Economic Reform, Growth and the Poor: Evidence from Rural Ethiopia

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Abstract: Using micro-level panel data from villages in rural Ethiopia, the paper uses standard decompositions of income changes and develops a new decomposition of poverty changes to analyse the determinants of growth and poverty changes during a period of economic reform (1989-95). Consumption grew and poverty fell substantially, but the experience was mixed. I find that common and idiosyncratic shocks mattered, but that the main factors driving income changes are relative price changes, resulting in changes in the returns to land, labour, human capital and location. A regression-based decomposition of the changes in poverty shows that the poor have benefited on average more from the reforms than the non-poor households. But the experience of the poor is mixed: one group of the poor in 1989, with relatively good land, labour and location, outperformed all other households, while another group with much poorer endowments and location experienced virtually unchanged and persistent poverty.

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1. Introduction

Since 1988, Ethiopia has gradually moved from a communist-inspired controlled economy to a more market-based economy. From 1992, these reforms became part of a structural adjustment programme sponsored by the IMF and the World Bank. Much has been written on the consequences of structural adjustment on growth and poverty (Cornia et al. (1987), Sahn (1994, 1996), Demery and Squire (1996)). More in general, new evidence on the role of growth on poverty alleviation has revived the debate as well (Ravallion and Datt (2000), Dollar and Kraay (2000), Srinivasan (2000)). Most studies appear to acknowledge that data remain a problem. Systematic micro-level evidence on both growth and poverty after market reforms take place remains limited.

This paper uses a panel data set on 362 rural households in six communities collected in 1989 and in 1994-95. This is not only a small data set but also not a representative sample of rural Ethiopia. Consequently, the results in this paper should not be viewed as evidence for overall poverty trends. The focus is on whether one can find evidence of the link between reforms, growth and changes in poverty. In this way, the paper provides evidence on the mechanisms by which, given the current conditions and policies, growth is transmitted into rural poverty alleviation. In order to achieve this, a simple panel-data based decomposition of the effects of growth on poverty is presented, allowing one to distinguish the contribution of different factors to overall poverty changes. In particular, I can distinguish the impact of reforms from the consequences of shocks and of exogenous changes in assets.

Methodologically, this study differs substantially from other studies in the literature (for reviews, see Lipton and Ravallion (1995), Azam (1994)). Ignoring the many studies using flimsy, non-comparable or highly aggregated data sources, some studies limit themselves to outcome indicators at different points in time and use a macroeconomic narrative to argue that observed changes are the consequence of the policy changes (for one such study, see Demery and Squire (1996)). A criticism against these studies is that they cannot separate the effects of the reforms from other factors, such as external shocks or simply the lagged consequences of past recessions. Computable general equilibrium models can avoid these problems, by allowing the impact of different counterfactual scenarios to be evaluated. Sahn (1997) presents a collection of such studies; earlier attempts are in Bourgignon et al. (1991). A drawback is related to the immense data requirements for them and the strong structure that needs to be imposed on such models, resulting in questions about the realism involved. Other studies are sectoral in nature and provide detailed evidence on the effects of reforms on particular activities. These studies provide important evidence but may not easily make conclusions about the overall welfare effects.

By using comparable data sets over time, more detailed analysis is possible, not just of outcome indicators, but also of other factors. For example, Grootaert (1995) uses detailed socio-economic characteristics to check whether in different periods of the adjustment process in Côte d'Ivoire the evidence is consistent with reforms driving the outcomes. Alternatively, econometric approaches can go some way to control for the problems of other factors driving the outcome, rather than the reforms, provided the information is available. In the context of Ethiopia, an important issue about rural outcomes is whether the outcomes are not just driven by different weather conditions in different years, rather than changing economic incentives. I

will do this by controlling for common and idiosyncratic shocks in the regressions. Nevertheless, when only repeated cross-section data sets are available, but if sufficient detail is available in the survey data to model the changing determinants of welfare outcomes, much can still be done. Micro-simulation approaches can then provide useful insights in the micro-level link between income growth and poverty (the study by Bourgignon et al. (2001) provides an example). The current paper is similar in spirit, but the availability of panel data has certain econometric advantages while allowing to have directly observed information on movements of individuals across the welfare distribution.

Generalising about the effects on poverty of macroeconomic and market-oriented reforms is difficult. Measures such as devaluation or liberalisation cause relative prices to changes and have *a priori* ambiguous effects on welfare (Kanbur (1987)). For example, a real exchange rate depreciation increases prices to the tradable goods sector relative to the non-tradable sector, but the effect on welfare for particular groups will depend on whether their earnings relative to their consumption will depend more on goods from one sector relative to the other. If the poor produce or earn a wage from tradables, while they mainly consume non-tradables, then they would benefit. However, whether this indeed characterises the poor cannot be stated in general (Lipton and Ravallion (1995)). Furthermore, reforms, as those in Ethiopia, involve many measures, including internal market reforms, affecting different households and regions differently. Finally, even if market prices move favourable for particular households, the net welfare effects of these price changes depend on the functioning of other markets. De Janvry et al. (1991) have analysed and illustrated using simulations that the supply responsiveness to increased tradables prices is strongly dependent on whether any factor and goods markets are missing or work imperfectly. Clearly, to understand the effects of general macro-level measures on households, a careful and local analysis of both relative price movements and local market functioning is needed.

In the next section, I briefly discuss the nature of the reform process in Ethiopia in this period. Then, the data available and villages studied are presented. Section 4 presents the methodology for studying the impact on real incomes of the reforms and the decomposition of the factors contributing to poverty changes. Section 5 gives the econometric analysis, while sections 6 and 7 provide the decomposition and some micro-simulations of counterfactual scenarios, such as the income and poverty changes if no reforms had taken place.

2. Economic reforms in Ethiopia 1989-95

The 1980s had been a period of crisis. Since the late 1970s, the urban economy had been organised into a state-controlled planned economy, using communist models. The rural economy was largely ignored and heavily taxed. Taxation took the form of direct taxes and levies of various kinds and forced labour on community development projects or other activities determined by the state. It also included regular forced delivery to a parastatal corporation, the AMC, of a specified quota of grain. Implicit taxation resulted from bans or restrictions on private grain trade and trade in export crops. In the mid-1980s, famine and war had not just created a big humanitarian disaster, but also pushed the economy further back. The fall of the Berlin Wall and subsequent political and economic events facing Ethiopia's main sponsors led to a serious economic crisis. By 1988, they triggered the start of economic reforms.

Although reforms have since continued, the nature of the reforms and other events in the period until 1994 was very dramatic. First, a new political situation emerged after the end of the civil war in 1991. Security was largely restored in most parts of the countries, at least until the late 1990s. Secondly, market reform had just started in food markets around the time of the first round of the survey. This period also saw the first encouragement of market-based activities after the declaration of the 'mixed economy' in 1988, resulting in some incentives for private sector activities from the late 1980s. In 1992, the birr was devalued by 142 percent and foreign exchange rationing gradually lessened. No inflationary effects followed from the devaluation, partly helped by good harvests. Close to zero inflation in 1992 and low inflation in subsequent years has meant a strong depreciation of the real exchange rate. In 1992, fertiliser market reform was started with the gradual removal of subsidies.

The national accounts reflect the changing fortunes of the Ethiopian economy. GDP data show first the dramatic collapse around the famine period of 1985, a subsequent recovery but a further collapse around the transition period of the end of the war. Recovery then started and by 1995, the economy was, in per capita terms, more or less back at the level of the end of the 1980s. Subsequent growth has meant that at last Ethiopia has passed its 1982 level of per capita GDP.

This pattern hides some important composition changes in this period. The collapse in overall GDP in the late 1980s can mainly be accounted for by a collapse in government expenditure, driven by a collapse in revenue collection, and a large fall in gross investment. Deflated private consumption per capita continued to rise. By 1995, it was just under 14 percent higher than in 1989. Gross investment also recovered fast, but the share of government consumption in GDP far less so. However, it would be wrong to attribute the decline in direct taxation to the reforms. With the war escalating, and given that a large part of taxation came from rural areas or trade, revenue collection had collapsed. The subsequent total collapse of the government implied further erosion of revenue collection.

All this makes Ethiopia an interesting case to study the link between economic reforms, growth and poverty. Contrary to a lot of other countries, no fundamental derailment of reforms occurred after devaluation. In fact, remarkable macroeconomic stability was maintained. Also, the cuts in government expenditure predated reforms, so there is no coinciding effect on households via substantial cuts in social expenditure – if anything, by the late 1980s social services had already collapsed, only to recover gradually well into the 1990s. The result is that we can study micro-level economic reform via changing incentives almost in isolation from some of usual macroeconomic and expenditure reducing 'side effects'.

How did economic reform affect the rural economy? In order to study this, it is useful to distinguish the effects on incentives for food production, for non-food crops and for off-farm activities. Food market reform started from 1990 onwards. As was mentioned, the quota system on farmers and the high taxation on movement of crops both imposed heavy taxes on farmers. The main direct effect of the removal of the quota is a real income gain by farmers. The effect on open market food prices is harder to predict; it can be shown to have been ambiguous (Azam (1994), Dercon (2001)).

The effects on prices from the relaxation and later abolition of restrictions on private grain trade are easier to predict. Unlike other African countries (and despite the anti-private sector attitude of the economic policy in the 1980s), private interregional trade was not banned, with the exception of a few surplus regions (such as Gojjam). Traders were however heavily taxed when trying to move grain around the country. They were forced to sell 50 percent or more of the quantity traded to the Agricultural Marketing Corporation, at fixed prices below market prices. The consequence of the traders' quota was to increase the marketing margins between different regions on the open market. Liberalisation would then have resulted in upward pressure on prices in surplus areas and downward pressure in deficit areas.

In annex 1, evidence is presented on this. The main conclusion is that margins indeed became lower. Prices in surplus areas went up in real terms, while prices in deficit areas remained more or less stable. The most important effects were found to have taken place during the liberalisation period, even before the end of the war, suggesting that the effects are directly linked to reforms. Furthermore, one observes lower seasonality in food prices as well.

The impact of the reforms in this period on internationally traded non-food crops such as coffee and chat (a popular drug in the Eastern part of Ethiopia and surrounding countries) mainly came from the large exchange rate devaluation in 1992. However, these effects are complicated because of large-scale parallel market activity and smuggling before the devaluation.

Coffee, the most important export crop, is such a case. The farmgate price recovery was not as substantial as the devaluation would have suggested. Substantial volumes were smuggled, while (given high domestic coffee consumption) internal parallel markets also thrived. The relative stability of the black market exchange rate would have meant that the devaluation would not have affected coffee prices for those farmers. Nevertheless, relative to the black market, the official farmgate prices appear to have improved somewhat, so some response in official supplies and export volumes could be expected. Given the planting-output lags, there is evidence of some switching from parallel to official markets (Dercon et al. (1995)). Finally, the evolution of prices in our study period is however convoluted by the coffee boom of 1994-95, during which unit export values rose by up to 65 percent.

Other export crops were similarly affected. One of them deserves some more attention: chat[1]. Growing demand in surrounding countries had resulted in a doubling of the chat border price at the official exchange rate during the 1980s. While relative to coffee still a small export crop, it has become more popular throughout Ethiopia as a source of cash, also due to somewhat easier growing requirements. It has never been officially promoted, if only due to its addictive properties and the fact that it is illegal in most Western countries. Its relative neglect meant that taxation was limited, while smuggling relatively easy. For such a crop, the devaluation was again relatively irrelevant.

As was discussed before, consumer prices did not pick up after the devaluation. An important reason was that imports of many consumer goods had increasingly come via the parallel market and this did not change markedly in the first few years after the devaluation. Prices therefore did not change much. Other commodities, such as fuel, initially remained subsidised and

[1] Chat or q´at is a valuable amphetamine-type stimulant, increasingly popular in Ethiopia and in neighbouring countries.

increases were limited to levels below inflation. Fertiliser prices remained subsidised until after 1995, so they were also not much affected.

Finally, off-farm activities, such as business and wage labour, were positively affected by the reforms, even though not really promoted until well into the study period. During the 1980s, private sector activities had been at times repressed, while the war is likely to have had an important on labour and goods mobility. With the start of the reforms in 1990, most restrictions were lifted while the return to peace is likely to have had a positive impact as well. Even on the changing incentives for such activities, for example in the form of prices, are hard to come by, and the impact of reforms and peace are likely to be difficult to distinguish.

To conclude, economic reform is likely to have substantially changed relative prices in the rural economy. The impact on real food prices is likely to be dependent on whether villages are in surplus or deficit areas, while the impact of the real exchange rate depreciation will depend on the extent of smuggling and parallel market activity before the devaluation in a particular area. Finally, off-farm activities are likely to have been encouraged as well via the reforms, but the effect is likely to be convoluted with the impact of the return to peace and security after 1991.

3. The study villages and economic reform 1989-1995

In this section, I will introduce the six communities studied, from which a random sample was selected, yielding complete information on 354 households (the attrition rate between 1989 and 1995 was about 5 percent). The initial sample of villages was selected to study the crisis and recovery from drought and famine in the mid-1980s (Webb et al. (1992)). Details on the survey are in Dercon and Krishnan (1998). The villages are located in the central and southern part of the country. In 1989, the war made it impossible to survey any northern villages. Nevertheless, the villages combine a variety of characteristics, common in rural Ethiopia. Four of the villages are cereal growing villages, one is in a coffee/enset area and one grows mainly sorghum but has been experiencing rapid expansion of chat. All but one not too far from towns, but only half have an all-weather road.

Virtually all households are involved in agriculture and have access to land, although with important differences in quality and across villages. About 50 percent of income is derived from crops, the rest from livestock and off-farm activities. Many of the off-farm activities (such as selling home-made drinks or dungcakes) are closely linked to the agricultural activities. Alternatives are collecting firewood, making charcoal and weaving.

In this paper, we use data from 1989 and from the revisits during three rounds in 1994-95. The data from 1989 reflect conditions on the eve of the reforms, while the later data are from well into the post-reform period. During this period, the civil war affected the communities relatively little, at least in terms of direct effects. With most fighting in the north of the country, in no villages was any fighting or other direct effects from the war reported. Consequently, the direct effects of increased security, such as more opportunities for mobility towards local markets and lower price margins, are unlikely to have been very important.

Other changing conditions should also be taken into account when trying to explain welfare outcomes. Rainfall is generally erratic, but crucial for agricultural incomes. While 1994 was

quite a good year for all but two communities (i.e. above normal rains), it was only better than 1989 for two communities; on average it was worse in the sample (which is against the national average patterns). On average in the sample, the five-year average rainfall was slightly better in the 1990s than before. Few other village-level characteristics changed in this period; for example NGO-activity remained similar. There was some improvement to the road in Gara Godo, even though it still meant that the road was not an all-weather road.

So what happened in terms of welfare outcomes in these villages? We will report two indicators (details and more descriptive statistics on these indicators are in Dercon and Krishnan (2000b)). First, we use food consumption data per adult equivalent in real terms. No complete data on non-food consumption were collected in 1989, so they are not reported. Food consumption is deflated by a food price deflator, using regional prices collected by the Central Statistical Authority. Consumption is expressed in 1994 prices. Nutritional equivalence scales specific for East-Africa were used to control for household size and composition. Since food consumption is unlikely to be characterised by economies of scale, no further scaling is used (Deaton (1997)).

The underlying questionnaire was based on a one-week recall of food consumption, from own sources, purchased or from gifts. Seasonal analysis using the panel revealed rather large seasonal fluctuations in consumption, seemingly linked to price and labour demand fluctuations (Dercon and Krishnan (2000a)). Therefore, I used the food consumption levels in the same season as when the data had been collected in 1989, as the measure for food consumption in 1994/95. Consequently, only one observation of the three possible data points collected during the 1994/95 rounds.

Table 1 Changes in food consumption per adult equivalent between 1989 and 1994/95 (in 1994 prices) (n=354)

	DINKI	DEBRE BERHAN	ADELE KEKE	KORO DEGAGA	GARA GODO	DOMAA	ALL
mean food consumption 1989	50	53	64	37	27	25	42
mean food consumption 1994	62	96	108	40	20	80	64
yearly growth mean (%)	4.3	12.4	11.1	1.5	-5.0	21.4	8.8

Table 1 gives the results. Overall, we observe strong growth in mean per adult food consumption in this period in this sample: equivalent to about 9 percent per year. But there are substantial differences between villages. In one village, mean food consumption seems to have declined, while in three, growth is more than 10 percent. Note that growth is in four out of six cases well above the growth rate of private consumption per capita in the national accounts. It is also much higher than growth in agricultural GDP. Note that this does not need to be inconsistent since a large part of the possible welfare gain from the reforms would have been a reduction in implicit and explicit taxation of farmers, although it is still likely to be above the national trend.

It is of interest to look at what has happened in this period with households at the lower end of the distribution. A simple and intuitively appealing way is to first identify the poor using a poverty line and then consider the evolution of different poverty aggregates. The panel data also allows us to look at poverty transitions in this period. To identify the poor, I use an absolute, nutrition-based poverty line. It will be kept fixed in real terms both intertemporally

and spatially. In different areas in the sample it is in the range 35-45 birr per month per month[2]. This poverty line is applied to the real food consumption data. P-alpha poverty aggregates as in Foster et al. (1984) are used to express different dimensions of poverty. In particular, the head count, the average normalised poverty gap and the average squared poverty gap, are presented.

Table 2 Poverty between 1989 and 1994/95 (n=358)

	DINKI	DEBRE BERHAN	ADELE KEKE	KORO DEGAGA	GARA GODO	DOMAA	ALL
Head count 1989	0.42	0.34	0.42	0.73	0.80	0.86	0.61
Poverty Gap 1989	0.14	0.12	0.10	0.39	0.46	0.45	0.29
Squared Poverty Gap 1989	0.07	0.05	0.05	0.25	0.30	0.27	0.17
Head count 1994/95	0.57	0.26	0.16	0.62	0.95	0.39	0.51
Poverty Gap 1994/95	0.19	0.06	0.04	0.22	0.53	0.23	0.22
Squared Poverty Gap 1994/95	0.09	0.02	0.02	0.10	0.34	0.16	0.12
Percentage change							
Head Count	+36	-24	-61	-15	+18	-55	-16
Poverty Gap	+32	-49	-60	-45	+15	-48	-26
Squared Poverty Gap	+32	-66	-62	-60	+13	-39	-31
Poverty elasticity at mean[a]							
Head Count	1.53	-0.30	-0.88	-1.98	-0.68	-0.25	-0.30
Poverty Gap	1.37	-0.62	-0.86	-5.82	-0.57	-0.22	-0.49
Squared Poverty Gap	1.33	-0.84	-0.90	-7.88	-0.47	-0.18	-0.59

[a]The poverty elasticity is calculated as the ratio between the actual percentage change in poverty and the growth in mean consumption between 1989 and 1994/95.

Table 2 gives the results. Overall, poverty fell during this period. The headcount declined by 16 percent, the other poverty measures by even more. The different experiences across villages are also clear. In four villages, we observed a substantial decline; in the two other villages, an increase in poverty[3]. Overall, poverty remains high at about 50 percent. In five out of six villages are growth and poverty declines inversely related, as one would expect. Finally, note that the poverty elasticities are typically relatively small, except for in one village, where low growth appears to have coincided with substantial poverty declines. The overall poverty decreases across the sample are robust to the choice of the poverty line: in Dercon and Krishnan (2000b) first order welfare dominance was shown to exist for all reasonable poverty lines.

These figures hide substantial poverty transitions in both directions as well. About 35 percent of the sample remained poor in both years, while 26 percent moved out of poverty. But about 16 percent moved into poverty in this period as well. Finally, the Gini-coefficient moved up a little in this period, from 42.3 to 44.8. A decomposition of the total change in the head count into a 'growth' and a 'redistribution' effect (as in Datt and Ravallion (1992), Kakwani (1993a))

[2]The basis is a measure of the cost of basic food needs (Ravallion (1994), Ravallion and Bidani (1993)). The food needs are determined by considering the average diet of the lower half of the consumption distribution. Then, this diet is valued at local prices (using 1994 prices). The poverty lines obtained for each village in 1994 dollars suggest about 7 US dollars per month per adult. Even using a typical PPP-deflator of about a third, this is still well below the one-dollar-a-day norm.

[3] In Dercon and Krishnan (2000) significance levels of these poverty changes have been reported, following Kakwani (1993b). The overall declines and the changes in four out of six villages were significant at 5 percent or less.

showed that inequality increases made poverty higher by 3.1 percentage points but growth brought poverty down by 13.2 percentage points. In conclusion, growth was rather high in these villages and poverty declined considerably, although the poverty elasticity appears generally low. Inequality increases, movements into poverty and generally different experiences across communities in this period suggest that growth did not affect households in the same way. Differential impact of the reforms is a possible explanation, but their different exposure to weather and other shocks is also a plausible one.

How did reforms affect these communities? Given the relative importance of crop agriculture in the local economy, the evolution of producer prices relative to overall consumer price inflation provides a useful starting point for the analysis of the impact of the reforms. Table 3 gives the average increase in producer prices in each of the communities, relative to the consumer price evolution. It can be read as the percentage movement in terms of trade, using 1989 terms of trade between producer and consumer goods as a base. I report the percentage change of the average real producer prices per community for all crops, as well as for sub-groups[4]. Since the reforms generally provide increased incentives for tradable commodities, it is of interest to distinguish them from the price evolution in non-tradables. Even though, as in most African countries, relatively little large-scale international private food trade takes place (even if the markets become liberalised), there is a very active market in most food crops, especially cereals. Internal market liberalisation provides further incentives for trade in these commodities. From the point of the view of the village economy, it would appear appropriate to include those actively traded commodities as tradables. Non-tradables include commodities rarely moved across any large distances, mainly because of high transactions costs due to a low value in relation to weight and volume. In our data, these include root crops such as enset and sweet potatoes. Finally, I also report the relative price movement of the crops that were liable to quotas in each community. The abolition of the quota is likely to have an additional effect beyond the overall pattern in prices.

The results are generally consistent with the earlier predictions; Gara Godo appears to be an exception and will be discussed below. The abolition of the quota system and market reform appear to have resulted in increases in real producer prices: they have increased on average by about 26 percent. The increases are higher for those crops that used to be covered by the quota system, compared to other crops typically traded. As was discussed before, the predicted effect of the abolition of the quota system is ambiguous, while surplus areas are likely to have benefited from the liberalisation of regional trade. The national evidence pointed to higher producer prices in surplus areas. Quota crops were generally selected on the basis of predicted surpluses, so that the results in table 10 are consistent with this. Incentives for non-tradable crops have strongly decreased, in line with an increased market-orientation after liberalisation. Prices moved quite differently in Gara Godo. Located in a densely populated area, with overall relatively good road linkages, liberalisation appears to have brought down producer prices. Contrary to the other villages, most of whom are in or not far from surplus areas, it is a deficit area. The decline is less for the main cereals relative to non-tradables, but still substantial.

[4] Data used are for 1989 and for 1994. It could be argued that these may be 'exceptional' years, so that these price changes do not reflect genuine permanent movements, but rather transitory differences. A systematic comparison for longer periods was not feasible due to gaps in the data between 1990 and 1993, while the Census of 1994/95 stopped producer price data collection until late 1995. Still, an inspection of the available data suggests that the change is systematic and took effect at least after 1992. It also means that the usual problem of expectations and lag structure when analysing supply response is of less relevance.

Terms of trade for coffee, traditionally an important cash crop in the area, moved very favourably, partly influenced by the coffee-boom of 1994-95, but also benefiting from the devaluation. However, in the real producer prices faced by the households in the sample this is not reflected, simply because a virtual harvest failure occurred in 1994 due to pests and drought at a crucial point in the growth cycle[5]. Finally, chat, another important export crop in Ethiopia, is quite important in Adele Keke, but its terms of trade actually fell in the period 1989-94. As discussed before, this crop was rarely traded via the official channels and therefore its price has generally reflected the black market exchange rate, so that the devaluation has had little impact. Increased production and reduced rents from smuggling may well have depressed the prices somewhat. Still, it leaves these prices in real terms at about three times the levels of the early 1980s.

Table 3 Real producer prices (Percentage increases relative to 1989[a])

	DINKI	DEBRE BERHAN	ADELE KEKE	KORO DEGAGA	GARA GODO	DOMAA	AVERAGE
All crops	+28	+21	+12	+65	-37	+35	+26
Quota crops[b]	+29	+20	+15	+74	-22	n.a.	-
Tradables[c]	+28	+23	+15	+65	-12	+49	+31
Non-tradables[d]	-	-	-38	-	-77	-23	-
Food	+31	+21	+25	+65	-37	+35	+28
Coffee					+49		
Chat			-9				

Source: ERHS and Central Statistical Authority

[a]Percentage changes in terms of trade, based on the movement of producer prices relative to consumption price inflation. The producer prices for different crops are weighted using the contribution to total crop income in 1994 of each crop (including production for home consumption). The reported figures are based on the producer price indexes, averaged across households in each community and across the sample. Producer prices for all indexes were taken from publications on rural producer prices at the sub-regional level, collected by the Central Statistical Authority. To achieve maximum comparability, only consumer prices collected by the Central Statistical Authority were used as well. Data were compiled for the same months so that differences do not reflect seasonality.

[b]Quota crops: only using crops for which a quota had to be sold to the AMC.

[c]Tradables: regularly traded food and cash crops in Ethiopia, i.e. most cereals and cash crops.

[d]Non-tradables: crops such as enset and sweet potatoes.

A central question in much of the debate about the effects of market reform and increased incentives is whether farm households are actually responding to the changes in real producer prices. In Dercon (2001) this question in more detail. First, households switched away from the quota crops, suggesting that the system encouraged sub-optimal production choices. Area allocated to cash crop generally expanded. For example, quite a few farmers in Gara Godo planted new coffee. Chat did not expand much further in these villages, in line with the stabilisation of the price.

As was argued before, direct measures of price changes for non-agricultural activities are not readily available. However, since most of the off-farm activities are linked to agriculture, price changes may well have gone in the same direction. In any case, there is evidence that more households became involved in off-farm activities (Dercon (2001)). The expansion is largest

[5] Later rounds of the panel survey in subsequent years not used in this paper have shown an important recovery in coffee output in this area.

for casual wage labour and especially crafts for sale and trading. There is also a move away from basic gathering activities to activities requiring more investment and skill.

In conclusion, growth and poverty reduction appears to have taken place in most of these villages, but not all. In general, real producer prices have increased substantially on average, but the pattern is not the same for all crops and for all villages. However, the changes are consistent with expected food price changes after liberalisation and the effect of the devaluation, given widespread parallel markets. Next, the question arises whether the relation between growth, reforms and poverty can be understood or whether it is spurious.

4. Decomposing growth and poverty changes: methodology

In this section I develop a framework to assess to what extent these changes in welfare can be attributed to the economic reforms that have taken place, rather than, say, to climatic conditions or idiosyncratic shocks faced by the household. Reforms affect household incomes and consumption by changing prices and wages in the economy. They may also be affected by changes in availability of public goods or direct transfers. There is little evidence of changes in transfers or public goods during the period under consideration, so I will not consider this issue in the econometric analysis.

Decomposing income changes

Household net incomes can be seen as total returns to the different assets and endowments the household owns or has access to. They include land, labour, human capital and local endowments, such as agricultural potential and infrastructure. These assets are applied to a typically diversified portfolio of activities, possibly with some other inputs, such as fertiliser in agriculture or string to tie firewood before sale. Most activities are business activities – running a farm or off-farm activities - with close links to the farm, such as selling local beer or livestock products. As will be shown below, (virtually) all households in the sample have access to some land. Relatively little income is derived from wages or transfers. At the same time, little labour tends to be hired in or out, while land sales are prohibited. To simplify the analysis, one can think of the problem as the household trying to allocate some fixed and variable inputs to produce output and profit. The fixed inputs coincide with the household's endowments (such as land, land quality, labour or human capital) and their presence is equivalent to assuming missing markets for these production factors, while some inputs such as fertiliser or seeds are bought.

The approach assumes that different household activities, including non-farm and farm activities, can be considered as being described by one production process producing some composite good. While in agricultural economic analysis, this approach is not uncommon when considering total farm output, it may be more problematic when applied to all household income generating activities. However, as will be discussed below further, most non-farm activities appear closely linked to the farm output as well, so that the approach is less problematic than may seem at first.

In order to separate out the effects of changing relative prices in the economy, as part of the reform program, I use a profit function approach, with a simple underlying production function

to represent the household's allocation of inputs (Singh et al. (1986), De Janvry et al. (1995)). Since we have panel data, the standard problem of the lack of variation in prices to estimate price responsiveness is avoided. Also, since we do not have good data on all output and income sources, estimating a profit function allows us still to make inference on the overall effects of the reforms on production. At the same time, heterogeneity across households can be addressed via panel data, at least under certain assumptions about the form of heterogeneity.

Let the household's joint income generation process be described by $q=g(x,k,u)$, in which q is total output, x is a vector of n variable inputs, k is a vector of j fixed inputs and u is a vector of m stochastic factors, such as agro-climatic conditions. Risk is introduced as a factor in the production function. The household is assumed to maximise profits from its activities[6]. The maximisation problem can be simply written as:

$$\max_{x} Y = p.g(x,k,u) - p^{x}x \tag{1}$$

in which p is the output price and p^x are input prices.

The optimal x can be substituted back into the objective function to define the profit function Y as a function of input and output prices, fixed factors and exogenous shocks. If one assumes that the production function takes on the Cobb-Douglas form, i.e. $q=a.x^{\alpha}k^{\beta}u^{\gamma}$, then straightforward manipulation yields a profit function, defined as:

$$Y = a^{\frac{1}{1-\alpha}}.\alpha^{\frac{1}{1-\alpha}}.(1-\alpha).k^{\frac{\beta}{1-\alpha}}p^{\frac{1}{1-\alpha}}p^{x\frac{-\alpha}{1-\alpha}}u^{\frac{\gamma}{1-\alpha}} \tag{2}$$

Taking logs, a useful form for empirical analysis emerges as:

$$\ln Y = \ln a^{*} + \frac{1}{1-\sum_{n}\alpha_{n}}\ln p + \sum_{n}\frac{-\alpha_{n}}{1-\sum_{n}\alpha_{n}}\ln p_{n}^{x} + \sum_{j}\frac{\beta_{j}}{1-\sum_{n}\alpha_{n}}\ln k_{j} + \sum_{m}\frac{\gamma_{m}}{1-\sum_{n}\alpha_{n}}\ln u_{m} \tag{3}$$

$$\text{with } \ln a^{*} = \frac{1}{1-\sum_{n}\alpha_{n}}\ln a + \sum_{n}\frac{\alpha_{n}}{1-\sum_{n}\alpha_{n}}\ln\alpha_{n} + \ln(1-\sum_{n}\alpha_{n})$$

For further manipulation, using subscripts i to denote different households and introducing a household-specific effect δ_i for each household i, (3) can written as:

$$\ln Y_{i} = \delta_{i} + \ln a_{i}^{*} + \varphi^{*}\ln p_{i} + \sum_{n}\alpha_{n}^{*}\ln p_{in}^{x} + \sum_{j}\beta_{j}^{*}\ln k_{ij} + \sum_{m}\gamma_{m}^{*}\ln u_{im} \tag{4}$$

[6]Note that this implies that, to keep the analysis tractable and simple, recursivity is assumed between consumption and production. In general, this is not easily justified since it is clear that many markets are imperfect in Ethiopia, including land, credit and insurance markets. The reasons include the standard theoretical ones, as well as, such as in the case of land, extensive restrictions for political purposes, which will be discussed below. The nature of food market interventions may also have implied a breakdown of recursivity as will be discussed further. In the econometric analysis, the fact that panel data are used allows, heterogeneity across households to be addressed, including in (shadow) prices, so that the recursivity assumption is less restrictive than it may seem.

When comparing incomes over time after a period of reform, a number of elements in (4) may have changed. First, reform is likely to affect input and output prices, affecting incomes. Secondly, households may have expanded or reduced some of their fixed inputs. For example, the available labour or human capital may have changed. Thirdly, over a number of years, there may have been some changes in the technology employed, encouraged by the reforms. More realistically, since the model assumes the production of one composite commodity, relative output and input price changes may have induced a shift in the optimal portfolio, implying some changes in the optimal technology used (such as more intensive in some variable or fixed production factors)[7]. Finally, the shock variables are likely to take on different values. Allowing for these different possible changes, considering periods t and t+1 as respectively before and after the reforms, and denoting Δ as the difference in values between t+1 and t, differences in profits over time can be described as:

$$\Delta \ln Y_i = \Delta \ln a_i^* + \varphi_{t+1}^* \Delta \ln p_i + \Delta\varphi^* \ln p_{it} + \sum_n \alpha_{nt+1}^* \Delta \ln p_{in}^x + \sum_n \Delta\alpha_n^* \ln p_{int}^x$$
$$+ \sum_j \beta_{jt+1}^* \Delta \ln k_{ij} + \sum_j \Delta\beta_j^* \ln k_{ijt} + \sum_m \gamma_{mt+1}^* \Delta \ln u_{im} + \sum_m \Delta\gamma_m^* \ln u_{imt} \qquad (5)$$

Introducing an error term and estimating (5) provides estimators of the different elasticities relative to prices and changes in fixed inputs, controlling for heterogeneity in the form of household fixed effects. At the same time, an estimate is obtained for any changes in these elasticities over time due changes in the underlying technology of combining inputs. Equation (5) allows one to distinguish the effects of changing prices from changes in the household endowments and from shocks faced by the household. Provided that price changes can be linked to the reform programme, this allows a direct assessment of whether any observed changing income levels can be traced to the reforms. A simple means of presenting these results is to calculate using the estimates from (5) the contribution of each of the these factors to explaining mean income changes, similar to a Oaxaca-Blinder decomposition (Oaxaca (1973), Blinder (1973)). In particular, (5) can be summed for all i, and each term then divided by the sum of changes in log incomes. When (5) is estimated using a method imposing that the expected error term is zero (such as OLS), this provides an exact decomposition.

Linking poverty and growth - simulating the impact of variables

The analysis described above allows us to see the contributions of different factors to changes in the mean levels of real income. However, in this paper, our interest is not just to explain growth in incomes but also how the poor fared in this context. In particular, I am interested in trying to establish the contribution of different observed factors to the change in poverty over time. This is not self-evident. A poverty index is in general not a linear function of real incomes; consequently, changes in real incomes are not linearly related to changes in poverty. For example, the poverty gap index is for each poor individual linear in real incomes, but non-linear as an aggregate measure. When considering changes over time via particular factors, the group of poor and non-poor may change as well, so that there is no simple, exact way to link

[7]Note that this allows for changes over time in the marginal value product of particular fixed factors beyond changes brought about by changes in prices of output and variable inputs.

the effects of growth to the effects on poverty[8]. The standard approach to study the effects of changes over time of particular factors on poverty is to construct the counterfactual real income distribution (via micro-simulations) and then to calculate the difference in the poverty indicator between the original and the counterfactual distribution. In section 7, we will use this approach to investigate the specific individual contributions of different factors on the changes in poverty during the period under consideration.

However, it is possible to derive a simple analytical result that *describes* the calculations one implements during such micro-simulation exercise given the questions asked in this paper. In principle, *any* counterfactual can be simulated and its impact assessed on any poverty index. However, suppose we are specifically interested in investigating the contribution to poverty changes of some variables crucial in explaining growth. Since (5) considered changes in the natural logarithm in income, let us use a poverty index that is defined in log income as well. Furthermore, let us consider an additive separable poverty index, which for the each poor person is linear in log incomes. The normalised poverty gap, defined over the log of income as the underlying household welfare measure, satisfies this property[9].

Formally, denote $\ln Y_{it}$ as y_{it}, z as the log of the poverty line, q_t as the number of people falling below the poverty line in the current period and n as the total number of individuals which are all observed over time[10]. If we order all individuals from poor to rich in each period, then this measure can be defined as:

$$P_t = \frac{1}{n}\sum_{i=1}^{q_t}\frac{z - y_{it}}{z} \qquad (6)$$

Let us consider two periods of time, 0 and 1, and introduce a specific counterfactual, in which the change of income over time is equal to X_i. For example, this could be the change in real income stemming from the actual change in one of the fixed endowments in (5), or $X_i = \beta^*_{jt+1}\Delta \ln k_{ij}$. It is then possible to calculate the counterfactual real income for person i, y_{i1}^*, as:

$$y_{i1}^* = y_{i0} + X_i \qquad (7)$$

Given this change, the number of poor will change. It is possible that some become poor and others escape poverty. Let us call the actual and counterfactual number of poor in period 0 and

[8] Datt and Ravallion (1992) developed a simple approximate decomposition in growth and distribution effects of changes in poverty - however this is not an exact decomposition, while the contribution of different factors cannot directly derived from the decomposition.

[9] By using lnY, the result is effectively the same as when using the Watts measure. Since the poverty gap is more commonly used in discussions of changes in poverty, I state the problem in terms of this index. In the econometric analysis, I will also present results on a linear (rather than log-linear) profit function defined in terms of Y rather than lnY. While the theoretical foundations for such profit function is weaker (one could think of it as a Leontief model but without most of the interaction terms), it provides a poverty change decomposition directly defined over the standard poverty gap measure, defined in terms of the level of income. The Watts poverty measure is defined over the log of Y, so it is a natural candidate to use in the decomposition.

[10] In this exposition, I do not consider attrition in the panel. As is discussed below, in the data set used, attrition rates were very low in the period considered.

1 respectively q_0 and q_1^*. We can then define the change in poverty between period 1 and 0 as:

$$P_1^* - P_0 = \frac{1}{n}\sum_{i=1}^{q_1^*}\frac{z - y_{i1}}{z} - \frac{1}{n}\sum_{i=1}^{q_0}\frac{z - y_{i0}}{z} \qquad (8)$$

Let us now order the individuals, so that the poor in both periods are from i=1,... q^*_{11}, those moving into poverty i=q^*_{11}+1,…q^*_{01} (i.e. non-poor in period 0 and poor in period 1), those moving out of poverty ranked i=q^*_{01}+1, …q^*_{10}, and finally, those non-poor in each period as i=q^*_{10}+1,…n. Then, (8) can be written as:

$$P_1^* - P_0 = \frac{1}{n}\sum_{i=1}^{q^*_{11}}\left(\frac{z - y^*_{i1}}{z} - \frac{z - y_{i0}}{z}\right) + \frac{1}{n}\sum_{i=q^*_{11}+1}^{q^*_{01}}\frac{z - y^*_{i1}}{z} - \frac{1}{n}\sum_{i=q^*_{01}+1}^{q^*_{10}}\frac{z - y_{i0}}{z} \qquad (9)$$

i.e. the change in the gap consist of the change of the gap of those poor in both periods, plus the gap of those poor in the second but not in the first period, minus the gap in the first period of those leaving poverty[11]. Dividing the left and right hand side of (9) by (P_1^*-P_0) yields a decomposition in terms of the contribution to the total poverty change of those staying poor, those becoming poor and those leaving poverty. Note that this is an exact decomposition.

This can be rewritten in terms of changes in real income. The part in brackets in the first term of (9) is directly defined in terms of y^*_{i1} - y_{i0} = X_i. We can also pre-multiply the terms within the summation sign for each of the two subsequent terms by $\frac{y_{i0} - y^*_{i1}}{y_{i0} - y^*_{i1}}$. Slightly rewritten, (9) becomes:

$$P_1^* - P_0 = \frac{1}{n}\sum_{i=1}^{q^*_{11}}\left(\frac{y_{io} - y^*_{i1}}{z}\right) + \frac{1}{n}\sum_{i=q^*_{11}+1}^{q^*_{01}}\left(\frac{y_{io} - y^*_{i1}}{z}\right).\left(\frac{z - y^*_{i1}}{y_{io} - y^*_{i1}}\right) - \frac{1}{n}\sum_{i=q^*_{01}+1}^{q^*_{10}}\left(\frac{z - y_{i0}}{y_{io} - y^*_{i1}}\right)\left(\frac{y_{io} - y^*_{i1}}{z}\right) \qquad (10)$$

or

$$P_1^* - P_0 = \frac{1}{n}\sum_{i=1}^{q^*_{11}}\left(\frac{-X_i}{z}\right) + \frac{1}{n}\sum_{i=q^*_{11}+1}^{q^*_{01}}\left(\frac{-X_i}{z}\right)\left(\frac{z - y^*_{i1}}{y_{io} - y^*_{i1}}\right) - \frac{1}{n}\sum_{i=q^*_{01}+1}^{q^*_{10}}\left(\frac{z - y_{i0}}{y_{io} - y^*_{i1}}\right)\left(\frac{-X_i}{z}\right) \qquad (11)$$

This expression suggests (rather self-evidently) that when calculating the total counterfactual poverty change, for households who leave or enter into poverty, only the real income change up to or counting from the poverty line will be taken into account, while for those staying poor, their entire real income change is relevant. This allows us to define the share of the real income change that has to be taken into account as:

[11] As suggested earlier and using the notation as before, the Watts poverty measure is defined as:

$$W_t = \frac{1}{n}\sum_{i=1}^{q_t} z - y_{it}$$

so that the decomposition in (8) is in practice a decomposition of the Watts poverty measure. Just as the squared poverty gap, it is convex in levels of real income, implying that income levels far below the poverty line have a higher weight than levels closer to the poverty line, unlike the poverty gap, which is linear in levels of income.

$$s_i^* = 1 \quad \text{for } q_i \in \{1,\ldots q^*_{11}\}, \tag{13a}$$

$$s_i^* = \frac{z - y_{i1}^*}{y_{i0} - y_{i1}^*} \quad \text{for } q_i \in \{q^*_{11}+1,\ldots,q^*_{01}\} \text{ and} \tag{13b}$$

$$s_i^* = \frac{z - y_{i0}}{y_{i1}^* - y_{i0}} \quad \text{for } q_i \in \{q^*_{01}+1,\ldots,q^*_{10}\} \tag{13c}$$

Note that these shares s_i* are dependent on the specific counterfactual studied (i.e. they are endogenous). Furthermore, they are all between zero and one.

Using (13a), (13b) and (13c), (12) can be rewritten as:

$$P_1^* - P_0 = \frac{1}{n}\sum_{i=1}^{q^*_{10}} s_i^* \left(\frac{-X_i}{z}\right) \tag{14}$$

Equation (14) is only of limited interest: if only one factor is considered in the counterfactual, the equation only describes what in practice is calculated via simulations. Calculating the weights s_i* is probably more time consuming than calculating the change in poverty directly from the derived and the actual distribution. Furthermore, (14) is restricted to very specific poverty measures, while micro-simulations can handle any measure. Nevertheless, (14) becomes more interesting when X is itself determined by different variables.

Simulating and decomposing the impact of a group of variables

Consider a counterfactual that consists of two parts (V and W), and assume that for each i, $X_i = V_i + W_i$. Now (10) can be used to study the contribution of each factor V_i and W_i in the total counterfactual change. For a given total change in real income *(i.e. for a given total counterfactual),* the shares s_i* will be constant, so that (14) can be written as:

$$P_1^* - P_0 = \frac{1}{n}\sum_{i=1}^{q^*_{10}} s_i^* \left(\frac{-V_i}{z}\right) + \frac{1}{n}\sum_{i=1}^{q^*_{10}} s_i^* \left(\frac{-W_i}{z}\right) \tag{15}$$

This implies that for a given total change, the contribution of different factors to the change in poverty can be written derived from (15). In particular the contribution of factor V_i given total change X_i, $\theta(V|X)$ can be defined as:

$$\theta\left(V_i \middle| X_i\right) = \frac{\frac{1}{n}\sum_{i=1}^{q^*_{10}} s_i^* \left(\frac{-V_i}{z}\right)}{P_1^* - P_0} \tag{16}$$

Note that these contributions sum to one, but also that they are always defined relative to a particular total counterfactual change. For example, let us define $P_1{}^V$ ($P_1{}^W$) as poverty in period 1 when V (W) has been added to y_{i0}. Even though $(y_{i0} + X_i) = (y_{i0} + V_i + W_i)$, it can be easily

seen that:

$$P_1^* - P_0 \neq (P_1^V - P_0) + (P_1^W - P_0) \quad (17)$$

In other words, the total poverty change due to adding V and W both to real income is not simply equal to the poverty change induced by adding V and W separately. Obviously, this means that the decomposition has to be carefully interpreted. (15) and (16) will be used below to interpret the contribution to poverty changes of different elements linked to economic reform.

Linking poverty and growth - an overall assessment

The decomposition described above provides a simple way of assessing the contribution of different factors to a particular counterfactual poverty change. One counterfactual is of particular interest for the current research: assessing the contribution of different factors to the *actual observed* total change in poverty (P_1-P_0). With an appropriate residual term (ε_i), equation (5) provides a prediction model for changes in real income for each person, based on different factors. Or, more in general, suppose $X_i = V_i + W_i + \varepsilon_i$. Equation (14) can then be rewritten as (dropping asterisks, since the counterfactual considered is the actual change in poverty):

$$P_1 - P_0 = \frac{1}{n}\sum_{i=1}^{q_{10}} s_i\left(\frac{-V_i}{z}\right) + \frac{1}{n}\sum_{i=1}^{q_{10}} s_i\left(\frac{-W_i}{z}\right) + \frac{1}{n}\sum_{i=1}^{q_{10}} s_i\left(\frac{-\varepsilon_i}{z}\right) \quad (18)$$

Equation (18) provide then simple ways of describing the contribution of these different factors (and the error term) to the observed poverty changes, using shares s_i based on the *actual* observed poverty transitions.

Equation (18) shows a direct link between changes in individual incomes over time and the poverty outcome. Furthermore, replacing the income change by the predicted contribution of different factors using (5) and dividing each term by the total poverty change gives the contribution of these factors to the change in poverty. For example, let $\theta_{\Delta pi}$ be the contribution of changes in output prices to the total poverty change and $\theta_{\Delta ki}$ be the contribution to the total poverty change of changes in particular endowments k, then using (5) and (18), they are defined as:

$$\theta_{\Delta p_i} = \frac{-\frac{1}{n}\sum_{i=1}^{q_{10}} s_i \varphi^*_{t+1} \Delta \ln p_i}{z.(P_1 - P_0)} \quad (19a)$$

$$\theta_{\Delta k_i} = \frac{-\frac{1}{n}\sum_{i=1}^{q_{10}} s_i \beta^*_{t+1} \Delta \ln k_i}{z.(P_1 - P_0)} \quad (19b)$$

The overall result is a decomposition of the poverty gap into the effects of changes in fixed endowments, changes in input and output prices, and random events*, for a given total change in poverty*. The decomposition will now be applied to data related to 1989 and 1994/95, before

and after a major set of reform measures was implemented. The decomposition of income changes in (5) is exact when using an estimation method which impose that that the sum of the residuals is zero, such as OLS. But the proposed decomposition is done on a sub-sample only, so that this property does not hold. Consequently, decompositions based on (18) are not exact and the contribution of the error term will have to be added:

$$\theta_{\varepsilon} = \frac{-\frac{1}{n}\sum_{i=1}^{q_{10}} s_i \varepsilon_i}{z.(P_1 - P_0)} \tag{19c}$$

5. Econometric model and results

In this section, the econometric model discussed in section 4 will be used to explain the changes in welfare between 1989 en 1995. The estimates will then be used in the next section to conduct a decomposition of mean welfare and poverty changes. The main issue is to establish whether reforms rather than other factors can explain the observed changes. Introducing an error term e_{t+1}, equation (5) can be rewritten as an econometric model explaining changes in real income over time in terms of the change in the output price, input prices, fixed input changes and shocks, such as rainfall or idiosyncratic events. Since structural change in the technology used during this period is plausible, due to reorganisation of the activity portfolio, changes in the coefficients are also allowed for. A general change in total factor productivity (i.e. technological progress) is measured by a change in the constant in the underlying production function. The result is equation (20):

$$\begin{aligned}\Delta \ln Y_i = {} & \eta + \varphi^*_{t+1} \Delta \ln p_i + \Delta\varphi^* \ln p_{it} + \sum_n \alpha^*_{nt+1} \Delta \ln p^x_{in} + \sum_n \Delta\alpha^*_n \ln p^x_{int} \\ & + \sum_j \beta^*_{jt+1} \Delta \ln k_{ij} + \sum_j \Delta\beta^*_j \ln k_{ijt} + \sum_m \gamma^*_{mt+1} \Delta \ln u_{im} + \sum_m \Delta\gamma^*_m \ln u_{imt} + e_{t+1}\end{aligned} \tag{20}$$

Since this is not a standard difference model, a few comments on the econometric implications of (20) are useful. By estimating this difference model by OLS, one effectively controls for fixed (level) effects, i.e. household heterogeneity in the profit function, despite the fact that equation (20) includes terms in levels of prices and inputs. Household heterogeneity is typically an important problem in estimating profit or production functions, since many relevant variables to explain a household's outcomes remain typically unmeasured and may be correlated with some of the observed variables. For example, ability as a farmer is likely to matter but unobserved as well as possible correlated with other observed variables, biasing the estimates on some variables included in the regression. If it is a fixed effect, a difference model will produce unbiased estimates on those variables that change over time. However, it can be straightforwardly shown that the coefficients on variables that do not change over time but are included in the model to capture changes in coefficients, do not benefit from this property, i.e. they may still be biased. In fact, the estimated coefficients in (20) will be exactly the same as the difference of the coefficients if they would have been estimated using the level equation (4) and using OLS, for each year independently. Nevertheless, estimating them in (20) will be more efficient (Glewwe and Hall (1994)).

Using (20) on the data requires careful justifications for the inclusion of the right hand side variables. First, land and labour supply available to the household will be considered as fixed inputs, meaning that labour and land markets are assumed missing. As was discussed before, land is a non-tradable in Ethiopia. Land is state owned and allocated to peasants by a local council, who cannot buy or sell it. Land rental was illegal until the 1990s, but even afterwards cultivated land and land owned remain closely correlated[12]. Wage labour, whether in agriculture or otherwise, remains relatively rare. Rural wage labour markets remain underdeveloped, even though probably increasing compared to the repression of this activity before 1989. Informal labour transactions take nevertheless place in the village, in the form of labour sharing arrangements ('debbo' or 'wenfel'). However, these arrangements are largely reciprocal, so own labour remains the basis of these transactions, limiting the scope for relative factor equalising trade within villages.

Consequently, and for simplicity, both factors are therefore considered fixed. Labour considered will include male and female adults and children[13]. Land holdings are not homogenous across the sample. There are substantial differences in soil fertility and agricultural potential within and across communities. Information from the survey is used to control for these differences. Changes in land and labour availability allow us to estimate the coefficients in (20), which are directly linked to marginal returns. I assume that soil fertility and potential has not changed in this period: while they may well have been changing over longer periods of time, in a five-year period, this is unlikely to be very important. In any case, no information is available to control for this.

Another fixed input considered is location and infrastructure, proxied by the presence and quality of roads and distances to urban centres. In community surveys any changes in road presence and quality were investigated, but in these communities and period, changes reported were limited. Consequently, these variables are only included to investigate changes in their returns during this period, without establishing the information necessary to calculate marginal returns to roads and distance from towns.

The most direct result of the reform programme appears to have been the changes in agricultural output prices, with improving terms of trade for five out of six communities considered. This price change will be included in the analysis. Crop related income is however not the only source of income: the estimated value of the harvest contributed only about 43 percent to total income in 1994. Even though this is likely to have been an underestimate of the true relevance of crop income, non-crop income, such as business income or livestock product sales are also important. Unfortunately, no price information is available on these other sources. Nevertheless, I want to argue that this is not a serious shortcoming in the current

[12]Before 1989, any form of land rental was also illegal, with some exceptions related to widows, disabled people or families of serving soldiers. Sharecropping is relatively widespread and the simple set-up of the regressions does really account for this, except for considering it as one part of the portfolio of activities to allocate land and labour to, given relative endowments and prices faced. Although the number of sharecropping transactions are relatively high – in the cereal farming system villages up to 20 percent engaging in it – the land areas involved remain relatively small. For example, the correlation between household land holdings suitable for cultivation and actual land size cultivated per household (after transactions) is above 90 percent.

[13]Children are considered from the age of five upwards. In the survey, it was found that children performed a variety of farm and non-farm related activities. Gross primary school enrolment rates in 1994 were only about 20 percent.

context. On the one hand, most of these activities involve substantial inputs from local crop agriculture – such the raw materials for much of the petty food trade or food processing. The movement in producer terms of trade would suggest that these products also gained similar amounts relative to other traded consumer goods. The producer terms of trade changes would then capture the increased returns quite well. On the other hand, since these activities typically involve some trading with urban areas, the shadow output may well be proxied by inclusion of infrastructure and distance variables, as in our specification. Although very few purchased inputs tend to be used in both farm and off-farm activities, they should also be included. Again, no data are available on this. Nevertheless, since they tend to be supplied via nearby urban centres, the relative movement of these input prices may well be captured via the inclusion of the infrastructure and distance variables.

The result is a reduced-form specification in which agricultural output prices, infrastructure and distance variables allow the identification of a direct effect of the reform policies on real incomes via price changes. Changes in labour and land allow us to identify the marginal (physical) products underlying the production process. The levels of these fixed inputs at t+1 provide us with evidence on any *changes* in the marginal products, that affect the marginal return to inputs beyond price changes (see equations (3) and (4) for this). This may seem problematic, since it suggests that the underlying production technology has changed. Nevertheless, a reform programme, by changing the overall incentive structure for both agricultural and non-agricultural activities, may well have affected the relative (physical) returns to land, labour and infrastructure. This could have been achieved via a more efficient use of resources, in response to the lifting restrictions on crop choice (via the quota system) or increasing mobility, beyond those measured by price changes[14]. Furthermore, given that the left-hand side variable is effectively a composite commodity, consisting of farm and non-farm activities, shifts in the production function may be a reflection of a relative shift of the composition of the activities. For example, if reforms mainly restore the returns to agriculture, then crop-related activities may become relatively more important in the portfolio of activities in terms of the allocation of time and other inputs. This would result in a higher contribution of land to profits, linked to an increase in its marginal product.

Observed changes in real income are likely to have been affected by both common and idiosyncratic shocks as well. Ideally, detailed information on these should have been used, but much detail was missing from the 1989 survey. Nevertheless, two key variables are available: rainfall, both long-term changes and changes in the last year, and episodes of serious adult illness in the period between the two survey rounds[15]. The latter is likely to be the most important type of idiosyncratic shock[16]. Controlling for such shocks is crucial for a correct interpretation of the effects of policy, since marginal returns to land and labour are bound to be sensitive to shocks.

The result is an econometric model that explains changes in the log of real income (i.e. the

[14]Any changes in the returns to roads and distances may also be linked to the effects of the return to peace.

[15] The question on illness asked in 1994 whether any household member had suffered a serious, life-threatening illness in the last five years. Length of illness was also asked.

[16] Dercon and Krishnan (2000a) report that shocks to labour supply, such illness and death of household have very important effects on welfare in rural Ethiopia. About 40 percent of households in the Ethiopian Rural Household Survey mentioned it as a cause of serious hardship in the last twenty years, after harvest failure, mainly due to drought (78 percent) and the policy measures of the Dergue (42 percent).

growth between t and t+1) in terms of changes in fixed endowments and changes in their returns, changing real prices and common and idiosyncratic shocks. Let us define p_{it}^a as agricultural output prices and T_{it} as labour available in year t. L_{it} is land available in year t, I^k_{it} is a vector of k location and/or infrastructure characteristics in year t. $\Delta \ln S_i$ is the illness shock and $\Delta \ln R_I$ is the change in rainfall in t+1 relative to t. The econometric model can then be defined as:

$$\Delta \ln Y_i = \eta + \beta^1_{t+1} \Delta \ln T_i + \Delta \beta^1_t \ln T_{it} + \beta^2_{t+1} \Delta \ln L_i + \Delta \beta^2_t \ln L_{it} + \\ + \sum_k \Delta \alpha_k \ln I^k_{it} + \varphi^*_{t+1} \Delta \ln p^a_i + \gamma^1_{t+1} \Delta \ln S_i + \gamma_{t+1}{}^2 \Delta \ln R_i + e_{it+1} \qquad (21)$$

Another issue is an appropriate proxy for real income (the left-hand side variable). As was mentioned before, income was not very well measured in the survey, especially when concerned with comparing incomes over time. Consumption, at least for food, was much more carefully and consistently measured. This presents both problems and opportunities. First, consumption is hardly the same as income as a concept when measuring returns. However, since it is likely to be less sensitive to current circumstances, it will be more a reflection of the household's perceived typical return to its own assets and endowments. By the same token, to the extent that we do not measure well all the shocks and events affecting the household, consumption will also provide a better measure to assess the impact of reforms on living standards. Food consumption is typically a very high share of total consumption – in 1994 close to 80 percent, so using only food consumption is unlikely to be a large omission. Furthermore, since the income elasticity of non-food items is likely to be higher than those for basic food items, using food consumption will again underestimate the true response to reforms (although admittedly also to shocks, such as rainfall). Overall, therefore, using food consumption is unlikely to fundamentally affect linking data on the reforms to outcomes. If anything, it biases the results against any impact of the reforms, in favour of an interpretation linked to shocks. By using consumption in (21), the link with a welfare interpretation becomes more straightforward. Furthermore, a decomposition of poverty defined more appropriately in terms of consumption, rather than income, can be then performed.

Table 4 gives the estimation results, while table 5 gives the decomposition. Six different specifications are considered[17]. Each model is a difference model, allowing for fixed effects. Mean values are given in the last column. The left-hand side variable is the change in the log of real consumption, which can be viewed as the five-year growth rate. Consequently, the regression gives the contribution of different variables to the consumption growth. Recall that estimated coefficients right-hand variables in terms of differences will give the coefficients explaining real income in 1994/95, while coefficients on level variables in 1989 will give the increase in these coefficients since 1989. Growth between 1989 and 1994 is therefore allowed to come from increases in endowments and prices, and increases in the returns relative to 1989,

[17] All variables, except for dummies, are expressed in logs. Since some variables have zero values in the sample, 1 was added to those variables involved. The exception is land, where only 0.1 was added, in line with the suggestion in Pendgrist (1986). They suggested that the bias involved in adding arbitrary constants can be large, especially if the constant added is close to the mean value of the variable. As a simple means of investigating this in the current sample, regressions were repeated for samples without zero values for particular variables. In the case of land, if 1 was added, coefficients on land and on other variables were very different compared to a sample excluding landless households in 1989. If 0.1 was added, virtually identical coefficients were returned.

controlling for shocks.

The first specification uses fixed village level effects, i.e. all village level variables (e.g. prices) are perfectly captured by a set of dummies. The model includes land holdings and an index of land quality. It is a subjective index, scaled relative to the village level mean[18]. Three types of labour available are considered: male and female adults (above 15) and children above the age of 5. The model also uses average years of education of adults. Note that on average educational levels are extremely low, below one year per adult. They are assumed not to have changed between 1989 and 1994, so that only the change in the returns is measured[19]. The model also includes an idiosyncratic shock: the average number of serious adult illness episodes between 1989 and 1994 per adult in the family[20]. The results show significant effects on changes in land holdings and levels of land in 1989, and on some of the fixed effects. The land variables imply that growth is partly explained by some increases in total land holdings in some villages (21 percent of total growth, see table 18), but also by an increase in the marginal product of land since 1989, with an additional effect for those with higher soil quality. This can be understood as a shift in the income portfolio towards more land-intensive activities, i.e. agriculture, in line with the incentives provided by the reform process: household income is now produced by a more land-intensive technology, with a higher growth effect for households with better land. The education effect is low and not significant. Recall that educational levels are extremely low in this sample, so that the total contribution to growth is very small[21]. The largest effect comes from village fixed effects, suggesting that relative prices and changes in the returns to local conditions dominate overall growth (98 percent). Illness shocks are negative, and even though not significant, they reduced average growth by 11 percent.
Household labour composition does not appear to matter significantly in this specification. It appears however that the different labour variables could be taken together: a test of a linear restriction stating equality of coefficients on the level and changes in labour could not be rejected ($F(4,337)=0.19$). Alternative specifications with total household size or adult equivalent units (as used in the previous sections) gave very similar results, so from column 2 the labour variables are restricted to one measure in terms of adult equivalent units[22]. As expected, the results show a positive effect on changes in labour, explaining 7 percent of total growth. Although insignificant, it appears that the technology used in 1994 is less labour intensive, reducing the marginal returns of labour and contributing minus 34 percent to the growth. This is consistent with the shift towards more land-intensive activities. Note that if the reforms aimed to stimulate more labour-intensive rural production, then this is not achieved. Also, if the poor have typically more labour than other assets this would have contributed to a relatively low poverty elasticity of the growth process in this period.

[18]Households were asked to categorise their land according to three local well-known concepts of land quality ('lem', 'lem-teuf' and 'teuf'), equivalent to good, medium and poor quality. The meaning of each of the three is unlikely to be comparable across widely varying farming systems, but within villages likely to be consistent.
[19] By lack of data on education in 1989, the 1994 values are assumed to be valid for 1989. This is unlikely to be a problem, given the low enrolment rates in Ethiopia (by 1994, gross primary enrolment was only about 20 percent) and the collapse of the educational system by the end of the 1990s).
[20] Serious illness shocks were defined as life-threatening illness episodes, affecting the individual for a considerable length of time. Recall was used in 1994 to collect information about all adults in this respect.
[21] A few other educational variables were tried as well, such as literacy or whether any household member has education. In none of the specifications used were these terms significant.
[22] Strictly speaking, the F-test reported suggests a multiplicative labour term, not an additive term (such as household size). Results remained similar, while the interpretation is more straightforward when adding up adults.

In the next four columns, price and community level information is added. In model 3, the percentage change crop producer prices is added (see table 10 for details). It was constructed to reflect changes in household price incentives, so the community fixed effects can remain. Given the presence of the fixed effects, its significance (at 7 percent) is encouraging. Its coefficient directly measures price responsiveness, i.e. the output elasticity is the coefficient minus one. However, the value of 0.55 has to be interpreted with caution. Since household real income is more than just crops, it could be compared with the share of crop income in total income. In 1994 this was 43 percent, suggesting that an aggregate crop output elasticity of about 28 percent (0.55/0.43). Nevertheless, since it was shown before that many other activities are closely related to crops and their prices may have similarly moved, this must be seen as an upper bound. In any case, the average producer price increase, clearly linked to the reforms, mattered: about 39 percent of total growth is explained by it.

Since the different land variables appear to be having very similar effects, column 4 introduces a further restriction by using 'augmented' land as a variable, i.e. the product of the land and the soil variable, further multiplied by a control variable for 'agricultural potential'. Since land and (on the basis of the available information) soil cannot easily compared across areas in terms of potential (both physical and monetary), a variable measuring this was added to model 4[23]. A linear restriction on the three land variables was then found not to be rejected ($F(2,340)=0.01$), so augmented land was used subsequently. Note that all variables have similar effects in the decomposition as before.

In column 5 and 6, the community fixed effects are replaced by rainfall, infrastructure and location variables. The particular variables were chosen to give explanatory power to the regression but provided that they did not changed the effects and contribution of the household level variables. In particular, since fixed effects capture perfectly community level prices and conditions, any substantive change in the other coefficients would suggest missing community level variables. Nevertheless, the results will have to be interpreted with caution since there is evidence of multicollinearity between community characteristics and only limited scope for introducing information in the regression (given only six different communities).

[23] It was constructed as log of the village-level average yield per hectare times the village-level unit value per kg in 1989, scaled by the mean. The result in that mean potential (just as mean soil quality) in the sample is one for the mean household. Mean augmented land holdings are then equal to actual land holdings.

Table 4 Econometric model real income function. Dependent variable: change in log consumption between 1989 and 1994 (mean 0.3733; N=354). Robust standard errors corrected for village cluster effects.

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		sample
	Coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value	Coeff	p-value	coeff	p-value	mean
Constant	0.23	0.37	0.26	0.27	-0.11	0.68	0.00	0.99	0.18	0.15			1.000
ln(land in 89 ha +0.1)	0.21	0.13	0.21	0.17	0.21	0.17							0.294
ln(soil quality)	0.20	0.21	0.20	0.21	0.23	0.20							-0.041
ln(augmented land)							0.21	0.13	0.20	0.11	0.19	0.11	0.160
Δ ln (land in ha + 0.1)	0.24	0.04	0.24	0.05	0.23	0.05	0.24	0.03	0.22	0.03	0.22	0.02	0.327
ln(adults in 89)			-0.08	0.19	-0.08	0.24	-0.08	0.30	-0.06	0.46			1.549
Δ ln (adult equiv.)			0.30	0.31	0.31	0.28	0.31	0.26	0.32	0.23	0.35	0.21	0.091
ln(male ad. 89+1)	-0.02	0.96											0.797
ln(fem ad in 89+1)	-0.07	0.78											0.864
ln(children 89+1)	-0.04	0.81											1.379
Δ ln (male adults+1)	0.25	0.26											0.176
Δ ln (fem adults+1)	0.02	0.89											0.133
Δ ln (children+1)	0.14	0.55											-0.087
ln(yrs adult educ+1)	0.01	0.97	0.01	0.96	0.03	0.88	0.03	0.88	0.01	0.96	0.01	0.96	0.202
ln(adults serious ill+1)	-0.22	0.36	-0.22	0.37	-0.22	0.37	-0.22	0.38	-0.20	0.39	-0.19	0.43	0.188
dummy Dinki	-0.14	0.26	-0.17	0.14	0.04	0.78	0.55	0.07					0.150
dummy D.Berhan	0.16	0.16	0.13	0.12	0.37	0.05	0.03	0.80					0.175
dummy Adele Keke	0.44	0.02	0.42	0.03	0.71	0.02	0.30	0.09					0.121
dummy Gara Godo	-0.02	0.92	-0.06	0.78	0.48	0.20	0.52	0.01					0.155
dummy Domaa	0.58	0.00	0.57	0.00	0.72	0.00	0.24	0.38					0.144
Δ (% real prod prices)					0.55	0.07	0.60	0.00	0.37	0.12	0.59	0.00	0.263
Δ ln (rain last 5 years)									1.15	0.06			0.002
Δ ln (rain last season)									0.22	0.45			-0.179
Δ ln(rain 5 yrs*seas)											0.43	0.04	-0.177
ln (distance to town)									-0.24	0.21	-0.28	0.08	0.000
Road infrastructure?									0.17	0.40	0.27	0.03	0.706
F joint	F(16,337) =2.73		F(13,341) =3.63		F(13,340) =3.54		F(12,341) =3.85		F(11,342) =4.15		F(9,345)= =10.59		
adj R	0.072		0.082		0.085		0.088		0.089				
testing restrictions	labour levels equal?						land terms equal?				constant, lnaeu89		
	F(2,337)= 0.01						F(2,340)= 0.01				F(2,344)= 1.03		
	Lab. changes equal?										rain variables equal?		
	F(2,337)= 0.74										F(1,344)= 1.30		

Table 5 Decomposition of real consumption growth in percentages.
(Total change=37 percent)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
increase in land	0.21	0.21	0.21	0.20	0.20	0.19
increase in adult labour	0.09	0.07	0.08	0.07	0.08	0.09
change in returns to land (technology shift)	0.14	0.14	0.14	0.09	0.08	0.08
change in returns to labour (techn shift)	-0.32	-0.34	-0.31	-0.31	-0.24	
changes in returns to education of adults	0.01	0.01	0.02	0.02	0.01	0.01
crop producer prices change			0.39	0.41	0.26	0.42
change returns to infrastructure/location					0.32	0.51
relative rainfall shock					-0.10	-0.20
effect of illness shocks	-0.11	-0.11	-0.11	-0.11	-0.10	-0.10
village level effect	0.98	1.02	0.59	0.62		
constant effect					0.49	
sum of all effects	1.00	1.00	1.00	1.00	1.00	1.00

Since real consumption is used on the right hand side, measured outcomes reflect household strategies to cope with the consequences of risk, such as credit and savings. Any effect on rainfall variables, especially short-run rainfall, reflects therefore uninsured risk. Also, introducing long-term rainfall experience would become relevant: one year of poor rains may well be handled within the household via asset transactions, but several is much harder. Still, if household have generally difficulty to handle shocks, then more recent rainfall should matter as well for outcomes. Without further analysis on smoothing behaviour, it appears appropriate to consider both the short and long-term experience in rainfall. Consequently, I use relative rainfall in the most recent crop season comparing 1994 with 1989, and the relative average rainfall in the five years preceding each survey round. In column 5, both are positive, but only long term rainfall appears significant. However, since the variables are highly correlated, introducing either gave significant outcomes at at least 6 percent, while a linear restriction imposing equality of both effects could not be rejected ($F(1,344)=1.30$). In column 6, this equality was imposed.

For road infrastructure, the variable reported is whether the village has a road (either an all-weather road or a dirt road). Other finer distinctions were not significant. A measure of relative remoteness was constructed using the distance to the nearest town, scaled by the mean distance to the nearest town in the sample. In column 5 they were both insignificant, but once further restrictions were tested and imposed (including on rainfall, but also dropping the constant and the number of adults in 1989, the latter both individually and jointly insignificant), they became strongly significant.

Good rainfall typically boosts growth. In 1993/94, rains were as discussed before on average not as good as in 1988/89 (contrary to the national experience), even though slightly better in the most recent five years than before. The overall result suggests that rainfall kept growth down by about a fifth. The effect on roads means that returns to infrastructure have strongly increased since 1989. Again, this suggests that reforms, by encouraging more trade-oriented activities, have contributed to growth, despite higher transport or traded input costs. Nevertheless, even though the war had not directly affected the villages concerned, this is also consistent with increased mobility of goods and people with increased security. Similarly, the effect on distance suggests that

proximity to towns contributed positively to growth but remoteness negatively. The total contribution to growth of infrastructure and location is about 51 percent, underlying its importance in this period.

In conclusion, according to our econometric decomposition, better returns to roads and to a lesser extent remoteness contributed the largest share to growth between 1989 and 1994. As a consequence, the model predicts that those with poor location and no infrastructure would only have had half the growth rate of the others during this period of reform and return to peace. Better crop prices contributed also a very high share, 42 percent, but recall that one village faced worse prices than before the reforms, explaining some of its poor record. Acquiring more fixed assets is obviously good: the increases in land holding (mainly in one village following the disbanding of the producer co-operative) and more labour adds to real household income. However, their overall contribution in this period remains relatively small. Returns to education also appear to have increased considerably, but low average levels of education mean that only a small contribution is made in this period. An interesting finding is an increase in returns to land via its marginal product, suggesting a shift to a more land-intensive production mode. On average, the effect contributes only 8 percent to growth, but it means that those with more land will have seen higher growth rates. Furthermore, since this also includes an additional return to better soil quality and higher potential, this means that effects across the distribution may be larger: those in low potential areas or with relative poor soil would have had a lower growth rate from the same levels of land. In other words, any shift towards a more agricultural based production mode will have given disproportionate growth to farmers better-off in terms of land. Finally, poor rains and illness kept growth down by about a third.

In annex 2, the robustness of the results were checked further in three ways. First, by using income rather than consumption, even if one is aware that there are problems with the collection of the income data. Secondly, by investigating whether there is any evidence of different responsiveness of the poor relative to the non-poor to the key variables. Finally, by changing the parametric estimation technique used to quantile regressions. As is discussed in the annex, the results are qualitatively unaffected.

6. Explaining real income changes of the poor

Table 6 brings a large number of characteristics of the poor together, by their poverty status in 1989 and 1994. Income and livestock changes are consistent with consumption for each group those poor in either period. The largest increases in land were for those becoming non-poor. Patterns in mean land holdings are consistent with poverty in each round. Those poor in both periods have least land. Chat is consistent with being non-poor and moving out of poverty by 1994, while coffee is not (recall that the village with coffee suffered a bad coffee harvest in 1994). Fertiliser use does appear to be strongly related to poverty: those moving out of poverty and the non-poor use are more likely to use more by 1994 than before. Livestock and business income has increased most for the non-poor, but the largest effect for those becoming non-poor is from higher crop income. Those becoming poor in 1994 suffered declines in crop incomes. The persistently poor and those becoming poor have seen the largest increases in labour supply within the household in terms of adults or adult equivalent. Most education can be found by those becoming non-poor, but the levels remain very low. Those remaining poor and those

Table 6 Household characteristics by poverty transition (n=354)

		always poor	non-poor in 1989,became poor 1994	non-poor in 1994, poor in 1989	always non-poor	Overall mean
Outcomes	real food consumption per adult in 1989 (94 prices)	19.68	70.77	22.11	75.93	41.05
	real food consumption per adult in 1994	21.99	26.39	104.81	111.16	64.62
	real total gross income per adult per month in 1989	13.80	31.13	21.39	42.99	25.25
	real total gross income per adult per month in 1994	25.55	26.42	39.87	56.70	36.29
Livestock	real value livestock per adult in 1989	155.32	550.92	344.72	828.89	418.60
	real value livestock per adult in 1994	265.13	418.39	462.60	736.04	445.26
	number of livestock units owned per adult in 89	0.16	0.54	0.33	0.79	0.41
	number of livestock units owned per adult in 94	0.38	0.56	0.64	0.89	0.59
land	land per adult in 89	0.34	0.55	0.42	0.66	0.46
	land per adult in 94	0.39	0.51	0.55	0.63	0.50
agricultural potential	quality of soil (scaled relative to village mean)[b]	1.11	0.93	0.93	0.96	1.00
	agricultural potential per village (relative to overall mean)[c]	1.01	0.94	1.02	1.00	1.00
	augmented land per adult (land times quality and potential)	0.29	0.37	0.47	0.53	0.41
export crops	chat grown now?	0.07	0.08	0.16	0.26	0.14
	coffee grown now?	0.35	0.15	0.02	0.05	0.17
fertiliser	fertiliser used in 1994	0.57	0.53	0.48	0.60	0.55
	Using more modern inputs than 5 years ago in 1994?	0.11	0.19	0.27	0.29	0.20
income source	real crop and land income per adult per month in 89	7.15	16.55	8.72	20.97	12.14
	real crop and land income per adult per month in 94	11.06	10.79	17.99	22.96	15.44
	real livestock product income per month per adult in 89	0.32	1.83	1.28	3.61	1.54
	real livestock product income per month per adult in 94	0.80	2.07	2.63	5.39	2.49
	real livestock sale income per adult per month in 89	1.90	4.55	5.34	8.32	4.66
	real livestock sale income per adult per month in 94	6.03	6.20	10.12	16.35	9.40
	real wage labour income 89 per adult per month	0.42	1.67	1.39	2.94	1.43
	real wage labour income 94 per adult per month	1.01	0.44	1.36	1.19	1.04
	real business income 1989 per adult per month	2.15	4.56	2.38	4.21	3.06
	real business income 1994 per adult per month	5.61	6.83	6.89	8.78	6.84

	real private transfers per adult per month in 89	0.71	0.72	0.92	1.21	0.88
	real private transfers per adult per month in 94	1.02	0.10	0.39	1.33	0.78
	real ffw plus aid income per month per adult 89	0.07	0.28	0.06	0.09	0.10
	real ffw plus aid income per month per adult 94	0.02	0.00	0.50	0.71	0.29
demographics	male adults in 1989 (above 15 years)	1.34	1.25	1.41	1.32	1.34
	male adults in 1994 (above 15 years)	1.99	1.78	1.81	1.68	1.84
	female adults in 1989 (above 15 years)	1.60	1.39	1.62	1.23	1.49
	female adults in 1989 (above 15 years)	2.23	2.12	1.63	1.59	1.92
	adult equivalent units in household 1989	5.56	4.65	5.42	4.29	5.08
	adult equivalent units in household 1994	6.46	5.70	5.35	4.89	5.69
	household size in 1989	6.90	5.71	6.70	5.32	6.29
	household size in 1994	7.85	6.88	6.46	5.91	6.89
	male headed household?	0.83	0.83	0.88	0.81	0.84
education	head completed primary school?	0.02	0.00	0.07	0.02	0.03
	average years education male adults (1994)	0.33	0.43	0.55	0.32	0.40
	average years education female adults (1994)	0.16	0.15	0.20	0.17	0.17
location	distance to nearest town by road in km	15.40	13.84	12.46	12.46	13.71
	any road (tarmac, dirtroad) through village?	0.75	0.67	0.62	0.77	0.71
	all weather road through village?	0.05	0.27	0.36	0.62	0.29
prices	percentage change in real producer prices for crops	19.86	28.27	37.70	23.26	26.69
shocks	any serious adult illness episodes between 1989 and 1994?	0.71	0.70	0.51	0.55	0.62
	the number of adult illness episodes per adult in family	0.34	0.27	0.21	0.32	0.29
	short run rainfall experience (1994 minus 1989)[d]	-0.28	-0.20	-0.11	-0.08	-0.18
	long-run rainfall experience (1994 minus 1989)[e].	-0.02	-0.02	0.06	0.02	0.01

[a]all values in 1994 prices. [b]based on subjective measure, asking farmers to nominate plots as being lem=good, lem-teuf=medium, teuf=poor soil. Land weighted average score, from 0.33 for teuf to 1 for good. Rescaled relative to village mean, i.e. difference index relative to mean soil quality. [c] average village level potential, based on unit value per kg times yield in kg per ha. [d] difference in percentage deviation from mean in 1994 and 1989. Deviation relative to long-term mean for main season in area. Measure of how good the last main season preceding the 1994 survey was relative to the last mean season preceding the 1989 survey round. [e]difference in percentage deviation from long term mean in 1994 and 1989. Rainfall of last five years relative to long-term mean. Measure of how good the last five years were relative to the previous five years.

becoming poor live furthest from towns, even though in terms of the presence of a road connection there is little difference. Nevertheless, all weather roads are far more likely to be found among the non-poor in 1994, especially those who remained non-poor throughout. Finally, producer prices changed least for those remaining poor in both years and increased most for those becoming non-poor. The incidence of serious illness in the household was highest among those remaining poor, and lowest among those becoming non-poor. Those remaining poor and those becoming poor suffered the highest incidence of poor rains in this period too, while the best rains in the long-run were for those turning non-poor.

Obviously, many of these mean variables are suggestive in line of the previous analysis. Table 7 summarises the extent to which the regression model used for the growth decomposition helps to explain the changes observed for each group. The top of the table gives the mean values, followed by the actual and predicted growth in consumption. As can be seen, the highest growth rate is predicted for those becoming non-poor and those remaining non-poor. Growth for the latter group is however underestimated considerably. Growth of those becoming poor is estimated to be much lower, but still positive, while the data suggest a decline in real consumption. In all, growth for those remaining poor and remaining non-poor is on average well estimated. It shows the differing fortunes of the poor in 1989. Predicted (and actual) growth of those remaining poor is only about half of the average growth rate. Predicted growth rates of those becoming non-poor exceed the average growth by 50 percent[24].

The bottom part of table 7 provides evidence on how these different groups fared differently during this period of high growth. It gives the decomposition for each group, but to allow direct comparison, relative to the overall growth in real consumption. For all groups, increased returns to infrastructure, price changes and rainfall are the main variables contributing to the total growth for each group. However, there are some interesting differences. In particular, in reply to the question did the poor benefit from the reforms, the answer appears to be 'yes, but some did so by more than others'. In particular, the group of poor that managed to escape poverty could do so because they had relatively more good land of high potential and soil quality, they had more education and benefited from their better geographical location. The group of poor in 1989 that stayed poor did so because they had lower levels of these endowments. On top of this, they faced worse rainfall since 1989 than this other group of poor

[24] Nevertheless, growth for those changing status is relatively poorly estimated, especially for those falling below the poverty line (the smallest group in the sample). How problematic is this for our analysis? Our main interest is in the effect of reforms, effectively the impact of changes in prices and returns on household welfare. If the poverty transitions were poorly estimated because of poor measurement of actual price changes, then this would of course be a problem for our analysis. However, the fact that the community fixed effects specification (see table 3) yields virtually identical results, this is unlikely to be the case. In particular, the predicted growth rates of a model with community fixed effects as in model 3 were virtually exactly the same, again underestimating the poverty transitions. Idiosyncratic shocks and measurement error in the left-hand side variable are therefore alternative and more likely explanations. As was discussed before, there is little ground to suspect measurement error to be *systematic*, while the issue of idiosyncratic shocks cannot be addressed by lack of further information for 1989. It would seem reasonable to conclude hat the current specification underestimates idiosyncratic shocks considerably, especially in view of evidence that this is typically high for rural households (on this see Morduch (1999) in general and Dercon and Krishnan (2000a) for evidence on Ethiopia). Still, even without idiosyncratic shocks, the growth losses from shocks are high. A simple counterfactual predicted growth rate under unchanged rainfall and no illness suggests that growth was halved by shocks for those remaining poor and the gap with the average growth rate would have been less than a fifth for them.

in 1989, and had more illness problems. Those that became poor in 1994 had a relatively poor growth performance because despite average price increases, they had a poorer geographical location and infrastructure with relatively little good quality land. Relatively poor rains pushed them further down. Finally, the non-poor throughout did not outperform average growth at all, taking into account their relatively good rainfall experience in this period. Despite clearly having the best land, crop producer prices increased below average for them in this period.

Table 7 Explaining consumption changes by poverty transition group (n=354). Decomposition using model 6.

	always poor	became poor 1994	non-poor in 1994	always non-poor	sample
mean values					
ln(augmented land)	0.06	0.06	0.21	0.33	0.16
Δ (land in ha + 0.1)	0.29	0.22	0.49	0.28	0.33
Δ (ln adult equiv.)	0.12	0.18	-0.03	0.12	0.09
ln (years of education per adult)	0.18	0.22	0.25	0.18	0.20
ln(adults serious ill+1)	0.23	0.15	0.14	0.20	0.19
% Δ (real prod prices)	0.20	0.26	0.38	0.23	0.26
Δ Ln(rain 5 yrs*seas)	-0.31	-0.23	-0.07	-0.07	-0.18
ln (distance to town)	0.12	0.05	-0.19	-0.01	0.00
Road infrastructure	0.75	0.67	0.62	0.77	0.71
Predicted and actual change in consumption					
Consumption growth	0.18	-0.78	1.36	0.37	0.37
predicted change in ln consumption	0.23	0.32	0.52	0.44	0.37
pred. Change in consumption, excl. shocks	0.40	0.45	0.58	0.51	0.48
% contribution to mean change in consumption					
changes in land	0.17	0.13	0.29	0.16	0.19
changes in labour	0.11	0.17	-0.03	0.12	0.09
returns to land (technology shift)	0.03	0.03	0.10	0.16	0.08
returns to education	0.01	0.01	0.01	0.01	0.01
crop producer price increase	0.32	0.42	0.60	0.37	0.42
returns to infrastructure and location	0.45	0.45	0.59	0.56	0.51
illness shocks	-0.12	-0.08	-0.07	-0.10	-0.10
rainfall shock	-0.35	-0.26	-0.07	-0.08	-0.20
pred.growth rate as percentage of mean growth	0.62	0.87	1.42	1.20	1.00

In short, growth appears to have been relatively pro-poor, but not pro-all-poor: the poor with good land, good location and high producer price increases, about a quarter of the sample, benefited more than any other group. But a third of the sample, the poorly endowed poor, in terms of land and location, also experienced the lowest price increases and their benefits from the reforms were limited.

7. Decomposing poverty changes

In this section, I will present the results of the decompositions as proposed in section 6, as well as some simulations of counterfactuals[25]. For transparency, all the results are for the

[25] Poverty measurement is done in terms of consumption per adult equivalent, while the analysis in the previous section was done in terms of total household consumption. Annex 3 gives details of the self-evident correction

normalised Watts measure, i.e. the poverty gap using log real income as the welfare measure. The actual poverty change of this index was about 29 percent in this period. First, table 23 presents simple micro-simulations in which I show the impact on poverty from the observed total change in each factor, i.e. changes in endowments, in returns or shocks, *ceteris paribus.* As in equations (7) and (14), they are derived by adding this factor to real incomes in 1989 and then looking at the poverty impact in percentages.

Table 8 Micro-simulations of the total impact of different factors on poverty (normalised Watts index)

	Impact on poverty of observed total change in particular factors (*ceteris paribus)* in percentages, relative to 1989
increase in land	-9
increases in adult labour	-1
change in returns to land (techn shift)	0
changes in returns to education of adults	0
crop producer price increase	-19
returns to road infrastructure	-21
return to location	0
rainfall shock	12
illness shocks	5
change in household size (adult equiv.)	6
Memorandum: total poverty change	-29

Better crop prices and higher returns to roads dominate, with even higher percentage effects than when explaining growth: the estimated changes in real income linked to crop price and returns to infrastructure increases resulted in very large poverty declines. On the other hand, rainfall and illness each appear to have even larger effects on poverty than on growth. The land transfers also have a substantial effect, while the contribution of increased returns to land, probably linked to a shift towards more land-intensive activities, is virtually nil, simply because of the limited amounts or the low potential of land available to the poor.

These simulations consider one particular change as the basis for the counterfactual. As was argued before, one 'counterfactual' is of particular interest: the actual total change and its contributing factors. Using (15) and regression model 6 (table 3) as before, table 9 gives these results. The poverty index used – the poverty gap but defined in logs – showed a 29 percent decline in poverty (which is quite similar to the decline the squared poverty gap reported in table 2). The second column gives the absolute decline in the poverty index by each factor, the third the contribution to the total change in percentages and the fourth the contribution in percentage points.

needed when using (18).

Table 9 Decomposition of the poverty gap (scaled Watts poverty index)

	absolute decline by factor	contribution to total change	percent change and contribution in percentage points
actual poverty change[a]	-0.037	100	-29
predicted poverty change	-0.038		
increase in land	-0.013	34	-10
increases in adult labour	-0.005	13	-4
change in returns to land (techn shift)	-0.001	2	0
changes in returns to education of adults	0.000	1	0
crop producer price increase	-0.023	62	-18
returns to road infrastructure	-0.028	76	-22
return to location	0.002	-4	1
rainfall shock	0.016	-44	13
illness shocks	0.006	-16	5
change in household size (adult equiv.)	0.008	-22	7
residual	0.000	0	0
Actual Poverty Gap 1989	0.128		
Actual Poverty Gap 1994/95	0.089		

[a]The actual poverty gap in 1989 was 0.128, declining to 0.089 in 1994.

Note first that this is not an exact decomposition for the reasons discussed in section 5. However, the residual is very small (less than 1 percent). The main patterns are maintained as before. As before, the largest contributions come from better crop prices and higher returns to roads. Part of the reason for these high numbers are the high contribution, in negative terms, of shocks: illness and especially rain jointly contributed 60 percent of the total the poverty gap change. Furthermore, increases in household size also increased poverty and contributed a fifth. Land increases contributed a third – much more than to growth, while the contribution of increased returns to land, probably linked to a shift towards more land-intensive activities, is virtually nil, simply because of the limited amounts or the low potential of land available to the poor.

Nevertheless, the largest part of this poverty decline is driven by one group.. Using equation (8), it is found that more than 80 percent of the actual poverty decline is accounted for by those leaving poverty between 1989 and 1994. Recall from table 22 that they had relatively good endowments, their crop prices increased most and they were lucky with good rains. Those remaining in poverty experienced limited growth; their poverty gap only declined by an insignificant 4 percent. With poor endowments and poorly accessible locations, increased returns via better prices were limited and virtually wiped out by poor rains and illness.

Table 10 gives the final key table of this report. First, it brings together the factors contributing to actual growth and poverty changes, as were reported before. Then, the table reports on two additional counterfactual simulations: one case in which there was no effect from shocks, as if there was full-insurance, say via safety nets. The other one is the case in which there were no reforms, so that none of the increases in returns nor in prices actually took place. The growth effect is derived simply by excluding these factors from the findings based on the first column of results. Since, as was argued before, the poverty decompositions in contributing factors are counterfactual dependent (i.e. they are only correct to describe to the contributing factors to a

particular overall change), they cannot be derived directly from the second column. They are obtained by constructing a specific counterfactual distribution and then apply the decomposition as in (15) and (16)[26].

Table 10 Decomposition of growth *per adult* and poverty gap. (Percentage point contribution to total growth.)

	actual		counterfactual no risk		counterfactual no reforms & peace	
	growth	poverty	growth	poverty	growth	poverty
increase in land	7	-10	7	-8	1	-2
increases in adult labour	3	-4	3	-4	3	-4
change in returns to land (techn.)	3	0	3	-1		
changes in returns to educated adults	0	0	0	0		
illness shocks	-4	5			-4	5
price change	15	-18	15	-16		
rainfall shock	-8	13			-8	14
returns to road infrastructure/location	19	-23	19	-21		
Residual	0	0	0	0	0	3
change in adult equiv.units	-5	7	-5	7	-5	7
percentage growth (sum of above)	32	-29	42	-44	-13	23

Total per adult growth (defined by the change in the logs of per adult equivant consumption) was 32 percent, while the poverty gap declined by 29 percent. The table gives the contribution in percentage points to this change. Since the percentage change in both is very close in absolute terms (suggesting a scaled Watts poverty elasticity of –0.90), the percentages can be directly compared.

From table 10, it can be concluded that growth in these villages was largely fuelled by the reforms and probably helped by peace: better crop prices and better returns to location explain most. Poverty reduction is determined by similar factors, but poor rains for some hindered the decline. Crop price increases, a factor most directly linked to the reforms, contributed more to the decline in poverty than in growth. The poor benefited somewhat more than proportionately from better returns to roads, even though the poor include a significant remote group with poor infrastructure. Poor households grew in this sample in size by more than average, contributing to lower per adult growth and higher poverty: there is a return via additional labour, but even adults cost more than their direct return in this period. Land increases for some of the poor meant that this disproportionately contributed to poverty reduction, but given the current (relatively equal) land distribution within communities and the history of land reform in Ethiopia, this is not easily repeatable nor desirable as a strategy. Since the poor typically have low potential or little land, they could not benefit from the increased returns to land, relative to the average household. Finally, the poor suffered disproportionately from illness shocks and were also unlucky with rain, limiting the poverty decline further.

The full-insurance simulation suggests large effects on growth and poverty: growth would have been higher by a third, while poverty reduction would have been about 50 percent higher.

[26] The decomposition of growth is repeated, but this time in terms of per adult real consumption. This simply implies an additional term defined by (minus) the change in the log of the number adult equivalent units in both years.

Clearly, the lack of insurance, for example in the form of properly functioning safety nets, would add substantially to poverty reduction and growth. The other counterfactual result is to speculate, using the econometric model, what the consequences for local growth and poverty reduction would have been if policies had not changed. Given that peace would have helped as well, but since we cannot easily differentiate, it should be under the assumption of no increased security either. Recall however that the impact on prices appears to have been largely from liberalising measures. In this simulation, none of the increased returns is assumed to have taken place, also implying a correction for the return on the changes in land (and optimistically assuming that they could have taken place). The relatively poor local rainfall in a few villages, illness shocks and population growth is then predicted to have resulted in a 13 percent decline in per adult consumption and a 23 percent increase in poverty. Looking further into this, most of this increase in poverty is for poor who were poor in 1989 and remained poor in the actual data; those who actually moved out of poverty would have experienced zero poverty growth in this counterfactual scenario. This confirms that even if reforms did not benefit all poor households in the same way, *no* reforms would clearly have made the plight of this persistently poor group even worse.

8. Conclusions

In this paper, the poverty and growth experience of six villages in rural Ethiopia was studied. By 1989, these were largely impoverished villages, having suffered and barely started to recover from the famine years, while the economy around them was at its knees. Since then, liberalisation, devaluation and other reforms substantially affected the relative prices faced by households in these villages. On average, real producer prices increased by 26 percent, even though differences between villages are substantial. Food consumption grew strongly in all but one village – on average by more than 8 percent per year on average. Poverty declined in four villages, and increased in the two others. Poverty fell more for the some of the poorest households: the headcount index fell by 16 percent but the squared poverty gap by 31 percent. Poverty remains high, nevertheless: the headcount index was in 1994/95 still more than 50 percent.

Inequality increased, but the panel data show that to some extent this may be misleading. The poorest households (the lowest decile) in 1989 had on average the highest growth rates; growth rates appear to have been monotonically declining by decile. However, mean consumption per adult for the lowest decile in 1994 compared to that for the lowest decile in 1989 had increased by less than mean growth (by a fifth less). This was in general the case for the lowest half of the distribution. Behind these seemingly puzzling results is rather a lot of movement across the consumption distribution, with a substantial number of households moving out of poverty, and a smaller group falling below the poverty line.

Can the growth be linked to the reforms? A reduced-form household fixed effects 'profit' function was estimated, linking real income to fixed endowments of land and labour, as well as prices, returns to location and shocks. The model allows for changes in the returns to assets between 1989 and 1994. The evidence presented suggests that increased producer crop prices are directly linked to the reforms and play a large part in explaining growth. Furthermore, there appears to be a growth effect from a shift back into agriculture, especially on good quality land

of high potential, consistent with the policies. Higher returns to roads and good location play a large part in explaining growth and are consistent with the increased encouragement of market-oriented activities, even though in this case this is also likely to be a reflection of a peace-dividend.

Has this growth been pro-poor? On average, yes. But, more correctly, it has been pro-some-poor. The poor are heterogenous and at least two group can be distinguished in 1989. A first group, about a third of the sample or half the poor in 1989, had since then rather good rains, but mainly had quite good land, faced high crop producer price increases and had good access to roads and towns. They outperformed the rest of the sample in terms of growth and contributed more than 80 percent to the overall estimated reduction in the poverty gap. The other half of the poor in 1989 stayed poor in both years and had much lower growth, about a third below average. They did not manage to grow as much due to their land endowment, either small or of poor potential, while typically these poor live in remote areas or with poor road connections. Most of the poverty benefit from the reforms was furthermore wiped out by poor rains and illness shocks. This group is not identical to the poorest households in 1989, even though they were more likely to come from the lowest deciles[27].

Have the reforms then been pro-poor? Yes, but mainly for some of the poor. The decomposition of the (scaled Watts) poverty gap index showed that crop price increases and higher returns to infrastructure actually contribute more to the percentage decline in the poverty gap than to growth. But for the same reasons as mentioned before, this was mainly benefiting only part of the poor: those with better endowments in terms of land and location. Some of the households with poorest endowments, such as poor location, also did not obtain much better crop output prices from the reforms.

The same factors seem therefore to be driving growth and poverty. But this also constrains any poverty reduction via growth. By 1994, the poor contain mainly households with poor endowments in terms of poor land, far from towns or with poor road infrastructure. While better rains or favourable movements in relative prices will still provide opportunities for some of them to move out of poverty, more may be needed. These households are unlikely to be able to respond strongly to increased incentives or indeed experience these increased incentives in the form of actually higher output prices or returns. This is reflected in the poverty-growth elasticity. It is well below one for all the poverty measures discussed: high growth does not yield more than a proportionate percentage decline in poverty. The counterfactuals discussed also highlight the role played by risk: for example, poor rains in the years preceding the 1994 survey is an important factor limiting growth for some of the poor. The growth benefits from better insurance systems and safety nets, but also to better savings and credit markets could be high.

Despite the fact that these reforms do not deliver similar benefits to all the poor, the results indicate the high costs linked to not implementing these reforms. If there had been no reforms (and peace), returns to assets and real relative prices had remained as they were in 1989. In that case, per adult consumption would have declined further and poverty increased by a fifth. Some of the poorest would have been worst affected, since they faced the largest negative shocks in this period. These households also typically remained poor in 1994/95 in the actual data. Even

[27] Two-thirds of the poorest two deciles stayed poor in 1994 while half of the 5th decile stayed poor.

though they may not have benefited as much as others from the reforms, they would have suffered more if the reforms had not taken place.

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Annex 1
The impact of economic reforms on food prices 1989-95

Table A.1 The evolution of real teff prices

	Price per kg*	Local price as a percentage of the Addis Ababa Price								
		Deficit regions			Surplus regions					
	Addis Ababa	Dire Dawa	Dessie	Harar	Ambo	Debre markos	Assela	Hos-aenna	Ne-kempte	Shash-emene
1981-83	1.53									
1984-86	1.92									
1987-89	1.48	119	91	130	73	52	72	61	67	74
1990-92	1.45	119	93	118	82	75	86	72	77	87
1993-95	1.31	119	103	120	92	88	93	82	86	95

Source: calculated from Agricultural Marketing Corporation data files.
*=wholesale price per kg, in constant 1990 prices, using Consumer Price Index as a deflator (source of the CPI: International Financial Statistics, International Monetary Fund)
Note that 'deficit' are towns in typically net importing regions; 'surplus' are towns in typically net exporting regions.

To what extent are these measures reflected in the evolution of food prices in this period? Table A.1 reports some evidence on this. Prices are deflated by the Consumer Price Index and given in 1990 prices. The table shows first that prices by the beginning of the 1990s were at low levels compared to the 1980s, although this has to be treated with some caution, since harvests had been generally better in the 1990s. The table shows that real prices in the main deficit area, Addis Ababa, did not increase after liberalisation. The relative prices between Addis Ababa and other towns in Ethiopia present rather suggestive of the consequences of liberalisation, in line with predictions. In other large towns in deficit areas, the main trend (if any) appears to be a closing of the gap with Addis Ababa, in line with better market arbitrage possibilities. The main effect on the level of prices seems to be found in typically surplus areas. Relative to Addis Ababa, we find a systematic increase in prices, between 26 to 69 percent in real terms. The largest increase happened in Debre Markos, in Gojjam, one of the regions in which interregional trade was totally banned and the AMC had been given a monopoly. In general, this suggests a positive effect on prices paid to farmers, probably without affecting net consumers much in deficit areas. Note that it may well have been the case that net consumers in surplus areas may well have suffered from the liberalisation.

In Dercon (1995), the evolution of grain prices in the period before and after liberalisation has been analysed further. Using standard time series analysis of price dynamics in food markets, I found that before liberalisation, price series behaviour suggested that markets were only slowly interconnected, consistent with a serious discouragement of private trade. After liberalisation, most of the markets analysed appear to have been experiencing fast arbitrage between them. Transaction costs margins did not only decline between markets, arbitrage became faster as well, suggesting further increases in efficiency from the liberalisation of food markets. Crucial for our analysis is that this paper disentangled the effects from liberalisation (which happened in 1990) and the end of the war (in May 1991). The results showed that the larger impact on marketing margins came from the liberalisation and only on some routes did the end of the war have a significant impact.

A further result of market liberalisation and improved arbitrage between regions appears to have been better intertemporal arbitrage. In particular, local seasonal effects are likely to have been reduced by stronger interregional interconnectedness. Although the available time series are relatively short, a simple indicator illustrates this. For this I used data from 22 urban markets for which we have data for wholesale teff prices (as in table 1), at least since 1987. In all markets, the ratio of the highest yearly price (in real terms) relative to the lowest price has decreased for the period from 1991 onwards, compared to the period before 1990. The decline is on average from 41 percent to 24 percent; the range declined from between 32 and 103 percent, to between 18 and 36 percent. In short, seasonal fluctuations appear to have been reduced considerably.

Annex 2: How robust are the econometric results?

As was mentioned before in section 3, the design of the questionnaire results in problems with income measurement for comparative purposes. Nevertheless, in table A.2, the regressions of model 6 are performed using total real income (with decompositions in table A.3). The first column uses the log of real total gross income changes, while column two reports the results excluding livestock sales income, since as was discussed before, they may include substantial asset transactions that probably should not be counted in income. Illness shocks were dropped since they refer to a much longer period, while the number of adults in 1989 was added again, since the regressions confirmed the earlier discussion of a possible shift away from labour to land-intensive mode of production, even though the coefficient is again not significant. The main finding is that the effects are remarkably consistent to those reported using real consumption, with roads and crop prices dominating the effects.

Table A.2 Robustness test: using real income with and without livestock sales income (N=342) (same specification as in model 6, except for serious illness and ln(adults in 89)), robust standard errors corrected for clustering.

	total income		**income without livestock sales**	
	coefficient	**p-value**	**coefficient**	**p-value**
Ln(augmented land)	0.21	0.16	0.15	0.27
Δ (land in ha + 0.1)	0.47	0.01	0.36	0.02
Δ (ln adult equiv.)	0.34	0.07	0.34	0.05
Ln(adults in 89)	0.03	0.92	-0.13	0.61
Ln(yrs adult educ+1)	0.18	0.53	0.36	0.36
Δ (% real prod prices)	0.83	0.01	0.92	0.01
Δ Ln(rain 5 yrs*seas)	0.12	0.52	0.48	0.10
Ln (distance to town)	0.19	0.50	-0.08	0.78
Road infrastructure	0.15	0.78	0.44	0.41
joint sign. F(9,322)	16.77		14.25	

Table A.3 Decomposition of income regression (table A.2) (as percentage of total contribution

	total income	income without livestock
increase in land	0.26	0.23
increases in adult labour	0.05	0.06
change in returns to land (techn shift)	0.06	0.05
change in returns to labour (techn shift)	0.07	-0.40
changes in returns to education of adults	0.06	0.14
crop producer prices change	0.36	0.47
change returns to infrastructure/location	0.18	0.61
relative rainfall shock	-0.04	-0.17
total	1.00	1.00
mean change	0.60	0.51

The core findings largely depend on the ability to disentangle the price change effects from the effects of shocks, such as rainfall. Note first that most effects, including the effect on prices, remains stable after introducing the community level variables. This supports the view that the price changes are genuine, i.e. not caused by temporary (village level) price movements, such as caused by bad rains. Nevertheless, OLS by attempting to perfectly predict mean real income changes, may affect the findings as well. To check the robustness of the specification further, two alternative approaches were used. First, it could be argued that poor households may have had different ability to respond to real price changes, even given differences in land, labour and location (which the regression controls for). To test this, interaction terms were used on the key variables to check whether there was any sign of different behaviour for the poor in 1989 versus the non-poor. Both the effect on rainfall and on real prices were insignificant (at 52 and 17 percent). Secondly, quantile regressions were used to re-estimate model 6 (at the 33th, 50th and 66th percentile). The results were largely unchanged: strongly significant price results and, in terms of the decomposition, price and infrastructure/location effects of similar size, and a strong negative effect of rainfall[28].

There may be other concerns related to the specification. The choice of land and labour as fixed factors was discussed before. Treating them as endogenous, for example via estimating shadow prices for them, may be possible, but ultimately among the appropriate instruments for doing this would typically assets and demographics, i.e. land owned and labour available, so this is unlikely to be much different from the current approach. Secondly, it could be argued that other variables should be included. A variety of variables were introduced. For example, age of the household head and its square (as a proxy for farming experience) was not significant. Also, readers familiar with Ethiopia may wonder why oxen or livestock were not included as a determinant in the growth regression. Oxen are of course very important in most farming systems, but can hardly be seen as a fixed asset, since they can be freely acquired in the market. They would be endogenous to the model, not least because they are also the main alternative to not consuming real income and are actively accumulated. Furthermore, livestock and oxen ownership is positively correlated with land (whether augmented or not). Introducing livestock (unit value) prices gave insignificant results, but this may be linked to multicollinearity with rainfall, which are significantly positively correlated. Lower prices for livestock contribute 7 percent to growth in this expanded version of model 6.

[28] To allow comparison with the other results, the decomposition still used mean characteristics.

The large changes in real consumption for some households raises the suspicion that a lot of the movement in real consumption is just measurement error. A starting point for investigating this is simply to run an autoregressive model, i.e. to regress changes on the lagged value of real consumption. The lower (closer to –1) the value on the value in 1989, the more the movement presents something just seemingly 'noise'. In our case, the value was -0.81 and significantly different from one, but still quite high. However, once we include the variables used in model 6, this value drops to –0.21, i.e. a much higher persistence in consumption, once the explanatory variables are accounted for. There is little reason to suspect measurement error in consumption to be specifically correlated with values included in the regression (e.g. why would those with roads or after 1989 having high crop price increases systematically have underreported consumption in 1989 or overreported in 1994?). Consequently, it is unlikely to be undermining our conclusions.

Annex 3 Poverty when welfare is measured per adult equivalent

Poverty measurement requires a correction for household size, such as in terms of adult equivalent units. Consequently, the decomposition in (18) (or any other counterfactual based on the regression) will have to take this into account. Define aeu_{it} as the number of adult equivalent units in household i in year t and $y_{it} = \ln c_{it} / aeu_{it}$, then we can define:

$$P_1 - P_0 = -\frac{1}{n}\sum_{i=1}^{q_{10}} s_i \left(\frac{\ln c_{i1} - \ln c_{iO}}{z}\right) + \frac{1}{n}\sum_{i=1}^{q_{10}} s_i \left(\frac{\ln aeu_{i1} - \ln aeu_{iO}}{z}\right) \qquad (A.1)$$

so that a decomposition of changes of poverty simply requires an additional term that corrects for changes in household adult equivalent units. Otherwise, the analysis can be implemented as discussed before.