Changes in Poverty in Rural Ethiopia 1989-1995: Measurement, Robustness Tests and Decomposition

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WPS/98-7

March 1998

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Abstract: Assessing changes in poverty levels over time is bedevilled by problems in questionnaire design, the choice of the poverty line, the exact timing of the survey and uncertainty about the appropriate cost-of-living deflators. In this paper, we focus on testing the robustness of measured changes in poverty to these common problems, using household panel data collected in rural Ethiopia in 1989, 1994 and 1995: in particular, we implement a simple graphical technique for assessing the impact of uncertainty in measured inflation rates. We find that poverty declined between 1989 and 1994, but remained virtually unchanged between 1994 and 1995. However, the last result disguises substantial seasonal fluctuations in 1994. We also find that households with substantial human and physical capital, and better access to roads and towns have both lower poverty levels and are more likely to get better off over time. Human capital and access to roads and towns also reduce the fluctuations in poverty across the seasons.

1. Introduction

Identifying the pattern of change in welfare and poverty over time is of increasing importance in the policy debate about reform in Africa. It is recognised that the reform programmes are only sustainable in the long run if they also result in poverty alleviation. However, the data available on changes in poverty in Africa is surprisingly limited compared to Asia[1]. Despite the various household surveys recently implemented (Deaton (1997)), problems ranging from access to data to incompatible surveys, have meant that few studies on the changes in welfare since the 1980s have been attempted[2]. Cross-section data could be used to perform this task, provided coverage and sampling are done with great care (Deaton (1997)). Panel data, although not without their own methodological problems are more reliable in establishing changes at least within the sample collected. In the context of Africa, with the exception of the rolling panels in some LSMS surveys, such as in Côte d'Ivoire (Grootaert et al. (1997)), the number of panel data sets that could be used for assessing the changes in welfare are limited. In this paper we use data from a survey conducted in 1989 in six villages in the Southern and Central part of the country. In 1994, these households were re-visited as part of a larger household survey covering 15 villages throughout Ethiopia. Subsequently, the larger sample was interviewed again in the second half of 1994 and in 1995. The result is a two-fold panel, the smaller one allowing the analysis of welfare changes between 1989 and 1994, and a larger panel, covering 1994 and 1995.

The period analysed in this paper is ideal for such an exercise in the context of reform in Ethiopia. The first survey, conducted in 1989, provides a picture of the situation in Ethiopia towards the end of a long period of strict economic controls, bad weather and civil war[3]. The year 1994 marks the beginning of a structural adjustment programme, agreed by a new government that came to power after the end of the civil war in 1991[4]. Consequently, the smaller panel on about 350 households can address change in the period after the end of the war and after the first wave of the reforms. The second panel (on about 1450 households between 1994 and 1995) can be used to examine the initial consequences of the structural

[1] For example, in India, there has been systematic and regular collection of the information needed for an appropriate analysis of changes in poverty since the 1960s in the form of large cross-sectional surveys (Ravallion and Datt (1995)).

[2] Demery and Squire (1996) review six countries in which some attempt has been made to compare welfare over time. Grootaert et al. (1995) and Grootaert and Kanbur (1993) analysed changes in Côte d'Ivoire between 1985 and 1988.

[3] The civil war, although started many decades earlier, had intensified in the 1980s with recurring offensives by the government army and by the rebels in the Northern part of the country. The economy had been brought to its knees after a period of an experiment with a strict control regime, ideologically inspired by close ties with the communist bloc of Eastern Europe. By 1989 resource flows from the Soviet Union and other states had dried up after the collapse of the communist regimes in this region. Finally, the 1980s saw some of the worst famines ever in Ethiopia, induced by drought and war.

[4] In 1990, the previous government embarked on partial reforms, with food-market liberalisation, the abolition of much of rural taxation and the forced supply of grain by peasants. The government was defeated in 1991 by a Tigrayan-led coalition which brought to an end the protracted civil war. In 1992, the currency was devalued and in 1994, the new government agreed a programme of reforms and structural adjustment with the World Bank and the IMF.

adjustment programme[5]. An initial analysis of the results of the smaller panel between 1989 and 1994 (Dercon and Krishnan (1994)) showed substantial declines in poverty in some of the villages surveyed; in a few villages the decline was more limited. The results have been used in Demery and Squire (1996) and in Jayarajah et al. (1996). The results were preliminary and in this paper we test the robustness of these results and extend the period of analysis. In general, we find that our previous findings do stand. We observe an overall decline in poverty in the sample between 1989 and 1995; this poverty decline is driven mainly by strong improvements in some villages, while in others little change is observed, and these results persist when controlling for seasonal effects. There is little change in measured poverty between 1994 and 1995.

Measuring welfare changes is not without its problems[6]. In this paper, we explore whether the results obtained are robust to alternative solutions to some of the methodological problems. In line with most studies, we use consumption as our basis for measuring the standard of living[7]. Furthermore, we use a cost-of-basic-needs poverty line to calculate poverty measures (Ravallion and Bidani (1994)). The measures used are from the Foster-Greer-Thorbecke family of additively decomposable measures (Foster et al. (1984)).

We focus on three problems: first, are our results sensitive to questionnaire design; second, are they sensitive to the actual poverty line chosen (stochastic dominance) and third, are they sensitive to the sources of the price data used[8]. In particular, we examine the consequences of potential errors in the measurement of rural inflation in the survey sites. Of these problems, the first two have been discussed quite extensively (see Atkinson (1987), Deaton (1997), Ravallion (1994), Lanjouw and Lanjouw (1996)). In this paper, the discussion will be rather limited. The last problem of using appropriate price deflators, has been noted in some studies (Kanbur and Grootaert (1994), Ravallion and Bidani (1994)), although the consequences for poverty measurement have not been systematically explored in intertemporal poverty analysis. In this paper, we present a simple dominance result that could fill this gap.

The paper is organised as follows. In the next section, we describe the data used. In section 3, the construction of consumption and some of the problems in the data related to compatible definitions of consumption are discussed. In section 4, the poverty line used and the problems related to price information are analysed. In section 5, we present the poverty findings and test the robustness using stochastic dominance. In section 6, the issue of the sensitivity to the measurement of price changes is discussed and a comprehensible and readily implementable method presented. Once the pattern of the changes in welfare is robustly established, the next important issue is whether it is possible to explain these changes in the context of the panel data. In section 7 of the paper, a simple poverty profile is described and

[5] In 1997, a further round of surveys was completed, allowing a further comparison of change during the reform period, although the data are not yet available for this paper.

[6] For a discussion of some of the problems, see Lipton and Ravallion (1995)).

[7] Obviously, this is not without its critics, although there are good reasons to use it in practice (Anand and Harris (1994), Ravallion (1994), Hentschel and Lanjouw (1996)).

[8] Both the choice of the poverty line and the poverty measures have yielded by the largest literature on the methodological problems in poverty measurement (Atkinson (1987), Ravallion and Bidani (1994), Ravallion (1994)).

a first interpretation of the factors explaining the changes between 1989 and 1995 is given. A more detailed analysis is the subject of future work. Section 8 concludes.

2. The data used

In 1989, the International Food Policy Research Institute conducted a survey in seven villages[9] now located in the regions called the Amhara, Oromiya and the Southern Ethiopian People's Association. The study collected consumption, asset and income data on about 450 households. In 1994, the Centre for the Study of African Economies and the Economics Department of Addis Ababa University started a panel survey incorporating six of the seven villages earlier surveyed in 1989 in its sample (the remaining village in a semi-pastoralist area in Southern Ethiopia could not be revisited again because of violent conflict in the area). Nine additional villages were selected allowing for a total of 15 village studies, covering 1477 households (the Ethiopian Rural Household Survey, ERHS). They were interviewed thrice: in the first part of 1994, again later in the same year and in the first part of 1995.

In the 1989 survey, the households were randomly selected within each community, while the communities selected were mainly areas which had suffered from famine in this period (for details see Webb et al. (1992), Dercon and Krishnan (1996)). Consumption information from the six villages surveyed in 1994 is available for 363 households. However, due to the extremely difficult survey conditions, data on both food and non-food consumption were collected in only four villages (i.e. for 213 households), while only food consumption data were collected in the other two villages.

In 1994, the sample was expanded with nine additional communities, which were selected to account for the diversity in the farming systems in the country, including the grain-plough areas of the Northern and Central highlands, the enset-growing areas and the sorghum-hoe areas[10]. It is a self-weighting sample, with each person representing approximately the same number of persons from the main farming systems. For 1994 and beyond we have complete data for most households (1411) for all three rounds. Within each village, random sampling was used, stratified by female headed and non-female headed households. In annex 1 we give details of the sampling method used. The resulting sample can be considered broadly representative of the households in the different farming systems in the country. Obviously, with only 15 communities, but relatively large samples within each village, the interpretation of the results in terms of rural Ethiopia as a whole has to be done with care. No other sources allowing a comparison over time exist, however, so that the current data set is probably the only one currently available to make any statements about change in Ethiopia[11].

[9] We use the term "village" in the paper for simplicity, although in fact the sampling unit is the "Peasant Association" , a formal administrative term describing one village or sometimes a small number of villages, controlled by one administrative authority.

[10] The first round of the 1994 survey was conducted in collaboration with IFPRI, Washington D.C..

[11] The survey collected also extensive information on health and anthropometric outcomes of all persons in the sample. In the same year, the Central Statistical Office collected a data set as part of the Welfare Monitoring System. Many of the average outcome variables, in terms of health and

An important issue for panel data is the attrition rate across rounds. Despite the fact that the 1989 survey was not designed in order to start a panel household survey, only 7 percent of households were lost in 1994. In most cases, this was due to poor recording of names, rather than any systematic reason that could have biased the resulting sample. In 8 percent of cases, the head of the household had changed (due to death, illness or transfer of headship to a son or daughter because of age). These households were retained. Less than 2 percent of households were lost between the three rounds of the ERHS in 1994 and 1995.

Annex 1 gives more details about the survey sites. The survey was not conducted in exactly the same months in each round, so that comparison has to be done with care. If seasonal consumption smoothing is less than perfect, for example due to variable food prices or imperfect credit and asset markets, then comparing different survey years may reveal apparent welfare changes over time, which are in fact due to seasonality. One simple way to avoid this problem is to compare results on welfare using as closely related periods as possible. As can be seen in annex 1, this is not the exactly the same for all sites when comparing 1989 and 1994, although the first round of 1994 (referred to as 1994a) can be directly compared (in terms of timing) with the third round (1995) for all villages.

3. Problems in questionnaire design and measurement issues

Several potential problems with comparing poverty over time exist and have been discussed in the literature. In this section we address the main problems related to questionnaire design and the measurement of consumption. First, the problem of changes in questionnaires[12] over different rounds of a survey needs to be addressed. Comparability is badly harmed with substantial changes in questionnaire design. For the 1994a, 1994b and 1995 round we do not have this problem since the questionnaires were not changed. For 1989 data there is no fundamental problem: the 1994-questionnaire is modelled on the 1989 questionnaire, with all the main items prompted for in exactly the same way. The format of the consumption questionnaire is the same in all rounds: three questions on ‘did you purchase’, ‘did you consume from own production/stock’, ‘did you consume from gift or wage in kind’, with lists of items for which the interviewee was prompted. However, the difference between the 1989 and 1994 questionnaire was that the list of items used in 1994 was slightly longer, since following piloting it was found that more items were commonly consumed than asked for in 1989. Questions on ‘did you consume anything else’ were asked in all rounds, including 1989, so in principle the items not listed or added as ‘other item’ were included in the 1989 survey. The fact that the list was also shorter ex-post in 1989 than 1994 could simply be due to shortages before the reforms and at the height of the economic crisis of the late 1980s. Nevertheless, as an additional check on the results, we recalculated the 1994 figures using only the items which were explicitly prompted for in 1989. We use the same poverty line for both the limited and the expanded definition of consumption. By

nutrition were very similar to the results in the ERHS, suggesting that the resulting sample may well be broadly representative of the general situation in rural Ethiopia. See Collier et al. (1997).

[12] Grosh and Jeancard (1994) and Lanjouw and Lanjouw (1997) discuss some of the consequences if this were to happen. Appleton (1996) discusses the consequences for poverty comparisons in Uganda.

limiting the items used in the calculations for consumption after 1994, we may well bias the results against a reduction in the measured number of poor[13].

Another issue is the actual definition of consumption used. The actual consumption definition used is the sum of values of all food items, including purchased meals and non-investment non-food items. The latter was interpreted in a limited way, so that contributions for durables and house expenses were excluded, as well as health and education expenditures (see Hetschel and Lanjouw (1996)). Although there may be methodological reasons to so measure welfare in practice, excluding these items is also done to avoid further bias due to different prompting of items in 1989 and 1994. However, one would expect that since 1989, and the end of the war in 1991, households are spending more on durables or construction - assets which are typically risky investments in insecure times (Collier and Gunning (1996)). As a consequence, again, we may, if anything, bias the results against reductions in the levels of poverty since 1989.

Another standard problem is related to the valuation of own production or gift consumption. We avoided the problem of using 'within survey' prices to value the very large consumption from own production or from gifts in kind (see Deaton (1989)). We collected data on prices in each village at the time of the consumption survey itself[14]. However, such a local price survey was not available in 1989. Rather than using unit values, we decided to focus on identifying an alternative source which could be used both in 1989 and 1994. A widespread price data-collection exercise is undertaken every month by the Central Statistical Authority (CSA), but prices are reported at an aggregated level (e.g. only 4 prices are available for the vast SEPA region or Oromiya region). We also assess how using different price series would affect our findings[15].

Consumption data are available only at the household level so further corrections are needed. Households in developing countries often have fairly complicated structures. In annex 2 we briefly discuss the concept of the household used, since several definitions were embedded in the questionnaire. Irrespective of the concept of the household, correcting for household size and composition is also an important issue. We calculated adult equivalent units using World Health Organisation (WHO) conversion codes. Since data on household size and composition was collected in each period, we adjusted the household size and the adult equivalent units in each period[16,17]. In many respects, this remains a relatively

[13] Lanjouw and Lanjouw (1996) suggest an alternative procedure for making poverty comparisons when consumption definitions differ.

[14] This proved more difficult than expected. Many items are not standard or available, even on the nearest urban market. These urban markets are often 5-10 km away and prices relevant for the households are not necessarily the same. Deaton (1997) reported that similar problems existed in many of the LSMS-surveys. See also Grootaert and Kanbur (1994) for Côte d'Ivoire.

[15] A specific problem in Ethiopia was that no standard measures (kg, lt) are used by the population. We identified about 100 different weights and measures, and to convert quantities, we conducted village-level conversion surveys. It was found that each village appears to have its own definition of commonly used measures, complicating our activities further. We also recalculated all the consumption data from the raw 1989 data (questionnaires were checked again) to make sure that differences in the conversion factors used by the research team in 1989 were not responsible for any of our findings. Capéau and Dercon (1998) report on an alternative econometric approach to estimate prices and conversion factors. In that paper it is shown that the results obtained from the econometric approach and from the community level surveys are relatively similar, while methods using unit values provide a very different result.

[16] The equivalent scales used are in annex 3.

arbitrary correction, especially since consumption is not limited to just the intake of calories. Ravallion and Lanjouw (1995) provide a careful analysis of the robustness of poverty measures to the weight attached to household size. This is beyond the scope of the current paper.

Table 1 provides means of total monthly consumption and food consumption per adult equivalent for the 1994 round for the six villages for which data are available for 1989 as well. They are in birr per month (the official exchange rate at the time was 5 birr per dollar). In the table, the comprehensive definition refers to a full list of items in 1989, while the limited definition includes only those items which were prompted for in the 1989 survey. The data in table 1 are for the 6 panel sites using the 363 observations. Note that we did not calculate the limited definitions for areas in which no equivalent data were collected in 1989.

Table 1 Consumption per adult equivalent in the panel sites in 1994: issues of definition

type of consumption	consumption definition	Dinki	Debre Berhan	Adele Keke	Koro-degega	Garagodo	Domaa
total	comprehensive	67.5	122.5	161.7	45.5	30.9	60.2
		(73.9)	(92.9)	(137.9)	(29.7)	(26.3)	(47.7)
	limited	63.9	119.2	147.7	n.a.	27.8	n.a.
		(74.7)	(92.5)	(102.1)		(25.0)	
food	comprehensive	58.9	103.6	119.8	39.5**	25.8	52.6
		(70.2)	(89.1)	(114.6)	(26.0)	(25.0)	(46.8)
	limited	55.0	104.7	105.1	31.4	22.4	40.0
		(70.0)	(89.2)	(80.6)	(22.3)	(23.4)	(40.7)

Data from the 1994 round of the ERHS. All consumption figures are mean per adult equivalent in the village, on average per month. Standard errors in brackets. Limited definition means that the list of items explicitly prompted for in 1989 is used in 1994 as well. Comprehensive definition uses all data food and non-food consumption items recorded in the survey, excluding durables, health and education.
** = limited definition is significantly smaller than comprehensive definition at 1 percent or less.
n.a. = not applicable, since no data in 1989

The differences on employing the alternative definitions do not appear very large. Only in one village is the difference in food consumption significant. Of course, these are mean values, not poverty measures. We investigate the consequences of the different definitions for poverty below.

[17] For two villages in the 1989 survey no complete age profile of household members had been collected. We only had numbers of male or female adults, and total number of female and male children under 15 years of age. We used the rest of the data to estimate the typical relationship between adult equivalent units and the age-household structure as given by male and female adults and children (i.e. aeu=f(male children, male adults, female children and female adults)). The results of the estimation were: aeu=1.04*male adults+0.80*female adults +0.76*male child+0.69*female child. This regression was then used to obtain adult equivalent units in the two villages with aggregate information only.

4. Constructing Poverty Lines to Analyse Changes in Poverty

The study of poverty in a country is ultimately an attempt to compare living standards across households or individuals. It therefore suffers from all the usual problems associated with tastes, circumstances, price differences and behavioural responses. While economists may have little problem with using consumption measures, one still needs to make careful corrections to allow monetary measures to reflect poverty differences. As usual, poverty will be defined relative to a poverty line. Although alternative methods to define the poverty line are possible (Anand and Harris (1994), Greer and Thorbecke (1986)), we use the cost-of-basic-needs approach to estimate a poverty line (Ravallion and Bidani (1994)). A food poverty line is constructed by valuing a bundle of food items providing 2300 Kcal. A specific value for this basket is obtained per survey site. To this value, an estimated non-food share is added to obtain the total consumption poverty line per day per adult.

We identify two specific problems with this approach in the Ethiopian case. First, pricing a basic basket assumes the availability of all these commodities in the local market, which is difficult to believe especially for 1989. Indeed, we encountered problems with finding price data for some commodities in the local markets[18] even in 1994. A second problem is that in rural areas we are dealing with very different farming systems (enset versus cereal based systems, see annex 1). Their diets are very different, implying very different product availability in markets affecting our pricing. The main consequence of the latter problem appears to be very different cost-of-living measures depending on which diet is used (specific per site or common for all sites). As discussed in Dercon and Krishnan (1996), the appropriate procedure is not self-evident[19]. In this paper we settled for a common diet for everyone, to increase comparability across sites.

As will be seen below, the issue of prices becomes even more crucial when attempting to do comparisons over time and space. We know from other work that price dispersion is high in Ethiopia, with markets taking considerable time to perform arbitrage (Dercon (1995)). Also, rural areas are not well served by rural markets, probably due to very poor infrastructure, while even in small urban markets the availability is often poor. Even if markets always clear, price variability over time is high, and is not explained by seasonal factors. Such variability is very difficult to deal with in analysing poverty. Temporary price increases will make the minimum food basket very expensive, and the expected behavioural response is to reduce consumption as long as prices are very high. When prices return to lower levels consumption may then be boosted. Depending on whether consumption was measured when prices were high or low has important consequences for finding

[18] These problems are common in this type of survey. See Deaton (1997) and Capéau and Dercon (1998) for a discussion and some alternative solutions.

[19] The problem is linked to the issue of compensation for needs versus tastes (Ravallion and Bidani (1994). If it is clearly a matter of choice that in some areas, such as urban areas, households consume more expensive commodities, then compensation for these expensive tastes is unlikely to be appropriate in rural-urban poverty comparisons. However, the differences in diets in Ethiopia are closely linked to farming systems that have developed over very long periods. This may suggest that a specific poverty line for each system or village in the survey may not be inappropriate. In Dercon and Krishnan (1994), it is shown, however, that this reverses the order of villages in terms of poverty. In this paper, we are dealing with changes over time, and it was found that the pattern of change is hardly affected by this discussion, so that we settled for the simple common poverty line (in terms of the quantities included in the diet, not in terms of its value) for all sites.

whether households were poor or non-poor. In fact, since allowing consumption to fluctuate may be part of the same consumption plan, the interpretation of the poverty figures is difficult: when prices are (temporarily) high, poverty is likely to be overestimated, while when prices are low, poverty is likely to be underestimated[20]. Seasonality presents a similar problem, but here, information about the likely patterns of prices is available since the seasons are always with us.

W decided to use the same basket of commodities for each period and site to increase transparency and comparability in the analysis, using 1994 as a base year to determine the basket of commodities included[21]. As in Ravallion and Bidani (1994), we constructed a typical diet for the poorest half of the sample in nominal consumption using the 1994 data and calculated its calorie contribution[22]. We then scaled this measure to reach 2300 Kcal per day. The diet is given in annex 3, table A.5.

We used the approach described in Ravallion and Bidani (1994), to estimate the required non-food share by estimating an Engel curve and then determined the food share of the representative household whose total consumption is exactly equal to the food poverty line. Details are given in annex 4[23]. The value of the non-food share at the poverty line can then be interpreted as representing the absolute minimum basic needs in terms of non-food items, for which households should be compensated, on top of the minimum food requirement. The resulting food share at the poverty line is 83 percent on average. Note that this share is very high, so that the non-food share to be added to the food poverty line is actually quite low. The consequence is that this implies that the total consumption poverty lines calculated in this way are relatively low. Indeed, they are close to 10 dollars per month per adult, much lower than one would find in many other African countries.

A few remarks on this 'low' poverty line are in order. Although the approach aims to establish an 'absolute' poverty line by measuring the actual cost of basic needs, its application does not necessarily result in a poverty line that could be directly used for comparisons across countries. We use data from the survey itself to decide the relevant minimum food bundle to establish the poverty line. In doing so, we limit it to calorie-intake. Of course, calorie-intake is only a limited part of a healthy diet; if a large part of the country is then to perforce forego other more expensive nutrients to obtain a calorie-intensive diet, then the resulting diet to reach 2300 Kcal is biased against the inclusion of other nutrients. If other nutrients were included in the construction of the diet, then we would probably have reached a much more expensive food diet. For example, the only protein intake included is from pulses and milk; no meat or fish is included, since the poorer half of the sample

[20] If the problem is mainly intertemporal variability, a possible solution is to make the minimum basket of commodities dependent on the time period - effectively adjusting over time the quantities needed to obtain the minimum level of consumption. If the variability is mainly spatial then one may argue in favour in taking location-specific diets. However, this raises again the problem of comparability.

[21] The poverty line then effectively becomes a cost-of-living index with budget weights taken from the poorer half of the sampled households.

[22] Fortunately, all these commodities were prompted for in the 1989 survey as well.

[23] One could argue that non-food shares could be calculated for each site separately. However, if implemented in this way, this would only have been appropriate if they reflected genuine differences in needs or relative food/non-food prices across areas. Since we could see little ground for such an approach in our survey villages, and given the relatively small samples within each village, one non-food share was used for all areas.

simply do not consume it. Since food shares decline with total expenditure, non-food shares near these new food poverty lines with more nutrients would also be higher, resulting in an even higher total poverty line. An important consequence is that the poverty measures calculated in this way can hardly be used for cross-country comparisons; for such comparisons, one-dollar-a-day or similar approaches may be more appropriate.

The poverty line used for each period uses the same basket throughout, but valued at the prices for the survey period. The poverty line can therefore also be thought of as a price deflator allowing comparisons across villages and over time. A potential problem is that in 1989 and 1994 we are forced to use different prices through lack of a specific price survey in the survey area during 1989, while during the three rounds since 1994, a site-specific price survey was collected. The regional price data from the CSA (Central Statistical Authority) are the alternative available. Since the CSA collected similar data in 1989, 1994 and in 1995, in the same period as the rural survey, we use their data to value the minimum food basket for these three periods[24]. This will give us a means of checking whether the price data sources matter for the poverty comparisons over time.

In annex 5 we give the poverty lines for each site for 1989 to1995 for the six panel sites and for all sites in 1994 and 1995. In table 2 and 3, we give the average of the poverty lines used both for the longer and the shorter panel. We also express them as an index to compare it with other data sources on price changes.

Table 2 Poverty lines and implied inflation rates : panel sites only

	Poverty line ERHS	Poverty line CSA	Price index ERHS	Price index CSA	Price index CPI	Price index Food CPI
1989		22.3	(100)*	100	100	100
1994a	49.2	44.2	221	198	175	185
1994b	48.3		216		184	197
1995	50.8	48.0	228	215	180	193

*using CSA 1989 =100 as base

Sources: ERHS = price survey of the Ethiopian Rural Household Survey; CSA = regional price data based on Central Statistical Authority price data collection; CPI = official Consumer Price Index based on urban price data; Food CPI = food Consumer Price Index

Poverty lines for ERHS and CSA data are population weighted averages within the sample.

In table 2, the first two columns provide comparisons of the poverty line using the ERHS price survey, compared to the regional data from the CSA. The 1994a poverty line is 11 percent higher when using the ERHS data. Since, for the 1989 poverty line, we use the CSA data, we may overestimate the increase in the cost of living between 1989 and 1994 if we were to use the ERHS data for the latter period. Note that this difference is perfectly plausible, given the different markets in which prices were collected. The CSA data include many rural market towns, while our sample specifically uses the local market, closest to the village, which in some cases is quite remote.

The differences between these two data sources become relatively small, however, when comparing the results with the situation using the CPI (official

[24] We do not have equivalent data from the CSA coinciding with the second round of the ERHS, since all activities of the CSA were suspended at the time due to the 1994 Census.

Consumer Price Index) data. Irrespective of whether we use the overall or the food CPI, both the ERHS and to a lesser extent the CSA price data suggest much larger price increases between 1989 and 1994 than the official CPI. This points to the dangers if no careful choices are made with respect to price data: if we were to make poverty comparisons simply using the CPI as the appropriate adjustment of the cost-of-living over time, then we are likely to underestimate the cost of basic needs, i.e. underestimate the level of poverty in our sample in 1994, in comparison to 1989. Part of the reason is likely to be the fact that the CPI is based on urban data only.

We looked for other means of checking the results. A possibility is to esti–mate poverty lines without price information. Greer and Thorbecke (1986) use such an approach. We estimate a variant of their model. By regressing the logarithm of calorie consumption per adult equivalent on the logarithm of food consumption per adult equivalent, one is able to find the level food consumption that implies in the data the consumption of 2300 Kcal per day per adult equivalent. Estimation with food rather than total consumption was done because of the limitations on the data available for 1989 (see section 2). We then calculated the value of food consump–tion at which the poverty line of 2300 Kcal per day was consumed. We find remarkably close estimates of the food poverty line to those calculated by the other approach: 20.7 birr in 1989 and 41.3 birr in 1994 (for comparison: the average food poverty line underlying table 2 is 18.5 birr for 1989, while for 1994, 36.7 birr using the CSA data and 40.7 birr using the ERHS price survey). These estimated food poverty lines suggest a 99 percent increase in nominal terms since 1989 - virtually the same as in the CSA rural prices, but higher than the CPI price increases. This appears to confirm the problems related to using the CPI for rural price changes. The level of the estimated food poverty line in 1994 is however closer to the food poverty line using the ERHS, suggesting that the ERHS price survey is the more appropriate absolute measure of the cost of living to reach consumption levels close to the poverty line. However, since we are especially interested in measuring the change in poverty as accurately as possible, it appears more appropriate to use the CSA price data for the poverty line in both 1989 and 1994[25] . In sections 5 and 6, we look at the consequences of using different price sources.

Table 3 Poverty lines and implied inflation rates : all sites

	Poverty line ERHS	Poverty line CSA	Price index ERHS	Price index CSA	Price index CPI	Price index Food CPI
1994a	44.5	44.4	100	100	100	100
1994b	47.0		106		105	106
1995	50.0	47.6	113	107	103	104

sources: see table 2

Table 3 highlights another potential problem. Using the ERHS price survey, we observe much larger price increases between 1994 and 1995 than those implied by the CPI during exactly the same period: the ERHS data suggests a 13 percent increase, while the CPI suggest only a 3 percent rise. The CSA regional prices

[25] An alternative would be to impute a poverty line for 1989 from the 1994 food poverty line using the ERHS data and using the inflation rate in each site implied by the CSA data. This implies additional imputation, possibly causing further measurement error.

increased less than the ERHS, but still more than the CPI. Again, this illustrates the problems with using the CPI within the rural sample as a means of adjusting the poverty line over time.

5. Poverty levels and changes

Having constructed poverty lines and consumption measures of welfare, we can now analyse levels and changes in poverty. First, we focus on the panel households for the trends between 1989 and 1994. Recall that for four villages, we have data on total consumption for both 1989 and 1994. For the six villages (and 361 households) surveyed, we have data only on food consumption in 1989 for comparison with 1994. We construct food poverty levels using the full sample and total poverty levels for the 211 households with only food consumption data in 1989. Next, we look at the pattern since 1994 as well. From 1994 onwards, we have a full panel with relatively little attrition (see Annex 1). By 1995, the sample consists of 1411 with full information in all three rounds for our purposes.

The poverty measures reported are from the FGT-family of poverty indexes (Foster et al. (1986)). Let y_i denote consumption per adult equivalent which is ordered for all households from low to high, and z the poverty line and if there are q households with consumption per adult below the poverty line z, then the P_α family of poverty indexes can be defined as:

$$P_\alpha = (1/n). \sum_{I=1}^{q} ((z-y_i)/y_i)^\alpha \qquad (1)$$

for different values of α: if $\alpha = 0$, this is the head count index, $\alpha=1$ is the poverty gap and $\alpha=2$ is the severity of poverty index.

Since poverty measures are calculated using sample data, it is important to treat them as statistics[26] . We report poverty levels for households, not at the level of the individual. Often poverty is reported by individuals by using the household sizes to convert the household level observations in apparent individual level data. We do not follow this practice, because it artificially makes it appear that the sample size is

[26] Kakwani (1990) provided standard errors and showed the conditions under which differences between poverty measures are asymptotically normally distributed. He shows that standard error (SE) of the difference between the estimates of two independent poverty measures P_1^* and P_2^* is equal to:

$$SE(P_1^* - P_2^*) = (\sigma^*_1/n_1 + \sigma^*_2/n_2)^{1/2} \qquad (2)$$

in which σ^*_1 and σ^*_2 are the sample estimators of the variances of the asymptotic distributions of $n_1^{(1/2)}. P_1^*$ and $n_2^{(1/2)}. P_2^*$.The test-statistic for testing equality of the two measures:

$$\eta = (P_1^* - P_2^*)/ SE(P_1^* - P_2^*) \qquad (3)$$

follows an asymptotic normal distribution with zero mean and unit variance. He shows that the variance of the asymptotic distribution of each estimated poverty measure of the P_α - family equals:

$$var (n^{1/2} .P_\alpha^*) = (P_{2\alpha}^* - P_\alpha^{*2}) \qquad (4)$$

much larger than actually is the case. This is important when calculating standard errors of the poverty measures, as in Eqn (4) (see footnote): the larger the sample size, the lower the error and the levels and differences will more often be significantly different from zero. By using the data as if the number of times each household's consumption level appears in the data is equal to the number of household members, the formula for the variance in (4) is not correct, since it does not take into account the extensive clustering implied by using the household as the sample unit, and not the individual. In principle, we could correct for this problem by calculating the corrections for clustering (see Deaton (1997), Howes and Lanjouw (1996) for details), but this is beyond the scope of this paper.

To investigate the robustness of the results relating to the change between 1989 and 1994, we use two different definitions of consumption for 1994: the comprehensive and the limited definition discussed in section 3. We also use two different poverty lines: one using the CSA prices and one using the ERHS price survey data collected in the sample villages. Table 4 reports food poverty level for the full panel (six villages) between 1989 and 1994.

Table 4 Food poverty levels 1989-1994; 6 panel villages (n=361)

	1989	1994a - ERHS prices & comprehensive definition		1994a - ERHS prices & limited definition		1994a - CSA prices & comprehensive definition		1994a - CSA prices & limited definition	
P_0	61.2	49.0	(-3.32)	58.2	(-0.83)	44.6	(-4.54)	52.1	(-2.49)
P_1	29.3	20.6	(-4.09)	26.5	(-1.28)	18.2	(-5.39)	23.3	(-2.77)
P_2	17.5	11.2	(-4.21)	15.4	(-1.29)	9.8	(-5.16)	13.6	(-2.40)

ERHS= poverty measure using poverty line valued at ERHS price survey;
CSA = poverty measure using poverty line valued at CSA regional price survey;
comprehensive definition = food consumption per adult using all items recorded in 1994;
limited definition = food consumption per adult only using items prompted for in 1989.
In brackets, the t-test statistic for testing differences in levels of poverty with 1989.
The standard errors of each measure are not reported, but each was significantly different from zero.

Looking at the results, it is obvious that poverty levels in 1989 in these villages were very high, with a head count index of 61 percent. Using all food consumption items recorded in the questionnaire in 1994 and using the local price survey collected at the time of the survey, we find a large and significant decline in poverty. The head count declined by a fifth and the intensity of poverty index by a third. The subsequent columns investigate whether the particular method of calculating consumption and the use of the ERHS price survey in 1994 and CSA prices in 1989, affects the results. Since the ERHS prices appear to suggest larger price increases since 1989 than the CSA data, it is obvious that in that case the poverty decline is smaller. Similarly, by excluding some values for consumption items from the food consumption estimate, poverty is increased. Note however that poverty still declines: only if both the relatively high ERHS prices and the lower consumption estimates are used is the consumption decline insignificant. If we use the same definition for consumption and the same (CSA) source of prices for both 1989 and 1994, then the poverty measures decline by 15 to 22 percent, depending on the measure. However, this decline hides the differences in experience across the different villages in the sample. Table 5 gives details for food poverty levels in 1989 and in 1994, using on

the one hand the full data and prices from the 1994 survey, and on the other hand the same data and definitions as in 1989.

Table 5 Food poverty levels 1989-1994 - panel villages

	Dinki		Debre Berhan		Adele Keke		Korodegaga		Garagodo		Domaa	
P_0 89	41.5		33.9		41.9		74.7		80.0		84.9	
P_0 94 (1)	47.2	(0.59)	19.4	(1.85)	14.0	(3.04)	57.9	(2.50)	85.5	(0.76)	60.4	(2.95)
P_0 94 (2)	45.3	(0.39)	16.1	(2.33)	4.7	(3.04)	68.4	(0.97)	90.9	(1.64)	62.3	(2.74)
P_1 89	14.4		11.8		10.4		39.7		45.9		44.2	
P_1 94 (1)	16.2	(0.43)	5.0	(2.35)	3.8	(1.95)	21.8	(4.56)	47.2	(0.25)	28.5	(2.91)
P_1 94 (2)	15.3	(0.21)	2.4	(3.52)	4.3	(1.75)	25.8	(3.44)	58.3	(2.36)	30.5	(2.46)
P_2 89	6.6		5.4		4.7		24.8		30.2		26.5	
P_2 94 (1)	7.2	(0.24)	1.6	(2.47)	1.4	(1.53)	10.4	(5.02)	29.4	(0.19)	16.7	(2.33)
P_2 94 (2)	6.6	(0.03)	0.5	(3.33)	1.9	(1.30)	13.1	(3.90)	40.0	(2.12)	19.1	(1.63)
obs.	53		43		62		95		55		53	

note: 94 (1) = poverty measure using poverty line valued at ERHS price survey and consumption per adult using comprehensive definition of consumption;
94 (2) = poverty measure using poverty line valued at CSA regional price survey and consumption per adult using definition of consumption, limited to items explicitly included in 1989 survey.
In brackets, t-test of difference of estimate with the estimates in 1989.

In two villages we observe increases in food poverty, while in the others we observe substantive decreases in poverty. The increases in Dinki are not significant, but those in Garagodo are, for the poverty gap and the intensity of poverty, provided we use the limited consumption definition and the CSA prices. In the other villages, the decreases are generally significant for all measures and for the different methods[27] .

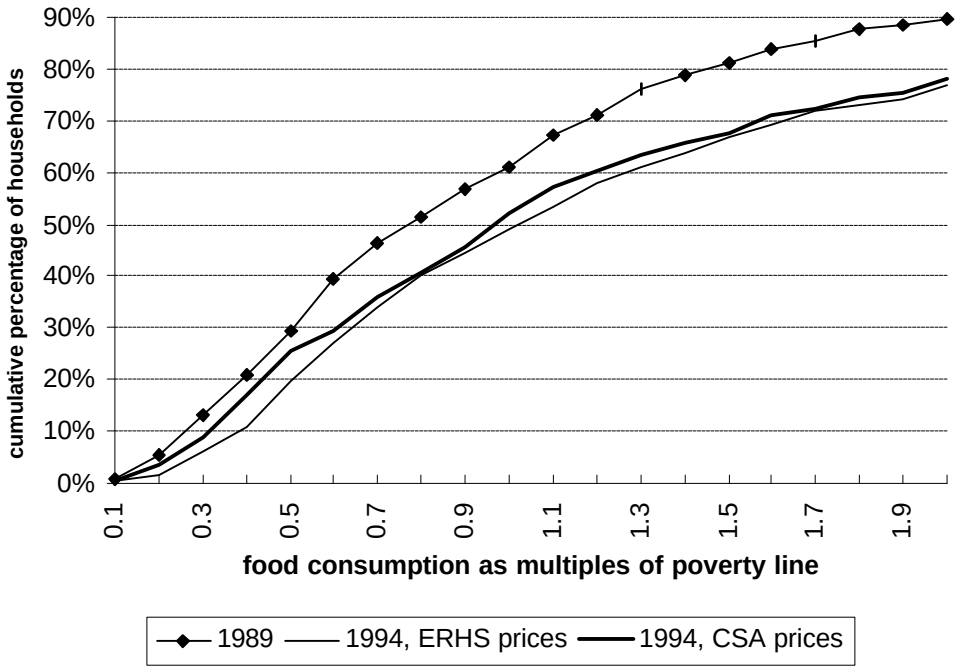
Stochastic dominance tests provide further robustness tests of the conclusions about the changes in poverty. Atkinson (1987) discusses the relevant conditions to apply dominance tests for poverty measures[28] . Figure 1 gives the appropriate cumulative distribution for 1989 and for two definitions of consumption and price sources for 1994: consumption using the comprehensive definition with the ERHS price data, and consumption and poverty lines using the same definition and source of price data for both periods, i.e. the limited definition with CSA prices. We use the food poverty data for panel households in the six villages. The figure demonstrates that everywhere, for a very wide range of poverty lines, the alternative

[27] For two villages, Domaa and Korodegaga, we do not have non-food consumption data. In both villages we observe important decreases in food poverty, so it should not be a surprise that if we estimate for the four remaining villages total poverty estimates, we find insignificant changes. In two villages poverty increases, in the two remaining villages, poverty decreases. Overall, in the sample of 211 households for which we have total poverty estimates, poverty marginally increases for all poverty measures, poverty marginally increases for all poverty measures. The head count index using the same definitions and price data sources in both years goes from 39.8 to 41.7 percent; the poverty gap from 17.1 to 19.1 and the intensity of poverty index from 10.1 tot 11.5 percent.

[28] For the FGT-poverty measures used in this paper and any other monotonic transformation of an additive measure, First-Order Dominance can be defined for a particular range of poverty lines from 0 up to, say, z^+. The condition states that poverty between two periods has unambiguously fallen if the poverty incidence curve for the latter period lies nowhere above that for the former period within the range defined by 0^- and z^+. In our context, the poverty incidence curve is the cumulative distribution of households over different levels of consumption per adult. Since the different distributions over time have to be put in the same graph, consumption per adult needs to be expressed in comparable units, which is possible by defining them as multiples of the poverty line in each period (so that at the original poverty line as defined in table 2, real consumption is equal to one).

definitions for 1994 have little influence on the curves, and everywhere, the 1994 poverty incidence curve is well below the 1989 curve. First-Order Dominance therefore applies for all reasonable food poverty lines. Note that this means that also for higher order P_α measures, food poverty will be unambiguously lower in 1994 (Atkinson (1994)).

Figure 1
Stochastic Dominance Food Poverty 1989-1994



Thus far in this section, we have only concentrated on the households in the sample for which data exist in 1989. The ERHS household survey for 1994-1995 has more extensive coverage and data were collected thrice over the year. The data in 1995 were collected in more or less the same month as in the first round of 1994 (1994a). Therefore, they provide a test whether a year later, any change has occurred in the sample. The second round of 1994 (1994b) provides an interesting test on whether the exact timing of data collection matters for these welfare comparisons over time. In other words, seasonal effects can be captured. Table 6 presents the results for the P_α measures. In brackets, we give the t-values of the test in the difference in the estimated poverty measure with the equivalent measure in 1994a. In annex 6, we give the same table for food poverty levels (table A.10). The results are very similar in either case.

Table 6 Poverty levels 1994 - 1995 - ERHS panel households

	Northern Cereal		Central Cereal		Southern Cereal		Southern Non-cereal		All Areas	
P_0 1994a	32.5		23.1		32.2		46.9		34.1	
P_0 1994b	23.1	(-2.53)	14.3	(-3.26)	26.7	(-1.46)	41.8	(-1.52)	26.9	(-4.14)
P_0 1995	28.7	(-1.00)	23.3	(0.08)	28.8	(-0.90)	55.9	(2.62)	35.4	(0.71)
P_1 1994a	11.6		6.8		13.6		19.6		13.0	
P_1 1994b	6.1	(-3.63)	4.0	(-2.79)	7.6	(-3.60)	13.9	(-3.39)	8.2	(-6.40)
P_1 1995	11.2	(-0.20)	6.7	(-0.13)	8.9	(-2.73)	24.0	(2.36)	13.3	(0.28)
P_2 1994a	5.9		2.9		7.3		11.1		6.9	
P_2 1994b	2.4	(-3.76)	1.9	(-1.69)	3.2	(-3.95)	6.7	(-3.84)	3.7	(-6.48)
P_2 1995	6.0	(0.06)	2.8	(-0.09)	4.0	(-3.24)	13.1	(1.56)	6.8	(-0.15)
n	286		407		292		426		1411	

Notes: Northern Cereal are villages located in the Northern Highlands grain-plough complex; Central Cereal are villages located in the Central Highlands grain-plough complex; Southern Cereal are the villages in the grain-plough areas of Arsi/Bale or with sorghum plough/hoe; the Southern Non-cereal are the enset villages with or without coffee/cereals. For details see table A.1 and A.2. In brackets, the t-values testing the difference in the estimate of the poverty measure in the particular period with the estimate in 1994a.

In terms of the full sample, there is a large and significant decrease in poverty between the first and second round of the 1994 survey: poverty decreased by a fifth in terms of the head count and with even larger declines in the higher order measures. The results for 1995 illustrate, however, that this is most likely to be a strong seasonal effect. Although there are differences between many areas in the exact timing of harvests, in the majority of the areas, the second round is the beginning of the harvest in most cereal areas, when food is relatively plentiful. The first (1994a) and the third round (1995) were conducted several months past the main harvest in most of these sites. Overall, we cannot detect a significant change between 1994a and 1995: aggregate poverty appears not to have been affected by the reforms initiated 1994, at least in the short run.

As is to be expected, this obscures some differences between areas. In all areas, the decline in poverty between 1994a and 1994b is observed, and virtually in all cases it is significant. Only in the Southern cereal areas do we observe a significant decline in poverty between 1994a and 1995, while in the Southern non-cereal villages we observe a significant increase. A tentative explanation for the latter effect is that this is largely due to an increase in enset pests destroying some crops in one village and a large decline in the possibility of seasonal migration due to ethnic conflict in another village, which affected slack season earnings substantially in the area.

These results may well be specific to the actual poverty lines chosen. To check the sensitivity of the results to different poverty lines, we show the results of testing for stochastic dominance by plotting as before the cumulative distribution of households under the poverty line for different multiples of the poverty line in each period (figure 2). It can seen that these poverty incidence curves for 1994a and 1995 (the first and the third round, collected at roughly the same months) are barely distinguishable, confirming very similar poverty levels in both periods. Note that the curves appear to cross a few times, suggesting the absence of first order stochastic dominance between 1994a and 1995. In principle, we could look into second or higher order dominance by plotting the curves resulting from the integration of these incidence curves (Atkinson, 1987; Ravallion, 1994). However, given that the difference in poverty is sufficiently small as never to be significant, we did not

conduct these tests. From figure 2, we observe that the difference between the two periods in 1994a and 1994b is very large irrespective of the poverty line, suggesting consistently significant seasonal differences in poverty between these two periods. Since it was found to be valid for all poverty lines larger than zero, first order dominance applies, so that poverty for all measures considered is unambiguously lower in 1994b compared to 1994. This confirms that seasonality may well affect any attempt to measure changes in poverty over time very considerably. Most studies do not consider these problems when comparing survey data over time.

Figure 2 Stochastic Dominance
Poverty Incidence Curve 1994-1995

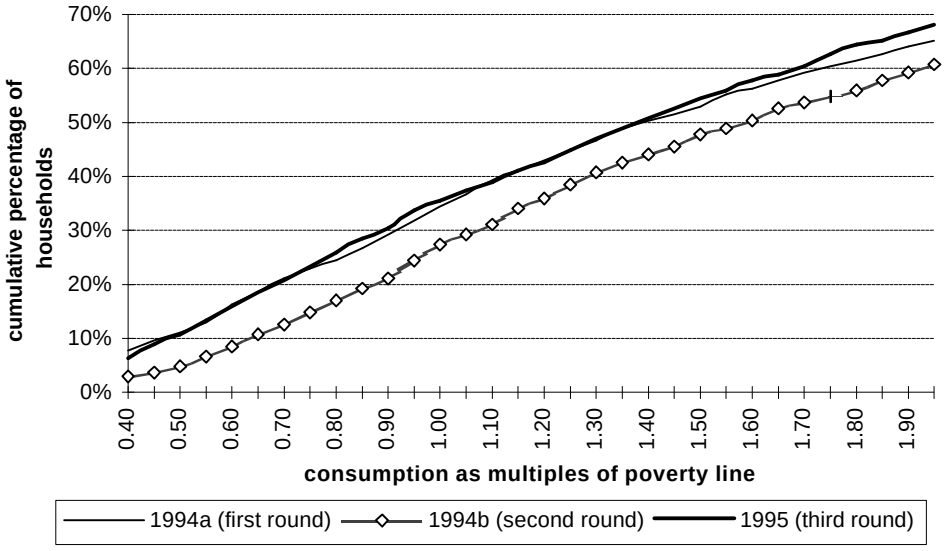


Table 7 presents the levels of food poverty, following the initial sample in 1989 over the three subsequent rounds. The results are broadly similar, even though the actual levels of poverty from 1994 onwards are higher than in the full sample. This reflects the fact the 1989 survey focused on villages which had suffered from the drought in the 1980s, making them poorer than the average village. Note that the seasonal effect in these villages is even larger than in the full sample. The decline in poverty between 1994a and 1995 is not significant but the observed decline between 1989 and 1995 is substantial: about a quarter lower for the head count, a third less in terms of the poverty gap measure and 40 percent lower in terms of the severity of poverty index.

Table 7 Changes in food poverty 1989-1995 - panel households (n=351)

	1989	1994a		1994b		1995	
P_0	61.3	49.6	(-3.13)[a]	33.3	(-4.51)[b]	45.3	(-1.13)[b]
P_1	29.2	21.1	(-3.82)[a]	11.8	(-5.19)[b]	18.6	(-1.27)[b]
P_2	17.4	11.4	(-3.93)[a]	5.9	(-4.52)[b]	10.3	(-0.78)[b]

[a]=t-test of difference with poverty in 1989

[b]=t-test of difference with poverty in 1994a

Note that the results deviate marginally from table 4 since some additional households were lost in 1994b and 1995, compared to 1989.

Since seasonality of poverty looms large in these data, it is worthwhile to construct a more careful comparison in poverty between 1989 and 1995. Given that the exact dates of data collection differ between 1989 and the first round of 1994 or the 1995 data in some areas, we constructed a new comparison, taking the closest month of data collection in the 1994-1995 rounds to make the relevant comparison with the 1989 poverty levels. Table 8 gives the results. As might have been expected from table 7, in table 8 we still observe a large decline in poverty since 1989. Nevertheless, the observed decline is not a pure seasonal effect: poverty declined substantially between 1989 and 1995 in this sample[29] .

Table 8 Changes in food poverty 1989-1995, controlling for seasonality (n=351)

	1989	1994-1995	
P_0	61.3	45.9	(-4.14)
P_1	29.2	18.4	(-5.17)
P_2	17.4	9.9	(-4.88)

note: (1) Debre Berhan and Dinki = 1994a; Garagodo and Domaa =1995; 1994b=Korodegaga and Adele Keke.
(2) T-test for difference in poverty measure in brackets.

6. Sensitivity of Poverty Measures to Price Changes

The results on changes in poverty in the previous section were derived using the ERHS price survey, with some testing of the sensitivity if the CSA regional price data were used instead. There is little difference in using either source of price data. However, both data sources predict relatively larger price increases than some other price data sources. For example, the CPI increased by only 3 percent between 1994a and 1995, while on average the ERHS data suggest an increase by 13 percent (table 3). Estimated price increases between 1989 and 1994a also differ by the data sources.

It is likely that these problems arise in many other contexts. In the LSMS-data on the Côte d'Ivoire, for example, these concerns about price data have given rise to several different price index estimates. Grootaert and Kanbur (1994) have documented the sensitivity of the poverty measures to these results, by calculating a large range of different measures. In practice, this is very time consuming and at times no alternative data are available to cross-check a constructed price index with alternative price sources. Ideally, one would like to have some dominance results in terms of ranges of inflation rates over which one can confidently predict that the poverty orderings over time (or across space) remain the same.

Standard stochastic dominance tests do not allow for this problem. Effectively, the dominance results as in Atkinson (1987), are for poverty comparisons with a common poverty line for "real" consumption, i.e. consumption values comparable over space or over time. In this paper we use the equivalent

[29] Of course, these results hide differences between the experiences in different villages. In two villages (Korodegaga and Domaa) there are large and significant declines in poverty using the measure correcting for the seasonality in poverty. In two other villages (Debre Berhan and Adele Keke), the decline is generally not significant, while in the two remaining villages there are increases, although in one village (Dinki) they are not significant at all, and in the other village (Garagodo) only significant at 5 percent.

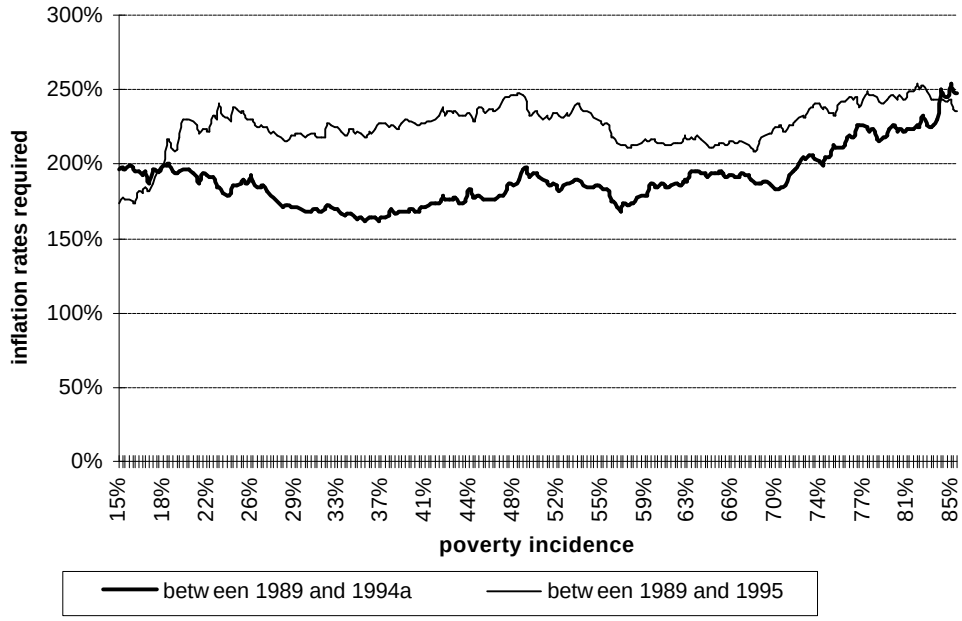
formulation of poverty defined over nominal consumption, with the poverty measures corrected for price changes. It is readily seen that for all poverty results based on the normalised poverty gap, (z-y)/z, such as the measures defined by (1), this is equivalent to using a constant poverty line z and a price deflator p_t. Formally, let $z_t = p_t.z$. The normalised poverty gap can then alternatively be written as $(z_t-y)/z_t$ and $(z-y/p_t)/z$.

Stochastic dominance tests in poverty analysis checks whether the poverty ordering remains the same over different multiples of the poverty line. Formally, they investigate poverty ordering for different poverty lines defined as $k.z_t$, in which k is scalar which is varied and z_t is a specific poverty line in period t. Despite the fact that k is allowed to vary, the ratio z_{t+i}/z_t is kept constant across the poverty curves. Consequently, none of the dominance results obtained illuminate the problem of the sensitivity to uncertainty about the relative poverty lines. It is possible to derive some dominance results in this context (see e.g. Jenkins and Lambert (1997)). We propose however a very simple graphical technique to illustrate the robustness of the results to the analyst (for a formal discussion, see Dercon (1998)).

The basis of the technique is to define the estimated price change (inflation rate) at which poverty level are the same in the two periods[30] . In principle this could be calculated for any poverty measure. Here we illustrate it for the head count. In figure 3 we give the inflation rates between 1989 and 1994 for the 6 panel villages which would have made poverty in terms of the head count the same in each period, for different values of the head count. To calculate this line, we first ordered nominal consumption per adult and constructed the cumulative distribution of households for each level of nominal consumption. By looking at this distribution, we could, for each cumulative percentage of households, determine the corresponding nominal consumption levels in each period. Since the head count in simply the percentage of households with less than a particular level of consumption, the ratio of the nominal consumption levels obtained in each period would give the price deflator needed to put exactly the same number of households under the poverty line in either period. This deflator, expressed as a percentage change between 1995 (1994a) relative to 1989 is given in figure 3. If actual inflation is higher than this figure, then poverty would have increased between 1989 and 1994-95; if it is lower, then a decline would have been observed.

[30] The approach can be easily adapted to problems of relative prices across localities.

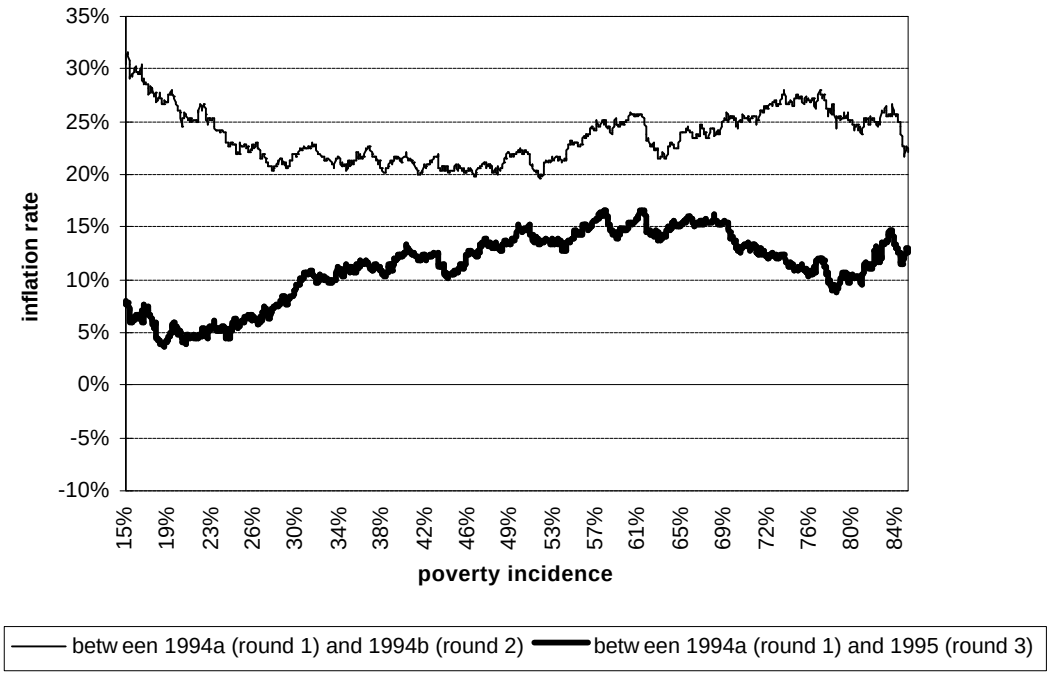
Figure 3 Inflation rates for equal poverty 1989-1995



Recall that table 2 showed that the ERHS data suggest an average inflation rate of 121 between 1989 and 1994a and 128 percent between 1989 and 1995. Inflation was estimated to be much lower by all other sources. Equal poverty would have required a poverty rate well above 150 percent - and at higher levels of the poverty line, even larger than 200 percent. Hence, for poverty to have remained equal between 1989 and 1995, even higher inflation levels would have had to apply. Clearly, the observed changes in the six villages are robust even to substantial underestimation of inflation in the ERHS survey. Problems with the inflation rates are unlikely to matter here.

The changes between 1994 and 1995 can be analysed in a similar way. Figure 4 gives the results, comparing 1994b with 1994a and also 1995 with 1994a. This allows an analysis of the sensitivity of the results to the price factors in the seasonal and the one-year changes. Again, if inflation figures are higher than those implied by the curve, then measured poverty is bound to have increased; if they are lower, a poverty decrease is likely to be observed.

Figure 4 Inflation rates for equal poverty 1994-1995



The top curve, showing the inflation rates between 1994a and 1994b needed to keep poverty equal illustrates the robustness of the seasonal effect needed: only if prices had increased more than 20 percent would poverty have increased across a large range of initial poverty levels and corresponding lines. Since both the CSA and ERHS sources suggest a rural price inflation rate in this period of about 5-6 percent, the result on the seasonal decline in poverty is unlikely to be affected by the uncertainty about the actual inflation figures in this period. However, the change between 1994a and 1995 is more sensitive. At most levels of initial poverty, inflation rates below 10 percent would have implied declines in poverty. Since the CPI estimates inflation at only 3 percent, the use of these data would have resulted in estimates of substantial poverty declines, but such declines are contradicted by the data collected in the survey sites. In contrast, over a very large range of poverty lines, the prediction of 13 percent inflation as in the ERHS-survey would be consistent with little change in poverty between 1994 and 1995.

7. Decomposing poverty changes

The FGT-poverty measures used in the analysis are additively decomposable, i.e. they can be written as a weighted average of poverty measures for subgroups, the weights being proportional to the population shares (Foster et al. (1984)). Formally, for m different subgroups, the poverty measures can be written as:

$$P_\alpha = \sum_{i=1}^{m} w_i P_\alpha^i \qquad (5)$$

in which w_i is the population share of subgroup i and P_α^i is the poverty measure for the subgroup. This property carries over to changes in poverty as well. Let s and t

be two periods in poverty measures are calculated and let (for simplicity) w_i be constant over time. Consequently, it follows from (5) that

$$P_\alpha^t - P_\alpha^s = \sum^m_{i=1} w_i \, (P_\alpha^{ti} - P_\alpha^{si}) \qquad (6)$$

It is then also possible to define θ_α^i, the contribution of each group to the change in poverty between t and s, as:

$$\theta_\alpha^i = w_i.(P_\alpha^{ti} - P_\alpha^{si})/ (P_\alpha^t - P_\alpha^s) \qquad (7)$$

If θ_α^i is larger (smaller) than w_i, then the subgroup i has experienced proportionately larger (smaller) changes in poverty than the total population. As a first step in the analysis of the dynamics of poverty, this is a useful statistic. Obviously, it is just a start and the interpretation suffers from all the problems static poverty profiles suffer from (Ravallion (1996)). The results must be regarded as descriptive statistics.

Applying this decomposition to the data from Ethiopia, we focus on a few characteristics of the endowments of the households in the sample, which can be considered fixed in the short period under consideration. First, we look at some human capital variables in the broad sense: education (whether the head has completed primary school) and some labour supply characteristics of the head of the household (the sex and the age of the head). Next, we consider some physical assets: land owned in hectares and whether the household owns any oxen (or bulls). The former can be treated as exogenous to the household: land is not privately owned and is allocated by the peasant association to the household. Oxen are crucial in the main farming system for ploughing and cattle in general are an important source of wealth for accumulation. Of course, since markets exist, oxen ownership may well change over time, although the accumulation is generally slow. For the poverty profile below, we use the ownership of oxen in 1994a[31] . Finally, we look at some infrastructure and location variables. As discussed before, there are some critical differences in the experience of certain villages and village-level variables may well account for this. We grouped villages according to the distance to nearest all-weather road and to the distance to the nearest town.

We look at the contribution of different groups to changes over three periods: first, the change between 1989 and 1994-95 for the core panel villages, secondly, the change within 1994 allowing for some assessment of the sensitivity to seasonal variation and thirdly, the change between 1994 and 1995. For the first, we use the food poverty measures and use food poverty in 1994-95 in the equivalent period of the data collection in 1989. We group the households in two (using the median value for continuous variables[32]). We provide a t-test of the changes in poverty for each subgroup and the contribution of each subgroup to the total poverty change. The relevant total changes for the full sample are given in tables 6 and 8.

[31] The analysis of the dynamics of oxen ownership in relation to poverty is beyond the scope of this paper.

[32] For land, we considered both a grouping according to median land per village and according to median land per adult in the entire sample. If there are large differences in fertility, climate and farming systems across villages in the sample, then the results may have been sensitive to the alternative groupings. However, the results were very similar, so we only report the results relative to the median of land per adult in the entire sample.

Tables 9 a) to 9 g) give the results of the decompositions for the changes between 1989 and 1994/95 for the panel villages. Recall that poverty declined by about 15.4 percentage points in this period (table 8). Human capital variables matter in accounting for the changes in this period. Although very few heads of household are educated, they contributed proportionately more to the poverty decline. Similarly, households with younger heads experienced a larger decline in poverty than those with an older head of the household; the decline for the latter not significant even for the head count index. The sex of the household also matters: female headed households experienced no significant decline in this period. Oxen and land ownership is also important: those owning oxen and those with relatively large land holdings contributed proportionately more to the decline in poverty. Landholdings particularly affect the poverty gap and the severity of poverty measure. The decline in poverty for those not owning oxen is not significantly different from zero at 5 percent for all measures. Finally, distance to roads and to towns also matters a lot. At least with the respect to the head count index, those close to all-weather roads contributed proportionately more to the decline in poverty. Those households living more than 10 km outside towns experienced no significant change in poverty; consequently, the entire decline between 1989 and 1994/95 can be accounted for by those in villages in the vicinity of urban areas.

Table 9 Decomposing changes in food poverty by sub-groups 1989-1994/95 (n=351)

a) Education

	Household head did not complete primary school (97%)					Household head completed primary school (3%)				
	Poverty 89	poverty 94	change	t-test	contrib to change	poverty 89	poverty 94	change	t-test	contrib. to change
P0	0,60	0,47	-0,14	-3,65**	87%	0,83	0,25	-0,58	-3,54**	13%
P1	0,29	0,19	-0,10	-4,74**	90%	0,42	0,11	-0,30	-3,38**	10%
P2	0,17	0,10	-0,07	-4,59**	93%	0,22	0,06	-0,15	-2,61**	7%

b) Age of the household head

	Head of the household is at least 45 years(45%)					Head of the household is below 45 years (55%)				
	poverty 89	poverty 94	change	t-test	contrib. to change	poverty 89	poverty 94	change	t-test	contrib. to change
P0	0,59	0,50	-0,09	-1,84	33%	0,64	0,41	-0,23	-4,18**	67%
P1	0,27	0,20	-0,08	-2,67**	39%	0,31	0,16	-0,15	-4,81**	61%
P2	0,16	0,11	-0,06	-2,70**	42%	0,19	0,09	-0,10	-4,34**	58%

c) Sex of the head of the household

	Female headed household (17%)					Male headed household (83%)				
	Poverty 89	poverty 94	change	t-test	contrib. to change	poverty 89	poverty 94	change	t-test	contrib. to change
P0	0,57	0,48	-0,09	-0,93	9%	0,62	0,45	-0,17	-4,12**	91%
P1	0,29	0,20	-0,10	-1,85	15%	0,29	0,18	-0,11	-4,84**	85%
P2	0,18	0,11	-0,07	-1,79	15%	0,17	0,10	-0,08	-4,55**	85%

d) oxen ownership

	Household does not own oxen (33%)					Household owns at least one oxen (67%)				
	Poverty 89	poverty 94	change	t-test	contrib. to change	poverty 89	poverty 94	change	t-test	contrib. to change
P0	0,65	0,55	-0,10	-1,62	22%	0,59	0,42	-0,18	-3,93**	78%
P1	0,32	0,25	-0,08	-1,92	23%	0,28	0,15	-0,12	-5,13**	77%
P2	0,20	0,14	-0,05	-1,82	24%	0,16	0,08	-0,08	-4,89**	76%

e) land ownership

	Large land holdings (50%) (above 0.45 ha)					Small land holdings (50%) (below 0.45 ha)				
	Poverty 89	poverty 94	change	t-test	contrib. to change	poverty 89	poverty 94	change	t-test	contrib. to change
P0	0,54	0,38	-0,17	-3,15**	54%	0,68	0,54	-0,14	-2,76**	46%
P1	0,27	0,13	-0,14	-5,26**	66%	0,32	0,24	-0,07	-2,38**	34%
P2	0,16	0,06	-0,10	-5,36**	68%	0,19	0,14	-0,05	-2,04*	32%

f) distance to all-weather road

	At least 5 km from all-weather road (56%)					Less than 5 km from all-weather road (44%)				
	poverty 89	poverty 94	change	t-test	contrib. to change	poverty 89	poverty 94	change	t-test	contrib. to change
P0	0,67	0,59	-0,08	-1,67	30%	0,54	0,29	-0,25	-4,54**	70%
P1	0,34	0,25	-0,10	-3,35**	50%	0,23	0,11	-0,12	-4,39**	50%
P2	0,21	0,13	-0,08	-3,61**	59%	0,13	0,06	-0,07	-3,53**	41%

g) distance to nearest town

	At least 10 km from town (47%)					Less than 10 km from town(53%)				
	poverty 89	poverty 94	change	t-test	contrib. to change	poverty 89	poverty 94	change	t-test	contrib. to change
P0	0,52	0,58	0,06	1,11	-19%	0,70	0,35	-0,34	-7,08**	119%
P1	0,23	0,25	0,02	0,50	-7%	0,34	0,13	-0,22	-7,99**	107%
P2	0,14	0,14	0,00	0,13	-2%	0,21	0,06	-0,14	-7,04**	102%

**=significant at 1 percent

*=significant at 5 percent

Turning to the larger sample, table 6 showed that poverty declined substantially between the two rounds in 1994 (1994a and 1994b), but between 1994a and 1995, two rounds collected at roughly the same point in the seasonal cycle, poverty remained unchanged. The change within 1994 clearly reflects seasonal fluctuations. Table 10 shows which groups are more affected by these fluctuations. First, note that households with older, female or uneducated heads have higher poverty levels in both periods. However, the gap in poverty levels becomes smaller in 1994b. For example, those households whose heads have completed primary education constitute only one-tenth of the sample, but they did not experience any significant fluctuation, i.e. the entire decline in poverty is experienced by those households without educated heads. Female-headed households while constituting about 22 percent of the sample, contributed to about 40 percent of the change in the poverty measures between 1994a and 1994b.

Higher asset ownership in terms of land and oxen, and distances to roads or towns implies consistently lower poverty levels - but also accompanies larger fluctuations in consumption[33]. Living closer to all-weather roads or towns is also correlated with lower poverty in both periods, but linked to lower fluctuations. In particular, those living further away from towns contribute the lion's share of the total poverty decline in this period. This may suggest that access to infrastructure and markets allows households to better smooth consumption. These are clearly issues that need to be researched further.

[33] This appears partly linked to the fact the fact that households with smaller land holdings are often specialising more in permanent food crops such as enset, which provide a more stable return over the season, which may help them to keep relatively smooth consumption.

Table 10 Decomposing changes in poverty by sub-groups 1994a-1994b (n=1411)

a) Education of the head of the household

	Household head did not complete primary school (91%)					Household head completed primary school (9%)				
	Poverty 94a	poverty 94b	change	t-test	contrib. to change	poverty 94a	poverty 94b	change	t-test	contrib. to change
P0	0,35	0,28	-0,08	-4,26**	99%	0,20	0,20	-0,01	-0,16	1%
P1	0,14	0,08	-0,05	-6,62**	101%	0,05	0,06	0,00	0,26	-1%
P2	0,07	0,04	-0,04	-6,68**	101%	0,02	0,03	0,00	0,39	-1%

b) Age of the household head

	Head of the household is at least 45 years(52%)					Head of the household is below 45 years(48%)				
	poverty 94a	poverty 94b	change	t-test	contrib. to change	poverty 94a	poverty 94b	change	t-test	contrib. to change
P0	0,39	0,31	-0,07	-2,91**	52%	0,29	0,22	-0,07	-3,00**	48%
P1	0,15	0,09	-0,06	-5,11**	60%	0,11	0,07	-0,04	-3,90**	40%
P2	0,08	0,04	-0,04	-5,20**	61%	0,06	0,03	-0,03	-3,90**	39%

c) Sex of the head of the household

	Female headed household (22%)					Male headed household (78%)				
	poverty 94a	poverty 94b	change	t-test	contrib. to change	poverty 94a	poverty 94b	change	t-test	contrib. to change
P0	0,40	0,28	-0,12	-3,17**	37%	0,33	0,27	-0,06	-2,99**	63%
P1	0,17	0,08	-0,09	-4,93**	40%	0,12	0,08	-0,04	-4,52**	60%
P2	0,10	0,04	-0,06	-4,84**	40%	0,06	0,04	-0,02	-4,63**	60%

d) Oxen ownership

	Household does not own oxen (48%)					Household owns at least one oxen (52%)				
	poverty 94a	poverty 94b	change	t-test	contrib. to change	Poverty 94a	poverty 94b	change	t-test	contrib. to change
P0	0,38	0,34	-0,04	-1,59	28%	0,30	0,20	-0,10	-4,37**	72%
P1	0,15	0,11	-0,03	-2,87**	34%	0,12	0,05	-0,06	-6,60**	66%
P2	0,08	0,05	-0,02	-3,08**	38%	0,06	0,02	-0,04	-6,71**	62%

e) Land ownership

	Large land holdings (50%) (above 0.23 ha)					Small land holdings (50%) (below 0.23 ha)				
	poverty 94a	poverty 94b	change	t-test	contrib. to change	poverty 94a	poverty 94b	change	t-test	contrib. to change
P0	0,28	0,16	-0,11	-5,22**	80%	0,40	0,38	-0,03	-1,10	20%
P1	0,10	0,04	-0,06	-6,46**	58%	0,16	0,12	-0,04	-3,34**	42%
P2	0,05	0,02	-0,03	-6,02**	50%	0,09	0,06	-0,03	-3,90**	50%

f) Distance to the nearest all-weather road

	At least 5 km from all-weather road (44%)					Less than 5 km from all-weather road (56%)				
	poverty 94a	poverty 94b	change	t-test	contrib. to change	poverty 94a	poverty 94b	change	t-test	contrib. to change
P0	0,47	0,36	-0,11	-4,09**	69%	0,24	0,20	-0,04	-1,87	31%
P1	0,20	0,11	-0,09	-6,61**	77%	0,08	0,06	-0,02	-2,33**	23%
P2	0,11	0,05	-0,06	-6,78**	80%	0,04	0,03	-0,01	-2,11*	20%

g) Distance to the nearest town

	At least 10 km from town (45%)					Less than 10 km from town (55%)				
	poverty 94a	poverty 94b	change	t-test	contrib. to change	poverty 94a	poverty 94b	change	t-test	contrib. to change
P0	0,38	0,24	-0,14	-5,44**	88%	0,31	0,29	-0,02	-0,67	12%
P1	0,15	0,08	-0,07	-6,17**	68%	0,11	0,08	-0,03	-2,88**	32%
P2	0,08	0,04	-0,05	-5,76**	65%	0,06	0,04	-0,02	-3,34**	35%

**=significant at 1 percent

*=significant at 5 percent

Table 11 gives the decompositions comparing the first round of 1994 with the 1995 data. Since overall the change is insignificant, the contribution to the percentage change in the table are not relevant. The table shows that for none of the groups defined by education, age of the head, the sex of the head or oxen ownership is there a significant change between 1994a and 1995. Those with relatively more land saw a further fall in poverty in this period. In terms of the higher order poverty measures, those living further from all-weather roads also improved their situation. The latter group is however still much poorer than those living near to roads and had not been able to benefit as much in the period 1989-1994, so if anything this effect suggests some limited catching up. The changes between 1994a and 1995 remain small, so the conclusion that relatively little changed in this period stands.

Table 11 Decomposing changes in poverty by sub-groups 1994a-1995 (n=1411)

a) Education of the head of the household

	Household head did not complete primary school (91%)					Household head completed primary school (9%)				
	poverty 94a	poverty 95	change	t-test	contrib. to change	poverty 94a	poverty 95	change	t-test	contrib. to change
P0	0,35	0,37	0,01	0,74	100%	0,20	0,20	0,00	0,00	0%
P1	0,14	0,14	0,00	0,24	84%	0,05	0,06	0,00	0,23	16%
P2	0,07	0,07	0,00	-0,23	153%	0,02	0,03	0,00	0,48	-53%

b) Age of the household head

	Head of the household is at least 45 years(52%)					Head of the household is below 45 years(48%)				
	poverty 94a	poverty 95	change	t-test	contrib. to change	poverty 94a	poverty 95	change	t-test	contrib. to change
P0	0,39	0,42	0,03	1,33	139%	0,29	0,28	-0,01	-0,42	-39%
P1	0,15	0,16	0,01	1,15	317%	0,11	0,10	-0,01	-0,95	-217%
P2	0,08	0,08	0,01	0,73	-385%	0,06	0,05	-0,01	-1,18	485%

c) Sex of the household head

	Female headed household (22%)					Male headed household (78%)				
	poverty 94a	poverty 95	change	t-test	contrib. to change	poverty 94a	poverty 95	change	t-test	contrib. to change
P0	0,40	0,37	-0,03	-0,66	-44%	0,33	0,35	0,02	1,17	144%
P1	0,17	0,14	-0,03	-1,49	-274%	0,12	0,13	0,01	1,21	374%
P2	0,10	0,07	-0,02	-1,63	574%	0,06	0,07	0,00	0,83	-474%

d) Oxen ownership

	Household does not own oxen (48%)					Household owns at least one oxen (52%)				
	poverty 94a	poverty 95	change	t-test	contrib. to change	poverty 94a	poverty 95	change	t-test	contrib. to change
P0	0,38	0,42	0,04	1,44	153%	0,30	0,29	-0,01	-0,52	-53%
P1	0,15	0,17	0,02	1,73	612%	0,12	0,10	-0,02	-1,66	-512%
P2	0,08	0,09	0,01	1,30	-529%	0,06	0,05	-0,01	-1,93	629%

e)Land ownership

	Large land holdings (50%) (above 0.23 ha)					Small land holdings (50%) (below 0.23 ha)				
	poverty 94a	poverty 95	change	t-test	contrib. to change	poverty 94a	poverty 95	change	t-test	contrib. to change
P0	0,28	0,23	-0,05	-2,07*	-189%	0,40	0,48	0,07	2,81**	289%
P1	0,10	0,07	-0,03	-3,13**	-635%	0,16	0,20	0,03	2,56**	735%
P2	0,05	0,03	-0,02	-3,35**	1142%	0,09	0,11	0,02	1,86	-1042%

f) Distance to the nearest all-weather road

	At least 5 km from all-weather road (44%)					Less than 5 km from all-weather road (56%)				
	poverty 94a	poverty 95	change	t-test	contrib. to change	poverty 94a	poverty 95	change	t-test	contrib. to change
P0	0,47	0,44	-0,03	-0,92	-89%	0,24	0,28	0,04	1,93	189%
P1	0,20	0,16	-0,03	-2,15*	-562%	0,08	0,11	0,03	2,79**	662%
P2	0,11	0,08	-0,02	-2,57*	1279%	0,04	0,06	0,02	2,70**	-1179%

g) Distance to the nearest town

	At least 10 km from town (45%)					Less than 10 km from town (55%)				
	poverty 94a	poverty 95	change	t-test	contrib. to change	poverty 94a	poverty 95	change	t-test	contrib. to change
P0	0,38	0,36	-0,02	-0,70	-67%	0,31	0,34	0,04	1,63	167%
P1	0,15	0,14	-0,01	-0,77	-197%	0,11	0,12	0,01	1,18	297%
P2	0,08	0,07	-0,01	-1,00	488%	0,06	0,06	0,01	0,85	-388%

**=significant at 1 percent
*=significant at 5 percent

7. Conclusions

This paper investigates the problems of comparing poverty over time in a panel household survey collected between 1989 and 1995 in rural Ethiopia. We used FGT-measures of poverty and implemented significance tests for changes in poverty. We found that poverty declined substantially between 1989 and 1995. Poverty remained largely unchanged between 1994 and 1995. We found substantial differences in poverty levels between the two rounds of data collection in 1994, suggesting substantial seasonal fluctuations.

These results were found to be robust, firstly, to changes in the definitions of consumption used and to small changes in questionnaire design. These factors affected the actual magnitudes involved, but not the overall thrust of the findings. Secondly, using stochastic dominance tests, the changes were found to persist across different poverty lines. Thirdly, the actual poverty measures were sensitive to seasonal factors: as the results for 1994 showed, the exact timing of the data collection matters for the magnitudes of the poverty measures. This point is rarely considered when comparing poverty over time in developing countries, especially since data collection usually takes many months to be completed which implies that consumption changes are not readily comparable. Still, this problem, while important in general, did not affect the main conclusions about poverty changes between 1989 and 1995 in our sample. Fourthly, there appears to be substantial inconsistency between different sources of price data in assessing the appropriate rural cost-of-living deflators for consumption between the different periods. Testing the robustness of the results to the uncertainty surrounding the cost-of-living deflators is not self-evident, since it is not possible using the standard dominance tests. We suggest and implement a simple graphical technique to do so. The results for the observed changes between 1989 and 1995 are clearly robust to any reasonable inflation estimate. The same applies to the changes within 1994. For the changes between 1994 and 1995, using the official inflation figures would yield a decline in poverty, but using the data collected in the specific rural areas would support the conclusion of unchanged poverty.

In a final section, we provide a simple decomposition of the findings across different groups. We found that those with relatively better human capital or labour supply characteristics (better education, male headed households and relatively young heads of households) experienced levels of poverty in each period. They also had larger poverty declines between 1989 and 1995 and lower seasonal fluctuations in poverty. Households with better physical capital endowments, in terms of land

and oxen, had lower poverty levels and saw larger poverty declines. They seem to face larger poverty fluctuations across seasons. Finally, those with good access to road infrastructure and those close to towns also had lower poverty levels throughout. They experienced a larger poverty decline between 1989 and 1995 and experienced lower within-year fluctuations.

These decomposition results are only the first step in the analysis of the dynamics of poverty. Nevertheless, the results appear to suggest that not only did physical, human and infrastructural capital matter in explaining levels of poverty, but that poverty declines during a period of reforms and the return to peace appear to be influenced by the initial levels of these sources of capital, so that better-endowed households were better placed to benefit much more from the changed circumstances. Similarly, access to infrastructure and proximity to towns, as well as better human capital circumstances, implies lower fluctuations in seasonal poverty levels, presumably linked to more opportunities for alternative income generation and smaller food price fluctuations. Clearly, these issues need to be investigated further. Note also that we while we did use panel data, we did not exploit its full potential[34] . In fact, the entire analysis, including the robustness tests to uncertainty about the inflation measures or the decompositions, could have been implemented on repeated cross-sections.

[34] An accompanying paper does exploit the panel dimension in examining the changes in welfare in this period.

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Annex 1 Sampling in the Ethiopian Rural Household Survey 1994

The practical constraints of running a panel household survey had to be squared with the methodological problems related to sampling. Farming systems were considered a much more important stratification basis than administrative boundaries. Nevertheless, the division of the country into agro-ecological zones is not self-evident. A sample of 15 villages remains too small to be representative for all villages, although the actual choice of villages does cover some of the diversity of communities in each zone. In the context of sampling theory, one could argue that the sampling frame to select the villages was strictly stratified in the main agro-ecological zones and sub-zones, and one to three villages per strata was selected.

Random sampling was used within each village, including an attempt to re-randomise the 1989 in the panel villages, via extra sampling from new entrants, splits and newly formed households. The information available for ex-ante or ex-post weighing of the sample when pooled is limited. The available population figures for Ethiopia at the time of the survey were based on a questionable census of 1984, while linking farming systems to population figures turned out not to be straightforward. In most panel villages in which interviews took place in 1989 this procedure also implied an increase of the sample size in those villages. A complete redrawing of administrative boundaries since then has meant that linking the provisional census figures from the 1994 census to the farming systems was just as difficult. Sampling size in each village was governed by an attempt to obtain a self-weighting sample, when considered in terms of farming system: each person (approximately) represents the same number of persons from the main farming systems. The advantage is that pooling of the data is simplified, although alternative procedures could easily have been implemented (Deaton (1997)).

When dealing with sample surveys for analysis, such as the measurement of welfare, it is important to take into account sampling design, not only for the measures but also for the standard errors in the analysis (Deaton (1997)). Howes and Lanjouw (1994) have discussed in detail the consequences if this is not done for poverty measures. The current survey can be considered to be a highly stratified sample, since stratification was both used to select the villages as well as the households within the villages. This would result in considerably lower standard errors than if the sample were considered a simple random sample. On the other hand, given the small number of villages selected, the sample of villages can hardly be considered as covering all agro-ecological zones and especially the sub-zones, i.e. the stratification is incomplete, for which the correction is not straightforward. Even ignoring the latter problem, given the lack of detailed census information on the agro-ecological zones, on the number of villages in each zones and on the appropriate population figures, it was not possible to implement the appropriate corrections in a satisfactory way. Standard errors presented are therefore those calculated as if it was a random sample.

Table A.1 gives the details of the sampling frame and the actual proportions in the total sample. It also gives information on the 1989 sample and the actual panel linking 1989 and 1994. First, it is clear that, broadly speaking, the sample is broadly consistent with the population shares in the 3 main sedentary farming systems. The classification used is based on Westphal (1976) and Getahun (1978). For the 1989 sample, however, the sampling proportions deviate more due the

absence of Northern Highlands villages which were at that time inaccessible because of war activity.

The sampling in the villages newly included in 1994 was relatively straightforward. A list of all households was constructed with the help of the local Peasant Association (PA) officials. (PAs were set up in the aftermath of the 1974 revolution, after which a programme of land reform had been started. Villages were organised in Peasant Associations, usually comprising one or a few villages. The PA was made responsible for the implementation of the land reform and holds up to now wide ranging powers as a local authority. All land is owned by the government. To obtain land, households have to register with the PA and lists of the households allocated land are kept.) Up to the late 1980s, they were responsible for the programme of continuous land redistribution which was meant to keep land tenure closely linked to household size and needs. Although this continuous land redistribution is not, in principle, meant to take place any more, registration with the PA remains essential for farm households[35] . In virtually all villages, therefore, there were good lists of the households in the village which could be used as a sampling frame.

It had been suggested that in some areas landlessness is increasing, since with the absence of redistribution and a ban on land sales and rental against fixed payment no legal mechanisms exist for young households to acquire land in land constrained areas. To make sure that these households were properly represented with stratified the sample within each village to ensure a representative number of landless households to be included. In practice, in most areas this resulted only in a very small number of landless households to be included. Similarly, we made sure that an exact proportion of female headed households was included via stratification.

In the villages included in 1989 as well, we first traced the earlier households. A household was kept in the sample even if the head of the household had left or died. A panel household was defined as a household which had still members of the 1989 household living in the village. Of the 445 households which were attempted to be traced, only less than 7 percent was lost. About 8 percent of the households had a different head, in most cases the spouse of the earlier head. The fact that households cannot obtain land when moving to other areas is clearly part of the explanation of the low attrition rate. In the panel villages, we also attempted to randomise the sample again by including an exact proportion of newly formed or arrived households in the sample, as well by replacing the lost households by households which were considered by village elders and officials as broadly similar to in demographic and wealth terms as the households which could not be traced. Also, households formed out of households interviewed in 1989 were also interviewed, usually sons or daughters who after marriage formed their own household. In this paper, when referring to 'panel households', we only include those households which were also interviewed in 1989 and successfully traced in 1994, without including those formed from these households or any of the replaced or newly entered households, but including households with a different head. Attrition across the survey rounds in 1994 and 1995 was very low, at just over 1 percent per round.

[35] Recently, evidence is emerging that redistribution has restarted, especially in Amhara Region. The process is politically very sensitive but has already led to demonstrations of peasants in Addis Ababa.

Table A.2 gives some characteristics of the sample areas included in the panel between 1989 and 1994. Table A.3 gives details of the timing of the survey. Note that due to the exact timing of the survey in 1989 and in 1994/95, and the potential problems of seasonality in consumption, the most appropriate dates to compare over time will be: for all sites the first round of 1994 (referred to as 1994a) and the 1995 round; compared to 1989: the 1995 round for Garagodo and Domaa, 1994a for Dinki, Debre and 1994b for Korodegaga and Adele Keke.

Table A.1: The sampling frame of the Ethiopian Rural Household Survey

	Population share* in 1994	Sampling share in 1994	Number of villages in 1989	Number of villages in 89 and 94	Sampling share in 1989	Panel households
Grain-plough complex Highlands						
Grain-plough complex - Northern Highl	21.2%	20.2%	3	0		
Grain-plough complex - Central Highl	27.7%	29.0%	4	2	31.0%	32.4%
Grain-plough/hoe complex						
Grain-plough Arsi/Bale	9.3%	14.3%	2	1	25.4%	25.6%
Sorghum plough/hoe Hararghe	9.9%	6.6%	1	1	15.0%	12.4%
Enset (with or without coffee/cereals)	31.9%	29.9%	5	2	8.7%	29.6%
Total	100.0%	100.0%	15	6	100.0%	100.0%

* percentage of rural sedentary population; pastoralist population is about 10 percent of total rural pop.
Sources: CSA Population estimates, own estimated and Westphal (1977).

Table A.2: Characteristics of the sample sites

Survey site	Location	Background	Main crops	Perennial crops?	Mean Rainfall mm
Haresaw	Tigray	Poor and vulnerable area.	Cereals	no	558
Geblen	Tigray	Poor and vulnerable area; used to be quite wealthy.	Cereals	no	504
Dinki	N. Shoa	Badly affected in famine in 84/85; not easily accessible even though near Debre Berhan.	Millet, teff	no	1664
Debre Berhan	N. Shoa	Highland site. Near town.	Teff, barley, beans	no	919
Yetmen	Gojjam	Near Bichena. Ox-plough cereal farming system of highlands.	Teff, wheat and beans	no	1241
Shumsha	S. Wollo	Poor area in neighbourhood of airport near Lalibela.	Cereals	no	654
Sirbana Godeti	Shoa	Near Debre Zeit. Rich area. Much targeted by agricultural policy. Cereal, ox-plough system.	Teff	no	672
Adele Keke	Hararghe	Highland site. Drought in 85/86	Millet, maize, coffee, chat	yes, no food	748
Korodegaga	Arssi	Poor cropping area in neighbourhood of rich valley.	Cereals	no	874
Turfe Kechemane	S. Shoa	Near Shashemene. Ox-plough, rich cereal area. Highlands.	Wheat, barley, teff, potatoes	yes, some	812
Imdibir	Shoa (Gurage)	Densely populated enset area.	Enset, chat, coffee, maize	yes, including food	2205
Aze Deboa	Shoa (Kembata)	Densely populated. Long tradition of substantial seasonal and temporary migration.	Enset, coffee, maize, teff, sorghum	yes, including food	1509
Addado	Sidamo (Dilla)	Rich coffee producing area; densely populated.	Coffee, enset	yes, including food	1417
Gara Godo	Sidamo (Wolayta)	Densely packed enset-farming area. Famine in 83/84. Malaria in mid-88.	Barley, enset	yes, including food	1245
Doma	Gama Gofa	Resettlement Area (1985); Semi-arid; droughts in 85, 88,89,90; remote.	Enset, maize	yes, some	1150

Source: Community survey ERHS, Webb and von Braun (1994), Bevan and Pankhurst (1996).

Table A.3: timing of activities and of the survey in 1994-1995

Survey site	Location	Main Harvest	Time of Interview		
			Round 1 1994	Round 2 1994-95	Round 3 1995
Haresaw	Tigray	October-November	June-July	January	March
Geblen	Tigray	October-November	June-July	January	March
Dinki	N. Shoa	December	March-April	November	January
Debre Berhan	N. Shoa	November-December	March-April	October	March
Yetmen	Gojjam	November-December	March-April	October	March
Shumsha	S. Wollo	October-December	June-July	December-January	May
Sirbana Godeti	Shoa	November-December	March-April	November	March
Adele Keke	Hararghe	November-December	May-June	October	April
Korodegaga	Arssi	October-November	May-June	November-December	May- June
Turfe Kechemane	S. Shoa	December	March-April	September-October	March- April
Imdibir	Shoa (Gurage)	October-December	March-April	October	March
Aze Deboa	Shoa (Kembata)	October-November	March-April	September-October	March
Addado	Sidamo (Dilla)	December-January	March-April	January	March
Gara Godo	Sidamo (Wolayta)	August-December	March-May	October	March
Doma	Gama Gofa	September-December	April-May	December-January	May-June

Source: Community survey ERHS and Bevan and Pankhurst (1996).

Annex 2 The definition of the household

The definition of the household could also potentially be a problem in the comparison and its interpretation. In the 1994 survey, we asked about several possible different concepts of the household. We investigated which people were sharing the same stock of food, which people lived in the same house and those people identified by the head of the household as belonging to his/her household. (a local concept for 'House' is used as referring to the homestead which could include a few buildings within some explicit or implicit boundary). We found differences, but they are not very large, probably due to the fairly nuclear nature of the household. In Table A.4, we present a summary of household size depending on the concept used. We distinguish those living under same roof, i.e. in what the household would consider as one house and those belonging to the same household as identified by the head of the household. The latter refers to the traditional household definition as 'beteseb' or equivalent concepts. We also distinguish between those named as belonging to either definition and those usually present. Given the cultural differences between Amhara, Tigrayan, Oromo and other highland people and some of the Southern people, we distinguish villages in the South from other villages.

Table A.4 Different definitions of the household in ERHS 1994: mean household size

	Northern and Central villages	Southern (SEPA) villages	All villages
Those living under single roof	5.36	7.09	6.00
Those living under single roof and usually present	4.96	6.22	5.42
Those belonging to household as defined by household head	5.27	6.92	5.88
Those belonging to household as defined by household head and usually present	4.87	6.06	5.31

The differences between the definitions were larger in the South (SEPA region) than in the northern or central regions. In the North, mean size was between 5.4 to 4.9 depending on definition; in the South it was between 6.1 to 7.1. In the 1989 survey no explicit difference was made between the definitions, except for noting those usually present or not. As a consequence, we used the definition 'those usually present in household in one house'. Given that the differences are *relatively* small, this choice is unlikely to affect the result considerably. Below some results are given on the sensitivity to the definition of the household.

Annex 3 Equivalence scales

Table A.5 Nutrition (calorie) based equivalence scales

Years of age	Men	Women
0 - 1	0.33	0.33
1 - 2	0.46	0.46
2 - 3	0.54	0.54
3 - 5	0.62	0.62
5 - 7	0.74	0.70
7 - 10	0.84	0.72
10 - 12	0.88	0.78
12 - 14	0.96	0.84
14 - 16	1.06	0.86
16 - 18	1.14	0.86
18 - 30	1.04	0.80
30 - 60	1.00	0.82
60 plus	0.84	0.74

Source: Calculated from World Health Organisation data

Table A.6 Diet used for poverty lines (per month)

teff	1.70	kg
barley	4.85	kg
wheat	3.15	kg
maize	4.48	kg
sorghum	2.67	kg
horse beans	1.29	kg
cow peas	0.23	kg
chick peas	0.69	kg
milk	0.55	litres
coffee	0.10	kg
sugar	0.10	kg
salt	0.70	kg
oil	0.15	litres
spices	0.25	birr
potatoes	1.51	kg
enset	0.19	kg
onions	0.20	kg
cabbage	0.38	kg

Source: Ethiopian Rural Household Survey (1994a), diet to achieve 2300 Kcal per month per adult, using diet of poorer half of sample.

Annex 4
Engel Curve regressions and determination of the non-food share

We want to derive the expenditure share devoted to non-food items by households whose total expenditure is equal to the food poverty line. To obtain this, we run an Engel-curve, with the logarithm of total consumption per adult equivalent expressed divided by the food poverty line as the consumption variable on the right hand side (see Ravallion and Bidani (1994)). At the food poverty line, this variable has the value of zero and the food share for a representative household can be calculated from the regression. For our purposes, we use the characteristics of the poorer half of the consumption distribution, i.e. the mean characteristics of the households with less than mean consumption per adult. The percentage of the food poverty line devoted to non-food consumption by households with total consumption equal to this poverty line is considered essential non-food consumption. The total poverty line can therefore be calculated as (2-food share) times the food poverty line.

Table A.7 Regression of food share

	coefficients	standard error
constant	0.7076	0.0215
log real consumption per adult equivalent	-0.0075	0.0072
log real consumption per adults equiv. Squared	0.0046	0.0037
age of head	0.0021	0.0003
male adults above 15	-0.0149	0.0038
male children 0 and 5	0.0082	0.0061
male children 5 and 15	0.0019	0.0040
female adults above 15	0.0106	0.0064
female children 0 and 5	-0.0031	0.0041
female children 5 and 15	0.0010	0.0039
(village level dummies)		

joint significance F(23,1446)=20.29
adjusted R-squared=0.232

Annex 5 Poverty lines

Table A.8 Total poverty line: 1989 panel sites (in birr per adult per month)

	Dinki	Debre Behan	Adele Keke	Koro-Degega	Garagodo	Domaa	Average
1989 line	23	25	25	22	18	23	22.30
1994a CSA	40	53	53	39	56	44	44.24
1994a ERHS	44	53	53	44	49	58	49.20
1995 ERHS	53	59	59	41	47	35	48.25
1995 ERHS	62	61	61	46	41	44	50.79
1995 CSA	51	54	54	39	45	40	48.04

Note: (1) poverty lines = food poverty lines/0.826, in which 0.826 is estimated food share for households just consuming food poverty line.
(2) ERHS prices were collected during the survey period in the nearest markets; 1994a and 1995 CSA prices are for retail prices on the basis of the published averages for the relevant area. Due to a continuing shift in the institutional structure in the country, regional areas for which averages may different over time.
(3) Average is population weighted.

Table A.9 Total poverty line 1994-95

	1994a ERHS	1994b ERHS	1995 ERHS	1994a CSA	1995 CSA
Atsbi	44	42	44	56	51
Haresaw	55	50	55	56	51
Dinki	44	53	62	40	51
Debre Berhan	49	51	50	40	53
Yetemen	40	51	54	33	48
Suhmsha	42	52	59	51	55
Sirbana Gode	38	46	51	40	47
Adele Keke	53	59	61	53	54
Korodegaga	44	41	46	39	39
Shashemene	36	45	43	39	40
Imdibir	38	45	51	40	45
Aze deboa	36	48	41	40	45
Dilla	41	40	48	43	40
Garagodo	49	47	41	56	45
Domaa	58	35	44	44	40
average	44.54	47.23	50.28	44.38	47.45

See Table A.8 for explanation.

It can be seen that all sources reveal critical differences in prices across space in rural Ethiopia, although the variability is larger in the ERHS price survey data. This is logical since the CSA data are already averages over a substantial number of markets in a particular geographical area.

Annex 6 Poverty measures

Table A.10 Food poverty levels 1994-1995 - ERHS panel households

	Northern Cereal		Central Cereal		Southern Cereal		Southern Non-cereal		All Areas	
P_0 1994a	30.8		29.5		39.7		54.5		39.4	
P_0 1994b	19.6	(-3.11)	11.8	(-6.39)	30.5	(-2.25)	40.4	(-4.16)	25.9	(-7.75)
P_0 1995	25.2	(-1.49)	26.0	(-1.10)	32.9	(-1.73)	61.0	(1.95)	37.8	(-0.85)
P_0 1994a	11.3		9.5		17.2		24.4		16.0	
P_0 1994b	5.0	(-4.28)	3.6	(-5.21)	9.2	(-4.39)	16.1	(-4.55)	8.8	(-8.68)
P_0 1995	9.9	(-0.84)	7.9	(-1.27)	11.0	(-3.26)	28.0	(1.89)	15.0	(-1.05)
P_0 1994a	5.8		4.5		9.6		14.0		8.7	
P_0 1994b	1.9	(-4.14)	1.7	(-3.74)	4.1	(-4.45)	8.4	(-4.37)	4.3	(-7.87)
P_0 1995	5.1	(-0.64)	3.9	(-0.72)	5.4	(-3.18)	16.0	(1.43)	8.1	(-0.91)
n	286		407		292		426		1411	