation is observed in the allocation towards maize products where richer households allocate more towards less-refined maize flour relative to poorer households.

In general therefore, this finding supports the earlier suggestion that in the face of a spike in food prices, richer households in urban areas actually only substitute to cheaper cereals but maintain consumption of proteins. On the other hand, poorer households still allocate a low share of their food budget towards animal-source proteins. This is a more nuanced finding than the hypothesis that households, predominantly those in urban areas would reduce expenditure on protein as they substitute animal-source protein for energy-rich foods such as maize. Furthermore, given the budget shares and price observations in Zambia, the expectation is that a rise in the price of vegetables, kapenta, beans and cooking oil would have the biggest impact on nutrition outcomes in the country.

Another striking factor is that commodities such as kapenta, cooking oil and vegetables that faced the highest price spike were more intensively consumed by the less well off before the crisis (2006). This is particularly so in urban areas. For example, poorer households in urban areas devoted about 7 per cent of their food budget towards kapenta in comparison to only 3 per cent among the richer households. This finding suggests that the poorer households in urban areas would be worse off by virtue of them consuming commodities that faced the largest price increases.

Table 5: 2006 Expenditure Shares by Quintile

Commodity	2006 Rural			2006 Urban		
	Lowest Quintile	Highest Quintile	Difference	Lowest Quintile	Highest Quintile	Difference
Maize grain	0.206(0.237)	0.049(0.093)	0.157***	0.159(0.240)	0.009(0.039)	0.151***
Refined maize flour	0.003(0.051)	0.065(0.154)	-0.062***	0.041(0.169)	0.115(0.153)	-0.074***
Less-refined maize flour	0.004(0.055)	0.019(0.099)	-0.014***	0.047(0.171)	0.019(0.096)	0.028***
Hammermill maize flour	0.019(0.089)	0.022(0.111)	-0.003	0.034(0.133)	0.006(0.053)	0.028***
Rice	0.017(0.060)	0.044(0.056)	-0.027***	0.017(0.060)	0.044(0.056)	-0.027***
Cassava	0.088(0.175)	0.022(0.104)	0.066***	0.050(0.160)	0.003(0.014)	0.047***
Millet	0.011(0.063)	0.004(0.038)	0.007***	0.003(0.045)	0.00(0.006)	0.002
Sorghum	0.008(0.062)	0.001(0.006)	0.008***	0.007(0.051)	0.001(0.007)	0.007***
Bread	0.017(0.048)	0.061(0.058)	-0.044***	0.021(0.072)	0.089(0.074)	-0.069***
Sweet Potatoes	0.002(0.014)	0.005(0.027)	-0.003***	0.001(0.016)	0.002(0.009)	-0.000
Irish Potatoes	0.001(0.015)	0.018(0.038)	-0.017***	0.002(0.013)	0.021(0.027)	-0.020***
Chicken	0.077(0.133)	0.06(0.056)	0.015***	0.022(0.074)	0.093(0.064)	-0.070***
Other poultry	0.001(0.014)	0.004(0.027)	-0.003**	0.000(0.005)	0.002(0.012)	-0.001***
Beef	0.018(0.066)	0.062(0.066)	-0.045***	0.009(0.040)	0.082(0.067)	-0.073***
Pork	0.014(0.052)	0.016(0.061)	-0.002	0.012(0.047)	0.009(0.026)	0.003
Goat meat	0.011(0.049)	0.026(0.066)	-0.014***	0.005(0.027)	0.008(0.027)	-0.003**
Mutton	0.000(0.008)	0.003(0.031)	-0.002	0.000(0.000)	0.001(0.010)	-0.001***
Game meat	0.008(0.049)	0.015(0.047)	-0.006***	0.002(0.020)	0.009(0.030)	-0.007***
Bream fish	0.075(0.122)	0.071(0.087)	0.003	0.065(0.107)	0.056(0.052)	0.009*
Kapenta	0.054(0.088)	0.049(0.064)	0.005*	0.068(0.096)	0.034(0.037)	0.033***
Vegetables	0.029(0.070)	0.028(0.032)	0.001	0.072(0.121)	0.046(0.041)	0.026***
Beans	0.032(0.068)	0.027(0.029)	0.004**	0.043(0.074)	0.026(0.023)	0.017***
Onion	0.008(0.025)	0.017(0.026)	-0.010***	0.017(0.036)	0.020(0.019)	-0.003*
Tomatoes	0.028(0.052)	0.032(0.036)	-0.004**	0.049(0.081)	0.037(0.028)	0.012***
Eggs	0.004(0.023)	0.026(0.028)	-0.022***	0.007(0.004)	0.031(0.030)	-0.025***
Cooking Oil	0.087(0.113)	0.063(0.056)	0.024***	0.107(0.119)	0.051(0.031)	0.056***
Groundnuts	0.025(0.069)	0.017(0.038)	0.009***	0.013(0.039)	0.012(0.027)	0.001
Butter	0.000(0.003)	0.015(0.019)	-0.015***	0.000(0.003)	0.018(0.019)	-0.018***
Sugar	0.064(0.091)	0.058(0.003)	0.007**	0.067(0.096)	0.049(0.038)	0.018***
Honey	0.003(0.029)	0.004(0.033)	-0.001	0.000(0.000)	0.002(0.009)	-0.002***
Tea/ coffee	0.001(0.008)	0.016(0.023)	-0.015***	0.003(0.015)	0.016(0.020)	-0.013***
Fresh milk	0.008(0.033)	0.025(0.045)	-0.017***	0.004(0.021)	0.033(0.040)	-0.029***
Powdered milk	0.000(0.007)	0.010(0.029)	-0.010***	0.000(0.000)	0.007(0.019)	-0.007***
Salt	0.072(0.104)	0.012(0.018)	0.060***	0.048(0.084)	0.008(0.011)	0.040***
Fruits	0.001(0.011)	0.010(0.023)	-0.010***	0.001(0.007)	0.017(0.026)	-0.016***
Non-alcoholic drink	0.004(0.027)	0.024(0.035)	-0.019***	0.006(0.058)	0.028(0.036)	-0.022***
Total	1.00	1.00		1.00	1.00	

Source of Data: Estimated from LCMS raw data

*Notes: Standard deviations in parenthesis. Significance of the difference in means based on a t-test for continuous variables. ***p<0.01, **p<0.05, *p<0.1*

Table 6: 2010 Expenditure Shares by Quintile

Commodity	2010 Rural			2010 Urban		
	Lowest Quintile	Highest Quintile	Difference	Lowest Quintile	Highest Quintile	Difference
Maize grain	0.193(0.223)	0.117(0.166)	0.076***	0.108(0.166)	0.026(0.066)	0.082***
Refined maize flour	0.030(0.113)	0.008(0.040)	0.022***	0.064(0.146)	0.006(0.028)	0.058***
Less-refined maize flour	0.010(0.065)	0.027(0.066)	-0.017***	0.079(0.161)	0.068(0.074)	0.011***
Hammermill maize flour	0.064(0.146)	0.025(0.073)	0.040***	0.034(0.090)	0.004(0.021)	0.030***
Rice	0.005(0.027)	0.041(0.078)	-0.037***	0.005(0.027)	0.041(0.078)	-0.037***
Cassava	0.087(0.176)	0.044(0.137)	0.043***	0.031(0.102)	0.005(0.026)	0.026***
Millet	0.013(0.058)	0.004(0.031)	0.009***	0.002(0.017)	0.001(0.019)	0.001
Sorghum	0.005(0.047)	0.002(0.012)	0.003***	0.001(0.019)	0.000(0.005)	0.001
Bread	0.015(0.043)	0.060(0.10)	-0.045***	0.043(0.073)	0.087(0.085)	-0.044***
Sweet Potatoes	0.008(0.037)	0.012(0.054)	-0.004**	0.011(0.032)	0.008(0.029)	0.002***
Irish Potatoes	0.001(0.011)	0.010(0.027)	-0.009***	0.003(0.019)	0.020(0.036)	-0.017***
Chicken	0.035(0.093)	0.061(0.079)	-0.026***	0.021(0.072)	0.101(0.081)	-0.080***
Other poultry	0.000(0.010)	0.001(0.011)	-0.001***	0.001(0.018)	0.002(0.016)	-0.001**
Beef	0.008(0.038)	0.043(0.096)	-0.035***	0.014(0.048)	0.069(0.075)	-0.055***
Pork	0.007(0.037)	0.009(0.044)	-0.002	0.008(0.034)	0.010(0.030)	-0.002**
Goat meat	0.007(0.036)	0.020(0.066)	0.013***	0.005(0.026)	0.009(0.037)	-0.008***
Mutton	0.000(0.006)	0.002(0.020)	-0.002*	0.001(0.014)	0.001(0.009)	-0.000
Game meat	0.007(0.044)	0.007(0.029)	0.000	0.002(0.019)	0.008(0.031)	-0.007***
Bream fish	0.024(0.067)	0.044(0.072)	-0.020***	0.029(0.069)	0.074(0.073)	-0.046***
Kapenta	0.028(0.058)	0.039(0.071)	-0.011***	0.043(0.060)	0.038(0.053)	0.005***
Vegetables	0.168(0.141)	0.078(0.096)	0.090***	0.135(0.114)	0.057(0.055)	0.078***
Beans	0.025(0.056)	0.031(0.060)	-0.007***	0.032(0.054)	0.027(0.035)	0.005***
Onion	0.011(0.024)	0.014(0.028)	-0.004***	0.024(0.037)	0.020(0.030)	0.005***
Tomatoes	0.025(0.046)	0.023(0.034)	0.002	0.049(0.050)	0.030(0.030)	0.019***
Eggs	0.005(0.024)	0.019(0.034)	-0.014***	0.014(0.040)	0.030(0.035)	-0.015***
Cooking Oil	0.046(0.061)	0.038(0.050)	0.008***	0.069(0.072)	0.039(0.039)	0.030***
Groundnuts	0.012(0.040)	0.018(0.037)	-0.007***	0.009(0.030)	0.012(0.024)	-0.030***
Butter	0.000(0.004)	0.006(0.013)	-0.005***	0.001(0.011)	0.014(0.027)	-0.013***
Sugar	0.042(0.069)	0.040(0.046)	0.002	0.061(0.063)	0.041(0.039)	0.020***
Honey	0.001(0.010)	0.002(0.013)	-0.001***	0.000(0.001)	0.002(0.020)	-0.002***
Tea/ coffee	0.002(0.013)	0.005(0.010)	-0.003***	0.005(0.015)	0.009(0.030)	-0.004***
Fresh milk	0.007(0.032)	0.019(0.045)	-0.012***	0.005(0.027)	0.026(0.045)	-0.021***
Powdered milk	0.000(0.004)	0.006(0.019)	-0.006***	0.000(0.003)	0.005(0.018)	-0.005***
Salt	0.025(0.040)	0.010(0.051)	0.015***	0.021(0.039)	0.006(0.027)	0.015***
Fruits	0.021(0.056)	0.035(0.066)	-0.014***	0.024(0.051)	0.039(0.044)	-0.015***
Non alcoholic drink	0.013(0.049)	0.015(0.061)	-0.002	0.007(0.029)	0.004(0.020)	0.003***
Total	1.00	1.00		1.00	1.00	

Source of Data: Estimated from LCMS raw data

*Notes: Standard deviations in parenthesis. Significance of the difference in means based on a t-test for continuous variables. ***p<0.01, **p<0.05, *p<0.1*

3 PRICE ADJUSTMENTS

In order to conduct meaningful household welfare analysis, it is important to make prices comparable across time (temporal differentiation) and across space (spatial differentiation). A price index helps achieve this purpose. The price indexes are also very relevant for the estimation of poverty. As suggested by Coudouel et al., (2002), ignoring the regional and inter-temporal corrections can lead to important distortions of poverty measurement. There are two ways of obtaining a price index in the context of this research. The first is to use the official consumer price index estimated by the government's Central Statistical Office (CSO). The second is to estimate the index using the LCMS household data.

For the period under review (2006 to 2010), the CSO was using an old index, derived from the 1993/1994 Household Budget Survey. As such, it was not representative of current household consumption patterns. As recognised by members of the CSO, comparing current prices with that of almost two decades ago has negative implications on the calculation of the Index (Government of the Republic of Zambia, 2011).

Furthermore, given the price spike in 2007/8 and the evidence in the previous section, patterns of household expenditure on food changed after the crisis. It was therefore imperative to estimate a new price index using revised weights. In this context, I estimated the price index using more recent household surveys (2006 and 2010). This was done by using updated weights from the shares calculated in *section 2*. Furthermore, I aggregated the index calculations at district level unlike the CSO that estimates the inflation at national level only.

There are different types of price indexes that make temporal and spatial adjustments of prices. In this paper, three indexes are initially considered, the Laspeyres, Paasche and Fisher Indexes (see for example, Deaton and Tarozzi 2000). The Laspeyres index is the most commonly used index. It measures the changes in the cost of a fixed basket of goods from a base period. It therefore uses the base period budget shares as weights and is estimated as:

$$L_{dt} = \sum_{i=1}^{n} W_{di2006} \left(\frac{P_{dit}}{P_{ni2006}} \right), \qquad \text{(ii)}$$

where W_{di2006} is the average household budget share of the total food expenditure at district level devoted to the food commodity i in the base year (in this case, 2006). P_{dit} is the price of food item i for district d in period t (2006). P_{ni} is the national average price of food item i. To construct the index, the district commodity price in 2006 is divided by the national commodity price in the same year. This is then multiplied by the 2006 budget share of each commodity at district level. To calculate the index, I compute district level shares (w_{di}) by taking the average household shares estimated through equation (i)[6]. These household budget shares are therefore taken as the weighted average of the comparable budget shares across all households in the district and period under consideration.

As the Laspeyres index measures the cost of a fixed basket of goods by using base period budget shares as weights, it assumes no substitution due to relative price changes and usually overestimates the "true" cost-of-living index (Boskin et al., 1998; p. 7-8). Therefore, I also estimate the Paasche Index. The Paasche index is at the other end of the spectrum from

[6] This is done using a collapse command in stata.

Laspeyres as it weights by current consumption pattern. That is, it uses the budget shares for the current period as weights (in this case, 2010). This likely overstates substitution and understates the change in cost-of-living index relative to an earlier base period *(ibid)*. The Paasche index is estimated as follows:

$$P_{dt}^{P} = \sum_{i=1}^{n} W_{di2010} \left(\frac{P_{dit}}{P_{ni2006}} \right), \qquad \text{(iii)}$$

where W_{di} is the average budget share for a particular food commodity for households in each district in the specified year. For this research, I aggregate the index at district level where the price of food item in district d in the base year is denoted in the equation by P_{dit}. t denotes the period (either 2006 or 2010 for this research). The variable P_{nit} is the national average price of food item in the base year. Deaton and Tarozzi (2000; p.6) argue that "neither Laspeyres nor Paasche indexes do an adequate job of capturing consumer substitution, that when faced with differences in relative prices, consumers are likely to adjust their consumption patterns towards relatively cheap goods, and away from relatively more expensive ones".

To address the under and over-estimation of substitution by the Laspeyres and Paasche indexes, I also estimate a third index called the Fisher Ideal Index. This index tries to overcome the weaknesses of the other two indexes by taking the square root of the product of the Laspeyres and Paasche indexes. The Fisher Index is therefore the geometric mean of the Laspeyres and Paasche indexes (Fisher, 1922). Deaton and Tarozzi (2000; p.16) noted that the Fisher Ideal Index does a better job than the Laspeyres and Paasche indexes in reflecting substitution. Another advantage noted by these authors is that the Fisher Index uses budget shares from initial and terminal periods, rather than just one of the periods.

The following is the equation for the Fisher Index:

$$F_{dt} = \sqrt{L_{dt} P_{dt}^{P}} \qquad \text{(iv)}$$

In 2012, the CSO revised their methodology by adopting the Fisher index to calculate the national level index (Central Statistics Office, 2011). The new expenditure weights were calculated from the 2002/03 LCMS. In addition, the CSO will be publishing provincial level rates of inflation in the second quarter of each year (Government of the Republic of Zambia, 2012). While this is a step in the right direction, it would be better to have the indexes estimated at a smaller geographical unit, for example, district-level rather than provincial[7].

As stated above, I use the calculation of the price index made in this paper as the CSO's most recent updates do not cover the period of interest (2006 and 2010). Furthermore, calculating the index from the 2006 and 2010 LCMS ensures the use of updated household expenditure

[7] In this analysis, I estimate price indexes for the 41 districts where price data exists.

data. This is imperative due to the price shock experienced in 2007/8. Perhaps more importantly, the governments' Consumer Price Index (CPI) reflected the national level price adjustments. Conversely, I estimate the index for this research at district level, which is a smaller geographical unit than a province. By virtue of using different budget shares and estimating indexes for different geographical units, the indexes calculated for this research are not comparable to the governments' indexes.

Another reason why these indexes have to be understood in the context of this research alone is that, as mentioned in *section 1.1*, the process for selecting the food items used to calculate the price indexes involved making the food items consistent across the 2006 and 2010 survey rounds. On the other hand, the estimates exclude the majority of the non-food costs, some of which are important costs such as housing and transportation. Considering that the excluded non-food items such as housing and transport are costly and therefore important to household budgets, particularly in urban areas, the rate of inflation in this research is likely to be understated. A similar decision was made by Deaton and Tarozzi (2000) where up to a third of the budget were excluded, including housing and transportation.

According to the annual inflation estimates by the government, the food component showed more volatility than the non-food component, which was relatively stable between January 2008 and December 2010 (see Government of the Republic of Zambia, 2010a for specific figures)[8].

Price index estimates

This section provides a series of measures of price changes based on the differences among the three indexes. *Table 7* presents the results for the three indexes (Laspeyres, Paasche and Fisher). The results confirm the theory that Laspeyres estimates are the upper bound, Paasche estimates are the lower bound and the Fisher index provides a mid-range estimate. For both 2006 and 2010, the Fisher index consistently lies between the Laspeyres and Paasche indexes. Further interpretations of the price adjustments in this research will therefore be based on the Fisher index only (*Table 8*).

[8] Also visible in *figure 1.3.*

Table 7: Indexes by District

District	Province	Paasche		Laspeyres		Fisher	
		2006	2010	2006	2010	2006	2010
Chibombo	Central	0.749	1.204	0.831	1.321	0.789	1.261
Kabwe	Central	0.741	1.177	0.760	1.230	0.750	1.203
Mkushi	Central	0.807	1.353	0.861	1.422	0.834	1.387
Mumbwa	Central	0.771	1.194	0.786	1.218	0.778	1.206
Serenje	Central	0.712	1.183	0.797	1.414	0.753	1.294
Chingola	Copperbelt	0.838	1.295	0.895	1.421	0.867	1.356
Kalulushi	Copperbelt	0.742	1.226	0.783	1.299	0.763	1.262
Kitwe	Copperbelt	0.772	1.113	0.824	1.197	0.797	1.154
Luanshya	Copperbelt	0.707	1.216	0.711	1.151	0.709	1.183
Mpongwe	Copperbelt	0.857	1.367	0.921	1.441	0.889	1.403
Mufulira	Copperbelt	0.728	1.177	0.787	1.256	0.757	1.216
Ndola	Copperbelt	0.844	1.328	0.823	1.312	0.833	1.320
Chadiza	Eastern	0.813	1.406	0.751	1.285	0.781	1.344
Chipata	Eastern	0.793	1.221	0.794	1.260	0.794	1.241
Katete	Eastern	0.722	1.097	0.772	1.214	0.747	1.154
Lundazi	Eastern	0.842	1.141	0.883	1.280	0.862	1.209
Petauke	Eastern	0.757	1.182	0.769	1.297	0.763	1.238
Kawambwa	Luapula	0.754	1.118	0.785	1.166	0.769	1.142
Mansa	Luapula	0.710	1.167	0.795	1.285	0.751	1.225
Mwense	Luapula	0.646	0.934	0.741	1.135	0.692	1.030
Nchelenge	Luapula	0.745	0.933	0.802	1.108	0.773	1.017
Samfya	Luapula	0.709	1.232	0.757	1.250	0.733	1.241
Chongwe	Lusaka	0.923	1.280	0.938	1.329	0.931	1.304
Luangwa	Lusaka	0.890	1.426	0.952	1.623	0.920	1.521
Lusaka	Lusaka	0.857	1.420	0.874	1.456	0.865	1.438
Isoka	Northern	0.664	1.121	0.721	1.243	0.692	1.180
Kasama	Northern	0.711	1.103	0.757	1.213	0.734	1.157
Luwingu	Northern	0.756	1.455	0.853	1.387	0.803	1.420
Mbala	Northern	0.773	1.116	0.853	1.266	0.812	1.189
Mpika	Northern	0.716	1.141	0.786	1.273	0.750	1.205
Kasempa	North Western	0.913	1.417	0.872	1.311	0.892	1.363
Mwinilunga	North Western	0.850	1.208	0.821	1.311	0.835	1.258
Solwezi	North Western	0.876	1.371	0.849	1.331	0.862	1.351
Choma	Southern	0.847	1.274	0.794	1.226	0.820	1.249
Kalomo	Southern	0.737	1.280	0.790	1.392	0.763	1.335
Livingstone	Southern	0.836	1.326	0.846	1.313	0.841	1.319
Mazabuka	Southern	0.799	1.266	0.843	1.287	0.821	1.277
Monze	Southern	0.793	1.366	0.814	1.361	0.803	1.363
Kaoma	Western	0.894	1.285	0.973	1.376	0.933	1.330
Mongu	Western	0.884	1.086	0.815	1.123	0.849	1.104
Senanga	Western	0.866	1.349	0.812	1.316	0.839	1.332

Source of Data: Estimated from LCMS raw data

In relation to *Table 8*, the most expensive districts in 2006 were Luangwa and Chongwe in Lusaka province and Kaoma in Western province. In 2010 however, the districts with the highest prices were Lusaka city and Luangwa in Lusaka province, Mpongwe on the Copperbelt province and Luwingu in Northern province. By implication, households in these areas are expected to experience the highest welfare loss due to the steep increase in prices. However, the effect will also depend on the households' net selling position. The lowest prices post 2007/8 food crisis were observed in Mongu district (Western province) and Nchelenge and Mwense districts in Luapula province.

In general, *Table 8* shows that prices rose in all districts in 2010 relative to 2006. The results in column 5 show that the price increase was uneven ranging from 30.12 per cent in Mongu district (Western province) to 76.88 per cent in Luwingu (Northern province). As suggested by Deaton (1997; p.283), in developing countries, markets are not always well integrated. Similarly, the finding in this research resonates with that of the FAO during the assessment of the 2007/8 food price swing in Eastern and Southern Africa, which found that it took between 3.1 and 8.3 months before prices fully adjusted to the South African market (Rapsomanikis, 2009). Furthermore, Ferreira, et al., (2013) observed that spatial heterogeneity in infrastructure, transport costs, and market structures within countries often causes non-trivial regional differences in prices, even inside a given country. The results also show that for the majority of the districts, the inflation levels were between 50 and 76 per cent.

A second observation is that, aside from Monze and Kalomo, which are along the line of rail, the districts that faced an inflation of about 70 per cent were relatively more remote. This result may be as a result of the added transport costs being passed on to consumers. The result also suggests that increases in food prices were highest in places that are not typically considered to be high cost towns, such as the 4 major cities of Zambia. Among the cities, Lusaka had the highest price inflation (66 per cent) followed by Ndola (Copperbelt province) at 58 per cent, Livingstone in Southern province (57 per cent) and finally Kitwe (Copperbelt province) at 47 per cent. In general, districts in Western province had the lowest rise in inflation.

The possible reasons for these observations are varied. First, for some districts such as Lusaka city, the high prices are a result of limited agriculture production. For others such as Mpongwe, Chongwe and Luangwa, proximity to big cities could be a factor. Also, as suggested above, other districts are remote hence, the cost of transport is passed on to consumers, for example, Luwingu. In a focus group discussion with the market executive committee in Chikwanda area (Mpika district), the participants attributed the rise in food prices to higher transport costs. The narration was as follows: "*The rise in food prices, in particular, fish and Kapenta, has been due to the high transport costs. From Nakonde (a fish and Kapenta harbour in the Northern province), the cost of transport a year ago was between K100,000 and K120,000 but transport costs currently range between K150,000 to K180,000 depending on the form of transport used"* (field interview, IDS/ Oxfam project, 2011).

Table 8: Fisher Index Results

District	Province	Fisher		Inflation (base year=2006)
		2006	2010	
Chibombo	Central	0.789	1.261	159.78
Kabwe	Central	0.750	1.203	160.38
Mkushi	Central	0.834	1.387	166.42
Mumbwa	Central	0.778	1.206	154.91
Serenje	Central	0.753	1.294	171.76
Chingola	Copperbelt	0.867	1.356	156.51
Kalulushi	Copperbelt	0.763	1.262	165.47
Kitwe	Copperbelt	0.797	1.154	144.72
Luanshya	Copperbelt	0.709	1.183	166.92
Mpongwe	Copperbelt	0.889	1.403	157.91
Mufulira	Copperbelt	0.757	1.216	160.58
Ndola	Copperbelt	0.833	1.320	158.39
Chadiza	Eastern	0.781	1.344	171.96
Chipata	Eastern	0.794	1.241	156.31
Katete	Eastern	0.747	1.154	154.55
Lundazi	Eastern	0.862	1.209	140.21
Petauke	Eastern	0.763	1.238	162.24
Kawambwa	Luapula	0.769	1.142	148.40
Mansa	Luapula	0.751	1.225	162.99
Mwense	Luapula	0.692	1.030	148.80
Nchelenge	Luapula	0.773	1.017	131.48
Samfya	Luapula	0.733	1.241	169.39
Chongwe	Lusaka	0.931	1.304	140.12
Luangwa	Lusaka	0.920	1.521	165.31
Lusaka	Lusaka	0.865	1.438	166.16
Isoka	Northern	0.692	1.180	170.56
Kasama	Northern	0.734	1.157	157.65
Luwingu	Northern	0.803	1.420	176.88
Mbala	Northern	0.812	1.189	146.37
Mpika	Northern	0.750	1.205	160.63
Kasempa	North Western	0.892	1.363	152.74
Mwinilunga	North Western	0.835	1.258	150.64
Solwezi	North Western	0.862	1.351	156.62
Choma	Southern	0.820	1.249	152.39
Kalomo	Southern	0.763	1.335	174.94
Livingstone	Southern	0.841	1.319	156.88
Mazabuka	Southern	0.821	1.277	155.55
Monze	Southern	0.803	1.363	169.69
Kaoma	Western	0.933	1.330	142.58
Mongu	Western	0.849	1.104	130.12
Senanga	Western	0.839	1.332	158.82

Source of Data: Estimated from LCMS raw data

The immediate impact of such levels of inflation was ably depicted through the research conducted by IDS and Oxfam (IDS/ Oxfam, 2008 – 2009). Community members in Kabwata, the urban site for the food price volatility project were asked to illustrate how food prices had changed over the past year. This was demonstrated by collecting food items amounting to

K5000[9] and arranging them according to the current prices and then what that same amount could purchase the previous year. The results of this exercise are illustrated in *Figure 1*.

Figure 1: Comparison of prices and food items over a period of one year -urban site

February 2008 February 2009

Source: IDS/ Oxfam (field interview, IDS/ Oxfam project, 2008 – 2009)

The households interviewed in both the rural and urban sites confirmed that the persistent rise in food prices during 2006 and 2010 eroded the purchasing power of the households. In *Box 1*, a single mother, Ms. K, shows how she is rationalising her income in the context of the deteriorating purchasing power owing to the less than proportionate increase in her income. Kabuswe supplements her income with regular remittances received from her siblings. Occasionally, she borrows money to meet other personal and household needs.

***Box 1:* Case study of how a female headed household is rationalising her income**

Ms. K is a 29-year-old single mother to a three year old child. She lives alone with her daughter in a two bed-room family house. She works as an administrator in a law firm and her monthly net salary is K800, 000. The following is a list of her monthly expenditure:

Food Item	**Quantity**	**Cost (K)**
Maize flour	1 x 10kg bag	18, 500
Beef	1kg	18,000
Chicken	2	40,000
Eggs	1 unit	6,700
Milk	2 litres	10,100
Juice	2.5 litres	18,000
Beans	1kg	11,400
Kapenta	500 grams	23,500
Vegetables	20 bundles	20,000
Tomatoes	30	16,800
Onion	10	17,600
Cooking Oil	750mls	18,000
Sugar	1kg	5,100
Bread	8 loaves	30,400
Sub-total		**254, 100**
Non food items		
Bathing soap (lifebuoy)	3 tablets	5,400

[9] As at February 2009, an average middle exchange rate of ZM K5000 was equivalent to 1US$

Laundry soap (boom)	2 x 400 g	8,200
Tissues	4 rolls	20,000
Vaseline	1 x 250mls	4,500
Electricity	250 units	70,000
Water and Sanitation (average cost)		50,000
Sub-total		**158,100**
Some other additional costs		
Health scheme at Kabwata clinic (her and child)		4,000
Nanny wage		180,000
Transport (bus fare round trip)		212,000
Tithe (taken to church)		80,000
sub-total		**476, 000**
Grand Total		**888, 200**

Source: IDS/ Oxfam Food Price Volatility field interviews in Lusaka, February 2009

CONCLUSION

This paper contributes to the understanding of the evolution of food budget shares and price indexes in Zambia. While such estimations are not enough to make claims on the welfare of households, they are a necessary preliminary step for the assessment of the impact of rising food prices on household poverty and nutrition. I did this by examining the change in the share of the household budget allocated to each food commodity in 2006 and 2010. The budget shares were further disaggregated by geographical location and quintile. I also estimated the food price index using the Fisher index.

The results in this paper show that on average, the household food budget share as a proportion of total expenditure increased in 2010 relative to 2006. In general, households spent a higher share of their food budget on cheaper cereals such as less-refined maize flour in 2010 in comparison to 2006. Once disaggregated by geographical area, in urban areas, the reallocation of food expenditure in 2010 negatively affected the consumption of refined maize flour and beef. The interpretation of these findings could be that households maintained calorie consumption by reallocating a higher budget share away from the superior and more refined maize flour and towards inferior maize flour. The findings are similar to other authors including Ruel et al., (2010) who argued that households may switch from cheaper and often less preferred quality staples to protect energy intake.

Furthermore, the consumption pattern between the top and bottom quintile varies across regions. In 2006, the poorer households (bottom quintile) in rural areas spent 21 per cent of their food budget on maize grain while the richer households (top quintile) spent only 5 per cent of their food budget on maize grain. On the other hand, the top quintile allocated a higher portion of their food budget share towards animal-source proteins. The quintile-disaggregated results further show that while the changes in budget shares were in the expected direction for rural households (increasing cereals but reducing proteins), this was more nuanced in urban areas. The richer households in urban areas adjusted the consumption of maize flour by devoting a higher share of their food budget towards less-refined flour while the share towards protein-rich foods was similar to 2006. In some cases, the budget share for animal-source protein foods (bream fish and chicken) increased. For poorer households in urban areas however, the budget share towards protein-dense foods remained low in both years. As suggested by Jensen and

Miller (2008), this scenario could occur for poorer households who may already be consuming a cheap diet and therefore, have limited substitution options.

The findings therefore suggest that households in rural Zambia reduced the diversity of food consumed. Richer households in urban areas on the other hand maintained the consumption of protein but reduced the share of the food budget towards refined maize flour while increasing the share of the budget for less-refined maize flour. Furthermore, the evidence in this paper suggests that when assessing the impact of rising food prices on consumption, it is important to focus on a number of food commodities rather than only focussing on a staple crop.

In relation to the price index, the Fisher index results show that the inflation level was over 50 per cent in the majority of the districts. These results suggest that the effects of rising food prices on household welfare in Zambia are expected to be relatively homogenous across regions.

APPENDIX

Table A.1: Average Quantities Consumed (in kilogrammes)

	2006	2010		2006	2010	
Commodities	**Rural**	**Rural**	**Difference**	**Urban**	**Urban**	**Difference**
Maize grain	26.08(29.20)	55.54(62.94)	-29.46***	1.80(15.90)	3.82(18.36)	-2.01***
Refined maize flour	49.81(72.85)	29.66(21.72)	20.15***	60.84(282.78)	27.80(17.86)	33.04***
Less-refined maize flour	52.28(64.55)	53.69(101.73)	-1.40	62.64(130.87)	55.40(92.97)	7.24*
Rice	3.20(4.60)	8.33(11.56)	-5.13***	5.62(7.98)	7.61(7.71)	-2.00***
Cassava	28.55(55.73)	31.34(59.71)	-2.79	17.42(27.83)	16.73(27.42)	0.69
Millet	-	-		-	-	
Sorghum	-	-		-	-	
Bread	3.07(5.15)	6.58(12.20)	-3.51***	11.16(13.45)	12.21(16.82)	-1.05***
Sweet Potatoes	7.95(23.11)	19.63(30.43)	-11.68***	9.42(12.60)	16.70(48.41)	-7.27***
Irish Potatoes	4.69(6.98)	9.06(13.20)	-4.37***	6.78(7.85)	9.86(12.06)	-3.09***
Chicken	1.38(1.25)	3.18(4.64)	-1.80***	3.74(4.62)	5.78(6.21)	-2.02***
Beef	1.48(2.62)	3.19(8.46)	-1.7***	3.26(4.12)	3.53(4.62)	-0.28***
Pork	0.59(1.00)	1.46(3.70)	-0.87***	1.14(1.82)	1.72(2.23)	-0.58***
Bream fish	0.51(0.75)	0.82(0.87)	-0.31***	0.87(1.20)	0.96(0.90)	-0.09***
Kapenta	0.47(0.66)	0.47(0.69)	-0.007	0.69(1.03)	0.58(0.91)	0.10***
Vegetables	6.20(7.10)	21.90(48.34)	15.70***	14.40(15.94)	16.82(60.57)	-2.41***
Beans	1.59(1.79)	2.30(4.44)	-1.40***	2.41(2.35)	2.95(3.74)	-0.54***
Onion	1.31(2.99)	2.07(3.06)	-0.76***	2.85(3.53)	3.06(5.03)	-0.21***
Tomatoes	3.12(4.73)	6.15(108.72)	-3.02*	8.68(10.48)	6.47(6.98)	2.20***
Eggs	0.58(0.99)	1.37(1.77)	-0.79***	1.70(2.49)	2.19(15.72)	-0.50***
Cooking Oil	1.65(1.80)	1.62(2.11)	0.03	3.51(2.80)	3.17(57.36)	0.33
Groundnuts	1.95(2.68)	3.71(5.22)	-1.76***	1.94(3.22)	2.71(4.17)	-0.78***
Butter	0.39(0.61)	0.44(0.46)	-0.05	0.44(0.80)	0.50(1.13)	-0.05***
Sugar	2.43(3.12)	3.45(4.95)	-0.02***	5.10(6.15)	4.80(6.47)	0.30***
Tea/ coffee	0.42(0.73)	0.44(0.58)	-0.20	0.70(1.07)	0.60(2.40)	0.10***
Fresh milk	2.16(3.84)	3.43(5.67)	-1.28***	5.85(7.93)	4.99(7.87)	0.86***
Powdered milk	0.62(0.53)	1.37(1.32)	-0.74***	0.97(0.90)	1.15(1.04)	-0.18***
Salt	1.53(2.14)	1.11(2.08)	0.42***	1.78(2.52)	1.13(6.20)	0.65***
Fruits	2.59(5.19)	8.36(99.31)	-5.76***	4.24(8.01)	6.49(11.92)	-2.25***

Source of Data: Estimated from LCMS raw data

Table A.2: Shares across geographical location and year

Commodity	Rural			Urban		
	2006	2010	Difference	2006	2010	Difference
Maize grain	0.152(0.187)	0.164(0.190)	-0.012***	0.031(0.087)	0.049(0.099)	-0.018***
Refined maize flour	0.011(0.067)	0.022(0.084)	-0.011***	0.094(0.136)	0.022(0.072)	0.072***
Less refined maize flour	0.011(0.069)	0.018(0.066)	-0.008***	0.031(0.104)	0.082(0.102)	-0.052***
Hammermill maize flour	0.021(0.090)	0.044(0.110)	-0.023***	0.011(0.067)	0.012(0.050)	-0.001*
Rice	0.026(0.057	0.016(0.015)	0.009***	0.035(0.042)	0.040(0.058)	-0.001
Cassava	0.062(0.139)	0.078(0.161)	-0.016***	0.009(0.049)	0.013(0.060)	-0.004***
Millet	0.010(0.054)	0.010(0.050)	-0.000	0.001(0.012)	0.001(0.016)	-0.000**
Sorghum	0.006(0.047)	0.004(0.036)	0.002***	0.001(0.015)	0.001(0.010)	0.001***
Bread	0.030(0.054)	0.031(0.062)	-0.001	0.073(0.073)	0.078(0.083)	-0.005***
Sweet Potatoes	0.003(0.021)	0.012(0.042)	-0.009***	0.002(0.011)	0.010(0.029)	-0.009***
Irish Potatoes	0.004(0.020)	0.004(0.020)	0.000	0.016(0.026)	0.013(0.031)	0.003***
Chicken	0.080(0.104)	0.050(0.086)	0.030***	0.080(0.070)	0.076(0.084)	0.004***
Other poultry	0.002(0.016)	0.001(0.013)	0.001***	0.001(0.012)	0.002(0.001)	-0.001
Beef	0.025(0.061)	0.016(0.053)	0.009***	0.060(0.064)	0.045(0.065)	0.015***
Pork	0.015(0.054)	0.007(0.033)	0.008***	0.010(0.030)	0.009(0.029)	0.001***
Goat meat	0.019(0.058)	0.012(0.048)	0.007***	0.008(0.027)	0.007(0.030)	0.000
Mutton	0.001(0.016)	0.001(0.010)	0.000	0.000(0.007)	0.000(0.009)	-0.000
Game meat	0.011(0.047)	0.008(0.040)	0.003	0.006(0.026)	0.006(0.028)	0.000
Bream fish	0.078(0.104)	0.029(0.066)	0.049***	0.058(0.061)	0.058(0.070)	0.000
Kapenta	0.059(0.075)	0.034(0.059)	0.024***	0.048(0.050)	0.042(0.053)	0.006***
Vegetables	0.032(0.059)	0.132(0.121)	-0.100***	0.061(0.060)	0.080(0.074)	-0.020***
Beans	0.035(0.057)	0.029(0.054)	0.006***	0.035(0.037)	0.033(0.044)	0.002***
Onion	0.012(0.025)	0.012(0.022)	-0.000	0.022(0.024)	0.023(0.027)	-0.001
Tomatoes	0.033(0.046)	0.025(0.037)	0.008***	0.047(0.041)	0.039(0.035)	0.008***
Eggs	0.010(0.028)	0.010(0.029)	-0.001	0.027(0.032)	0.027(0.038)	0.001
Cooking Oil	0.085(0.088)	0.044(0.050)	0.042***	0.071(0.053)	0.050(0.046)	0.021***
Groundnuts	0.027(0.061)	0.017(0.044)	0.010***	0.014(0.033)	0.013(0.028)	0.002***
Butter	0.002(0.011)	0.001(0.008)	0.001***	0.011(0.018)	0.009(0.021)	0.002***
Sugar	0.067(0.073)	0.042(0.059)	0.025***	0.057(0.047)	0.048(0.044)	0.009***
Honey	0.003(0.028)	0.001(0.016)	0.002***	0.001(0.010)	0.001(0.013)	0.000***
Tea/ coffee	0.004(0.014)	0.003(0.011)	0.001***	0.012(0.018)	0.009(0.021)	0.003***
Fresh milk	0.011(0.034)	0.011(0.035)	0.000	0.021(0.036)	0.018(0.036)	0.003***
Powdered milk	0.001(0.010)	0.001(0.010)	0.000	0.004(0.016)	0.003(0.015)	0.001***
Salt	0.044(0.072)	0.017(0.032)	0.028***	0.014(0.024)	0.010(0.023)	0.004***
Fruits	0.002(0.013)	0.027(0.055)	-0.025***	0.010(0.022)	0.032(0.044)	-0.022***
Non alcoholic drink	0.008(0.029)	0.012(0.042)	-0.005***	0.017(0.033)	0.005(0.020)	0.012***
Total	1.00	1.00		1.00	1.00	

Source of Data: Estimated from LCMS raw data

*Notes: Standard deviations in parenthesis. Significance of the difference in means based on a t-test for continuous variables. ***p<0.01, **p<0.05, *p<0.1*

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