UNITED NATIONS
UNIVERSITY
UNU-WIDER

This paper is a draft submission to

Inequality—Measurement, trends, impacts, and policies

5–6 September 2014 Helsinki, Finland

THE IMPACT OF FOOD PRICE VOLATILITY ON CONSUMER WELFARE IN CAMEROON

KANE Gilles Quentin[1], Faculty of Economics and Management, University of Yaoundé II-Soa, Yaoundé-Cameroon. kanegilles@yahoo.fr

MABAH TENE Gwladys Laure, Faculty of Economics and Management, University of Yaoundé II-Soa, Yaoundé-Cameroon. mabahlaure@yahoo.fr

AMBAGNA Jean Joël, Sub-regional Institute of Statistic and Applied Economics, Yaoundé - Cameroon. joelambagna@rocketmail.com

Abstract

The objective of this paper was to analyze the welfare effect of food price volatility in Cameroonian consumers. Using data from the third Cameroonian Household Consumption Surveys (ECAM III), the price elasticities are obtained from Quadratic Almost Ideal Demand System (QUAIDS) model. Price elasticities were then utilized to evaluate the distributional impacts of food price changes in terms of compensating variation. The paper found that: a) poor households are the most affected by food price volatility. b) the welfare losses from food prices volatility depends on the extent of price hike.

JEL: D12, P46, Q18

Keys Words: Price volatility, consumer welfare, Cameroon

[1] Corresponding author.

We are grateful to Professor Piot-Lepetit Isabelle and Professor Fondo Sikod for valuable guidance and comments.

1. Introduction

The world food market experienced a dramatic surge in prices for many commodities between 2005 and mid-2008, and these prices still remain volatile (De Janvry and Sadoulet 2008). This, considerably, raised the concern about the welfare of poor people in developing countries since they spend a large share of their income on food. According to the Food and Agriculture Organization (FAO), 24 million people in sub-Sahara Africa moved below the poverty line in 2008 because of rising prices and the number of undernourished increased from 850 million in 2007 to about 1.23 billion in 2009. The world food crisis of 2007-2008 has reduced the growth prospects and increased poverty in developing countries (HLPE 2011)[2]. In Cameroon, between 2005 and 2007, cereal price increased by 41.5 per cent, chicken price by 103 per cent, beef price by 44.5 per cent, and fish price by 30% per cent, while between June and December 2007 the price of a liter of palm oil increased by 72 per cent (Medou 2008). This negatively affected the purchasing power of households and led to adjustments in the distribution of their expenditures. Food prices are likely to continue to rise even beyond the peak levels of 2008, as a result of climate change that will increase the uncertainty and instability of agricultural production, the increase in demand due to use of biofuel and the anticipated rise in input cost related to energy scarcity (Blein and Longo 2009, FAO and OECD 2011)[3].

According to the OECD and FAO, all food prices will increase above average in 2020 compared to the previous decade. The price of rice and maize, for example, will increase by 15 per cent and 20 per cent compared to the average of the last decade. However, rising agricultural prices can also be an opportunity for farming households. Most of the poor households in developing countries live in rural areas. They are producers and sellers of food commodities and can be gainers of rising prices (De Janvry and Sadoulet 2008). So, there is a need to assess the impacts of rising food prices on households' welfare in developing countries.

In microeconomic theory, the impact of price changes on consumer welfare is generally analyzed in two ways: compensating variation and consumer surplus framework. The analysis of the

[2] High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security.
[3] Organization for Economic Co-operation and Development.

impact of the change in food price on household welfare using the compensating variation was introduced by Deaton (1989) and this approach is mostly used in the literature (Deaton 1989, 1997, Friedman and Levinsohn 2002, Niimi 2005, Ackah and Appleton 2007). The focus of this approach is that, when change in price occurs, there is a certain amount of money that the consumer can accept and requires to compensate this price change. While for the classical view, the effect of change in price on the household welfare can be estimated in the resulting change in consumer's surplus (Ferreira et al. 2011). For these two approaches, the Hicksian compensating variation can be used. However, as noted by Turnovsky et al. (1980), consumer's surplus as a measure of economic welfare is not a subject of consensus in empirical literature. Using consumer surplus framework, Ferreira et al. (2011) estimated the household welfare consequences of food price rise in 2008. The authors conclude that the overall impact of food prices volatility in Brazil was U-shaped. Indeed, it was the middle-income group that suffered more welfare losses than the very poor.

While using compensating variation framework, Bellemare et al. (2010) analyzed willingness to pay for price stabilization, and derive the measure of multivariate price risk aversion. The results suggested a distributional regressive benefit incidence from price stabilization policy in Ethiopia. Leyaro (2009) had shown that price increases had negative impact on consumers' welfare during the 1990s and 2000s. In particular, compared to the urban non-poor, the rural poor were mainly worst off. Similar results were obtained by Ackah and Appleton (2007) using linear approximate of the Almost Ideal Demand System (AIDS) model for food demand function in Ghana.

Tafere et al. (2010) used Quadratic Almost Ideal Demand System (AIDS) approach to examine the welfare impacts of rising food prices on rural households in Ethiopia. They showed that in the long run, real high food and agricultural prices benefited both net cereal sellers and buyers. However, very poor households with limited farm and non-farm income were adversely affected by high food prices. Also, in the long run, current net buyers may become net sellers if prices are stable and incentive enough for producers. Attanasio et al. (2013) also used Quadratic Almost Ideal Demand System (QUAIDS) approach to analyze the welfare consequences of recent increases in food prices in rural Mexico. They showed that poor households were affected by increases in relative food prices. Barrett and Dorosh (1996) using nonparametric density estimation and kernel smoothing techniques suggested that increases in the variance or mean of

rice prices had significant negative effect on households' welfare in Madagascar. But this effect was high for farm households that were below the poverty line. On other hand, Turnovsky et al. (1980) had shown that consumers' preference for price instability is function of the price elasticity of demand, the income elasticity of demand for the commodity, the coefficient of relative risk aversion, and finally the share of budget spent on the commodity where only single price is stabilized.

However, relatively little is known about how households in Cameroon respond to food price changes and the welfare effects of such a situation. Previous studies used statistical methods to measure the effect of food price volatility on the purchasing power of households (Medou 2008, MINEPAT 2008)[4]. They showed that food price volatility adversely affected the purchasing power of households and then their nutritional status.

This paper goes further and analyzes the impact of food price volatility on consumer welfare in Cameroon using data from the third Cameroonian household consumption survey. Since socio-economic and demographic characteristics of households play an important role in determining their demand patterns, the demand model is estimated taking into account heterogeneity across households. We then estimated price elasticities using QUAIDS model, and following the compensating variation framework we used those elasticities to estimate the welfare effect of price volatility. The major components of food consumption are taken into account in the following four composite categories: cereals, roots and tubers, vegetables, and animal products. The paper is organized as follows: section 2 outlines material and method, section 3 presents the results and discussion, and finally section 4 summarize the main conclusions.

2. Materials and Methods

2.1 Data

The data used in this study were from the 2007 Cameroonian household consumption survey called ECAM III, carried out by the National Institute of Statistics (NIS) of Cameroon. This

[4] Ministry of Economy, Planning and Regional Planning.

survey was conducted from May to July 2007, 11,391 households were surveyed from 32 strata (12 urban, 10 semi-urban and 10 rural), and four agro ecological zones namely Rural Forests, Rural Savannah, Other Towns and Rural High Plateaus. Following the first round of the ECAM in 1996, and the second in 2001, the ECAM III had as a principal objective to upgrade the poverty profile and provide living standards indicators which are useful in the evaluation of the realization of the Millennium Development Goals objectives through the implementation of the poverty reduction strategy paper (DSRP) in Cameroon.

As noted by the NIS (2008), this survey specifically aimed at: studying all dimension of poverty at both national and regional levels; establishing correlation between different poverty aspects; analyzing the effect of macroeconomic policies of the last five years through the study of the change in poverty between 2001 and 2007; evaluating the demand for education and identifying its determinants; and providing the useful database in order to update different official statistics.

The survey was nationally representative and recorded data with variables on: household expenditure, consumption and income; household demographics; economic activities and others useful for welfare analysis. For interviewed households, the sampling design was done in two stages. First, the primary sampling units (PSU) or clusters either in urban or rural area was selected all over the country. Second, a sample of household was randomly selected from each of selected PSU.

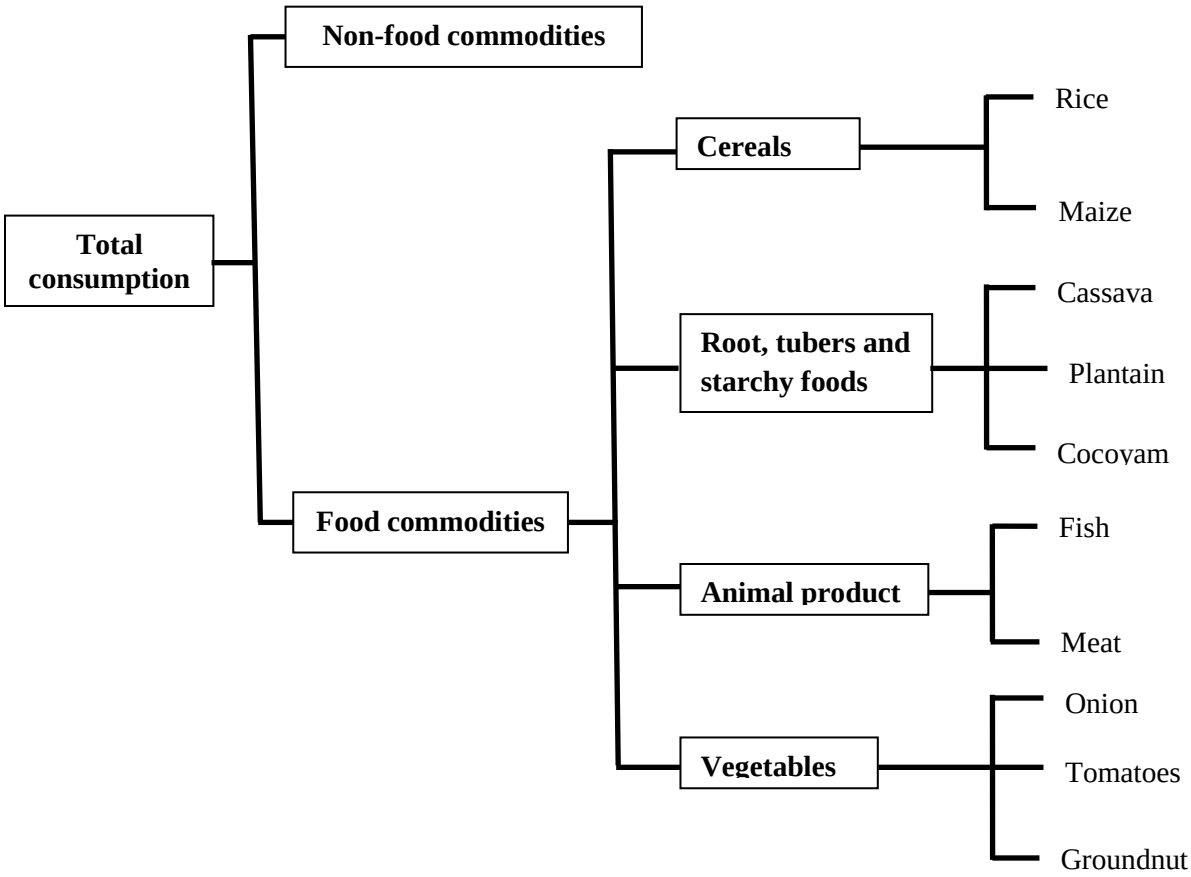
Due to data limitation and excluding households who do not consume the commodities retain in this studies, we use the sample of 2,665 households from ECAM III. Also, it was not possible to find data on food production for this sample since ECAM mainly focus on consumption information, thus this study only focused on consumers.

2.2 Food groups

We have aggregated the major components of food consumption into 4 groups: cereals, roots and tubers, animal products and vegetables. This is to deal with the large number of goods involved and facilitate the empirical analysis. The grouping of the food products was done according to the nomenclature adopted by the NIS. Additionally, we assumed separability of preferences as usual

in literature (Béké 2013). Under this assumption, the preference within a given food group is independent of the choices in the other groups. The separability of preference also implies independence between choice of foodstuffs and non-food items. Then, allocation of the total expenditure is sequential in three stages as present in the figure 1:

Figure 1: Utility tree for a three stage budgeting for food demand in Cameroon



Source: Adapted from Béké (2013)

2.3 Welfare impact of changing price

The effect of food price volatility on consumer welfare is evaluated using the compensating variation (CV) concept as usual in literature (Minot and Goletti 2000, Leyaro 2009, Tafere et al.

2010, Badolo and Traore 2012). Price volatility is taken into account by the induced change in price.

Recall that, compensating variation can be defined as the amount of money required to compensate a household for change in price and to restore the pre-change utility level (Tafere et al. 2010, Badolo and Traore 2012).

The CV can be expressed using the expenditure function as follows :

$$CV = e(p_1, u_0) - e(p_0, u_0) \quad (1)$$

Where $e(.)$ is the expenditure/cost function, p is the prices vector, p_1 and p_0 are respectively the after and the before the price change, and u is the utility.

Using second-order Taylor-series expansion and Shephard's lemma on equation (1), the effect of price changes on consumer is obtained as follows (Badolo and Traore 2012):

$$\frac{CV}{x_0} \cong CR_i \frac{\Delta p_i}{p_{0i}} + \frac{1}{2} \varepsilon_d CR_i \left(\frac{\Delta p_i}{p_{0i}} \right)^2 \quad (2)$$

Where $CR_i = \frac{p_{0i} q_i(p_0, x_0)}{x_0}$ is the consumption ratio defined as the proportion of budget affected to product consumption relative to the household income or the total expenditure.

p_i, q_i, x_0 and ε_d are respectively the price, the quantity demanded, the original income and the own-price elasticity demanded for a given product.

On the other hand, it is possible to derive the short-run (immediate) impact of changing price by assuming zero elasticities as follow:

$$\frac{\Delta w^1}{x_0} \cong -\frac{\Delta p_i^c}{p_{0i}^c} CR_i \quad (3)$$

Where Δw^1 is the first-order approximation of the net welfare effect of a changing price.

There is one major issue in such analysis; notably the use of appropriate price elasticities, since price elasticities are needed to calculate the compensating variation after demand adjustments (Ackah and Appleton 2007, Pons 2011, Attanasio et al. 2013). To overcome this, we estimated an

entire demand system for the entire commodity group in consideration as discuss in the next subsection.

2.4 The demand model

In literature, the most commonly used method in demand analysis in the last two decade is the Deaton and Muellbauer (1980) Almost Ideal Demand System (AIDS) model. Indeed the AIDS model has a number of desirable demand properties such as allowing testing for the symmetry and homogeneity through linear restriction among others. However, more recently, (Banks et al. 1997) generalized the AIDS model by demonstrating that the appropriate form for some consumer preferences is of quadratic nature contrary to the linear form in the basic AIDS. In addition, the QUAIDS model maintains the theory consistency and the desirable demand properties of the AIDS model.

Formally, the share equation in the (Banks et al. 1997) QUAIDS model is:

$$w_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \ln p_j + \beta_i \ln\left[\frac{m}{a(p)}\right] + \frac{\lambda_i}{b(p)}\left\{\ln\left[\frac{m}{a(p)}\right]\right\}^2 + \varepsilon_i \qquad (4)$$

Where w_i is a household's expenditure share for commodity i, defined as $w_i \equiv \frac{p_i q_i}{m}$ and $\sum_{i=1}^{n} w_i = 1$

On the other hand, the demand theory requires the following restrictions:

- Adding-up: $\sum_{i=1}^{n} \alpha_i = 1, \quad \sum_{i=1}^{n} \beta_i = 0, \quad \sum_{i=1}^{n} \gamma_{ij} = 0, \quad \sum_{i=1}^{n} \lambda_i = 0$ (6)
- Homogeneity: $\sum_{i=1}^{n} \gamma_{ji} = 0$ (7)
- Slutsky symmetry: $\gamma_{ji} = \gamma_{ij}$ (8)

The QUAIDS model in this study was carried out accounting for socio-demographic effects. Indeed, demographic factors can affect household behavior in term of demand and the allocation of expenditures among goods (Pollak and Wales 1981, Pollak and Wales 1992, Tafere et al. 2010,

Olorunfemi 2013). Then, Ray (1983) "demographic scalling" method was used to take into account demographics in this study as in Poi (2012). In this approach, the effects of change on the demographics are close to the effects of change in prices (Pollak and Wales 1992).

Considering z as a vector of s household characteristics z is a scalar representing the household size in the simplest case. Let $e^R(p,u)$ represent the expenditure function of a reference household with just a single adult.

For each household, Ray's method uses an expenditure function of the form:

$$e(p,z,u) = m_0(p,z,u) * e^R(p,u) \tag{9}$$

Further, Ray decomposes the scaling function as $m_0(p,z,u) = \overline{m}_0(z) * \phi(p,z,u)$

Where the first term measures the increase in a household's expenditures as a function of household characteristics, not controlling for any changes in consumption patterns. The second term controls for a change in relative prices and the actual goods consumed.

Following Ray (1983), QUAIDS parameterizes $\overline{m}_0(z)$ as $\overline{m}_0(z) = 1 + \rho' z$

Where ρ is a vector of parameters to be estimated.

The expenditure share expenditure equation takes the form :

$$w_i = \alpha_i + \sum_{j=1}^{k} \gamma_{ij} \ln p_j + (\beta_i + \eta_i' z) \ln \left\{ \frac{m}{\overline{m}_0(z) a(p)} \right\} + \frac{\lambda_i}{b(p) c(p,z)} \left[\ln \left\{ \frac{m}{\overline{m}_0(z) a(p)} \right\} \right]^2 \tag{10}$$

Where $c(p,z) = \prod_{j=1}^{k} p_j^{\eta_j' z}$

The adding-up condition requires that $\sum_{j=1}^{k} \eta_{rj} = 0$ for $r = 1, \ldots, s$.

The uncompensated price elasticity for commodity group i with respect to changes in price of commodity good j is:

$$\varepsilon_{ij} = -\delta_{ij} + \frac{1}{w_i} \left(\gamma_{ij} - \left[\beta i + \eta_i' z + \frac{2\lambda_i}{b(p) c(p,z)} \ln \left\{ \frac{m}{\overline{m}_0(z) a(p)} \right\} \right] * \left(\alpha_j + \sum_l \gamma_{jl} \ln pt \right) - \frac{(\beta_j + \eta_i' z) \lambda_i}{b(c) c(p,z)} \left[\ln \left\{ \frac{m}{\overline{m}_0(z) a(p)} \right\} \right]^2 \right) \tag{11}$$

The expenditure (income) elasticity for good or commodity group i is :

$$\mu_i = 1 + \frac{1}{w_i}\left[\beta_i + \eta_i' z + \frac{2\lambda_i}{b(p)c(p,z)} \ln\left\{\frac{m}{\bar{m}_0(z)a(p)}\right\}\right] \quad (12)$$

The compensated price elasticities are derived from the Slutsky equation:

$$\varepsilon_{ij}^c = \varepsilon_{ij} + \mu_i w_j$$

Note: all the lowercase Greek letters other that α_0 are the parameters to be estimate. Two demographics variables was finally used in this study, namely area (urban and rural), and household size.

The parameters are estimated by Interated Feasible Generalized Nonlinear Least-Squares (IFGNLS) which is equivalent to the multivariate normal aximum-likelihood estimator for this class of problems via Sata's nlsur command as suggested by Poi (2012).

After the presentation of the demand model, it is worth noting to discuss at least two major data issues, nalmely the price measure, and the treatment of outlier and missing values.

2.5 Data problems

price measure: unit value

In the demand analysis using microeconomic data, when the survey process is not accompanied by the entire questionnaire on price as usual in developing countries, they are mainly two sources for price data in crossed section analysis: regional price data and household price data (Deaton 1997). Regional data, when available from the statistical office can be used for constructing consumer price indexes. However, the main problem with such approach is the relatively few sites where prices are collected. This can cause inaccurate estimate of prices for some households.

On the other hand, household responses habitually provide useful information on price data. Then, the ratio of the household total expenditure divided by the total quantity purchased in each good gives the measurement of price or more accurately, of unit value. The unit value for a

purchase can be seen as the highest price acceptable and then "*subjective price*" (Pons 2011). However, this may be problematic, since they are not the same thing as price, since unit values reflect both quality and price variation[5] (Cox and Wohlgenant 1986, Deaton 1988, 1997). Therefore, a correction was needed, in order to take into account both quality effects and measurement error when using unit values as proxy of price. The Deaton (1988) method was widely used in literature for linear demand system. However, this method cannot be used in the case of QUAIDS due to nonlinearity (Attanasio et al. 2013). In addition, the assumptions on which this approach is based are strongly rejected by McKelvey (2011). For these reasons, this paper uses the same method as Attanasio et al. (2013), for the lack of better alternative. The median unit value for each cluster was used as the measure of price of a given goods for each locality.

The treatment of Outlier and missing values

When outlier are detected, it will be replaced by the cluster median (obtained in the presence of these values) or regional median when the cluster median is null for the consider group product, since it can be too costly to drop such observations. In the case where data on expenditure, or quantity, or both are missing for some households, the cluster median value or regional median when the cluster median is null for the consider group product replaces the missing unit value.

3. Results and discussions

3.1 Description of variables

An understanding of the differences in households food expenditure patterns accross regions and income groups is important to design effective food price policies. In order to look at expenditure patterns for food demand in Cameroon, this subsection describes statistics for food expenditure, prices and expenditure shares by area and poverty status.

[5] For example, in presence of change in price or income, household not only respond by change in quantity but also by change in quality of food expenditure. Also, since quantities can be subject to measurement errors, these errors can be transmitted to the derived unit value.

Table 1 shows that on average, the highest food expenditure were on roots and tubers. Table 1 reports also that in rural areas, cereals expenditures are higher than that in urban areas. This can be explained by the fact that cereals are more consumed in rural areas. In the same line, animal products expenditure are higher for non-poor households than that for poor households[6].

Table1 : Summary statistics for expenditure by area and living standard (in FCFA)

	Area		**Poverty status**		
	urban	**rural**	**poor**	**Non-poor**	**entire sample[7]**
Cereal	4919.201	5712.848	5546.770	5233.599	5523.054
Animals product	6357.015	5486.209	4693.121	6218.543	6066.899
Root and tuber	6601.493	7773.826	7015.113	7174.600	7135.325
Vegetables	2687.294	2720.729	2454.918	2755.335	2757.457

Source: Author's computation from ECAM III.

On average, food prices were higher in urban regions than in rural ones (table 2). This can be explained by the fact that agricultural production mostly takes place in rural areas which provide urban areas with food products.

Table 2. Average Food prices in urban and rural areas (in FCFA)

Food groups	**Area**		**Entire sample**
	urban	**rural**	
Cereals	281.1529	219.3193	252.3947
Animal products	1195.896	1056.202	1056.202
Roots and tubers	197.5873	171.6362	171.6362
Vegetables	459.0365	457.1031	457.1031

Source: Author's computation from ECAM III

Table 3 reports that on the average, roots and tubers constituted the largest share of households total food budget. Poor households spend more of their food budget on cereals than on animal

[6] Poor households is defined by the NIS as a household in which the average per adult equivalent consumption does not exceed 269 443 F CFA per year at a price of Yaoundé (about 738 CFA per day equivalent to 1.5082 USD). This poverty threshold was obtained using adult equivalent consumption as a measure of welfare. Indeed, this measure compared to the total consumption of households and the per capita consumption has the advantage of taking into account both the size and composition of the household.

[7] The size of the entire sample here is 2,665 households selected over the 11,391 surveyed during the third Cameroonian household survey (ECAM III).

products while non-poor households spend rather more on animal products than on cereals. This reflects the fact that maize and rice are staples for most of poor households while fish and meat are considered as luxury goods.

Table 3. Average expenditure shares of food commodities by area and poverty status

Food groups	**Area**		**Income groups**		**Entire sample**
	urban	**rural**	**poor**	**non poor**	
Cereals	.2438614	.2653359	.2823012	.2478251	.253849
Animal products	.298809	.2529891	.2448695	.2844068	.2774986
Roots and tubers	.3232621	.3570203	.3484115	.3369622	.3389627
Vegetables	.1340675	.1246547	.1244177	.1308059	.1296897

Source: Author's computation from ECAM III

3.2 Demand elasticities

The expenditure elasticities (table4) show that, cereals, roots and tubers, and vegetables are normal goods, with elasticities between 0 and 1. Only animal products are luxury goods, with elasticity higher than one. Similar results were found by Béké (2013) in the case of Cote d'Ivoire.

Table 4 : Expenditure elasticities

Commodity groups	**Expenditure elasticities**
Cereals	.9230848
Animal products	1.192594
Roots and tubers	.9961353
Vegetables	.7164125

Table 5 reports estimates by area of the Hicksian elasticity which contain only price effects, contrary to the Mashallian elasticity which contain both income and price effects (Table, A1). All the own-price elasticities (see the diagonal of the matrix in bold) for the commodity group in

consideration satisfied the negativity property. This is consistent with demand theory and suggests that the relation between changes in own-price indexes and quantities demanded is inverse. The own-price elasticities suggest inelastic demand for all commodity group analyzed (elasticity absolutely < 1). Except for vegetable and animal product in rural area, the remains commodity groups carry positive signs for cross-price elasticity as expected for substitute product. Cereal, and root and tuber are identified as substitutes by households.

Table 5: Price elasticity from the QUAIDS Model

Compensated/Hicksian Elasticity								
	Urban				**Rural**			
	CER	**ANP**	**ROT**	**VEG**	**CER**	**ANP**	**ROT**	**VEG**
CER	**-.9137663**	.4277656	.3293677	.1566330	**-.8922705**	.3821418	.357859	.1522688
ANP	.3739183	**-.7231574**	.3217032	.0275358	.4160866	**-.7931145**	.3787809	-.001753
ROT	.2639336	.2965729	**-.6407257**	.0802191	.2728092	.2653477	**-.6189327**	.0807757
VEG	.3042376	.0582732	.1952205	**-.5577314**	.3242906	-.0040114	.2259223	**-.5462015**

Where CER=Cereal; ANP=Animal product; ROT=Root and tuber; VEG=Vegetable

3.3 Estimated Impact of Rising Food Prices on consumer Welfare

Empirically, the CV can be seen here as a measure of the total transfer required to compensate households for the change in price, as a percentage of their initial total food expenditure. The CV is disaggregating by area and poverty status in order to illustrate which groups of households are more vulnerable to the price change. We utilize the estimated Hicksian elasticities to implement the CV as usual in literature (Ackah and Appleton 2007).

Following the compensating variation (CV) framework, equations 2 and 3 are used to estimate the impact of changing food prices on consumer welfare. We simulate the welfare impact of the increase in each commodity group by 10 per cent and 40 per cent in both short and long run.

The tables 6, 7, 8 and 9 below present the long run and short run welfare effects of the food prices increases. One should note that in the short run, households cannot respond to prices changes and then prices elasticities are equal to zero.

Table 6: Compensating variation implied by cereals price change

Percentage increase in price	**10%**		**40%**	
	Short run	Long run	Short run	Long run
area				
Urban	2,44%	2,55%	9,75%	11,54%
Rural	2,65%	2,77%	10,61%	12,51%
poverty status				
non-poor	2,48%	2,59%	9,91%	11,71%
poor	2,82%	2,95%	11,29%	13,32%
poverty status	**Rural**	**Rural**	**Rural**	**Rural**
non-poor	2,60%	2,72%	10,40%	12,26%
poor	2,79%	2,91%	11,16%	13,15%
poverty status	**Urban**	**Urban**	**Urban**	**Urban**
non-poor	2,40%	2,50%	9,58%	11,33%
poor	2,92%	3,06%	11,69%	13,82%
Entire sample	2,61%	2,73%	10,43%	12,32%

Table 7: Compensating variation implied by animal product price change

Percentage increase in price	**10%**		**40%**	
	Short run	Long run	Short run	Long run
area				
Urban	2,99%	3,10%	11,95%	13,68%
Rural	2,53%	2,63%	10,12%	11,72%
poverty status				
non-poor	2,84%	2,95%	11,38%	13,08%
poor	2,45%	2,54%	9,79%	11,31%
poverty status	**Rural**	**Rural**	**Rural**	**Rural**
non-poor	2,58%	2,68%	10,33%	11,97%
poor	2,39%	2,49%	9,58%	11,10%
poverty status	**Urban**	**Urban**	**Urban**	**Urban**
non-poor	3,02%	3,13%	12,09%	13,84%
poor	2,61%	2,70%	10,43%	11,94%
Entire sample	2,78%	2,89%	11,10%	12,77%

Table 8: Compensating variation implied by root and tuber price change

Percentage increase in price	**10%**		**40%**	
	Short run	Long run	Short run	Long run
area				
Urban	3,23%	3,34%	12,93%	14,59%
Rural	3,57%	3,68%	14,28%	16,05%
poverty status				
non-poor	3,37%	3,48%	13,48%	15,18%
poor	3,48%	3,59%	13,94%	15,68%
poverty status	**Rural**	**Rural**	**Rural**	**Rural**
non-poor	3,55%	3,66%	14,20%	15,96%
poor	3,62%	3,73%	14,48%	16,28%
poverty status	**Urban**	**Urban**	**Urban**	**Urban**
non-poor	3,25%	3,35%	12,99%	14,65%
Poor	3,08%	3,18%	12,32%	13,90%
Entire sample	3,31%	3,41%	13,56%	15,27%

Table 9: Compensating variation implied by vegetable price change

Percentage increase in price	**10%**		**40%**	
	Short run	Long run	Short run	Long run
area				
Urban	1,34%	1,38%	5,36%	5,96%
Rural	1,25%	1,28%	4,99%	5,53%
poverty status				
non-poor	1,31%	1,34%	5,23%	5,81%
poor	1,24%	1,28%	4,98%	5,52%
poverty status	**Rural**	**Rural**	**Rural**	**Rural**
non-poor	1,27%	1,30%	5,07%	5,62%
poor	1,19%	1,23%	4,78%	5,30%
poverty status	**Urban**	**Urban**	**Urban**	**Urban**
non-poor	1,34%	1,37%	5,35%	5,94%
poor	1,39%	1,43%	5,56%	6,18%
Entire sample	1,30%	1,34%	5,19%	5,76%

The results show that, on average, for each group of households there is a welfare loss due to the increase in food prices. However the results reveal some heterogeneity in the welfare impact of food price volatility. Poor households in both urban and rural areas are the most affected as suggested in the literature (Ackah and Appleton 2007, Attanasio et al. 2013, Badolo and Traore 2012). For example, on average poor household need to be reimbursed by about 15.68 per cent of their expenditures as the result of a 40 per cent change in root and tuber price. We observed also that the highest welfare losses are due to the increases of roots and tubers prices. This is as expected since households spend more of their food budget on those commodities.

Poor urban households were more affected by an increase in cereals and vegetables prices than poor rural ones. This can be explained by the fact that in rural area, poor households can produce some of the agricultural products they consume while poor urban households may not. On the other hand, due to an increase in roots and tubers price, it is the welfare of poor rural households that is most reduced. Similar results was found by Leyaro (2009) and Ackah and Appleton (2007). Whereas an increase in the price of animal products mostly affect the non-poor households in urban areas. This is in line with the fact that it is those households that spend more of their total food budget on animal products.

The tables report also that the welfare effect of food prices increase depend on the extent of the increase. Thus, there is an expected positive relationship between prices increase and households welfare losses. The results also show that a welfare effect in the long run was greater than that in the short run.

4. Conclusion

This paper estimates the welfare impact of food price volatility in Cameroon. Using the QUAIDS model, we calculated expenditure, own-price and cross-price demand elasticities for the 4 main component of food consumption of most Cameroonian households. The results show that demand for food commodities in Cameroon is price sensitive. In addition, at means poor households are the most affected by prices hike. But the welfare losses from food price volatility reveal some heterogeneity.

These results are important since it will be difficult to design efficient food policies without a thorough understand of how different types of households in different area are affected by change in food price and how sensitive they are. By having such information, policy makers will be able to implement more specific and efficient policies to fight against hunger and poverty in developing country as Cameroon. Nevertheless, while such studies are important in developing countries, data constraints remain a major problem. For future research, it will be interesting to investigate how households are affected by change in food price with information on both producers and consumers.

Appendix

Table A1: Uncompensated/Mashallian Elasticity from QUAIDS model

	Urban				Rural			
	CER	**ANP**	**ROT**	**VEG**	**CER**	**ANP**	**ROT**	**VEG**
CER	**-1.149320**	.1582713	.0358988	.0349649	**-1.158581**	.1375937	.0085518	.0271543
ANP	.0707443	**-1.070015**	-.0560114	-.1290592	.1171294	**-1.067641**	-.0133482	-.1422051
ROT	.0059980	.0014720	**-.9620793**	-.0530094	.0042896	.0187711	**-.9711383**	-.0453765
VEG	.1179232	-.1548867	-.0369025	**-.6539663**	.096628	-.2130690	-.0726917	**-.6531585**

Where CER=Cereal; ANP=Animal product; ROT=Root and tuber; VEG=Vegetable

References

Ackah, C. and S. Appleton (2007). 'Food Price Changes and Consumer Welfare in Ghana in the 1990s'. CREDIT Research Paper no. 07/03.

Attanasio, O., V. Di Maro, V. Lechene and D. Phillips (2013). 'Welfare Consequences of Food Prices Increases: Evidence from Rural Mexico'. *Journal of Development Economics,* 104: 136–151.

Badolo, F. and F. Traore (2012). 'Impact of Rising World Rice Prices on Poverty and Inequality in Burkina Faso'. CERDI Working Paper E 2012.22.

Banks, J., R. Blundell and A. Lewbel (1997). 'Quadratic Engle Curves and Consumer Demand'. *Review of Economics and Statistics,* 79: 527-539.

Barrett, C. B. and P. A. Dorosh (1996). 'Welfare and Changing Food Prices: Nonparametric Evidence from Rice in Madagascar'. *American Journal of Agricultural Economics,* 78(3): 656-669.

Béké, T. E. (2013). 'Analysis of Substitutions in Demand for Food Crops in Ivory Coast'. Paper presented at the African Economic Research Consortium biannual. Nairobi

Bellemare, M. F., C. B. Barrett and R. David (2010). 'The Welfare Impacts of Commodity Price Fluctuations: Evidence from Rural Ethiopia'. Available at: http://economics.adelaide.edu.au/research/seminars/20130405-bellemare-barrett.pdf (12/06/2014).

Blein, R. and R. Longo (2009). 'Food Price Volatility – how to help Smallholder Farmers Manage Risk and Uncertainty'. Discussion Paper. IFAD's Governing Council.

Cox, T. and M. Wohlgenant (1986). 'Prices and Quality Effects in Cross-Sectional Demand Analysis'. *American Journal of Agricultural Economics,* 68(4): 908-919.

De Janvry, A. and E. Sadoulet (2008). 'Estimating the Effects of the Food Price Surge on the Welfare of the Poor'. UNDP/RBLAC, Poverty and MDG Cluster project.

Deaton, A. (1988). 'Quality, Quantity and Spatail Variation of Price'. *American Economic Reciew,* 78: 418-430.

Deaton, A. (1989). 'Rice Prices and Income Distribution in Thailand: a Non-parametric Analysis'. *Economic Journal,* 99 (395 Supplement): 1–37.

Deaton, A. (ed.) (1997). *The Analysis of Household Surveys: a Microeconometric Approach to Development Policy*. Baltimore: Johns Hopkins University Press.

Deaton, A. and J. Muellbauer (1980). 'An Almost Ideal Demand System'. *American Economic Review* 70(3): 312-326.

FAO and OECD (2011). 'Price Volatility in Food and Agricultural Markets: Policy Responses'. Policy Report.

Ferreira, F. H. G., A. Fruttero, P. Leite and L. Lucchetti (2011). 'Rising Food Prices and Household Welfare : Evidence from Brazil'. Working paper 2011-200. ECINEQ.

Friedman, J. and J. Levinsohn (2002). 'The Distributional Impacts of Indonesia's Financial Crisis on Household Welfare: A "Rapid Response" Methodology'. *World Bank Economic Review* 16: 397–423.

HLPE (2011). 'Price Volatility and Food Security'. Rome: High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security.

Leyaro, V. (2009). 'Commodity Price Changes and Consumer Welfare in Tanzania in the 1990s and 2000s'. School of Economics - University of Nottingham.

McKelvey, C. (2011). 'Price, Unit Value, and Quality Demanded'. *Journal of Development Economics,* 95: 157–169.

Medou, J. C. (2008). 'Evaluation de l'impact de la Flambée des Prix des Denrées Alimentaires sur les Ménages dans les Milieux Urbains Camerounais'. WFP.

MINEPAT (2008). 'Autosuffisance et sécurité alimentaire au Cameroun : une analyse basée sur la flambée des prix des Produits alimentaires de première nécessité'. Republic of Cameroon.

Minot, N. and F. Goletti (2000). 'Rice Market Liberalization and Poverty in Viet Nam'. Research Report 114. Washington, DC: IFPRI.

Niimi, Y. (2005). 'An Analysis of Household Reponses to Price Shocks in Vietnam: can Unit Values Substitute for Market Prices?'. Poverty Research Unit Working Paper no. 30. University of Sussex.

NIS (2008). 'Conditions de vie des populations et profil de pauvreté au Cameroun en 2007'. ECAM3 Report. Republic of Cameroon.

Olorunfemi, S. (2013). 'Demand for Food in Ondo State, Nigeria: using Quadratic Almost Ideal Demand System'. *Journal of Sustainable Development in Africa,* 15(6): 16-45.

Poi, B. P. (2012). 'Easy Demand-System Estimation with QUAIDS'. *Stata Journal* 12(3): 433-446.

Pollak, R. A. and T. J. Wales (1981). 'Demographic Variables in Demand Analysis'. *Econometrica,* 49: 1533-1551.

Pollak, R. A. and T. J. Wales (ed.) (1992). *Demand System Specification and Estimation*. New York: Oxford University Press.

Pons, N. (2011). 'Food and Prices in India: Impact of Rising food Prices on Welfare'. Delhi: Human Sience Center.

Ray, R. (1983). 'Measuring the Cost of Children: an Alternative Approach'. *Journal of Public Economics,* 22: 89-102.

Tafere, K., S. A. Taffesse, S. Tamru, N. Tefera and P. Zelekawork (2010). 'Food Demand Elasticities in Ethiopia: Estimates Using Household Income Consumption Expenditure (HICE) Survey Data'. ESSP II Working Paper 11. Addis Ababa: IFPRI.

Turnovsky, S. J., S. Haim and A. Schmitz (1980). 'Consumer's Surplus, Price Instability, Consumer Welfare'. *Econometrica,* 48(1): 135-152.