5 November 2004

Price Deflators and Food Poverty in Urban Ethiopia

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Abstract

Using the Ethiopian Urban Household Survey of 1994, the paper investigates the sensitivity of food poverty estimates to the choice of spatial price deflators. It compares a price deflator obtained from an official survey of average prices across urban areas with deflators derived from household information on expenditures and quantities purchased. It shows that the ranking of poverty estimates by city is highly sensitive to choice of deflator – in particular, use of the official price data systematically underestimates poverty in urban localities outside Addis Ababa, relative to the capital itself. This discrepancy, we argue, arises from the failure to treat quality differences in commodity purchases across localities and disparities in reporting units of measurement across households.

Key words: Food poverty; spatial price deflators; poverty indices

JEL classification: D12; O12; O55;

Acknowledgements

The tradition of urban poverty studies in Ethiopia on the basis of household surveys was pursued by the late Mekonen Tadesse, who is the source of inspiration for the present paper. Kedir would like to thank his PhD examiners and two referees for helpful advice and comments; the University of Nottingham and the African Economic Research Consortium for research support and the Department of Economics at the University of Addis Ababa for access to the data, to whom copyright belongs.

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1. Introduction

Mistakes in poverty estimation are often triggered by poor data. This paper focuses on how poverty measurement is sensitive to the choice of price deflator when household expenditures are adjusted for spatial price variation. In this respect it follows a small but growing literature on price indices and poverty measures (Deaton, 2001a, b; Deaton and Tarozzi, 2000; Grootaert and Kanbur, 1994). Specifically, the paper examines the sensitivity of food poverty measures to spatial price deflators (constructed under five alternative price measures) for the main urban centres in Ethiopia, using the Ethiopian Urban Household Survey data for 1994. It shows that choice of price index does indeed matter – using price indices for each locality constructed from an official survey of average prices for each urban area significantly understates urban poverty in localities outside Addis Ababa, relative to the capital itself, when compared with the use of price indices derived from information on household expenditures and quantities purchased in the Urban Household Survey.

To see how this result can arise, consider a simple illustration. If prices in the capital city are higher than elsewhere (as is often the case), and these prices are used to construct a nationwide minimum expenditure level, poverty may be overstated in other regions where the same basket of commodities can be purchased more cheaply. To handle this issue of non-uniformity of prices across localities, two approaches can be applied. One is to use official data, if available, on price variations for given commodities across localities. In fact the Ethiopian Central Statistical Authority (CSA) collects city level price data for a range of food commodities, and these city-level price variations are used to value the basic nutritional requirement basket by a number of the existing studies of poverty both in urban and rural Ethiopia. [1]

There are, however, potential problems with this solution. First, there may be variation of prices by locality within large urban centres, especially Addis Ababa, so that the level of disaggregation implied by official statistics is insufficient to pick up

[1] The increased availability of data in recent years has also led to a significant increase in studies on poverty in rural Ethiopia e.g. Capéau and Dercon (1998); Dercon (2001), Dercon and Khrishnan

differences in poverty across localities. Second, variations in the 'average price' across localities may incorporate quality differences. For example, the capital city may have both higher priced *and* higher quality commodities. If there is in general a positive correlation between average income level and average quality across urban centres, then ignoring quality differences in such circumstances may *understate* variations in poverty across those centres. Third, in household surveys, it is apparent that many consumers respond to questions concerning expenditures and quantities by using non-metric units (see the evidence for Ethiopian urban areas in Disney, Kedir and McKay, 2001 and in rural areas by Capéau and Dercon, 1998). These disparate quantity measures are important ingredients in measuring unit values of purchases and need to be handled in some way.

The alternative strategy to using official surveys of average prices is to utilise imputed price data or unit values from household expenditure surveys. Many, if not most, such surveys do not collect price data but, typically in Africa (and unlike say the Consumer Expenditure Survey in the US and the Family Expenditure Survey in the UK), surveys collect both expenditures on particular items in the survey period as well as *quantities* purchased. Dividing expenditure by quantity gives a unit value for each commodity purchased by each household. This unit value in itself is not the same as a 'price', without adjustment for quality differences in purchases across households, handling choice of units of measurement, as well as other sources of measurement error (Deaton, 1997). But if the appropriate adjustments to unit values can be made, then in principle we can construct city-specific price indices that can be applied to deflate the household welfare measure and to compute the food poverty indices on the basis of the poverty lines generated.[2] This is what is done here under the assumption of alternative price computation scenarios. It is novel in the context of urban Ethiopian poverty analysis and has implications for similar exercises elsewhere.

As with a number of other studies, our study adopts the Food Energy Intake (FEI) approach to compute the poverty lines for each urban area – that is, it seeks to find the value of food expenditure in each locality which purchases an FEI sufficient

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(2000), Dercon and Tadesse (1997), Tadesse (1997). Some of these studies make some urban-rural comparisons: Tadesse (1997) and Kedir (1999) focus on urban poverty.

[2] In fact Disney, Kedir and McKay (2001) show that even calculated price elasticities of demand using this adjusted unit value information are more plausible than those derived from the 'average' prices for each locality provided by the CSA – plausible in the sense that the coefficients are of the 'right' sign and of a sensible magnitude.

to meet a pre-determined absolute food energy requirement, and then to measure what fraction of the household population are unable to achieve this target (Kyereme and Thorbecke, 1987; Greer and Thorbecke, 1986). Note that choice of price index affects both the 'cost' of achieving the poverty line and also the distance (if any) between actual household purchases and this target. We focus on the absolute magnitude of food poverty in each locality, but also on how the ranking of urban centres by extent of poverty alters as the assumptions underlying the calculation of this 'threshold' value of food expenditure are varied due to changes in the calculated local price indices.

This use of poverty indicators based on nutritional requirements has a long history – right back to the Joseph Rowntree studies in York. Whilst food poverty is likely to be particularly pervasive in rural areas given urban-rural income differentials, crop failures and transport costs, we confirm other studies that show that there is also significant food poverty in some of the main urban centres of Ethiopia (FDRE 2000; Kedir, 1999; Tadesse, 1997). Moreover, given the long history of food shortages in many parts of Ethiopia, there has been a good deal of attention in Ethiopia devoted to measuring nutritional requirements, and in converting various local foodstuffs into calorific equivalents (EHNRI, 1999). Although any consumption-based measure of poverty is to some extent arbitrary, we believe that the care that has gone into studying these food nutrition issues in Ethiopia justifies in part the use of such measures. We discuss the issues associated with this poverty definition in greater detail in Section 3.

We reiterate that the novelty of our analysis does not primarily lie in the use of nutrition-based measures, nor even in examining urban poverty in Ethiopia (although the latter is less frequently examined than rural poverty), but in how food poverty estimates are affected by the choice of price index. Our results show that comparisons of food poverty across Ethiopian urban areas using the CSA/official price data overstate price differences between Addis Ababa and other urban areas, relative to household-survey based constructed price data that adjust for quality differences and selectivity bias/non-randomness in choice of unit of measuring quantities. These differences are not trivial. We normalise on Addis Ababa, where our headcount index suggests that 33% of households exhibit food poverty. Using the CSA measure, food poverty is lowest in Bahar Dar in the Central Highlands (16%)

and highest in Dessie to the North (53%). In contrast, using our preferred adjusted household survey data-based method, we find a poverty rate in Bahar Dar of 29% and in Dessie of 70%, compared to the same (normalised) rate for Addis Ababa of 33%.[3] The policy implications of changes in these rankings are obvious – in particular our results suggest that policies that might be politically expedient (for example, price subsidies on food in the capital city) are poor targeting mechanisms. We also briefly describe whether differences in welfare and food poverty by household characteristics are sensitive to choice of price index.

The paper is organised as follows. Section 2 briefly explains the poverty reduction strategy paper and related issues of food policy currently in operation in Ethiopia. Section 3 discusses some general methodological issues concerning poverty measures and price indices. Section 4 describes the data and the methods underlying the construction of various prices and price indices from unit values. Section 5 calculates the price indices and provide measures of food poverty across the main Ethiopian urban centres. Section 6 provides a brief conclusion.

2. Food prices and poverty policy in Ethiopia: Implications of the Poverty Reduction Strategy Paper

Ethiopia has had a chequered political history in recent years, with periods of decentralised market-oriented economic policy interspersed with eras of state intervention and control. For more than a decade in Ethiopia until 1992, a range of household purchases were subsidised and rationed by the government such as sugar, bread and kerosene. Ration cards were issued to all households registered in a given *kebele*.[4] These cards were distributed to all households, irrespective of income. Households who were holders of these cards were able to get food items at a subsidised price from government shops in each *kebele*. Apart from signalling households' eligibility to access *kebele* shops, the cards were used to indicate the quantity of food commodities that each household was allowed to purchase, based on

[3] Tadesse (1997) uses CSA data to value his basket of basic household food requirement and constructs his food poverty index somewhat differently from ours. For instance, he does not control for quality effects and non-metric units of measurment. He obtains a headcount index of 53% for Addis Ababa, 28% for Bahar Dar and 35% for Dessie. This comparison emphasises our point in the text concerning poverty targeting.

[4] The smallest local administrative unit in Ethiopia. *Kebeles* may be involved in the distribution of food relief.

household size. The change of regime and subsequent shift in economic policy led to a series of price liberalisation and deregulation measures in 1991/92 and the government shops that supplied all the basic needs of households at subsidised prices were dissolved. Currently, households buy their food items and other necessities in the open market. This shift away from rationed and subsidised commodities has important implications for the trend in the level of food poverty in the country.

In line with IMF and World Bank guidelines, Ethiopia's Poverty Reduction Strategy Paper (PRSP) sets out the country's comprehensive, long-term plan to reduce poverty (FDRE, 2000). So far Ethiopia has prepared an Interim-PRSP (I-PRSP) which gives a "road map" to the preparation of a full PRSP. The I-PRSP contains a description of the existing extent and patterns of poverty and the main elements of its existing poverty reduction strategy. It focuses particularly on reducing rural poverty and on increasing the income-earning capacity of the poor through its highly publicised agriculture-development-led-industrialisation (ADLI) strategy.

The strategy paper does not have a comprehensive data analysis on the basis of newly available sources of household level information and nor is there any explicit link between ADLI and overall poverty reduction. In addition, it does not give indicators of malnutrition and vulnerability, nor the implementation strategy of its food security policy. A more detailed analysis is therefore essential in order to identify particular groups that suffer from poverty with disaggregation by region, gender, employment status and other relevant categories. Our research contributes to filling this gap by providing a household-based analysis of food poverty.

3. Methodological issues

a. Welfare measures

The primary focus of the current literature on cross-sectional indicators of household welfare is on income-based versus consumption-based indicators, leaving aside such non-pecuniary measures as life expectancy and other health measures (Ravallion, 1994; Anand and Harris, 1994; Chaudhuri and Ravallion, 1994). Assuming individuals can smooth consumption (at least partially), consumption will exhibit less volatility, both over time and across households, than income. Both household income and consumption are subject to measurement error and, for given permanent income streams, households may differ in their consumption patterns

according to tastes. Nevertheless, consumption-based indicators tend to predominate in the literature, especially concerning low income countries, reflecting the basic economic principle that individuals seek to maximise consumption (rather than income), subject to constraints and preferences over leisure (Lanjouw and Lanjouw, 2001; Deaton, 1997, 2001a; Deaton and Grosh, 2000).

Focusing on food expenditure as a sub-set of consumption expenditure is in principle still more contentious, although again most justifiable in a low income context. First, food expenditure is typically regarded as a necessity, and constitutes the largest share of the typical low income household's budget. Second, in the presence of liquidity constraints, expenditure on other goods (especially durables) tends to be more volatile than consumption of basic foodstuffs. Third, food expenditure is most often measurable and recorded in the survey period. Fourth, it is amenable to calculations concerning absolute standards of living, such as nutritional measures and calorific intake. Of the choice between two measures of food expenditure: budget share and absolute food expenditure per adult equivalent, there has been further discussion (Anand and Harris, 1990, 1994; Girma and Kedir, 2002) and, in common with these studies, we focus on the latter measure.

b. Food poverty

Given our focus on food expenditure, food poverty can be defined as a condition where the household lacks the resources necessary to acquire a nutritionally adequate diet. The food energy intake (FEI) method is often used to estimate a food poverty line, defined as the minimum nutrition required by households to lead a healthy life (Greer and Thorbecke, 1986; Kyereme and Thorbecke, 1987). Typically, the poverty line can then be set as the minimum food expenditure per capita or per adult equivalent per month required to obtain the nutrient recommended daily allowance (RDA).

To derive this poverty line in the present context, we first converted quantities of food reported in non-metric units into their metric equivalents using relative conversion factors defined using the unit value information obtained from the survey. Then we used the food composition table compiled by the Ethiopian Health and Nutrition Institute (EHNRI) to convert quantities consumed of each of the food commodities that we observe to be purchased in the household survey data into their

calorific equivalents. The food composition tables have been regularly compiled since 1968 and include information on 180 food types checked by the Institute of Medical Chemistry in Uppsala with the assistance of the Swedish International Development Association (SIDA). Samples are collected in all the main Ethiopian regions, normally at least twice a year (EHNRI, 1999). Given the care in the research and the longitudinal nature of these data, we believe the calorific conversions are of good quality and representative of the main regions, crops and diets. Our household questionnaire also permits us to distinguish 'food consumed' from 'food purchased' and enable us to arrive at the actual food consumption of households.

With information on food expenditure and calorie consumption, we estimated the cost of acquiring 2200 kcal per day per adult using the cost-of-calorie function given in Greer and Thorbecke (1986). For each city, separate regressions were run to derive city-specific food poverty lines, because tastes and commodity availability may differ across cities.[5]

The costs of children relative to adults and the extent of economies of scale are of first-order importance in poverty and welfare calculations (Deaton and Zaidi, 1999). To allow for inter-personal variation in consumption, we utilise the standard approach which computes the 'equivalent household size' (E) given as (Banks and Johnson, 1998; Deaton, 1999):

$$E = (A + \gamma K)^{\theta} \qquad (1)$$

where:

A = number of adult members
K= number of children
γ = the cost of children relative to adults
θ = household economies of scale

Since food is effectively a private good, there are unlikely to be significant economies of scale in household consumption (unlike, say, heat and light). γ and θ

[5] Some versions of the FEI method regress calorie intake against food consumption expenditure and invert the estimated function. In this case, we simply reverse this process. These two methods need not give the same answer although it should not affect the ranking of cities (see Kyereme and Thorbecke, 1987; Ravallion, 1998).

are parameters, each of which lies between 0 and 1. We assign a value of γ of 0.5 and of θ of 0.95, in common with comparable studies in similar contexts.[6]

c. Poverty measures

There are of course many poverty measures in the literature. Based of the poverty lines estimated for each city using the FEI method, we have estimated the head count ratio, the poverty gap and the poverty intensity index developed by Foster, Greer and Thorbecke (1984).

d. The price indices

As with poverty measures, there is an extensive discussion as to the appropriate price index to use in making comparisons over time and space. The key issue is how the specific index handles differences in commodity weights in the 'basket' of goods (here, food items) across these dimensions (Deaton, 2001b; Deaton and Tarozzi, 2000). This is particularly pertinent when we anticipate that consumers will substitute cheaper items for more expensive ones in the budget. Here, a Superlative price index (i.e. the Fisher Ideal index) is used which is defined as the geometric mean of the Laspeyres (base weighted) and the Paasche (current weighted) indices. This index captures the potential substitution bias more fully than the other two indices.

4. Data and Construction of Price Indices

a. The household data set

The analysis is based on the Ethiopian Urban Household Survey (EUHS), which was collected by the Department of Economics of Addis Ababa University, Ethiopia, in collaboration with the Department of Economics at the University of Göteborg, Sweden, during 1994. The total sample size of 1500 households has been distributed over the seven main urban centres in Ethiopia (of 100,000+ inhabitants) in proportion to their respective populations. These centres were Addis Ababa, Mekele, Dessie, Bahar Dar, Awassa, Dire Dawa and Jimma, representing a geographical cross section of the country.

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[6] See, for example, Deaton and Paxson (1997); Deaton and Zaidi (1999); and Duncan and Valenti (2001).

Data collected include household expenditures on numerous food and other items as reported by the respondent. Depending on the nature of the commodities, expenditure and quantity data is obtained on the basis of 7-days and 30-days recall periods. By varying the period according to the item, the problem of extensive zero expenditures for many commodities over relatively short periods is minimised. In addition, quantities of these purchases are noted, with households reporting in metric as well as non-metric units. This core information is supplemented by background data on demographics, economic status, ethnic and religious affiliation.

Households are classified into clusters (i.e. geographical areas of various sizes). Three types of geographical cluster can be identified. The first is the urban centre, reflecting the classification of the country into administrative regions loosely based on these centres. At this level of aggregation, Addis Ababa in particular is a large, heterogeneous, unit. The second level of disaggregation is the division of urban centres into *weredas*, totalling 42 in our data and the lowest administrative units are *kebeles*, which number 212 in total.

For the present analysis, we focus only on the quantities purchased, and expenditures on, 32 major food items categorised under cereals, pulses, spices, milk and milk products, meat and other animal products, vegetables, fruits, drinks and other stimulants, and other consumables such as sugar and honey. These commodities all have CSA average city level prices against which to compare our household-based calculations, and represent 64% of the total number of commodities for which there is expenditure and quantity data but 89% of total monthly expenditure on all commodities.

b. Alternative Price Measures and Spatial Price Deflators

Our major objective is to investigate sensitivity of food poverty measures to the variations in the prices used in computing spatial price deflators. We now explain the construction of the prices and indices used to deflate the household welfare measure – total household expenditure per adult per month. Denote the price indices as I_1 to I_5.[7]

[7] Note that these city-specific price indices are derived relative to the Addis Ababa price index, which we normalise at 100.

I_1: This measure takes the city-level average prices for 32 food commodities compiled from the CSA data (CSA, 1996), and weights them by the average purchased quantities by households in each city using data from the Urban Household Survey. Quantities reported in non-metric units are converted into their metric equivalents using relative conversion factors obtained by comparing unit value averages for metric and non-metric units at a disaggregate level (the *wereda*). In this index, the weights are therefore derived from the household data and the prices from official data (I_1).

I_2: This index uses a 'price' obtained directly from the household expenditure and quantity data. The 'price' for food commodity *i* and household *j* is the ratio of total household expenditure on the commodity (i.e. TE_{ij}) to quantity reported in kilograms (Q_{ijk}). Therefore, $I_2 = \frac{TE_{ij}}{Q_{ijk}}$ is the household unit value of the good in question per kilogram. These 'prices' are calculated only for households that report quantities in metric units. To eliminate within-cluster (household specific) measurement error and for comparability with the first measure, however, we then take city averages of the prices (since this procedure is followed in all cases, we now omit the household subscripts). We regard this as an inferior measure to I_1 and to the subsequent measures because it ignores within-cluster variation in quality and excludes information on those reporting in non-metric units.

I_3: This measure increases sample size by handling the issue of households that do not report in metric units. It is a unit value-based index computed on both the kilogram and non-kilogram sample of households. Non-metric quantities of commodity i (Q_{inm}) are converted to metric quantities using relative conversion factors constructed at the *wereda* level[8]. The *wereda* level conversions are more appropriate than city level conversion factors because they allow for possible between-wereda heterogeneity of quantity measurement units. After computing the

[8] Capéau and Dercon (1998) propose an econometric procedure to identify conversion factors and prices jointly, using data for rural areas of Ethiopia. It uses the within-cluster/between cluster dichotomy to identify the two effects. This makes some sense within rural localities where measurement units may be fairly homogeneous and the between-cluster differences in unit values can be utilised to identify price variation. However this identification strategy is more problematic in urban areas, where several measurement units can co-exist. Moreover, the within-between cluster distinction cannot then be used to identify quality differences, as explored by Deaton (1988).

average *wereda* level prices, $I_3 = \frac{TE_i}{Q_{ik} + Q_{inm}}$, the average of these prices in each city, is derived to construct the city-specific price index as in the previous case.

I_4: This extends the previous index to adjust unit values for quality differences, using the regression technique proposed by Deaton (1988). First, cluster means of variables are constructed. Then household unit values in logs are regressed on household characteristics thought to influence quality choice of households, as deviations from cluster means, for each of the commodities in the price index calculation. The corrected price, in logs, is computed as follows for each of the commodities;

$$I_4 = \ln \hat{V}^c - \hat{\beta} \ln \overline{Z}^c + \hat{\beta} \ln \overline{Z}^s \qquad (2)$$

where $\ln \hat{V}^c$ = log of cluster average unit price

$\overline{Z}^c$ and $\overline{Z}^s$ = vectors of cluster and sample means of the observable household characteristics that impact on quality choice of households respectively.

$\hat{\beta}$ is a vector of estimated parameters in the first stage (quality choice) regression.

The computed price index I_4 therefore nets out quality effects in unit values and adjusts the price measure for quality differences in purchases across households. The key regressor is total household expenditure (conditioned on family size), which accommodates the fact that richer households tend to buy better quality food. Note, that we are using the *within cluster* variation in household characteristics to identify quality effects by assuming households face common prices within the cluster. However, there can be cluster-specific differences in the average taste for quality in this general model formulation.

I_5: The final price index allows for the possibility of non-random reporting of purchase in local and metric units of measurement. This index therefore differs from I_3 in that average conversion factors for metric and non-metric units are not applied; instead, following Disney, Kedir and McKay (2001), a model is first estimated of the probability of the household respondent reporting quantities purchased in metric

units.[9] The two-stage cluster-based procedure utilised to construct I_4 is then applied to individuals reporting in metric units, conditioned on the selection of households into reporting in metric units. The second stage corrected unit value equation is estimated as before in deviation form and includes the computed inverse Mill's ratio (λ). The corrected unit values are computed similarly to (2) but allow for the correction for selection:

$$I_5 = \ln \hat{V}^c - \hat{\alpha}\bar{\lambda}^c - \hat{\beta} \ln \bar{Z}^c + \beta \ln \bar{Z}^s \qquad (3)$$

where $\bar{\lambda}^c$ = the mean selection adjustment terms averaged to the city level for each commodity group.

$\hat{\alpha}$ and $\hat{\beta}$ are vectors of estimated parameters in the second stage estimation.

Note that point estimates of I_4 and I_5 can easily be computed as exponents.[10] Our final index therefore uses the unit values from the household data, but allows for selection between metric and non-metric units, quality effects, and any systematic correlation between purchases of items and their calculated unit values. This last spatial price deflator is our preferred measure given the household data on expenditures and quantities purchased.

Table 1 describes the five city-specific Fisher price indices computed here:

Table 1
Fisher Ideal Price Indices under alternative price definitions

City	$\mathbf{I_1}$	$\mathbf{I_2}$	$\mathbf{I_3}$	$\mathbf{I_4}$	$\mathbf{I_5}$
Addis Ababa	100.0	100.0	100.0	100.0	100.0
Awassa	85.0	101.5	87.8	97.3	89.8
Bahar Dar	79.6	88.8	85.8	80.2	85.9
Dessie	88.7	99.5	95.1	105.4	113.9
Diredawa	97.4	108.8	119.1	103.1	104.6
Jimma	76.4	97.3	82.0	95.1	85.1
Mekele	89.2	103.3	97.9	98.9	101.0

Source: Calculated from the 1994 Ethiopian Urban Household Survey as explained in text, except $\mathbf{I_1}$ which is computed using the price information from the CSA.

These results show a clear pattern. Mekele is a good example. Here the official food price index (I_1) is just over 10% lower than that of Addis Ababa.

[9] Identification is obtained by omitting ethnic and religious affiliation from the unit value equations. Econometric results for all these procedures are available from the authors on request, as are the prices obtained and/or utilised in each of the price indices I_1 to I_5.

However the successive adjustments to unit values bring the final index based on household data back to approximate equality with the price index for Addis Ababa. This finding that price indices from household data are higher, relative to Addis Ababa than the CSA survey-based index is true throughout the table. Indeed, in some towns, such as Dessie (in the North) and Diredawa (in the East), using adjusted unit values produces price indices higher than that of Addis Ababa, in contrast to the official price data. The reasons differ among the constructed indices: in Dessie, for example, using the Deaton cluster-based method to handle quality differences and household selection on metric and non-metric units raise the price index substantially whereas it is the failure to account for selection of units of measurement in Diredawa that raises the index.

Together, these results suggest that using household data to construct a variety of price indices give poverty rankings that may be quite different from those using official data based on 'average' city prices. The relationship between the poverty ranking of the cities and choice of price indices are summarised in Table 2, where the rankings range from 1 representing the least costly city to 7 denoting the costliest city.

Table 2
Summary of Rankings of City Price Indices

City	Rank with I_1	Rank with I_2	Rank with I_3	Rank with I_4	Rank with I_5
Addis Ababa	7	4	6	5	4
Awassa	3	5	3	3	3
Bahar Dar	2	1	2	1	2
Dessie	4	3	4	7	7
Diredawa	6	7	7	6	6
Jimma	1	2	1	2	1
Mekele	5	6	5	4	5

Diredawa appears to be the most expensive place to buy foodstuffs by most indicators. This is perhaps not surprising as the city is located in one of the driest parts of the country. Except at official prices, the capital city is not the costliest place, although it is typically towards the upper end of the scale. Overall, Jimma (a city in the fertile and wet region of the country) is the least costly place. Fertility in

[10] See Deaton (1988, 1997) or Disney, Kedir and McKay (2001).

surrounding areas and access (transport costs) appear to be the key determinants of urban food price differences.

5. Food Poverty Estimates

We can now calculate estimates of food poverty and the various poverty measures described above. Tables 3a to 3c describe the fractions of households in each city that are food poor using, respectively, the head count, the poverty gap and the poverty intensity indices (Foster et al, 1984).

Table 3a examines the head count index. Bearing in mind the analysis of Table 1, we should expect increases in head count poverty relative to Addis Ababa (on which the various price indices are normalised) once we move away from using CSA prices (index I_1). And, in fact, a similar pattern emerges: food poverty in Dessie rises from just over half using official prices to over two thirds of households using our preferred index: I_5. In all urban localities other than Awassa, the head count of poor households is higher relative to Addis Ababa when survey-based prices are used than when official statistics are used, although it is also noticeable from Table 3a that this discrepancy is sharpest between I_1, the CSA index, and I_5. The impact of price changes on poverty rankings has also been examined by comparing a pair of cities at a time using cumulative distribution functions (not reported here) to show the impact of each price deflators on the poverty rankings. We found lack of robustness of the rankings in 38 percent of the 105 pairwise comparisons.

Table 3b examines 'poverty gaps' – loosely, how much expenditure (relative to total expenditure in that city) would be required to bring the food poor up to the threshold (assuming, unrealistically, that such a policy could be implemented with no deadweight loss and zero administrative cost). Here, again, Dessie in the northern region stands out as having by far the largest poverty gap, exacerbated when we use survey-based price indices rather than official prices. This has for many years been the centre of drought and food shortage and this is reflected also in the prices paid for foodstuffs in the region. Mekele, also in the north of the country, also stands out as having a significant food poverty gap.

Finally Table 3c provides the 'poverty intensity' measure. While most satisfactory as a welfare measure, this index has a less intuitive interpretation. However, the same 'story' emerges as with the other poverty indicators.

Table 3
Food poverty Measures with alternative price indices, by city

a) Headcount index (P_0)

City	I_1	I_2	I_3	I_4	I_5
Addis Ababa	0.33	0.33	0.33	0.33	0.33
Awassa	0.30	0.32	0.31	0.31	0.36
Bahar Dar	0.16	0.21	0.19	0.16	0.29
Dessie	0.53	0.55	0.54	0.61	0.70
Diredawa	0.22	0.26	0.29	0.25	0.35
Jimma	0.24	0.32	0.26	0.32	0.33
Mekele	0.42	0.49	0.45	0.46	0.54

b) Poverty gap index (P_1)

City	I_1	I_2	I_3	I_4	I_5
Addis Ababa	0.13	0.13	0.13	0.13	0.13
Awassa	0.15	0.17	0.16	0.17	0.19
Bahar Dar	0.06	0.07	0.07	0.06	0.12
Dessie	0.29	0.32	0.31	0.33	0.40
Diredawa	0.06	0.08	0.10	0.07	0.12
Jimma	0.08	0.12	0.09	0.12	0.13
Mekele	0.19	0.25	0.21	0.22	0.24

c) Poverty intensity index (P_2)

City	I_1	I_2	I_3	I_4	I_5
Addis Ababa	0.07	0.07	0.07	0.07	0.07
Awassa	0.11	0.12	0.11	0.12	0.15
Bahar Dar	0.04	0.04	0.04	0.04	0.06
Dessie	0.21	0.23	0.22	0.24	0.27
Diredawa	0.03	0.04	0.05	0.04	0.06
Jimma	0.04	0.07	0.05	0.06	0.08
Mekele	0.12	0.14	0.13	0.14	0.15

We also investigated whether the association between household characteristics and levels of household food expenditure is sensitive to choice of price index. We estimated household expenditure functions by OLS and quantile regressions.[11] Our results suggest that, in a linear specification in which household

[11] The characteristics were: age and educational attainment of head of household, family composition, assets of the household, a dummy for employment status, indicators of ethnicity and religious affiliation, and a dummy for urban location. Results are available on request from the authors.

food expenditure depends on characteristics and locality dummies, choice of price index only affects the locality dummies and does not change the coefficients significantly on characteristics. The quantile regressions however suggest that the sensitivity of results to the choice of the price index used to deflate expenditure is highest at the lowest (10^{th} percentile) of the expenditure distribution. Exploring non-linearities in specification, including interactions between localities and characteristics, may of course qualify this conclusion, but our tentative suggestion is that choice of price index affects the relative ranking of localities by their extent of food poverty, but not the types of households that are identified as poor within those localities.

6. Conclusion

The results of the paper show that the extent of food poverty within and across cities in Ethiopia is affected by the way prices are measured and hence by the choice of spatial price deflators. We distinguish in particular between price data obtained from surveys of average prices in different urban areas, and prices constructed from household surveys that utilise unit values adjusted for quality effects, non-metric units of measurement and measurement error in computing prices from unit values.

Our findings can be summarised as follows. First, different price measures impact on spatial price deflators. This is evidenced by the shifts in the cost of living rankings of the cities as different price measures are used (Section 4). In particular, using an index derived from the official survey of average city-level market prices appears to understate poverty significantly in urban areas outside Addis Ababa, relative to prices calculated from household survey data.

Second, price indices affect the location of the poverty lines by bringing about shifts in the distribution of real food expenditure, with a particularly pronounced impact on the headcount index (Section 5). Third, changes in spatial price deflators are not found to affect the magnitude and the statistical significance of other correlates of the incidence of food poverty and the level of household welfare, although this may be a product of using only linear specifications.

Overall, our study suggests, in the absence of observed prices, careful computation of spatial price deflators on the basis of prices that allow for quality

effects, and quantities reported in non-metric units show that it is necessary to improve estimates of food poverty in Ethiopia and other developing countries.

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