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Rising Food Prices and Household Welfare in Ethiopia: Evidence from Micro Data

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Rising Food Prices and Household Welfare in Ethiopia: Evidence from Micro Data

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ABSTRACT

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This paper analyzes welfare implications of rising commodity prices in Ethiopia based on household budget surveys. Our findings suggest that a rise in relative prices of such necessities as cereals would lead to a large deterioration in the welfare of households in urban areas. In rural areas generally land-rich households tend to benefit significantly from the recent surge in food prices, while the land-poor and typical farm households tend to experience negative growth. Thus, price shifts in favour of agriculture could aggravate poverty conditions in rural areas. Simulated Gini computed from simple demand systems indicate worsening income distribution in urban areas due to price shifts that would exacerbate the already dire poverty conditions. The paper also reported own and cross-price elasticities mainly for cereals to gain insight into magnitude of demand shifts due to income and price changes.

1. Introduction

The Ethiopian economy has witnessed a double-digit rate of inflation since 2003, culminating at 53% in June 2008. Particularly the significant rise in the relative prices of grain and other foodstuff such as sugar, edible oil and other necessities in recent period are very worrisome. Evidently such large changes in both absolute and relative prices in a space of few years can undermine the rebound in per capita incomes in the last decade and the poverty reduction effort of the government.

The gravity of the problem has been well understood by policy makers, and efforts are underway to cushion vulnerable households from the consequences of the price surge. The potential role of such interventions can only be known if welfare effects of rising prices are understood. In addition, better measures of the key parameters that drive the demand for grain and other goods is a useful input to the analysis of the causes of relative price changes in Ethiopia.

This paper attempts to fill some of the gaps in our knowledge of the link between welfare and rising prices by examining first what the distributional consequence of the rise in absolute price has been over the recent period in rural as well as urban areas. It provides quantitative estimates of the change in the measure of income inequality due to price changes alone. Such findings will indicate whether or not the poor have been affected relatively more than others during an inflationary period. Secondly, the study provides evidence on the welfare implications of changes in relative prices of key consumption goods by constructing concentration curves using non-parametric methods. The pair-wise comparison of concentration curves provides a useful analytical framework in generating partial ordering of welfare between consumption goods. This framework can be also used to analyze whether subsidies on wheat or other grain products could raise welfare, particularly so if it is financed through surtax imposed on other commodities, or income. Third, the paper estimates the effect of changes in the relative prices of agricultural goods on consumption growth for rural as well as urban households to capture welfare effects of the price shocks. Finally, a range of income and cross-price elasticity of demand values are reported to understand better the role of demand shifts in driving relative price changes. The key results emerging from our analysis are first, the recent dramatic rise in the general price could be responsible in raising the average Gini coefficient in urban areas by more than 2% every year. In other words, between 2000 and 2006, the Gini coefficient could rise by about 6 percentage points due to inflation alone suggesting the anti-poor bias the inflationary process has in urban areas. Secondly, consumption pattern for cereals and other food items suggest that subsidies targeted at maize in rural areas, and *teff* in urban areas financed say through a proportional income tax (surtax) could be welfare enhancing, particularly for the poor population. Finally, while real consumption growth deteriorated significantly following the rise in the real price of food (cereals) in urban areas, its effect on rural households depends on the potential to be net seller or buyer. As a result, land rich households tend to benefit significantly from real and nominal price movements of cereals while land poor households lose enormously. Thus, policy reforms designed to raise agricultural terms of trade in favour of the rural sector need to bear in mind that it has the potential to precipitate poverty by impoverishing the land-poor and consequently raising income inequality as well as pushing the average farm household into poverty.

The next section discusses in some detail the methodological framework used in the paper, Section 3 describes the data source and survey methodology, Section 4 discusses key results and Section 5 concludes the paper.

2. Methodological framework

2.1. Welfare implications of inflation

To establish empirically the impact of inflation on the poor, it is possible to use two approaches (though interrelated) based on household budget surveys. The first, and perhaps simplest, is incidence analysis using concentration curves for a wide range of commodities. In this case, the rise in price of a particular commodity is regarded as an implicit tax, and the expenditure profile of this commodity (or sets of commodities) is used to infer whether the rise in price affects poor households differently from non-poor ones. This exercise provides rich information on the aggregate welfare implications of increase in commodity prices and its distributional implications (see eg. Yitzhaki and Slemrod 1991). Furthermore, this approach allows for evaluating the welfare consequence of subsidizing a wide range of commodities.

Concentration curves are generalized forms of the popular summary distributional measure known as the Lorenz curve. The distribution of expenditure on various goods across a spectrum of household characteristics renders valuable insights to policy options[2]. The concept of concentration curves was first used by Roy, et al (1959); and later Kakwani (1980) provided proof of some of the empirical properties, and Yithaki and Slemrod (1991) used them to analyze issues of marginal tax reform in a revenue-neutral setting.

As defined by Yitzhaki and Slemrod (1991: 481), "the concentration curve is a diagram similar to the Lorenz curve. On the horizontal axis, the households are ordered according to their income, while on the vertical axis describes the cumulative percentage of the total expenditure on specific commodity that is spent by the families whose incomes are less than or equal to specified income level". This definition of a concentration curve embodies the income effects; and Rao et al (1959) introduced relative concentration curves to normalize the effects of differences in purchasing power so that the effect of differences in preferences for various commodities can be neatly captured. Kakwani (1980)[3] proved important theorems pertaining to concentration curves of which the following may be reproduced for the purpose of this paper:

> i. If the income elasticity of commodity i, E_i is greater than the income elasticity of commodity j, then, the concentration curve for i lies above the concentration curve for j;
>
> ii. The concentration curve for commodity i will be above (below) the egalitarian line if, and only if E_i is less (or greater) than zero for all income level greater than zero.

[2] see also Haggablade and Younger (2003), and Younger et al, (1999) for the application of concentration curves on African data and Michael (2003) on Ethiopia. Early attempt on Ethiopia using the 1980/81 household income and consumption survey was made by Shimeles (1993)

[3] Kakwani (1980), op cit, pp165-166.

iii. The concentration curve for commodity i lies above (below) the Lorenz curve if, and only if , E_i is less (greater) than unity for all income greater than zero.

It follows therefore, that if the concentration curve of a commodity lies above the 45^0 line, it is an inferior commodity, if the concentration curve lies between the Lorenz curve and the 45^0 line, it is a necessary commodity, and if the concentration curve lies below the Lorenz curve, the commodity is luxury.

Yitzhaki and Slemrod (1991) made an insightful use of concentration curves in the realm of public economics to analyze issues of tax reform. It is rather becoming conventional in the literature to look into the structure of indirect tax systems, and the possibility of reform by maximizing social-welfare function of the community subject to a government revenue constraint[4]. This approach presupposes the knowledge of Indirect Utility Function of the community, and thus the respective demand systems in order to be of any empirical use. When one looks at the severe limitations that developing countries face to meet the data requirements of this approach, then, the search for an alternative method remains a very compelling one. In this respect, the Marginal Conditional Stochastic Dominance Rules (MCSD) developed by Yithaki and Smlerod (1991) using the concept underlying concentration curves can be considered as a significant step to that end. MCSD is defined as a state where " if the (shifted) [due to tax incidence] concentration curve of one commodity is above the (shifted) concentration curve of another commodity, then, the first commodity dominates in the sense that a small tax decrease in the first commodity accompanied by a taxi increase in the second (with revenue remaining unchanged) increases social welfare functions. In other words, if and only if concentration curves do not intersect will all additive social-welfare functions show that the tax change increases welfare. We refer to these rules as Marginal Conditional Stochastic Dominance Rules"[5]. Normally this proposition would have required the plotting of n(n-1)/2 curves, which for a sufficiently large number of commodities becomes cumbersome. The Gini-coefficient has been used to identify a class of easily computable necessary conditions for welfare dominance via the translation into income elasticities. This condition states that the income elasticity of commodity i should be lower than that of commodity j in order for commodity i to dominate commodity j in the event they are subject to an indirect tax.

We may show the above relations explicitly using the concentration ratio or index concept, which is defined as one half of the area below the 45^0 line minus the concentration curve. That is,

$$c_i = \frac{Cov[X_i, F(y)]}{m_i} \qquad (1)$$

Where, c_i is one-half of the concentration ratio, m_i is the mean expenditure on commodity i, X_i is total expenditure on commodity i, and F (y) is the cumulative distribution of income.

[4]see Atkinson (1970) for the specification of a social-welfare function, Ahmad And Stern (1984), King (1983), Cragg (1991) for empirical application and Deaton (1979, 1981) for the implication of additive preferences to optimal commodity taxes.

[5]Yitzhaki and Smelord (1991), op cit, pp 482

Therefore, the area between the concentration curve of commodity i, and the concentration curve of commodity j can be written as:

$$c_i - c_j = [\frac{b_i}{S_i} - \frac{b_j}{S_j}]G_y \qquad (2)$$

Where,

$$b_i = \frac{Cov(X_i, F(y)}{Cov[y, F(y)]}$$

$$S_i = \frac{m_i}{m_y}$$

And m_y stands for mean income or expenditure. Here the revenue implication of the policy reform is assumed to be neutral that is there is no gain or loss to the government. We may interpret b_i/S_i as the weighted average income elasticities of commodity i, the weight being here the Gini-coefficient-implied welfare function, and is a nonparametric estimator of the slope of the regression line of S_i on y.[6] Thus for commodity i to dominate commodity j the weighted income elasticity of commodity i should be larger than for commodity j. The weighting scheme employed here is the Gini-index which also implies a specific form of social-welfare function. In fact, we can further broaden the weighting scheme by using the notion of the extended Gini index , which is given by:

$$G(\alpha) = \alpha \frac{Cov[y, 1 - F(y)]^{\alpha - 1}}{m_y}$$

where, G (α) is a parameter chosen by the investigator. The Gini is a special case of G (α) where, α is 2. The higher is α the greater is the emphasis on the bottom of the income distribution.

2.2. Demand systems and household welfare

A related approach is to construct a simple demand system for the commodities of interest and use the direct link between expenditure shares and Gini coefficients to quantify the extent to which the rise in prices has impacted on the overall Gini coefficient (Kakwani, 1980). From this exercise it would be possible to tell whether the inflationary process is against the poor, distribution neutral or biased against well off households. The basic framework is that of the Stone-Greary utility function that gives the Linear Expenditure Systems, which is given by:

$$p_{it} x_{iht} = p_{it} \gamma_i + \beta_i (y_{ht} - \sum_{k=1} p_k \gamma_k) \qquad (3)$$

[6] see Yitzhaki and Slemrod (1991), op cit , pp 487.

Where p_{it} is price of commodity *i* prevailing at period *t*, x_{it} is quantity of *i* demanded by household *h* at period *t*, y_{ht} is total income of household h at period *t* and γ_i and β_i are parameters to be estimated, representing respectively the "subsistence" consumption of commodity i, and β_i is the marginal budget share. The structure of the LES is motivated by the assumption that regardless of income levels, each household allocates its income first on subsistence goods and the remaining is driven by consumption preference. Estimation of (2) is complicated by the non-linear term linking marginal budget share with the "supernumerary" income or consumption expenditure so that a numerical approximation is used in the context of non-linear system of equations. Despite some limitations, the LES provides a simple framework to capture the welfare implications of changes in relative prices. Estimation of (3) from one cross-section data can be made using additional information on consumption decision, such as savings. For instance, it is possible to establish whether inequality of income changes due to changes in relative prices. To do that we use the result in Kakwani (1980) that links Gini coefficient between two price settings on the assumption that real income among households is held constant:

$$G_t = \frac{\prod_{i=1}\left(\frac{p_i^*}{p_i}\right)^{\beta_i}\mu_0 G_0}{\left(\sum_{i=1} p_i^* \gamma_i + (\mu_t - \sum_{i=1} p_i \gamma_i)\prod_{i=1}\left(\frac{p_i^*}{p_i}\right)^{\beta_i}\right)} \quad (4)$$

Where Gt is Gini coefficient at period t with price vector P*, μ_t is mean consumption expenditure at period t and μ_0 is mean consumption expenditure in period 0. Using estimated coefficients from (3), it is possible to compute the Gini coefficient at the new set of prices and examine whether or not it leads to a worsening state. The LES is less attractive to investigate price responses though.

A better framework to estimate price elasticities for a wide range of commodities, such as *teff*, wheat, and maize would be flexible demand functional form such as the Almost Ideal Demand System (AIDS) of Deaton and Mullebauer (1980), which is given as follows:

$$w_i = \alpha_i + \sum_j \delta_{ij} \log p_j + \beta_i \log(X/P) \quad (5)$$

Where: w_i is the i^{th} budget share, p_j is prices of commodity j, δ is the price coefficient and β is the income coefficient of demand for commodity i and P is a price index that is implicitly defined by logP as in equation 2:

$$\log P = \alpha_0 + \sum_k \alpha_k \log P_k + \frac{1}{2}\sum_j \sum_k \delta_{kj} \log P_k \log P_j \quad (6)$$

Demand theory imposes structure on equation (1) by assuming that demand function is homogenous of degree 1 in prices and income, and that price responses are symmetric across commodities. These assumptions lead to the following well known restrictions:

$$\sum \alpha_i = 1,\ \sum \delta_{ij} = 0,\ \sum \beta_i = 0,\ \delta_{ij} = \delta_{ji}$$

Several approximations have been suggested in the empirical literature to consistently estimate the system of demand equations given by (1) due to complexities involved in equation (5)[7]. Following Hayes et al (1990) we use the Laspeyers index to estimate equation 2 which is given by :

$$\log P = \sum_k w_k \log P_k \tag{7}$$

A linear approximation of the relevant elasticties is also given by the following equations:

Own-price elasticities:

$$\varepsilon_{ii} = (\delta_{ii} / w_i) - (1 + \beta_i) \tag{8}$$

Cross-price elasticities:

$$\varepsilon_{ij} = \frac{\delta_{ij}}{w_i} - \frac{\beta_i}{w_i} w_j \tag{9}$$

The income elasticities

$$\eta_i = \frac{\beta_i}{w_i} + 1 \tag{10}$$

Compensated (Hicksian) elasticity of demand is given by:

$$\varepsilon^*_{ij} = \varepsilon_{ij} + w_j \eta_i$$

To address possibility of non-linearity in expenditure functions, we complement our estimation with a quadratic specification of the AIDS model that is frequently used in applied work (see for example, Banks et al, 1997 for the derivation of quadratic AIDS model; and Bopape and Myers, 2007, Tasciotti, 2007 for recent applications). The quadratic AIDS demand system is given by:

$$w_i = \alpha_i + \sum \gamma_{ij} \log p_j + \beta_i \log\left\{\frac{x}{P(p)}\right\} + \frac{\lambda}{b(p)}[\log\left\{\frac{x}{P(p)}\right\}^2] \tag{11}$$

where,

$$b(P) = \beta_0 \prod p_k$$

$$\log a(P) = a_0 + \sum \alpha_i \log p_i + \frac{1}{2}\sum_i \sum_j \gamma_{ij} \log p_i \log p_j$$

Estimates of the appropriate own and cross price elasticities, as well as, the income elasticities is reported for equation (11) as a further test of robustness of the lineraized AIDS specification.

[7] In this study we use log-linerarized version of the AIDS model especially to approximate equation (3).

In addition to non-linearities involved in the estimation of the AIDS model, there are a number of other issues such as censoring of the expenditure data due to zero observations that pose econometric challenges. Parameter estimates are controlled for selectivity bias due to censoring. The censoring issue further complicates the soundness of the theoretical restrictions outlined above, like symmetry, adding-up and homogeneity assumptions. In this study we address some of the empirical issues, such as non-linearities in expenditure functions, of estimating a consistent price and income responses by a typical household.

3. Data

The data for this study comes from two sources. The first is the panel data set collected by Addis Ababa University in collaboration with Oxford University for rural areas and University of Gothenburg for urban areas covering the period 1994-2004 in five waves. This data set contains most of the variables of interest here. The sample is 3,000 households divided equally between urban and rural areas where nearly 90% of households for rural and 60% for urban have been interviewed in all waves. In the rest of the cases, appropriate replacements have been made. Thus, the unbalanced data consists of approximately the history of 3000 households in five waves. The second data set is the 1999/2000 Household Income and Consumption Expenditure Survey (HICES) of the CSA, which covered a nationally representative sample of 17000 households with variables on income, consumption expenditure, household demographics and others useful for welfare analysis.

The panel data set originally consisted of approximately 3000 households, equally divided between rural and urban areas. The nature of the data, the sampling methods and other features are discussed in detail in Bigsten et al. (2005). It is one of the few longitudinal data sets available for Africa. The data covers households' livelihoods, including asset accumulation, labor market participation as well as health and education and other aspects of household level economic activities.

The common problem in using consumption expenditure for welfare analysis is that of measurement errors. The major source of errors could come from problems associated with accurate reporting during data collection, which in general has to do with the level of disaggregation of consumption baskets. The finer the consumption breakdown the better is the accuracy of measurement (e.g. Deaton, 1997). In our case, the consumption breakdown is very detailed, and has been held constant to allow inter-temporal comparisons. In computing consumption expenditures, we used quantities reported for each commodity by respondents and per unit prices from the nearby market. However, major food expenses among households in Ethiopia are difficult to measure, particularly in rural areas, because of problems related to measurement units, prices, and quality. The consumption period could be a week or a month depending on the nature of the food item, the household budget cycle, and consumption habits. Own-consumption is the dominant source of food consumption in rural Ethiopia, particularly with regard to vegetables, fruits, spices and stimulants like coffee and *chat.*[8] Cereals, which make up the bulk of food consumption, is increasingly obtained from markets as farmers swap high cash-value cereals such as *teff* for lower-value ones, such as maize and sorghum. In the urban setting, the bulk of consumption items are obtained from markets and measurement problems are less. To address this issue, we used carefully

[8] *Chat is a* stimulant leaf commonly used in Ethiopia and neighboring countries.

constructed conversion factors for all types of commodities that are comparable across households.

There may also be other sources of error that are systematic across households (say better educated households could be relatively better at keeping records of their regular expenses), or across survey periods (seasonality effects). So, consumption expenditure is not immune to measurement error even in the best-administered surveys.

4. Discussion of results

4.1. Incidence analysis of the welfare impact of inflation

As described in Section 2, the pattern of consumption could provide important information on how changes in the relative prices of consumption goods might affect welfare across a cross-section of households. In this section, we discuss results based on the behaviour of concentration curves for a wide range of commodities to investigate two key issues. The first examines the distributional consequence of changes in the relative price of commodities. The second issue deals with welfare implications of possible government interventions through price supports financed mainly by raising taxes on commodities or income. Concentration curves for a wide range of commodities have been constructed for rural and urban households separately. To compare results, we have used the nationally representative income and expenditure survey of the CSA, 1999, focusing on urban households

To get a sense of the profile of consumption, Table A1 and Table A2 report detail profile of consumption expenditure by consumption quintile and rounds. It can be inferred from these tables that monthly total expenditure on consumption between 1994 and 2004 is devoted largely to food and drinks, as one might expect in a poor economy such as Ethiopia. Thus, changes in prices of food and drinks relative to non-food consumption items can have significant effects on consumption growth, an issue that will be taken up in great detail below. Among food items, cereals account in rural areas about 42% and in urban areas 22% of total consumption expenditure, of which teff, wheat and maize play a major role (Table A1 and Table A2). Thus, we focus on the welfare implications of changes in the relative prices of cereals, mainly that of teff, maize and wheat and discuss some of the policy lessons that can be drawn if subsidizing one of the commodities is taken as an option to support the poor population.

We report our results separately for urban and rural households based on visual inspection of the concentration curves for several commodities taking total consumption expenditure as a point of reference. In addition, the concentration curve results can also be used to make a pair wise comparison of subsidizing a particular commodity financed through revenues raised by imposing tax on the other commodity. The comparison with the Lorenz curve (or the concentration curve of total expenditure) is useful since it can capture a uniform commodity tax, such as value-added tax, which is common in Ethiopia, as it is the sum total of consumption expenditure obtained from the market. The Lorenz curve also provides a useful reference point to classify commodities into groups of necessities, luxuries and inferior goods. We report our results first for rural and next for urban households based on the pooled panel data.

Figure 1:

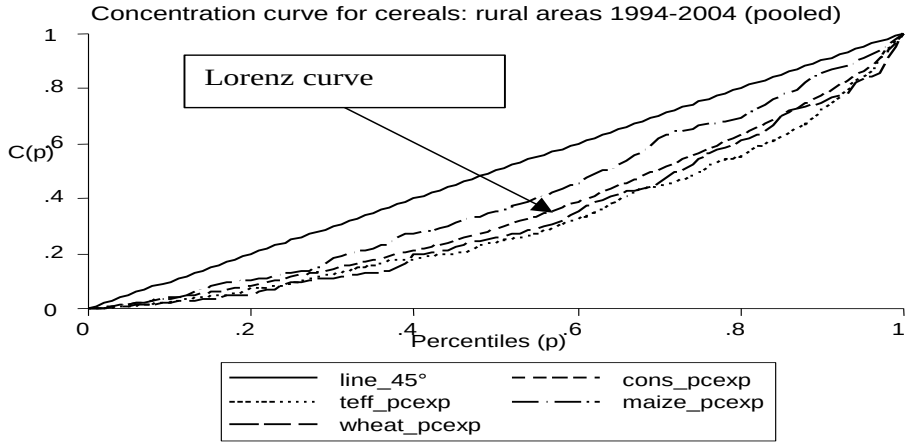


Figure 2

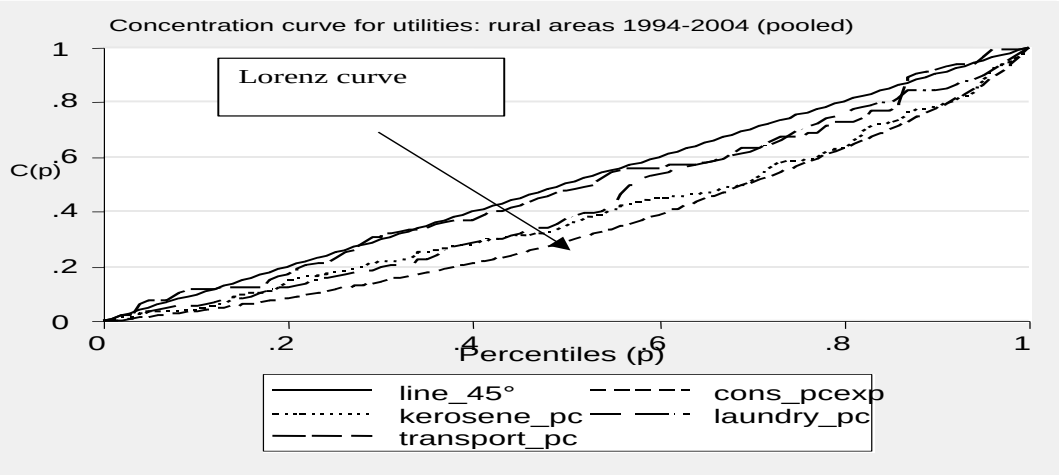
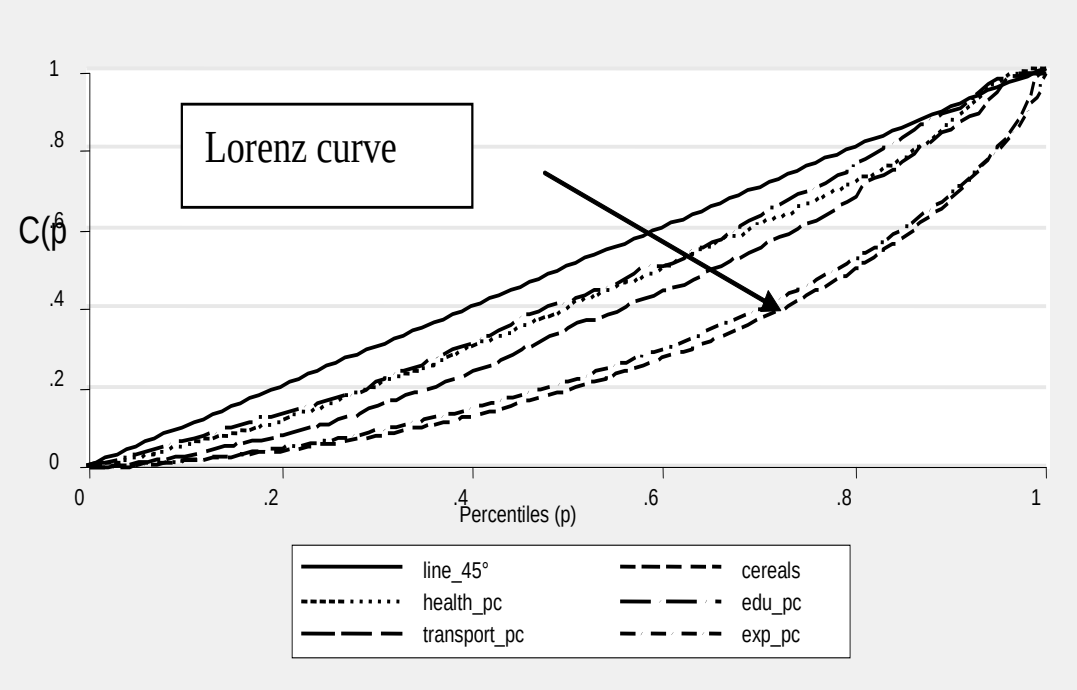


Figure 3: concentration curves for health, education expenditures in rural areas



In rural areas, the concentration curves for *teff* and wheat lie slightly above the Lorenz curve and in some quintiles the three curves cross (Figure 1). This implies that there is mixed welfare dominance for the poor and rich households (see Howe, 1993). However, for maize, consumption seems to be consistently closer to the 45^0 line suggesting that it is a super-necessity commodity. In general, price increases in *teff* and wheat adversely affect the non-poor rural population. According to the discussions in section 2, these commodities tend to be "luxuries" where their consumption increases with household income: where elasticity of demand with respect to income is greater than 1. We also considered welfare dominance for a set of commodities, which rural households generally tend to buy from the market: kerosene, laundry items (soap, soap powders, etc), and transport expenses. Our result suggests that increases in the relative prices of these commodities would particularly hurt the poor (see Figure 2).

Table 1: Summary of classification of commodities from concentration curves: rural areas

0<Elasticity of income<1 (Necessities)	η> Elasticity of income (Luxuries)	Elasticity of income <0 (Inferior goods)
Maize	*1.0 Teff*	
Transport	Wheat	
Kerosene	Charcoal	
Personal care	Meat	
Education	Pulses	
Health	Spices	
Matches, Battery, Fuel wood,	Enset (with crossing)	
Salt	Pasta (with crossing)	
Coffee	Milk	
Sugar (with crossing)		
Bread		
Cooking oil		

Source: authors' computations based on pooled panel data

Table (1) summarizes the sign and level of the income elasiticty for a group of commodities for rural households. Most consumption goods in rural areas tend to be necessities, including those that are officially provided free of charge, such as education and health. In this context, increase in the relative prices of *teff* and wheat do not have a major impact on rural poverty, though rise in the price of maize and various other non-agricultural goods and services can significantly affect the poor. This result is consistent with Derocn's (2004) analysis of terms of trade shocks on consumption growth. In this context, the widespread practice of distributing wheat freely or through food-work-programs is notable. T*eff*, while being the hallmark of Ethiopian diet, particularly in the Northern part of the country, is consumed by the relatively rich. Maize, animal products in general, spices and processed food such as pasta tend to be necessities and thus rise in the relative price of such commodities has adverse effects, or analogously an increase in tax to subsidize any of the commodities can improve welfare.

In urban areas the situation seems to be different. *Teff* and wheat tend to be necessities for all income groups, with maize lying above the 45^0 line- see Figure 3. Thus, a subsidy particularly on *teff* and wheat can improve welfare. In the case of maize a subsidy would benefit the poor disproportionately, as it is close to being an inferior commodity whose consumption declines with income. A subsidy for urban consumption of teff would have a much stronger welfare effect than a subsidy on wheat, which is currently practiced in the country. The welfare gain is also considerable since the overall share of *teff* in total cereal consumption is much higher in urban areas (Table A2).

Figure 4

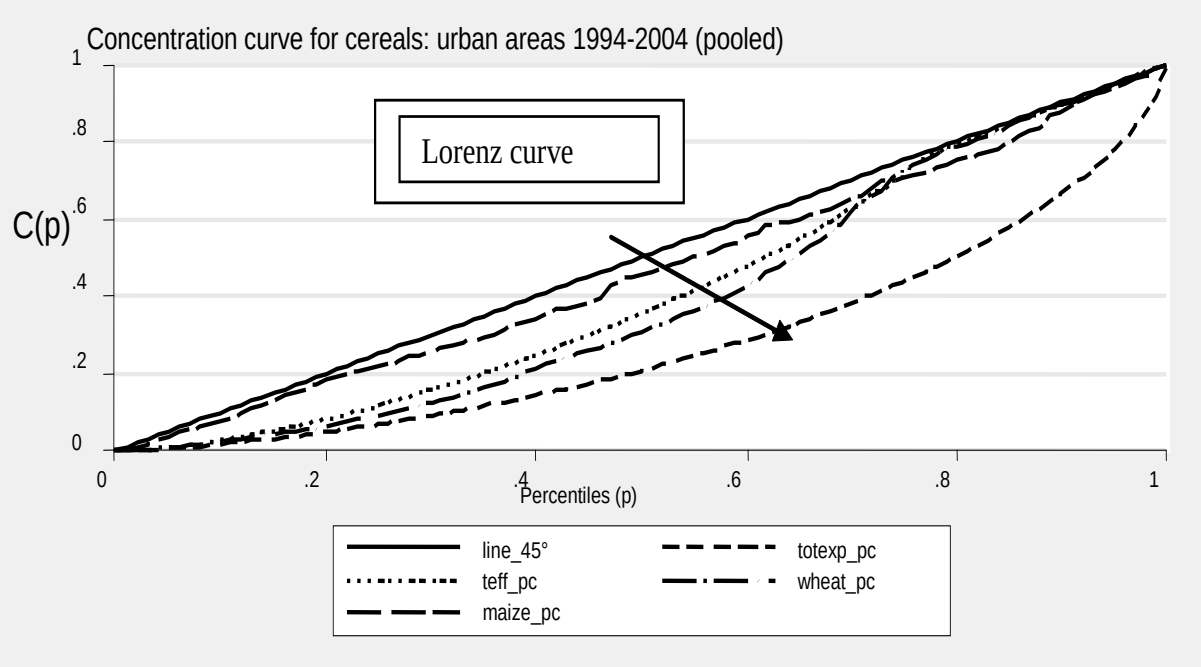


Figure 5

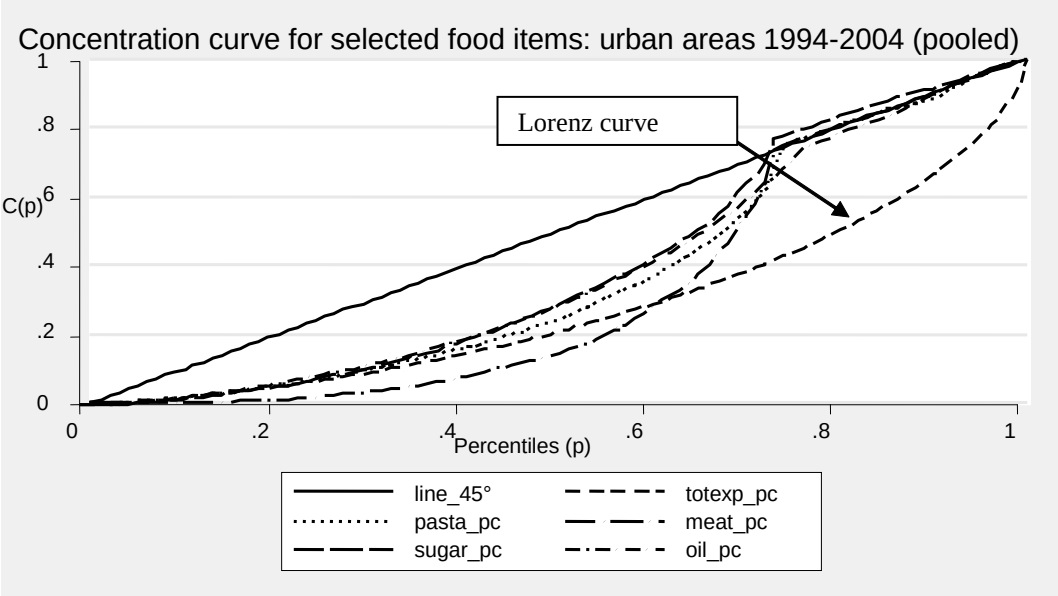
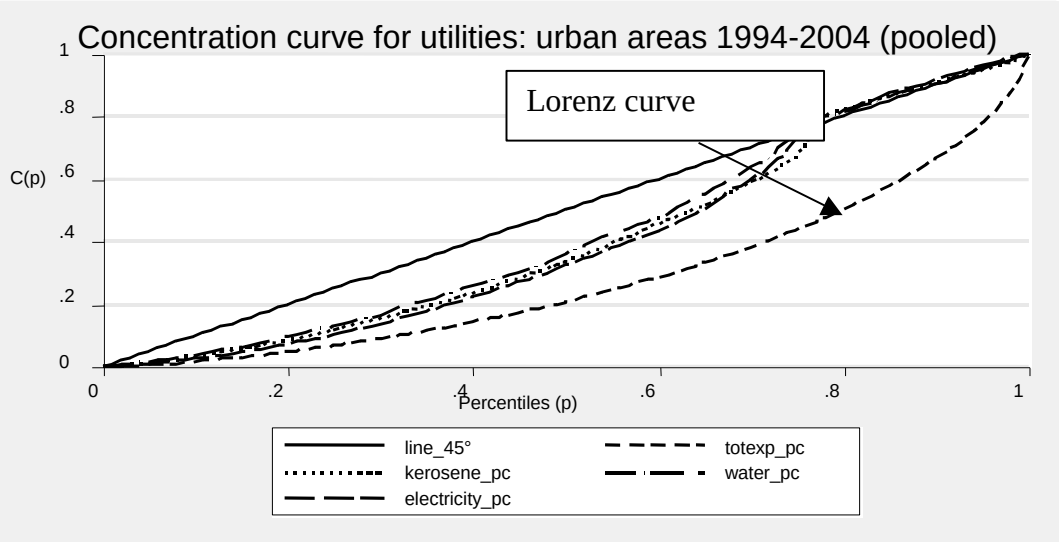


Figure 6



As depicted in Figure 4 and 5, and also Table (2), urban consumption pattern exhibits significant non-linearities in a large group of commodities, mainly at higher consumption quintiles.

Table 2: Summary of commodity classification based on concentration curves: urban areas

0<Elasticity of income<1	η> Elasticity of income (Luxuries)	Elasticity of income <0
Wheat (super necessity after 7th	Meat (cross Lorenz at 70th percentile)	
Teff	Pasta (becomes necessity at higher	Pulses (higher income)
Maize	Cooking oil	Shiro (higher income)
Sugar	Clothing (crossing Lorenz curve at	Fruits(higher income)
Kerosene, Fuel Wood, Charcoal	Transport (crossing Lorenz curve)	Transport (higher income)
Water	Fruits	Water (at higher income level)
Electricity	Drinks (crosses Lorenz curve at higher	Electricity (higher income)
Salt	Health expenditure (crosses Lorenz	Coffee, Tea (higher income)
Shiro		
Pulses		
Coffee, tea		
Personal care		
Education		

Source: authors' computations based on pooled panel data

In general, in addition to cereals, such items as sugar, kerosene, electricity, pulses, coffee, tea, education expenses and personal care fall under the category of necessities in urban areas so that an increase in the relative price of these commodities will have adverse effect more on the poor population than the non-poor.

4.2. Inflation, inequality and consumption growth in Ethiopia

4.2.1. Illustration with the Linear Expenditure System

Results from the preceding section indicated that relative prices can have different distributional impacts depending on whether a particular commodity is a necessity, luxury or inferior commodity, and that it is important to distinguish between rural and urban areas. We can extend this insight by linking the inequality of concentration curves with the overall inequality of consumption expenditure. That is, it is possible to evaluate by how much overall inequality as measured by the Gini coefficient changes due only to changes in relative prices holding household income constant. We base our computations on the normative concept of distribution of income that would maintain individual utility constant. To operationalize this, we use one of the earliest and simplest expenditure systems used in the empirical literature, the Linear Expenditure System, whose features have been sketched briefly in section 2. We estimated the coefficients of Equation (2) using savings to identify all the parameters (see Lluch, 1974 and Lluch and Powell, 1975).

The data used for this particular purpose is the urban Household Income and Consumption Expenditure Survey collected by CSA in 1999/2000 since it has a wider coverage and is nationally representative. We used single equation OLS to estimate first the parameters of each group of consumption items, and used savings as a residual "consumption good" to identify $\sum_{i=1} p_i \gamma_i$. Once the total subsistence expenditure is identified, then, we can use equation (4) to compute the "true-cost of living index" as well as the magnitude of changes in the Gini coefficient resulting from relative price changes. We used 9 commodity groupings, including savings. The saving information includes only *Iqub*[9] contributions and bank deposits at the time of the survey.

[9] Informal saving groups widely practiced in Ethiopia across all social groups.

Table 3: Robust Estimates of the parameters of the Extended Linear Expenditure System: urban areas, 1999/2000

Items	$p_i\gamma_i$ (Subsistence consumption expenditure, Birr)	β_i	Per capita consumption expenditure (Birr)	Estimated elasticity of income
Cereals and Drinks	476	0.43	795	
	(6.68)**	(9.52)**		1.03
Household Items	-43	0.08	144	
	(-2.97)**	(5.0)**		0.71
Clothing	-33.0	0.12	204	
	(-2.12)**	(12.7)**		1.07
Transport	-19	0.03	30	
	(-6.19)**	(2.05)**		1.02
Personal Care	-34	0.04	59	
	(-3.0)**	(4.05)**		1.9
Recreation	-29.9	.05	96	
	(-5.8)**	(6.0)**		1.3
Others	33.8	0.19	512	
	(0.71)	(5.04)**		1.0
Savings	0.0	0.06	51	…

*** significant at 1%, terms in brackets are t-tratios.*

Source: authors' computations based on HICES data set

The other consumption groups and the resulting estimates of the parameters of the Extended Linear Expenditure System are given in Table (3). The second column of Table (3) provides the minimum expenditure needed in each category for subsistence for a typical household. Negative values indicate the commodity in question may not be that "necessary" for subsistence (see for example Deaton and Mullebauer, 1980). In our case, only two commodity groupings, that is Food and Drinks and Others' categories led to positive minimum consumption expenditure. For savings, the subsistence amount is assumed to be zero. The total minimum amount needed for subsistence according to the ELES estimates is around Birr 510 per person, which can be computed by adding the second column of Table (4) with the negative values set at zero. The third column reports marginal budget shares for each group of commodities. Based on these estimates, it is possible to work out the cross and own price responses for these commodities, but, since the ELES is highly restrictive in generating price responses, we defer reporting the results. But, the last column of Table (3) reports the income elasticity values. Our interest here is to examine how changes in relative prices between 2000 and 2006 affected income distribution and thus ultimately poverty. The results are intuitive in that Transport expenditure and Personal Care belong to the "luxury" category. Food and Drinks as well as Clothing have a unitary elasticity of demand suggesting that both lie on the Lorenz curve in terms of distribution. So, a uniform increase in the price of Food and Drinks or Clothing is equivalent to a proportional increase in income tax.

Table 4: Welfare implications of relative price changes based on parameters of ELES: urban Ethiopia

Year	National price index	$\prod_{i}^{9}\left(\frac{p_{it}}{p_{i0}}\right)^{\beta_i}$	True cost of living index	Gini coefficient
2000	100	1.000	1.000	0.330
2001	100.8	1.004	1.005	0.340
2002	96	0.998	0.988	0.344
2003	110.5	1.099	1.101	0.340
2004	120	1.181	1.186	0.339
2005	128.2	1.344	1.327	0.344
2006	143.9	1.606	1.561	0.350

Source: authors' computations based on HICES data.

Table (4) reports measures of changes in the True Cost of Living Index10 as well as simulated changes in the Gini coefficient due to inflationary processes. The second column of Table (5) is the general price index obtained from the CSA. The third column provides the weights in the changes in the relative index that is needed to estimate equation (4). The fourth column provides the change in the True Cost of Living that takes fully into account consumption behaviour. The last column is the Gini coefficient corresponding to each period's price regime with the assumption that nominal income remained constant. Important points to note from this result are that first the True Cost of Living Index exceeds the general price index by about 12% between 2000 and 2006. This means that the degree of welfare loss due to inflation is much higher than implied by the general price index: that is households on the average would need an additional 12% increase in expenditure to remain as well off as they were in 2000, apart from adjustments they would need to make for the rise in the general price index. Secondly, income distribution would worsen by about 2-percentage point between 2000 and 2006 due only to inflationary processes. In effect, this means that inflation tends to erode more the welfare base of the poor than the non-poor in urban areas. If the trend of rising income inequality reported during the last decade (1994-2004) has prevailed in the last two years also in urban areas (see (Bigsten and Shimeles, 2007), then, one would expect a further worsening of poverty due to the inflationary process and changes in real prices. The adverse effect of changes in prices on the poor implied here did not take into account the possible offsetting increase in real per-capita income during the period. Still, the current change in overall prices in urban areas tends to affect adversely more the poor than the non-poor population.

[10] The True Cost of Living Index is based on the total expenditure that a consumer needs to maintain the same level of utility between two price regimes.

4.2.2. Consumption growth and price shocks

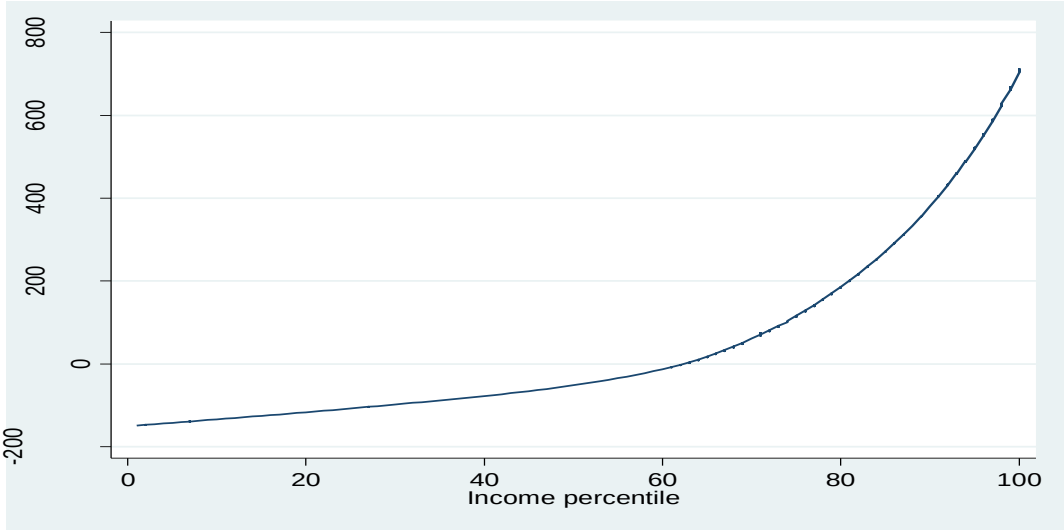
The above framework has a limitation in capturing welfare changes since it abstracts from the simultaneous changes in relative wages, and in the rural context, incomes in the wake of relative price changes. Thus, we may not be able to get the full impact of changes in prices on household welfare. An economy wide model might be of help, but its data requirements and the structure it imposes on the behaviour of economic agents, markets and institutions makes it less attractive in the Ethiopian context. Availability of panel data at the household level provides a rare opportunity to examine the price responses of consumption as in Dercon (2004). This is a dynamic model where consumption growth for each household is allowed to respond to price shocks after controlling for the effects of changes in other key determinants of consumption. The model specified is:

$$C_{it} = \alpha + \gamma C_{it-1} + \beta_i P_{it} + \sum_k \delta_k K_{ikt} + \sum_s \theta_s S_{sit} + u_i + \varepsilon_{it} \qquad (11)$$

Where C_{it} is consumption expenditure by the ith household in period *t*, P_{it} is relative price (in this case the terms of trade for agriculture), K_{ikt} represents household ith's k endowment (land, education, oxen, etc..) and S_{sit} captures other covariate or idiosyncratic shocks, such as drought, illness, etc. Equation (11) provides a convenient framework to quantify the effect of relative price shocks on the consumption growth of a typical household after controlling for the contribution of other determinants of income. We estimate (11) by a linear transformation through first-differencing (to identify u_i) for households in rural and urban areas covering the period 1994-2004 to decompose the change in consumption into components of shocks and changes in human and physical capital.

Nearly all households in our sample in rural areas are farmers so that a rise in food prices, particularly cereals, should be good for them as producers, but, bad as net buyers from markets. For net sellers, the benefit is both from the real income side (better revenue from crop sales) and improved utility from consumption of a commodity whose market price is rising fast. The common method of identifying net-buyers and net-sellers is to take the difference between reported crop sales and total crop output. Households with a net output position are net-sellers. For such households, a rise in the price of cereals or grain brings welfare gain through two channels, increase in household income as producers as well as increase in utility as consumers depending on their preference for cereals. For net buyers, the net welfare effect could be positive or negative, again depending on the strength of demand responses to changes in income and prices. Thus, the welfare impact on rural households of rising food prices is an empirical question. In Ethiopia, average income level is so low that very few households have a surplus in their monthly household budget (Figure 7) putting a majority vulnerable to price shocks.

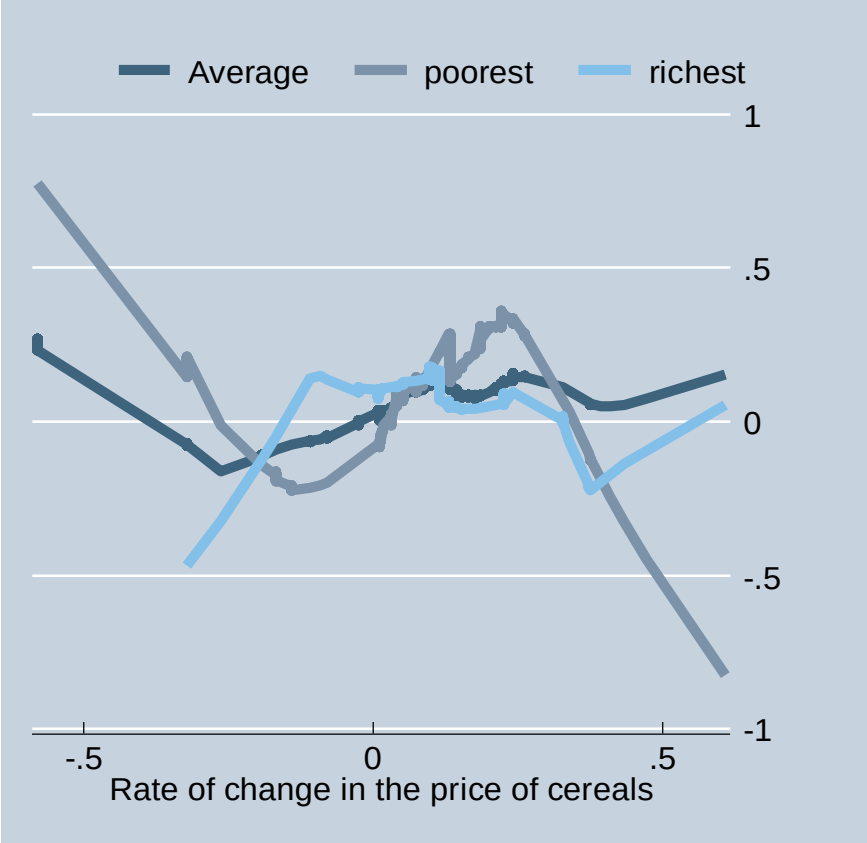
Figure 7: household level budget deficit in rural areas: mean 1994-2004



Source: authors' computations based on panel data

In a majority of cases, farmers in Ethiopia engage in the grain market in a complex way. Most produce high value crops (such as *teff*) for the market to buy cheaper ones for consumption, such as maize or barley. In other times, there is a tendency of switching to export or cash crops (mainly *chat*) in response to relative price changes. Thus, the criterion used to identify net sellers and buyers misses a very important dynamics in the choice of crops for production and consumption. To partially address this, we instead use size of land-holding as a potential indicator of net-crop position. A cursory look at the response of real consumption growth to price shocks could be seen in Figure 8 for different household groupings: land-rich, land-poor and the average household. The non-parametric estimate suggests that more or less land-rich households tend to experience real growth in consumption following rising food prices (weighted average prices of four types of cereals-*teff*, wheat, maize and barley), while for the poorest consumption seems to have deteriorated significantly.

Figure 8: real consumption growth and relative price changes by wealth status in rural Ethiopia



Such divergent outcomes beg further investigation. The order of magnitude involved can be obtained by estimating equation (11) for each category of households. We allow for the persistence of shocks so that we estimate a dynamic consumption model not only as a function of growth of endowments and shocks, we also include lagged consumption changes as additional explanatory variable.

Table (5) reports estimate of the parameters of equation (11) using Generalized Method of Moments to deal with issues of endogenity as a result of the lagged consumption on the right hand side of equation 11 (see for example Bond, 2002). We can infer from Table 5 that for the average or typical farm household, rise in the price of cereals could lead to deterioration in the rate of growth of consumption expenditure. A 1% increase in the rate of growth of price of cereals could dampen the rate of growth of consumption by nearly 0.9%. On the other hand, a rise in the rate of growth in the agricultural terms of trade leads to growth acceleration in consumption.

Table 5:Real consumption growth and its determinants in rural Ethiopia: 1994-2004

	Coef.	z-values
Rate of growth in real per capita consumption($_{t-1}$)	0.058241	1.54
Rate of growth in agricultural terms of trade($_{t-1}$)	0.296366	8.59
Rate of growth in the price of cereals ($_{t-1}$).	**-0.94347**	**-4.21**
Rate of growth in crop sale($_{t-1}$)	0.056706	2.32
Rate of growth in hhsize($_{t-1}$)	-0.76862	-8.86
Rate of growth in oxen ownership ($_{t-1}$)	0.126832	5.36
Rate of growth in land size($_{t-1}$)	0.029682	1.13
1997 dummy	0.017889	0.37
2004 dummy	-0.27786	-3.09
Village3*terms of trade	-1.03093	-2.8
Village4*terms of trade	0.031806	0.19
Village5*terms of trade	-0.06684	-0.28
Village6*terms of trade	-0.34245	-2.13
Village8*terms of trade	-0.77883	-4.22
Village9*terms of trade	0.302724	2.44
Village10*terms of trade	1.004457	3.01
_cons	0.074466	1.89
Sargan's overidentification test	0.2806	
Second order autocorrelation of eror terms		

**significant at 1% level of significance

2.0 Source: authors' computations based on the panel data

For the land-rich households, rising prices tend to contribute significantly to consumption growth (Table 6). Both rise in real and nominal prices of agricultural prices contribute to consumption growth for the land rich households suggesting that relatively wealthy farmers could benefit from price reforms that favor the agricultural sector.

Table 6: Real consumption growth and its determinants in rural Ethiopia for land rich households: 1994-2004

Rate of growth in real per capita consumption($_{t-1}$)	0.02413	0.45
Rate of growth in agricultural terms of trade($_{t-1}$)	0.424876	2.14
Rate of growth in the price of cereals ($_{t-1}$)	**1.251573**	**2.22**
Rate of growth in interaction terms b/n cropsales and cereal prices($_{t-1}$)	-0.05496	-0.9
Rate of growth in crop sale($_{t-1}$)	0.030258	1.23
Rate of growth in hhsize($_{t-1}$)	-0.6424	-5.24
Rate of growth in oxen ownership ($_{t-1}$)	0.073083	2.16
Rate of growth in land size($_{t-1}$)	0.019055	0.32
1997 dummy	0.164506	1.32
2004 dummy	0.478569	2.63
village4*tor	-0.40467	-1.01
village5*tor	-0.34491	-0.59
village6*tor	-1.20123	-2.34
village7*tor	-0.62834	-1.09
village 8* tor	0.817733	1.04
village9*tor	-0.71678	-1.46
village 10*tor	-2.02922	-1.8
_constant	-0.07815	-1.09
Sargan's overidentification test	0.3427	
Second order autocorrelation of eror terms		

The picture for land-poor households is rather bleak. They do not benefit from real price increases and actually lose significantly from increase in the rate of price of cereals. A 1% rise in the rate of growth of cereal prices could lead to 1.34% decline in real consumption growth. To keep per capita consumption levels unchanged, poor farm households need much innovation to do to raise farm productivity and identify other sources of income, such as non-farm activities or employment with other farmers.

Table 7: Real consumption growth and its determinants in rural Ethiopia for land poor households: 1994-2004

Rate of growth in real per capita consumption($_{t-1}$)	0.027867	0.42
Rate of growth in agricultural terms of trade($_{t-1}$)	0.00334	0.06
Rate of growth in the price of cereals ($_{t-1}$)	**-1.34007**	**-1.97**
Rate of growth in interaction terms b/n cropsales and cereal prices($_{t-1}$)	-0.21141	-1.89
Rate of growth in crop sale($_{t-1}$)	0.062633	1.32
Rate of growth in hhsize($_{t-1}$)	-0.83772	-5.69
Rate of growth in oxen ownership ($_{t-1}$)	0.102567	2.3
Rate of growth in land size($_{t-1}$)	-0.04482	-0.9
dummy 1997	0.667	4.67
dummy 2004	0.234161	0.95
village2*tor	0.181343	0.87
village3*tor	-1.04528	-1.46
village 5*tor	3.636928	0.94
village6*tor	-0.93955	-2.66
village7*tor	-0.32782	-0.63
village8*tor	-1.38326	-1.89
village10*tor	2.126619	2.14
_cons |	0.286125	4.08
Sargan's overidentification test	0.2806	
Second order autocorrelation of eror terms		

The situation is straight forward for households in urban areas. Rise in the relative price of food would decrease consumption expenditure significantly (Figure 9). During the decade under investigation, real consumption per adult equivalent declined on the average by approximately 1% in urban areas, while the real price of food in comparison to non-food items increased by about 1.8% per annum, leading to an approximately 2.9% decline in consumption (Table 8). So, over the decade, close to 30% of the decline in real consumption growth could be attributed to rising food prices. The trend since 2004 in the rise of food prices against non-food items is phenomenal. It is thus possible to imagine the impoverishment of households in urban areas.

Figure 9: Non-parametric estimate of effect of relative price on consumption growth in urban areas: 1994-2004

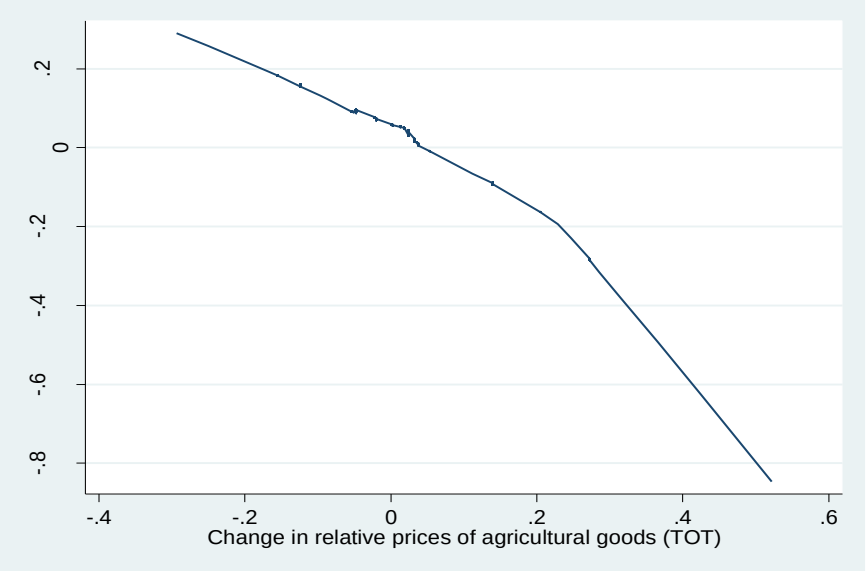


Table 8: GMM estimate of consumption growth in rural Ethiopia: 1994-2004

Dependent variable: consumption growth in current period	Coefficient	z-ratio
Growth in one period lagged consumption	.2847435	3.49**
Growth in two period lagged consumption	.1942577	3.44**
Change in agricultural terms of trade	-1.657991	-5.47**
Change in household size	-.9795375	-10.29**
Change in real household asset ownership	.0873953	3.46**
Lagged period dummy	-.1339127	-1.54
Constant	.3152891	3.39
Sargan's overidentification test (P-value)		0.2179

**significant at 1% level of significance

4.3. Own and cross-price elasticities for selected commodities using AIDS model

As part of the exercise to evaluate the welfare implications of changes in relative prices, in this section we report demand responses to changes in prices and income. Estimates of price and income elasticities can be useful for multi-market model analysis to examine the effects of price changes. Our estimates are based on the AIDS model, which has several attractive features, compared to say LES, which we estimated to illustrate welfare impacts of inflation. The AIDS model does not impose a structure on the type of utility function so long as it meets certain general criterion. Also linear Engel curves are not imposed (see section 3 for details of model specification and some estimation issues).

We report here four specifications of the AIDS model with and without controlling for a set of socio-economic characteristics of the household such as demographic profile, region of residence, education of the head, sex of the head and others to get a robust elasticity estimates. In all cases, restrictions required by choice theory are imposed on the coefficients. These are the additive restriction, which states that all coefficients of the price variables add up to unity, that the sum of marginal budget shares should add up to zero and symmetry of the price responses which is related mainly with the positive-definiteness of the second order condition for maximum (or the Slutsky matrix).

Table 9: Price and income elasticities for rural areas using cereals as total consumption expenditure: restricted AIDS model with socio-economic control variables

	Price of Teff	Price Wheat	Price of Maize	Expenditure elasticity
Teff	-1.2527	-0.1620	0.0263	1.3887
Wheat	-0.0179	-2.0862	1.2939	0.8114
Maize	0.2133	0.8815	-1.8260	0.8065

3.0 Source: authors' computations based on the panel data

Table 10: Price and income elasticities for rural areas using total consumption expenditure: restricted AIDS model with socio-economic control variables

	Price of Teff	Price Wheat	Price of Maize	Price of Others	Expenditure
Teff	**-0.0205**	-1.8442	-1.0267	1.0020	1.7559
Wheat	-2.7876	**-3.6329**	2.3150	2.5566	1.5811
Maize	-1.5341	2.5285	**1.4834**	-3.7070	1.1606
Others	0.5276	0.5920	-0.6005	**-1.1659**	0.6425

4.0 Source: authors' computations based on the panel data

Table 11: Price and income elasticities for rural areas using Quadratic AIDS model

	Price of Teff	Price Wheat	Price of Maize	Price of Others	Expenditure
Teff	**-2.19037**	-0.82538	-0.83390	-0.92011	1.81868
Wheat	-0.82538	**-3.07998**	-0.14283	-0.93583	1.84114
Maize	-1.09564	-0.21623	**-1.13090**	-1.25064	1.55124
Others	-1.13672	-0.99679	-2.63932	**-0.79126**	0.57190

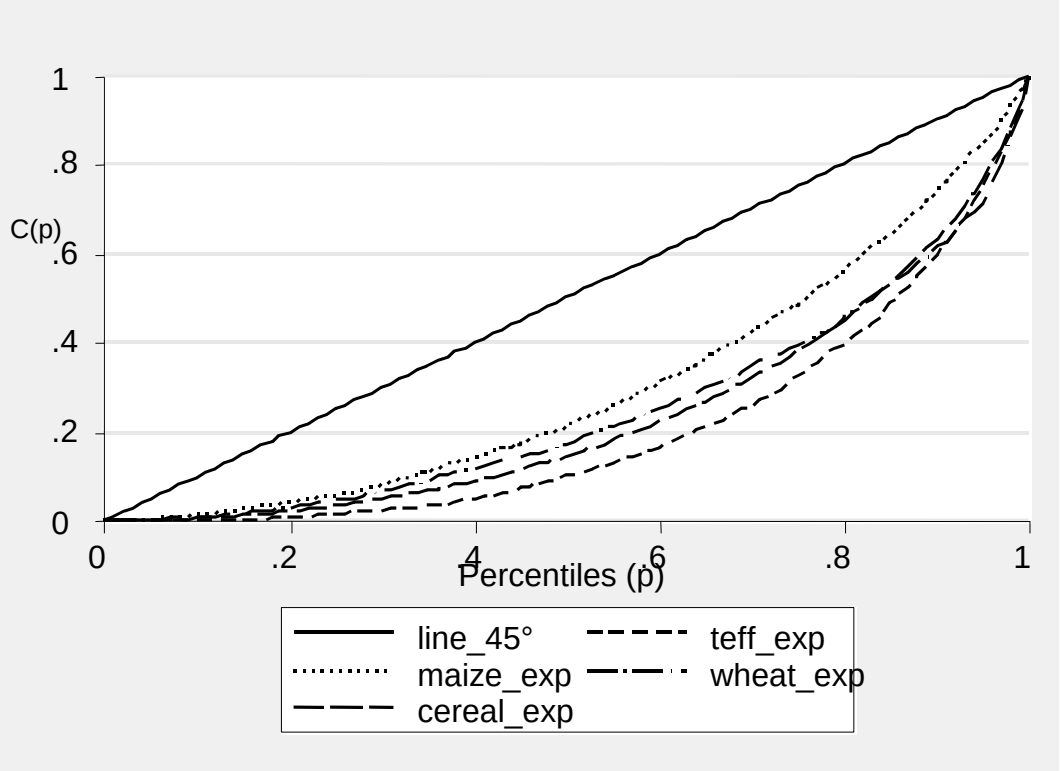
5.0 Source: authors' computations based on the panel data

The system of equations underlying the AIDS model has a non-linear component due to the specification of the general price given in equation (7). To simplify the complications involved we use instead the Lasperyes price index given by equation (8) to approximate the general price index (see also Molina, 1994). By thus re-specifying equation (7) as in (8), we make a linear approximation to the AIDS model. To allow for the possibility of non-linearity

of the Engle function, we used the Quadratic AIDS model fully specified in equation (11). The system of equations is estimated by 3Stage Least Square method with the above restrictions imposed on the coefficients. In addition, to allow for inter-temporal and spatial comparison, we used real prices instead of nominal prices. For this reason, we deflated each price variable with a weighted price index using 1994 as a reference period, and Harsaw, one of our rural sites as reference. Thus, all prices are adjusted for spatial as well as temporal variations.

Table (9) reports estimated elasticity using expenditure on cereals as a proxy for total household income. This is essentially based on the assumption of two-stage budgeting and separability of utility function where the focus is only on the response of demand to changes in the prices of *teff*, wheat and maize given the total income devoted in the consumption of cereals. Decisions on the consumption of other goods are made independent of consumption decision on cereals. Accordingly *teff* is a luxury good while that of maize and wheat are necessities. This is further confirmed by the non-parametric estimate as shown in Figure 10.

Figure 10: Concentration curves for *teff*, wheat and maize using cereal expenditure as reference



But, price responses tend to be stronger for the three types of cereals considered in our analysis. Once we broaden our commodity groupings, the price and income response change significantly. Table 10 for instance reports that *teff*, wheat, and maize become luxury items once we allow choices for other goods also. Own price elasticities tend to remain stable except for *teff*, which has declined markedly. Alternative commodity groupings are also reported in Table A3 and A4 where we have taken a larger set of choices for households. In this case, income elaticities for *teff* and wheat remained luxuries, and maize remained a necessity. Allowing for the non-linearity of Engel function does not change the degree of price or income responses of demand (Table 10). In fact, price and income responses tended to be much stronger than the linearized version of the AIDs model in rural areas. The overall trend regarding price responses is that the three typical cereals tend to be price elastic in many specifications, with evidence of wheat being a close substitute for *teff*, especially in cereal growing areas. This pattern is consistent across most of the alternative specifications, and thus appears to be robust.

Table 12: Gross own and cross-price elasticities and expenditure elasticity of demand: narrow classification(cereal growing rural areas)

	Price of teff	Price of wheat	Price of maize	Expenditure
Teff	-1.43	0.83	-0.55	1.15
Wheat	0.28	-3.14	1.35	0.89
Maize	4.25	4.56	1.95	0.88

6.0 Source: authors' computations based on the panel data

Table 13:Gross own and cross-price elasticities and expenditure elasticity of demand: narrow classification(Enset growing areas)

	Price of teff	Price of wheat	Price of maize	Expenditure
Teff	**-1.06**	-1.02	-2.80	1.79
Wheat	0.18	**-0.28**	0.04	0.64
Maize	2.00	1.93	**2.17**	0.99

7.0 Source: authors' computations based on the panel data

Regarding urban areas *teff* and wheat tend to have an elasticity closer to unity when allocation is restricted to cereals alone, suggesting some degree of being necessity and there is strong own price response, which is understandable given the high degree of substitutability indicated among these crops (Table 14). Maize tends to be an inferior commodity (negative income elasticity or very low income elasticity) with relatively high own-price responses. We also note that maize tends to be a good substitute for *teff* and wheat in urban areas, perhaps explaining part of the high own-price elasticity (Table 15).

Table 14: Price and income elasticities for urban areas using cereals as total consumption expenditure: restricted linearized AIDS model with socio-economic control variables

	Price of Teff	Price Wheat	Price of Maize	Expenditure
Teff	-1.4645	0.1341	0.2176	1.1133
Wheat	1.1176	-1.1514	-0.7181	0.7479
Maize	4.3915	-1.8463	-2.5570	-0.1215

8.0 Source: authors' computations based on the panel data

Table 15: Price and income elasticities for urban areas using Quadratic specification of the restricted AIDS Model

	Price of Teff	Price Wheat	Price of Maize	Expenditure
Teff	**-0.94465**	-0.97383	0.64818	0.77179
Wheat	-0.97383	**-0.52042**	-2.26954	0.82815
Maize	-0.81174	-1.50334	**-3.57145**	0.36254

9.0 Source: authors' computations based on the panel data

When we use broader commodity classifications with the Other group including total consumption expenditure, less expenditure on *teff*, wheat and maize, the price and income responses decline significantly. *Teff*, wheat and maize now become necessities for urban households, which also remained unchanged as shown in Table A5 and Table A6. In addition, allowing non-linearity in the Engel curve significantly changes the price and income responses as shown in Table (16). Except for maize, the other cereals are now price and income inelastic. This indicates the persistence of taste in affecting demand for *teff* and wheat in urban areas and is also consistent with the non-parametric estimate discussed in the preceding section.

Table 16: Price and income elasticities for urban areas using total consumption expenditure: restricted AIDS model with socio-economic control variables

	Price of Teff	Price Wheat	Price of Maize	Price of Others	Expenditure
Teff	-0.5961	-0.0535	0.1107	-1.0381	0.9405
Wheat	-0.3266	-0.9996	-0.5682	0.9766	0.9186
Maize	2.1664	-1.3454	-2.7679	1.4143	0.5348
Others	-0.2959	0.0854	0.0441	-0.8952	1.0618

10.0 Source: authors' computations based on the panel data

5. Summary and conclusions

This study investigated the welfare implications of changes in relative prices in rural and urban Ethiopia mainly based on a panel data of 3,000 households collected during 1994-2004. This data was generated by the Department of Economics, Addis Ababa University, in collaboration with University of Oxford and Gothenburg University. In addition, the 1999/2000 Household Income and Consumption Expenditure survey collected by the Central Statistical Authority was also used to complement some of the analysis.

We found that changes in the prices of such consumption goods as *teff*, wheat and maize could adversely affect the people at the higher income quintile in rural areas, while in urban areas increased prices tend to affect those in the lower income quintile based on their consumption patterns. Pair-wise comparisons of welfare dominance showed that most consumption items tended to be necessities in rural areas and increases in the price of transport, kerosene, coffee, cooking oil, and other consumption items would lead to the worsening of welfare of poor households. This means that for example commodity specific tax is not justified on welfare grounds. In urban areas, the choices for using specific commodity taxes to finance subsidy on cereals are broader. Taxes on such wide range of commodities, *such* as animal products (meat, milk, etc..), cooking oil, drinks, transport services, utilities such as electricity, imported items to finance targeted subsidies on cereals could potentially lead to higher welfare or less poverty. The current government program intended to subsidize wheat through taxes on a wide range of commodities could be welfare enhancing in urban areas.

Overall, the recent hike in relative prices was found to increase the true cost of living by an additional 12% in urban areas, suggesting the severity of the welfare loss associated with inflation. In addition, if unchecked, inflation in urban Ethiopia could worsen income inequality significantly. It is estimated that between 2000 and 2006, the Gini coefficient might have increased by 6.1% due to changes in relative prices, that were adverse to the urban the poor. This result coupled with the recent trend of rising inequality in urban areas (see for example Bigsten and Shimeles, 2006), suggests that gains in average per captia growth can be eroded easily leading to growing impoverishment of households in urban areas. The impact of rise in the real prices of cereals on the welfare of rural households is more complex. To partially address this issue, we specified a dynamic model of consumption growth, which is a function of changes in household endowments and price shocks. The model was estimated for three distinct groups which potentially could address the net-purchasing position of a household. These groups are: land-rich, land-poor and a typical farm household. Our result imply that real growth in consumption is positive for land-rich households while it remains negative for a typical farm household and deteriorates significantly for the land-poor households. Certainly such significantly diverse outcome would have a negative consequence on the pace of poverty reduction in rural areas.

Finally the study estimated a fully specified AIDS demand system for rural and urban areas to generate effects of price and income changes on demand, particularly that of cereals. Using pooled panel data, the estimates generally confirmed with what demand theory predicted. Own price elasticities tended to vary significantly with different specifications in rural areas. Overall, the evidence suggests that demand for *teff*, maize and wheat tends to be elastic, with evidence of substitutability, especially between *teff* and wheat. In urban areas, all three types of cereals tended to be necessities, and relatively price inelastic.

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Table A1: Expenditure share by round and income quintile for rural areas of Ethiopia (1994-2004)… cont'd (next page)

Items	1994						2004					
	All	Income Quintile Groups					All	Quintile Groups				
		Quint 1	Quint 2	Quint 3	Quint 4	Quint 5		Quint 1	Quint 2	Quint 3	Quint 4	Quint 5
Cereals	0.448	0.472	0.443	0.4159	0.4315	0.4926	0.4377	0.4399	0.3945	0.4256	0.4972	0.4989
Teff	0.1	0.08	0.082	0.0899	0.0857	0.1426	0.0856	0.0462	0.0577	0.0847	0.1342	0.149
Wheat	0.044	0.045	0.032	0.0436	0.0501	0.0667	0.0534	0.0276	0.0396	0.0654	0.0816	0.0698
Maize	0.096	0.08	0.094	0.1309	0.1105	0.1177	0.0773	0.0719	0.0861	0.0753	0.0863	0.0739
Sorghum	0.011	0.006	0.01	0.0106	0.016	0.0218	0.0219	0.0204	0.0313	0.0169	0.0273	0.0265
Millet	8E-04	0.001	1E-03	0	0.0005	0.001	0.0011	0	0.0015	0.0011	0.0011	0.0034
Animal Products	0.07	0.055	0.066	0.0852	0.0854	0.0915	0.0547	0.0289	0.0546	0.069	0.0517	0.0747
Pulses	0.066	0.069	0.07	0.0769	0.0672	0.0492	0.0903	0.0576	0.1023	0.1034	0.0942	0.0932
Drinks and Stimulants	0.017	0.015	0.02	0.0177	0.0152	0.0196	0.0192	0.0107	0.023	0.0197	0.0248	0.0211
Enset	5E-04	0.001	5E-04	0.0004	0.0002	0	0.0011	0.0006	0.0015	0.0014	0.001	0.0008
Energy	0.025	0.026	0.03	0.0218	0.0188	0.0235	0.0336	0.0417	0.0386	0.0315	0.0268	0.0285
Personal Care	0.024	0.021	0.028	0.0261	0.0203	0.0259	0.03	0.0391	0.0331	0.0297	0.0261	0.0252
Clothes	0.106	0.102	0.095	0.1173	0.1208	0.1318	0.1094	0.0951	0.101	0.1214	0.1122	0.1315
Transport	0.015	0.011	0.009	0.0109	0.0185	0.0292	0.0166	0.0094	0.0124	0.0184	0.0207	0.0258
Health	0.019	0.013	0.017	0.0202	0.0257	0.0222	0.0206	0.0197	0.0232	0.0221	0.0203	0.0212
Education	0.005	0.003	0.006	0.0072	0.0062	0.0086	0.0111	0.0087	0.0114	0.013	0.0105	0.0138
Total Food	0.76	0.767	0.775	0.7627	0.7656	0.7348	0.6982	0.7188	0.7254	0.7264	0.7528	0.7234
Total Non-food	0.219	0.197	0.215	0.2305	0.2266	0.2652	0.2499	0.2443	0.2539	0.2597	0.2373	0.2707

Cont'd…. (Previous page) **Table A1**: Expenditure share by round and income quintile for rural areas of Ethiopia (1994-2004)

Items	**1994-2004**					
	All	Quintile Groups				
		Quint 1	Quint 2	Quint 3	Quint 4	Quint 5
Cereals	0.4379	0.463	0.4316	0.4131	0.4627	0.4635
Teff	0.0933	0.0754	0.0686	0.0815	0.1026	0.1295
Wheat	0.047	0.0311	0.0381	0.0505	0.0637	0.0652
Maize	0.086	0.0785	0.099	0.1018	0.0935	0.08
Sorghum	0.017	0.0176	0.0205	0.0164	0.0176	0.0141
Millet	0.0018	0.0007	0.0016	0.0021	0.0028	0.0023
Animal Products	0.0506	0.033	0.0484	0.0545	0.0517	0.0674
Pulses	0.0783	0.0666	0.0806	0.0863	0.0843	0.0805
Drinks and stimulants	0.0192	0.0132	0.0188	0.0199	0.0225	0.0244
Enset	0.0006	0.0007	0.0009	0.0008	0.0005	0.0004
Energy	0.0239	0.0235	0.0282	0.0266	0.0227	0.0229
Personal Care	0.0281	0.0279	0.0286	0.03	0.0276	0.0289
Clothes	0.107	0.0915	0.0934	0.1095	0.1204	0.1268
Transport	0.0154	0.0083	0.01	0.0149	0.0192	0.0256
Health	0.0183	0.0132	0.0188	0.0216	0.0187	0.0204
Education	0.007	0.0047	0.0068	0.0077	0.0082	0.0092
Total Food	0.7385	0.7669	0.7624	0.7426	0.7311	0.7169
Total Nonfood	0.2278	0.1942	0.2173	0.2361	0.2408	0.2624

Table A2: Expenditure share by round and income quintile: Urban Areas

Items	**1994**						**2004**						**Pooled: 1994-2004**					
	All	Quint 1	Quint 2	Quint 3	Quint 4	Quint 5	All	Quint 1	Quint 2	Quint 3	Quint 4	Quint 5	All	Quintile Groups				
														Quint 1	Quint 2	Quint 3	Quint 4	Quint 5
Cereals	0.232	0.239	0.285	0.27	0.23	0.15	0.21	0.27	0.27	0.23	0.18	0.12	0.22	0.26	0.27	0.24	0.2	0.13
Teff	0.188	0.178	0.234	0.22	0.19	0.12	0.18	0.24	0.24	0.2	0.16	0.1	0.18	0.21	0.24	0.21	0.17	0.11
Wheat	0.029	0.034	0.029	0.04	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02
Maize	0.015	0.026	0.021	0.01	0.01	0	0.01	0.02	0.01	0	0	0	0.01	0.02	0.01	0.01	0.01	0
Animal Products	0.075	0.015	0.035	0.07	0.11	0.14	0.08	0.01	0.03	0.06	0.11	0.15	0.08	0.01	0.03	0.06	0.11	0.15
Pulses	0.055	0.077	0.062	0.06	0.04	0.04	0.05	0.07	0.06	0.05	0.05	0.04	0.05	0.07	0.06	0.05	0.05	0.04
Drinks and stimulants	0.068	0.068	0.068	0.06	0.07	0.07	0.07	0.07	0.05	0.06	0.07	0.08	0.07	0.07	0.06	0.06	0.07	0.07
Energy	0.053	0.072	0.061	0.05	0.05	0.03	0.07	0.08	0.08	0.07	0.06	0.05	0.06	0.08	0.08	0.06	0.06	0.04
Personal Care	0.021	0.026	0.018	0.02	0.02	0.03	0.02	0.03	0.03	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.02
Clothes	0.04	0.009	0.028	0.03	0.05	0.08	0.04	0.01	0.02	0.04	0.05	0.09	0.04	0.01	0.03	0.03	0.05	0.08
Transport	0.036	0.012	0.035	0.04	0.03	0.06	0.04	0.03	0.04	0.04	0.04	0.05	0.04	0.02	0.04	0.04	0.04	0.05
Health	0.017	0.012	0.013	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.02	0.03
Education	0.098	0.118	0.1	0.1	0.09	0.09	0.05	0.05	0.05	0.05	0.04	0.05	0.07	0.08	0.07	0.07	0.06	0.06
Total Food	0.687	0.69	0.704	0.72	0.7	0.63	0.71	0.72	0.72	0.72	0.73	0.68	0.7	0.71	0.71	0.72	0.72	0.66
Total Non-food	0.203	0.177	0.194	0.18	0.2	0.25	0.25	0.24	0.25	0.25	0.25	0.27	0.23	0.21	0.23	0.23	0.23	0.27

Table A3: Price and income elastcities for selected commodities in urban areas using AIDS model without controlling for socio-economic factors

	Price of *Teff*	Price Wheat	Price of Maize	Price of Milk	Price of Meat	Price of Sugar	Price of Coffee	Price of Cooking-oil	Price of Salt	Price of Pulses	Expenditure
Teff	**-0.92**	-0.04	0.08	-0.31	-0.04	0.10	-0.10	0.12	-0.14	0.21	1.03
Wheat	-0.25	**0.55**	-0.17	0.23	0.17	-0.44	0.20	-1.14	0.34	-0.48	1.03
Maize	1.32	-0.37	**-6.34**	0.08	-0.80	0.63	3.32	1.40	1.28	-1.02	0.63
Milk	-1.92	0.16	0.00	**0.17**	-0.02	0.36	-0.23	-0.07	0.07	-0.24	1.70
Meat	-0.38	0.08	-0.25	-0.01	**-1.03**	0.26	-0.18	-0.06	0.05	-0.18	1.59
Sugar	0.57	-0.33	0.20	0.38	-0.07	**-1.50**	-0.15	-0.23	-0.11	-0.01	0.85
Coffee	-0.22	0.14	0.84	-0.08	0.10	-0.10	**-0.83**	-0.32	0.04	-0.05	0.61
Cooking-oil	0.42	-0.59	0.30	0.01	0.12	-0.16	-0.32	**-0.43**	-0.02	-0.19	0.97
Salt	-2.19	1.10	1.71	0.37	0.41	-0.36	0.27	-0.01	**-0.62**	-0.68	-0.05
Pulses	1.26	-0.38	-0.37	-0.15	0.06	0.01	-0.06	-0.26	-0.20	**-0.31**	0.59

Table A4: Price and income elastcities for selected commodities in urban areas using AIDS model after controlling for socio-economic factors

Items	Price of *Teff*	Price of Wheat	Price of Maize	Price of Milk	Price of Meat	Price of Sugar	Price of Coffee	Price of Cooking-oil	Price of Salt	Price of Pulses	Expenditure
Teff	**-0.50**	0.04	0.07	-0.11	-0.01	-0.18	-0.11	-0.10	-0.01	-0.10	1.01
Wheat	0.28	**-0.17**	-0.71	0.88	0.09	-1.05	0.59	-0.57	0.13	-0.44	0.98
Maize	1.20	-1.62	**-5.78**	-2.25	-0.81	1.75	2.64	3.56	-0.17	1.27	0.57
Milk	-0.89	0.72	-0.87	**-0.04**	-0.01	0.21	0.02	-0.76	-0.51	0.46	1.77
Meat	-0.27	0.02	-0.25	0.00	**-1.02**	0.15	0.00	-0.58	-0.38	0.33	1.66
Sugar	-0.83	-0.80	0.57	0.25	-0.20	**-0.57**	-0.56	1.14	0.62	-0.88	0.86
Coffee	-0.26	0.37	0.67	0.09	0.09	-0.41	**-0.72**	-0.65	0.17	-0.03	0.61
Cooking-oil	-0.31	-0.29	0.79	-0.40	0.23	0.77	-0.61	**-0.58**	-0.15	0.23	0.96
Salt	0.18	0.45	-0.21	-1.67	0.45	2.54	0.93	-0.78	**-1.76**	2.06	-0.07
Pulses	-0.38	-0.34	0.46	0.52	-0.05	-0.94	-0.04	0.42	0.55	**-1.39**	0.58

Table A5: Price and income elastcities for selected commodities in rural areas using AIDS model without controlling for socio-economic factors

	Price of *Teff*	Price of Wheat	Price of Maize	Price of Milk	Price of Meat	Price of Sugar	Price of Coffee	Price of Cookingoil	Price of Salt	Price of Pulses	Expenditure
Teff	-2.53	0.50	0.85	-0.06	-0.02	0.13	-0.68	0.49	-0.10	-0.17	1.71
Wheat	0.86	-2.84	1.04	-0.21	0.17	-0.42	0.23	-0.27	-0.01	-0.23	1.49
Maize	0.87	0.61	-2.92	0.02	-0.20	0.43	0.29	0.03	-0.34	-0.07	1.24
Milk	-0.26	-0.78	0.15	-1.45	-0.26	-0.24	-0.18	-0.31	1.13	0.84	1.10
Meat	0.12	0.59	-0.79	-0.16	-1.89	-0.14	-0.10	-0.18	0.83	0.63	0.42
Sugar	0.79	-1.08	2.25	-0.16	0.66	-1.88	0.73	-0.66	0.73	-0.26	0.72
Coffee	-0.46	0.21	0.37	-0.01	0.15	0.14	-0.89	-0.02	0.08	-0.07	0.63
Cooking-oil	2.30	-0.48	0.21	-0.16	0.05	-0.50	-0.18	-1.47	-0.55	-0.30	0.85
Salt	0.06	0.13	-0.46	0.37	-0.02	0.34	0.15	-0.08	-1.13	0.32	-0.03
Pulses	-0.87	-0.66	-0.22	0.83	0.47	-0.37	-0.81	-0.47	0.77	0.40	0.56

Table A6: Price and income elastcities for selected commodities in rural areas using AIDS model after controlling for socio-economic factors

	Price of *Teff*	Price of Wheat	Price of Maize	Price of Milk	Price of Meat	Price of Sugar	Price of Coffee	Price of Cookingoil	Price of Salt	Price of Pulses	Expenditure
Teff	-2.30	0.32	0.85	-0.08	-0.05	0.19	-0.69	0.46	-0.13	-0.14	1.72
Wheat	0.58	-2.89	1.04	-0.13	0.24	-0.48	0.22	-0.28	0.05	-0.13	1.47
Maize	0.87	0.60	-2.80	-0.02	-0.25	0.46	0.24	-0.05	-0.31	-0.08	1.25
Milk	-0.41	-0.48	-0.12	-1.22	-0.07	-0.45	-0.03	-0.25	0.90	0.79	1.06
Meat	0.00	0.77	-1.06	-0.03	-1.63	-0.28	0.00	-0.03	0.68	0.60	0.41
Sugar	1.06	-1.24	2.39	-0.31	0.69	-1.58	0.72	-0.85	0.70	-0.41	0.74
Coffee	-0.47	0.20	0.34	0.01	0.12	0.14	-0.89	0.06	0.10	-0.08	0.62
Cookingoil	2.24	-0.33	0.08	-0.12	0.05	-0.65	-0.11	-1.40	-0.53	-0.28	0.81
Salt	0.01	0.20	-0.40	0.30	-0.05	0.32	0.19	-0.08	-1.11	0.28	0.01
Pulses	-0.67	-0.26	-0.26	0.78	0.44	-0.58	-0.85	-0.43	0.63	0.24	0.52

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