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Growth and shocks: evidence from rural Ethiopia

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Abstract

Using panel data from rural Ethiopia, the article discusses the determinants of consumption growth (1989–1997), based on a microgrowth model, controlling for heterogeneity. Consumption grew substantially, but with diverse experiences across villages and individuals. Rainfall shocks have a substantial impact on consumption growth, which persists for many years. There also is a persistent growth impact from the large-scale famine in the 1980s, as well as substantial externalities from road infrastructure. The persistent effects of rainfall shocks and the famine crisis imply that welfare losses due to the lack of insurance and protection measures are well beyond the welfare cost of short-term consumption fluctuations.

JEL classification: I32; O12; Q12
Keywords: Risk; Growth; Persistence; Famine

1. Introduction

The study of poor people's impediments to escape poverty remains at the core of development economics. This paper discusses the determinants of growth in living standards in a number of rural communities in Ethiopia between 1989 and 1997. The focus is on the role of shocks, such as drought and famine, on poverty persistence, as well as on identifying the correlates of welfare improvements.

Inspired by the standard growth literature, the paper uses household panel data covering 1989 to 1997 and six villages across the country to study rural consumption growth in this period using a linearised empirical growth model. The focus is on the impact of shocks, and more specifically on persistent effects of rainfall shocks on growth. The results suggest that idiosyncratic and common shocks had substantial contemporaneous impact.

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Especially better rainfall contributed to the observed growth. I also test for persistence of the effects of past shocks. I find that there is evidence of some persistence-lagged rainfall shocks matter for current growth. Furthermore, indicators of the severity of the famine in 1984–1985 are significant to explain growth in the 1990s, further suggesting persistence. Finally, road infrastructure is a source of divergence in growth experience across households and communities.

The study of growth in developing countries using micro-level household data is not common, largely because suitable panel data sets are missing to embark on such work. Deininger and Okidi (2003) and Gunning et al. (2000) look into the determinants of growth in Ugandan and Zimbabwean panel data. As part of a number of papers using data from rural China, Ravallion and Jalan (1996) use a framework inspired by both the Solow model and the endogenous growth literature to investigate sources of divergence and convergence between regions. In further work using the household level data from their panel (e.g. Jalan and Ravallion (1997, 1998, 2002, 2004), divergence due to spatial factors is explicitly tested for and discovered, suggesting spatial poverty traps. This paper draws inspiration from their approach by explicitly disentangling community and individual effects. It goes beyond their approach by focusing explicitly on the impact of uninsured risk on household outcomes.

It is well documented that households and individuals in developing countries use different strategies to cope with risk, including self-insurance via savings, informal insurance mechanisms or income portfolio adjustments towards lower overall risk in their activities. Literature surveys suggest that these mechanisms typically only succeed in partial insurance (Morduch, 1995; Townsend, 1995). Given that households are generally 'fluctuation averse', the resulting fluctuations in consumption and other welfare outcomes imply a loss of welfare due to uninsured risk. However, beyond this transient impact on welfare, there may also be a 'chronic' impact from uninsured risk, i.e. persistent or even permanent effects on levels and growth rates of income linked to uninsured risk. In particular, one can distinguish two effects. First, an ex-ante or behavioural impact: uninsured risk implies that it is optimal to avoid profitable but risky opportunities. Households may diversify, enter into low risk but low return activities or invest in low risk assets, all at the expense of mean returns. Second, an ex-post impact, after a 'bad' state, has materialised: the lack of insurance against such a shock implies that human, physical or social capital may be lost reducing access to profitable opportunities. In short, uninsured risk may be a cause of poverty. Several theoretical models of poverty traps and persistence have been developed whereby temporary events affect long-term outcomes (Banerjee and Newman, 1993; Acemoglu and Zilibotti, 1997). A number of empirical studies (e.g. Rosenzweig and Binswanger, 1993; Rosenzweig and Wolpin, 1993; Morduch, 1995) find evidence consistent with permanent effects linked to risk. There is also evidence from studies focusing on health and educational outcomes consistent with permanent impacts of shocks such as drought (Alderman et al., 2001; Hoddinott and Kinsey, 2001). A few recent studies investigate the impact of risk on growth using household data. Jalan and Ravallion, in press and Lokshin and Ravallion (2000) test the idea of a shock-induced poverty trap, by testing for whether the transition dynamics after a shock are convex; they do not find evidence of a transition to a low-outcome equilibrium but the recovery after a shock in income is nevertheless slow. Elbers et al. (2003), using data from Zimbabwe, calibrate and simulate a household optimal growth model accounting for both ex-ante and ex-post responses to risk, allowing them to quantify the losses linked to uninsured risk, which proved substantial in their data set.

This paper uses a reduced form econometric approach to test for the impact of uninsured risk. Measured recent and past shocks are directly introduced in the regressions, and their cumulative impact is quantified. This is similar to the study of persistence in macroeconomic series. Campbell and Mankiw (1987) investigate persistence in the log of GNP, i.e. whether shocks continue to have an effect 'for a long time into the future'. Formally, they estimate the growth in GNP as a stationary autoregressive moving average process. Their persistence measure is based on the cumulative impact of past shocks on the level of GNP. This is not the same as testing for the existence of a 'poverty trap' in the sense of the investigation of the threshold, below which there is a tendency to be trapped in permanently low income, from which no escape is possible except for by large positive shocks. Persistence within the time period of the data does not exclude permanent effects, but does not imply them either.

Ethiopia is an obvious setting to study the impact of uninsured risk. About 85% of the population lives in rural areas and virtually all rural households are dependent on rainfed agriculture as the basis for their livelihoods. Drought is a recurrent event, while high incidence of pests as well as animal and human disease affect their livelihoods as well. Insurance and asset markets are functioning relatively poorly, while safety nets, even though present and widespread, are not able to credibly guarantee support when needed (Jayne et al., 2002; Dercon and Krishnan, 2003). The data set used is relatively small—only 342 households with complete information for the core parts of the analysis. It implies that some care will have to be taken to interpret the findings; the paper may however give insights and suggestions on how to study these issues in other contexts and on larger data sets. Furthermore, the information available is relatively comprehensive: there are data on events, shocks and experiences over the survey period as well data collected using longer-term recall—including on experiences during the (by far largest recent) famine in the mid-1980s.

The sample is not a random sample of rural communities in Ethiopia, but they were initially selected since they had suffered from the drought in the mid-1980s, which had developed into a large scale famine due to the civil war and other political factors. During the 1990s, growth rates in GDP picked up considerably, with GDP per capita growing by about 14% between 1990 and 1997 (the study period). While the economic reform taking place in this period is likely to have been a necessary condition for this growth experience, it begs the question whether these growth rates should not be largely viewed as recoveries from earlier shocks. Indeed, it took until about 1996 for GDP per capita to surpass levels reached in the early 1980s, before the war, famine and repressive politics plunged Ethiopia into the crisis of the late 1980s. Furthermore, growth rates fluctuated considerably as well in the 1990s. In the survey villages, the issue of recovery and weather induced growth may even be more important. Consumption growth was well beyond national levels in the 1990s, implying impressive poverty reductions (Dercon and Krishnan, 2002). However, since the villages were chosen because the famine had strong effects, the question of recovery and differential effects across households and villages during this recovery becomes crucial to the understanding of the long-term impact of this type of crisis.

In the next section, I present the theoretical and empirical framework used. It is based on the standard 'informal' empirical growth model, drawing inspiration from both Mankiw et al. (1992) and endogenous growth theory, e.g. Romer (1986), and introduce into this framework an approach to the study of persistence. A number of testable hypotheses are derived. In Section 3, the context and data are presented. In Section 4, the econometric specifications are discussed and the estimates are presented are presented in Section 5. Section 6 concludes.

2. Theoretical and empirical framework

The framework used is a standard empirical growth model, allowing for transitional dynamics, inspired by Mankiw et al. (1992). In this model, growth rates are negatively related to initial levels of income, as well as related to a number of variables determining initial efficiency and the steady state, including investment rates in human and physical capital. In the context of panel data on per worker incomes of N households i ($i=1,\ldots N$) across periods t, y_{it}, this empirical model can be written as (see e.g. Islam, 1995):

$$\ln y_{it} - \ln y_{it-1} = \alpha + \beta \ln y_{it-1} + \delta Z_{it} + \gamma X_i + u_{it} \tag{1}$$

in which Z_{it} are time-varying and X_i fixed characteristics of the household, for example, determining savings rates or investment in human capital, while α is a common source of growth across households, and u_{it} is a transitory error term with mean zero. There are numerous reasons why one should be careful in applying this framework to any context, given the theoretical and empirical assumptions implied by this model (for example, see the reviews by Temple (1999) or Durlauf and Quah (1998). Still, one could use this framework as a starting point. A standard question is whether there is conditional convergence in the household data: a negative estimate for β would suggest convergence, allowing for underlying differences in the steady state. A relevant question in this respect is at which level this convergence is occurring: within or between villages. Eq. (1) can be rewritten as:

$$\ln y_{it} - \ln y_{it-1} = \alpha + \beta(\ln y_{it-1} - \ln \bar{y}_{it-1}) + \beta_1 \ln \bar{y}_{it-1} + \delta Z_{it} + \gamma X_i + u_{it} \tag{2}$$

in which $\bar{y}_{it-1}$ is the average per worker income in a community. A rejection of the null hypothesis of $\beta_1 = \beta$ would suggest that convergence within and across villages is occurring at different speeds. Of course, the growth theoretical literature is far richer than implied by this discussion. In different endogenous growth models, convergence may not exist. For example, models such as Romer (1986) imply that overall, inputs exhibit increasing returns to scale, so that capital levels (and by implication, output levels) may be positively related to growth levels. Ravallion and Jalan (1996) exploit this in the context of a convergence test, by distinguishing regional versus household initial levels of capital. A positive estimate for β_1, for example, would suggest divergence related to external effects from community wealth levels. Unpacking these effects further allows a more careful discussion of the role of different types of initial conditions in this respect. For example, let us define k_i as (a vector of) household level capital per worker and h_v village level capital, such as infrastructure or mean levels of household capital per worker. Let us write the relationship as in Eq. (2), but now in terms of capital goods as:[1]

$$\ln y_{it} - \ln y_{it-1} = \alpha + \zeta \ln k_{it-1} + \eta \ln h_{vt-1} + \delta Z_{it} + \gamma X_i + u_{it} \tag{3}$$

Although in the Solow model, growth rates will be decreasing in the level of a each production factor, the specification in Eq. (3) allows growth rates to be increasing functions of the endowment of some factors and decreasing of some other factors, as in some endogenous growth models.

Shocks have no explicit role to play in this formulation, even though it is generally acknowledged that shocks, e.g. due to climate, could be an appropriate justification to introduce a stationary error term. One way of interpreting this effect is that initial efficiency (the technological coefficient in the underlying production function) may be influenced by period-specific conditions (Temple, 1999). An important shortcoming of such approach is that it is assumed that there is no persistence in the impact of shocks. An alternative route would be to introduce information about shocks directly in Eqs. (1)–(3). To do so, and again referring back to the Cobb–Douglas technology assumptions as in the Solow model, let us assume that there is multiplicative risk, affecting the technological coefficient. Let us call the value of this source of risk at t S_{it}, which could be thought of as the level rainfall or a measure of health status in this particular period. This risk could be idiosyncratic or common. It is then possible to introduce risk into Eqs. (1)–(3), both as controls for shocks in growth rates, as well as to investigate whether there is any tendency of persistence in relation to shocks. No further distributional assumptions about these shocks need to be imposed. A positive impact from positive current shocks (changes in the log of S) would be expected.

It is possible to assess whether there is any persistence in shocks: do shocks in the period preceding the one for which growth has been measured still affect current growth? The notion of persistence used is similar to the presence of a distributed lag on shock terms (e.g. Campbell and Mankiw, 1987). If these past shocks matter, then persistence has been identified. Finally, adding indicators of serious shocks substantial time before the measurement of the growth rates would allow us to identify a further form of persistence. They are captured by $F_{it-\tau}$, measures of serious events that have occurred at $t-\tau$. In particular, I will introduce indicators of the impact of the famine of the mid-1980s on the household, which occurred several years before the beginning of the data period. If these shocks still affect *growth* a decade later, this would be a further sign of persistence. Persistence of shocks on growth and levels of income is not the same as identifying whether there is ever any recovery from these shocks in terms of outcome levels. Still, if these shocks have persistent effects on growth, the least that can be concluded is that these households would actually take a long time to recover from them, after first diverging. The presence of permanent shocks cannot be tested using this linear model—i.e. whether the steady state is permanently affected (see, e.g. Jalan and Ravallion, 2002). A general model

[1] Given Cobb–Douglas production technology defined over capital, labour and human capital, and constant returns to scale, as in the original Solow model, then Eq. (3) follows directly, from Eq. (2), and γ and η can be derived from the parameters of the production function and β.

to investigate determinants of growth in a reduced form regression could then be written as:

$$\ln y_{it} - \ln y_{it-1} = \alpha + \zeta \ln k_{it-1} + \eta \ln h_{vt-1} + \theta(\ln S_{it} - \ln S_{it-1}) + \lambda(\ln S_{it-1} - \ln S_{it-2}) + \delta Z_{it} + \gamma X_i + \varphi F_{it-\tau} + u_{it} \quad (4)$$

In this formulation, it is assumed that all cross-sectional variation in growth rates is captured by initial capital and by shocks, but specifically allowing for some other sources of heterogeneity across households. The econometric model below will take this up again.

3. Data

The data used in this paper are from six communities in rural Ethiopia. In each village, a random sample was selected, yielding information on about 350 households (the attrition rate between 1989 and 1994 was about 3%, between 1994 and 1997 only about 2%).[2] 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 to 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 the rapid expansion of chat (a valuable, aphetamine-like drug). All but one are not too far from towns, but only half have an all-weather road. The villages were initially 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) and in Dercon (2002).

The households in the survey are virtually all involved in agriculture. Almost all have access to land, although with important differences in quality and across villages. On average, about half their income is derived from crops, the rest from livestock and off-farm activities. Most 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, I use data from 1989 and from the revisits during four rounds in 1994–1997. Growth is measured using the growth rates in food consumption. Non-food consumption data were not collected in 1989 in all communities, so the analysis had to limit itself largely to food consumption—its implication for the analysis will be discussed below. Calorie intake data and a smaller data set on total consumption (using only four villages) are used to test the robustness of the results. Data are reported in per adult equivalent and in real terms, in prices of 1994. The food price deflator and any other price data used in this study are based on separate price surveys conducted by the survey team and by the Central Statistical Authority. The procedures used are discussed by Dercon and

[2] It is worthwhile to comment on the definition of the household used in these 8 years. The household was considered the same if the head of the household was unchanged, while if the head had died or left the household, the household was considered the same if the current household head acknowledged that the household (in the local meaning of the term) was the same as in the previous round.

Krishnan (1998). 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 1-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,b). Therefore, the data used for the analysis in this paper for food consumption in 1994/1995 are for food consumption levels in the same season as when the data had been collected in 1989. Consequently, only one observation of the three possible data points collected during the 1994/1995 rounds is used. The data for 1997 are matched to those of 1994/1995 in a similar way. The result was three observations on food consumption (1989, 1994/5 and 1997) and two growth rates for each households.

Table 1 reports average real food consumption per adult for each village. The table suggests substantial growth in mean per adult food consumption in this period: the average household level growth rate in the sample (i.e. the average of household level growth rates) is equivalent to more than 12% per year. There are nevertheless substantial differences between villages. In all but one village, growth was above national growth rates. In another paper, we studied poverty, and the data revealed substantial poverty declines as well, but again with substantial differences between villages (Dercon and Krishnan, 2002). In that paper, it is also shown that the choice of the data sources for the deflators matter for the exact magnitude of the results, but not for the overall and relative patterns involved.

These poverty declines are surprisingly high and they definitely do not square with the overall impressions of rural Ethiopia in this period. In general, an improvement in living standards could be expected but not at this scale. Nationally representative data for rural Ethiopia are only available for 1995 and 2000; estimates on these data suggest some marginal declines in poverty in rural Ethiopia and definitely not at this scale. However, the findings on other welfare indicators in the national Welfare Monitoring Survey would not necessarily contradict some substantial improvement. Primary school enrolment, for example, doubled in both gross and net terms between 1994 and 1998. However, this only brought net primary enrolment to about 19%. For these and other welfare measures, only by 1997 were the levels reached again equivalent to those from before the 1985 famine. In short, the increases in consumption in the sample may be an overestimate, but other indicators suggest substantial upward movement in some rural areas. However, much of this movement may well be the recovery from the lower levels in the late 1980s.

Table 1
Food consumption per adult equivalent (in 1994 prices) ($n=346$) (6 birr = 1 US $)

	Dinki	Debre Berhan	Adele Kele	Koro Degaga	Gara Godo	Doma'a	Whole sample
1989	42.2	45.6	52.2	31.0	21.0	22.4	35.0
1994/1995	68.2	84.4	86.7	43.9	17.0	76.2	60.2
1997	61.8	163.2	122.6	64.5	74.3	49.2	87.4
Growth (%p.a.)	0.7	13.6	12.2	16.9	23.4	3.4	12.4

Growth rates are average annual village level and sample annual growth rates calculated as the average of annual household level growth rates between 1989 and 1997.

Table 2
Yearly growth rates of alternative welfare and wealth indicators, per adult ($n = 346$) (6 birr = 1 US $)

	Dinki	Debre Berhan	Adele Kele	Koro Degaga	Gara Godo	Doma'a	Whole sample
Food consumption	0.7	13.6	12.2	16.9	23.4	3.4	12.4
Total consumption	− 0.1	12.0	9.0	–	19.0	–	10.0
Calories	2.4	11.5	4.2	14.0	21.5	− 5.2	9.1
Livestock values	1.0	0.8	1.5	3.7	1.0	2.3	1.9
Livestock units	4.4	− 0.4	14.4	29.7	12.1	29.1	16.1

Growth rates are average annual village level and total annual growth rates calculated as the average of annual household level growth rates between 1989 and 1997. Calorie conversion using World Health Organisation conversion tables. Total consumption based on complete data for four villages only. Livestock units are standard tropical units of different types of livestock, calculated on the basis of oxen = 1, cows = 0.70, bulls = 0.75, horse = 0.50, goat = 0.10, sheep = 0.100 and other similar values.

One may be concerned that these observed poverty declines are a consequence of the use of food consumption as an indicator of welfare. Table 2 gives a number of alternative measures calculated from data in this sample. Using the complete data from four villages, it can be seen that the increase in total consumption is slightly lower than those of food consumption in each village, but the differences are relatively small. Calorie intake data show a very similar pattern. Overall, this suggests that the evolution of relative food versus non-food prices, or in general, problems with the valuation and deflators of consumption are unlikely to be at the heart of the observed large changes. A look at the evolution of livestock confirms large positive improvements in this period. As in many of the poorest countries in the world, livestock is by far the most important marketable asset and typically is accounting for more than 90% of the value of assets. In all but one village, livestock values increased considerably during the survey period. In value terms, the yearly growth has been low, but this is largely due to a decline in livestock prices relative to consumer prices. In terms of standardised units, the overall increase is again very substantial, even though the pattern across villages is not identical to the consumption evolution.[3] Still, across the sample, livestock changes are positively correlated with changes in food consumption (the correlation coefficient is significant at 10%).

Both the high consumption and livestock levels may well have been helped by the overall rainfall pattern in this period. Table 3 gives details of the recent rainfall experience in these villages. The indicator used is the rainfall level in the village in the 12 months preceding the consumption data collection. In all villages included in the analysis, there is one main rainy season, and a relatively less important short rainy season. The consumption data were collected outside the rainy season, so that the use of a 12-month recall period would be appropriate. Other indicators, such only using the relevant 'main' rainy season,

[3] The patterns are better understood once taking into account circumstances in a number of the villages. Average livestock values and units were in Debre Berhan by 1989 already more than three times the levels in any other of the villages in the sample. Its location close to a zonal capital may well have made alternative off-farm investments more relevant, while in Doma'a levels were close to zero, linked to the fact that these households had only been resettled from other areas as part of a relief scheme in 1987, and still had to start building up livestock herds.

Table 3
Rainfall between 1989 and 1997 (rainfall in particular period relative to the long-term mean, reported as a percentage deviation)

	Dinki	Debre Berhan	Adele Kele	Koro Degaga	Gara Godo	Doma'a	Whole sample
1988–1989	− 13	+ 6	− 7	+ 2	+ 5	− 13	+ 2
1993–1994	+ 16	+ 7	+ 13	− 19	− 8	+ 16	+ 4
1996–1997	− 23	+ 4	+ 52	+ 32	+ 7	− 23	+ 10
1985–1989	+ 5	− 1	+ 5	+ 16	+ 7	− 6	+ 4
1990–1994	− 6	− 2	+ 17	+ 21	− 7	+ 6	+ 4
1994–1997	+ 6	− 15	+ 18	+ 48	+ 9	− 2	+ 8

Rainfall in the nearest rainfall station, based on data from the National Meteorological Office, Addis Ababa. The reported data are the rainfall in a particular period relative to the 'long-term' mean, expressed as a percentage deviation, i.e. $(\text{rainfall})_t/(\text{mean}) - 1$. Yearly rainfall is the rainfall in the 12 months preceding the survey. Long-term rainfall data are the percentage deviation of average rainfall in a particular 5-year period, relative to the long-term average. The long-term average is based on all available observations of the relevant rainfall station before the first interview in 1989, typically covering about 15 to 20 years. So, for example, in the whole sample, the rainfall in 1994–1997 was 8% better than the long-term average.

did not make much difference for the analysis. The data were collected from the nearest rainfall station from the community, with means calculated using all available historical data from before the first interview. For most of these villages, data have only been collected for less than 20 years.

Rainfall was on average better in more recent rounds, so it could plausibly account for some of the large increases in consumption and asset levels. This will be addressed in the econometric analysis. Note also the large fluctuations in rainfall in some of the villages in this period, and that mean levels in the 1990s have been above 'long-term' levels—which are strongly influenced by the disastrous levels in the early 1980s in these communities.

As mentioned earlier, these villages were initially selected because they had been affected relatively seriously by the famine crisis of the early 1980s. One of the questions is whether there are any persistent effects of this crisis period: do households that suffered substantially during this period have different growth in the 1990s? During the 1994 data collection round, the households' experience during the famine period was investigated further. It is not straightforward to find good individual level indicators of the severity of the famine. Table 4 gives details on the extent households were affected by the famine, largely using indicators of the coping strategies households had to use to cope with the crisis. First, it reports whether households experienced a serious loss of wealth directly triggered by harvest failure in this period. Two-thirds of the sampled households reported such a crisis. Household harvest failure is of course not a sufficient indicator of the severity of the crisis, as famine analysis has shown in general and in this particular case (Sen, 1981; Webb et al., 1992). Information on coping strategies provides some suggestive evidence of the extent households were affected. The table reports the number of meals households had during the famine (with a local norm of three meals a day) and whether they cut meal sizes. Fewer meals were taken and most households report to have cut back quantities consumed. Two thirds also report the consumption of unusual wild foods, and more than a third sold some of their most valued possessions in the worst year. The data also allowed an estimate (based on recall data) of the percentage of the value of their

Table 4
Responses and actions during famine in mid-1980s

	Dinki	Debre Berhan	Adele Kele	Koro Degaga	Gara Godo	Doma'a	Whole sample
Harvest failure?[a]	0.98	0.19	0.44	0.91	0.40	0.71	0.63
Meals consumed (no.)	1.04	2.85	1.71	1.98	1.51	2.43	1.94
Cut food quantities?[a]	1.00	0.49	0.90	0.92	0.91	0.90	0.85
Ate wild foods?[a]	0.88	0.05	0.78	0.63	1.00	0.73	0.66
Sold valuables?[a]	0.27	0.14	0.56	0.26	0.81	0.49	0.39
Percent of livestock sold?	0.21	0.08	0.12	0.21	0.55	0.62	0.29
Food aid in crisis?[a]	0.96	0.00	0.49	0.13	0.79	0.59	0.44
% Suffering in village?[b]	0.74	0.51	0.66	0.66	0.69	0.65	0.65
Anyone to feeding camp?[a]	0.00	0.02	0.13	0.01	0.36	0.21	0.11
Any distress migration ?[a]	0.04	0.00	0.07	0.19	0.04	0.04	0.07

[a] Percentage of households responding in particular way.

[b] The village level average estimate, based on household estimates on percentages suffering in the village during crisis.

livestock households had to sell or that died during this period. Households reported substantial sales and losses of livestock, so that by 1989 only about half the households owned any significant levels, compared to about 75% before the famine. In some communities, food aid was distributed to many during the crisis period, and about 11% even left for a feeding camp, and another 7% migrated during the crisis out of the region of their communities. An average assessment by households of the percentage of households that suffered during the crisis in each community suggested that about two-thirds suffered on average, with less suffering in Debre Berhan and most in Dinki. The other indicators seem to be consistent with this overall picture.

4. Econometric model

In this section, the framework and equations developed in Section 2 will be specified in more detail as an econometric model to take to the data. The left hand side variable used is the annualised growth rate in real food consumption per adult between 1989 and 1994, and between 1994 and 1997, with data carefully matched so that the data 1989 and 1997 (for which only one observation is available) are from the same period in the year as the respective data used from the 1994–1995 survey rounds, in order to avoid seasonality driving the results. The use of food consumption as the left hand side variable is potentially problematic. It is conceivable that growth in food consumption occurs leaving total consumption unchanged, purely due to relative price changes (food versus non-food). Indeed, local or national rainfall shocks may be responsible for these changes, so that the current analysis linking shocks to food consumption may simply identify the impact of relative price changes. Urban non-food prices decreased relative to food prices between 1989 and 1994, while they increased relative to food prices between 1994 and 1997, so they cannot account for the average increase in food consumption in both periods considered. Rural patterns could have been different, but unfortunately, local nonfood prices are not available. Still, to test the robustness of the results to these relative price effects, the impact of shocks was also investigated using the sub-sample of households for whom total consumption data is available. Further robustness to the specific deflators used is tested by using growth of total calorie consumption per adult as the left hand side variable.

The basic specification is based on Eq. (2), but augmented for a number of specific shock variables ($\ln S_{it} - \ln S_{it-1}$). In line with the discussion before, rainfall *shocks* are defined as the change in the logarithm of rainfall at t relative to $t-1$.[4] The data set also includes information on idiosyncratic shocks: an index of reported crop damage due to a number of reasons, including frost, animal trampling, weed and plant disease. 'No problems' is equal to the value 0, while problems reduce the index, with -1 the lowest value. An index of the extent to which livestock suffered due to lack of water or fodder is also included (the value 0 is best, -1 is worst). The average number of adults suffering serious illness, affecting the ability to work in between rounds, is included as well (zero is no illness). More details on these measures can be found in Dercon and Krishnan (2000b). Changes in demographics, in particular variables giving changes in male and female adults and children, are included as well (Z_{it}) to control for lifecycle and other demographic effects over this relatively long period.

$$\ln y_{it} - \ln y_{it-1} = \alpha + \beta(\ln y_{it-1} - \ln \bar{y}_{it-1}) + \beta_1 \ln \bar{y}_{it-1} + \theta(\ln S_{it} - \ln S_{it-1}) + \delta Z_{it} + u_{it} \tag{5}$$

This basic specification was then augmented to investigate the persistence of rainfall shocks. Two approaches were used. First, between each round of data used in the regression, about 4 years have lapsed. It is then possible to distinguish differences in rainfall in the year just before each survey round, and differences in average rainfall in the preceding years. For example, it could be that only the most recent rainfall failures affect consumption, but recovery is swift. Secondly, rainfall shocks in the period preceding $t-1$, i.e. ($\ln S_{it-1} - \ln S_{it-2}$), were included as well. Significant impact of past shocks would be evidence of persistence.

This first set of regressions include lagged consumption as a regressor. This may present econometric problems related to the endogeneity of lagged consumption in a consumption growth regression. All equations involved were also estimated using instrumental variables, including household and locational characteristics related to land, labour, human capital and infrastructure at $t-1$ as instruments, and Hausman endogeneity tests were implemented and reported. A more general problem typically bedeviling growth regressions is related to individual heterogeneity. The growth evolution observed in the data may simply be individual specific—for example, related to different time preferences, implying different savings behaviour. Although more general forms of heterogeneity will

[4] This way of measuring rainfall 'shocks' is consistent with the discussion in Section 2, and the data presented in Table 3. Rainfall levels are measured by S. In preparing Table 3, these levels were scaled by local long-term means, i.e. $S/\bar{S}$, to allow comparison across areas. Growth between t and $t-1$ is then linked to 'shocks', which following from the definition used in Table 3 could be defined as $\ln(S_{it}/\bar{S}) - \ln(S_{it-1}/\bar{S})$, equivalent to the definition used in the rest of the paper.

be explored below, the basic specifications will assume that $u_{it} = \omega_i + \varepsilon_{it}$, with ε_{it} assumed to i.i.d. with zero mean and ω_i is a household specific effect.

Next, the hypothesis of persistent effects from the deepest crisis in recent history, the famine in 1984–1985, was explored further. In particular, a number of indicators from Table 4 were included that suggest the extremes households had to go to cope with its impact, such as cutting back on meals, reducing quantities consumed, selling their most valuable possession, relying on unusual wild foods, moving to feeding camps or migrating outside the region in search of food. Basic correlation analysis between these variables showed that they were all correlated, which may well lead to multicollinearity problems. Preliminary analysis using these variables highlighted these problems so a simple index was constructed providing an average of these six indicators.[5]

Finally, the lagged household and village level consumption variables were unpacked further, as in Eqs. (3) and (4). In line with standard empirical growth model approaches, variables measuring capital goods suitable for accumulation and the underlying technology are relevant. The data set contains three variables that could be most relevant in this context: livestock, the standard asset for accumulation in this rural economy, which, in per capita terms, may or may not be liable to decreasing returns; education levels (average years of education of adults in the household), providing scope for increasing returns, for example, linked to the ability to innovate, and a geographical variable capturing whether there was a road connecting the village, relevant given the general poor road infrastructure in Ethiopia. Work in China using microgrowth models has found evidence in favour of positive externalities from roads as well as positive growth effects from household level education (Jalan and Ravallion, 2002), but De Vreyer et al. (2002) did not find a significant effect for either in Peru. Deininger and Okidi (2003) find evidence of the impact of community level infrastructure and of household level education on growth in their data, but only in a model without any control for heterogeneity. Limitations in the data from 1989 do not allow us to test the impact of other geographical variables. For example, both the Peru and the China study find evidence on the impact of health related variables (prevalence of particular diseases and the presence of health centres in the case of Peru, and the presence of medical personnel in the case of China), but this could not be tested in the Ethiopia data. Other variables are less relevant for the period under consideration. For example, Jalan and Ravallion (2002) find evidence of the impact of farm assets and of initial fertiliser use at the community level positively affecting growth, while Gunning et al. (2000) identify productivity increases linked to modern input use and extension as the most important source of growth in their Zimbabwe panel. In Ethiopia, the use of modern inputs was hardly relevant in the communities studied by 1989, even though during the second half of the 1990s they become again more important.[6]

[5] In this index, all 'yes/no' variables were simply given 1 if the strategy was used, and zero if not. If the household reduced meals from 3 to 1, 1 was added, while if it reduced to two meals, 0.5 was added. The simple average of these six values was then used as an index of the severity of the crisis.

[6] The work on Zimbabwe also highlighted the relevance of land holdings for growth, but given that in Ethiopia all land is state-owned and in the period considered was liable to repeated redistribution, the scope for investing in larger farm size was non-existent, justifying the use of livestock as the key asset for understanding accumulation.

The variables related to the 1984 famine and, since no new roads were build in this period, road infrastructure are time-invariant in this model. A standard fixed effects estimator would wipe out these effects, even though they are of interest. Assuming that all time-invariant and time-varying variables are all uncorrelated with the fixed effect would allow the estimation by random effects, but this is an extreme assumption, unlikely to be met in this data set. The econometric analysis explores three alternative ways of allowing a fixed effect, correlated with variables of interest, to be present, but still identifying time-invariant variables. The first method involves estimating a model using the fixed effects (within) estimator, but with initial levels of consumption unpacked using time variant variables (levels at $t-1$ of the average years of education per adult and the level of livestock holdings per adult), and fixed effects. The fixed effects were then regressed on a series of time-invariant variables, providing suggestive evidence of the impact of roads and of the famine on growth in the 1990s. Secondly, the Hausman–Taylor model (Hausman and Taylor, 1981) is used. This involves partitioning the time-invariant and time-varying vector of variables in two groups each, of which one group of variables is assumed to be uncorrelated with the fixed effect. The orthogonality assumptions provide then enough restrictions for a method of moments procedure. The partitioning assumptions are strong, but in the approach below all demographic variables and the illness shocks were included as endogenous time-varying variables, and the extent to which drastic coping strategies had to be used and (in the relevant version of the econometric model) the presence of a road were treated as endogenous time-invariant variables. Furthermore, depending on the version of the model, lagged consumption at the village and household level, or initial levels of livestock and education, and the presence of a road, are also treated as endogenous. All agricultural and rainfall shocks are treated as exogenous, while whether there was a harvest failure in 1984, the estimate of the proportion of the community that suffered substantially and the pre-famine levels of livestock were used as further instruments for the extent drastic household-level coping strategies had to be used. As a third alternative, the Jalan–Ravallion (Jalan and Ravallion, 2002) estimator that allows for some time-varying heterogeneity was used to check the robustness of the results (see also Holtz-Eakin et al., 1988). This estimator relies on a decomposition of the error term as $u_{it}=\rho_t\omega_i+\varepsilon_{it}$, with ε_{it} assumed to i.i.d. with zero mean, ω_i is a household specific effect and ρ_t are exogenous shocks, whose impact on the household is modified by ω_i. Quasi-differencing techniques can then be used to obtain estimates of parameters of interest, except for the household specific effect. To illustrate the procedure, consider a simplified version of Eq. (3), but with the error term allowing for a fixed effect multiplied by a time-varying shifter.

$$\Delta \ln y_{it} = \alpha + \gamma_0 \ln k_{it-1} + \delta Z_{it} + \gamma X_i + \rho_t\omega_i + \varepsilon_{it} \tag{6}$$

Defining $r_t=\rho_t/\rho_{t-1}$, then lagging and premultiplying Eq. (6) with r_t, and subtracting it from Eq. (5) gives a quasi-differenced equation in which the fixed effects ω_i have been removed, but in which δ can be identified provided $r_t\neq 1$.

$$\begin{aligned}\Delta \ln y_{it} = {} & \alpha(1-r_t) + r_t\Delta \ln y_{it-1} + \gamma_0 \ln k_{it-1} - r_t\gamma_0 \ln k_{it-2} + \delta Z_{it} - r_t\delta Z_{it-1} \\ & + \gamma(1-r_t)X_i + \varepsilon_{it} - r_t\varepsilon_{it-1}\end{aligned} \tag{7}$$

which can be estimated by imposing the relevant restrictions on the following equation:

$$\Delta \ln y_{it} = a_t + b_t \Delta \ln y_{it-1} + c \ln k_{it-1} + d_t \ln k_{it-2} + eZ_{it} + f_t Z_{it-1} + g_t X_i + v_{it} \quad (8)$$

All the parameters can be recovered from this equation (except for the level of the household specific effect ω_i) since r_t is the only cause of time-varying coefficients in this model. With three rounds of data (i.e. two growth rates), as in the available data set, the procedure can just be implemented. The model was estimated using restricted maximum likelihood estimation, imposing the cross-equations restrictions. In principle, the GMM procedure as in the work of Jalan and Ravallion (2002) or in the work of De Vreyer et al. (2002) would be most efficient, but the current procedure gives consistent estimators.

It is not self-evident to test whether the restriction that the fixed effects are time-invariant after all ($\theta_t = \theta$). Standard chi-squared asymptotic tests are not appropriate, since under the null $r_t = 1$, the parameters associated with the constant and the time-invariant variables are not identified. Jalan and Ravallion (2002) proceed by using a test suggested by Godfrey (1988), but, as they note as well, the power of this test will be weak in small samples such as the one used in this paper. As a consequence, the different procedures are not tested against each other, but just presented as cumulative evidence using different assumptions regarding the role of heterogeneity in explaining the present results.

5. Estimation results

Tables 5 and 6 present the results from testing the hypotheses against the data. Table 5 first focuses on the basic specification, presenting a fixed effects estimator of the growth in food consumption on initial levels of household and village consumption, and a set of common and idiosyncratic shock variables. Note that the regressions control for changes in demographic variables. The first column points to higher growth rates in richer villages, but lower growth rates for richer individual households. Overall, the coefficients point to a process of convergence within villages, but for a given initial consumption level, households experience a higher growth rate in richer than in poorer villages (i.e. village with a higher initial mean level of consumption).[7] Rainfall shocks clearly matter and a 10% decline in rainfall reduces food consumption by about 5%. There is some evidence of non-rainfall shocks also mattering. The impact of shocks is robust to the use of other welfare outcome measures. Using the four communities with complete total consumption data, the impact of a rainfall shock is smaller at about 3% for a 10% decline in rainfall.[8] This may suggest that some but not all impact of the rainfall shock is in fact the consequence of relative price changes: at higher rainfall levels, possibly locally declining food prices

[7] Referring to Eq. (2) above, the estimates here suggest $\beta = -0.319$ and $\beta_1 = -0.106$, and β_1 is significantly different from zero at less than 1%, i.e. there is a significantly different effect across than within villages.

[8] The total consumption regression suggests divergence between communities. However, with only a small number of communities included in this regression, the power of the estimates related to community level variables is obviously small, and overall, the issue of divergence and convergence between communities has to be interpreted with caution.

Table 5
Econometric results: basis specification

	Δln food cons (1)		Δln total cons (2)		Δln cal cons (3)		Δln food cons (4)		Δln food cons (5)	
	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value
ln food $cons_{t-1}$	−0.319	0.000					−0.318	0.000	−0.316	0.000
Village mean ln food $cons_{t-1}$	0.213	0.000					0.216	0.000	0.075	0.000
ln total $cons_{t-1}$			−0.294	0.000						
Village mean ln $cons_{t-1}$			0.461	0.000						
ln $calories_{t-1}$					−0.284	0.000				
Village mean $calories_{t-1}$					0.194	0.000				
Rainfall $shocks_t$	0.514	0.000	0.278	0.023	0.608	0.000				
Rainfall $shocks_t$ (last year only)							0.211	0.000	0.139	0.000
Rainfall $shocks_t$ (preceding years)							0.299	0.000	0.355	0.000
Rainfall $shocks_{t-1}$									0.160	0.001
Adult serious illness	−0.019	0.421	−0.029	0.383	−0.072	0.037	−0.016	0.495	−0.029	0.383
Crop shock (−1 is worst)	0.109	0.075	0.037	0.633	0.195	0.029	0.075	0.213	0.037	0.633
Livestock shock (−1 is worst)	0.015	0.757	−0.008	0.894	−0.052	0.453	0.011	0.811	−0.008	0.894
Constant	0.501	0.000	−0.569	0.070	0.440	0.013	0.481	0.000	1.011	0.000
Number of observations	682		402		674		682		682	
Number of groups	342		201		342		342		342	
Overall r^2	0.42		0.30		0.29		0.44		0.40	
Hausman-test *p*-value chi^2 (10)	0.986		0.992		0.998					

Real consumption growth between $t-1$ and t. Dependent variable: change in ln consumption per adult between survey waves (1989–1994 and 1994–1997). Fixed effects estimator.

Regressions control for demographic changes, Δln (male adults + 1), Δln (female adults + 1), Δln (male children + 1), Δln (female children + 1). Adult serious illness = whether adults had a serious illness in the period between survey rounds. Livestock shocks: index of self-reported extent of problems related to fodder and water, 0 is best (no problems) and −1 is worst possible outcome. Non-crop shocks: index of self-reported extent of problems on plots, beyond rain, 0 is best and −1 is worst. Rainfall shocks at t are defined as the difference in the logarithms of rainfall levels at t and $t-1$. Rainfall shocks at $t-1$ are defined as the difference in logarithms of rainfall levels at $t-1$ and $t-2$. Rainfall shocks at t (last year only) only consider the rainfall in the 12 months preceding t and $t-1$. Rainfall shocks at t (preceding years) only consider the average rainfall in the relevant period for t and $t-1$, but excluding the rainfall in the 12 months preceding t and $t-1$. Sample and group size differ only due to missing observations for particular variables.

relative to nonfood prices, increases food relative to nonfood consumption, and vice versa. However, the fact that total consumption in real terms responds to rainfall shocks suggests also that the results are not explained by just a relative price effect. Finally, column (3), using calorie intake data, suggests also that the sensitivity to rain and other effects are not driven by the choice of deflators—the effects are similar to using the growth in the value of food consumption in real terms.

All these specifications were estimated using instruments for lagged consumption (i.e. assets and infrastructure at $t-1$). A Hausman test for endogeneity could never reject the assumption of exogeneity. Similarly, using lagged characteristics (at $t-2$) and using twice lagged consumption as instruments similarly showed that exogeneity of lagged consumption could not be rejected.[9] As a consequence, I only report the uninstrumented regressions—in any case, the estimated coefficients were qualitatively very similar (which is of course what the Hausman test systematically investigated, by comparing the actual estimated coefficients using 2SLS and OLS).

To investigate persistence, the specification in column (1) has been expanded in column (4), disentangling rainfall in the 12 months relevant for the particular level of consumption, and the preceding years within the period during which growth has been observed. For example, to explain growth between 1994 and 1997, the shock based on rainfall in the 12 months before these years have been entered separately from average rainfall shock, based on the period 1994–1996 compared to 1989–1992. As column (4) shows, there is some sign of persistence: rainfall ‘shocks’ in the beginning of the period of observation have a significant impact on outcome changes, controlling for the effect from ‘shocks’ as reflected in the most recent rainfall levels. A 10% decrease in rainfall several years ago still has an impact of about 3% on food consumption. There is also evidence of persistence over longer periods. To test this, lagged rainfall was introduced, for example, rainfall shocks in the years before 1994 was used to explain growth between 1994 and 1997. Column (5) shows that a 10% decline in lagged rainfall reduces food consumption by 1.6%: rainfall shocks have a persistent effect, lasting many years.

Table 6 explores the impact of unpacking village and household level effects using specific community and household level variables, in particular livestock and education, as well as the presence of road infrastructure. Furthermore, the impact of the severity of the famine in the mid-1980s on growth in the 1990s is explored using the index of dependence on ‘extreme’ coping mechanisms in this period, based on six indicators as described before. Since the severity of the famine index and the presence of road infrastructure are time-invariant variables, a simple fixed effects estimation cannot illuminate matters. As discussed before, three different approaches have been used. The findings are broadly consistent, despite the small sample. First, the fixed effects were retrieved from estimating a specification in which initial levels of livestock and years of education were introduced. It can be seen that in this equation, livestock has a significant negative impact, suggesting decreasing returns per adult to livestock. This may be a reflection of increasing land pressure, resulting in more land brought into cultivation and less land available for

[9] Note that when using two lags, the regressions were reduced to a cross-section estimate of growth rates between 1994 and 1997, using values in 1989 as instruments, so that no fixed effects could be used.

Table 6

Econometric results: testing for persistence and unpacking initial conditions

	Δln food cons (6) (FE)		FE from (5) (6a)		Δln food cons (7) (HT)		Δln food cons (8) (HT)		Δln food cons (9) (JR)		Δln food cons (10) (JR)	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
ln food cons$_{t-1}$					−0.318	0.000			−0.204	0.000		
Village mean ln food cons$_{t-1}$					0.211	0.000			0.135	0.004		
Rainfall shocks$_t$	0.700	0.000			0.622	0.000	0.723	0.000	0.614	0.002	0.086	0.675
Rainfall shocks$_{t-1}$	0.097	0.025			0.069	0.016	0.106	0.017	0.195	0.013	0.048	0.605
Adult serious illness	−0.066	0.039			−0.043	0.076	−0.078	0.018	−0.053	0.064	0.001	0.983
Crop shock (−1 is worst)	−0.091	0.298			−0.014	0.757	−0.119	0.099	−0.217	0.041	0.011	0.870
Livestock shock (−1 is worst)	0.029	0.667			−0.018	0.704	0.014	0.773	−0.009	0.910	0.035	0.507
Severity of famine impact			−0.083	0.089	−0.116	0.079	−0.591	0.021	−0.397	0.068	0.039	0.445
Any road?			0.150	0.000			0.121	0.011			0.156	0.000
ln livestock per adult$_{t-1}$	−0.019	0.023					−0.015	0.066			−0.005	0.368
ln education per adult$_{t-1}$	−0.007	0.833					0.002	0.946			0.014	0.303
Constant	0.215	0.000	0.551	0.000	0.519	0.000	0.281	0.006	0.920	0.071	0.016	0.697
r									0.516	0.000	−1.085	0.000
Number of observations	682		338		636		636		319		319	
Number of groups	342				319		319					
Wald χ^2 joint significance	0.000				0.000		0.000		0.000		0.000	
R-squared	0.095		0.064									

Real consumption growth between $t-1$ and t. Dependent variable: change in ln food consumption per adult between survey waves (1989–1994 and 1994–1997). Fixed effects, Hausman–Taylor and Jalan and Ravallion estimators.

For variable definitions, see under Table 5. Regressions (7) and (8) use the Hausman–Taylor model, and assume rainfall shocks, livestock shocks and crop shocks as time-varying, exogenous variables, and demographic changes, illness shocks and (if applicable) lagged consumption at household and village level as time-varying endogenous variables. The index of the severity of the crisis experienced (coping index) was treated as time-invariant exogenous, as was (if applicable) whether there was a road available. As time-invariant exogenous variables and instruments, the presence of harvest failure during the famine period, the estimated percentage of households suffering in each village and the ln of livestock before the famine were used. They were each and jointly insignificant when introduced in Eqs. (7) and (8). A first stage regression predicting the coping index using these time-invariant variables found each and jointly significant, with pre-famine livestock negatively correlated with the coping index, and the estimated percentage suffering and the presence of harvest failure positively predicting the coping index. Sample and group size differ only due to missing observations for particular variables.

grazing, which usually took place on common land. In this (and other) specifications, there is no detectable effect from education. A possible explanation may lie in the limited diversification of the Ethiopian rural economy in nonfarm activities, limiting returns to education. It should also be emphasised that the levels of education per adult by 1989 were very low (on average less than three years of education per adult and many households with no formal educated adults at all). Column (6a) gives the results of a simple regression of the fixed effects on the severity of famine impact index and the presence of a road. Controls for household composition were included as well (not reported). It can be seen that there appears to be a high impact of both: the presence of a road increases growth by about 15% (about a third of the sample do not have access to a road in or near the village), while households with a less severe impact compared to those with a much higher impact of the famine (comparing the index at its 25th and 75th percentile) would have experienced about 3% lower growth in the 1990s (significant at 9%). Similar results can be found when using the Hausman–Taylor model.[10] Column (7) gives a version with lagged food consumption, rather than the specific assets. All results are similar to earlier reported results, including the impact of the severity of the impact of the famine, significant at 8%. Column (8), using initial levels of education and livestock, and the presence of a road also gives comparable results, even though the impact of the famine is substantially higher and significant at a higher percentage. The results from applying the Jalan–Ravallion estimator are reported in columns (9) and (10), based on specifications with lagged food consumption and unpacked in terms of initial assets.[11] Recall that to estimate this model, three rounds are minimally required. The results in column (9) are closely in line with earlier results, with evidence of convergence within villages, but higher growth in richer villages, a substantial and persistent effect from rainfall shocks, a (significant) negative impact from serious illness shocks and a persistent effect from the impact of the famine. The size of the effect related to the severity of the famine is again larger than the results implied by (6a) or (7), and significant at 7%: comparing the 25th and 75 percentile of households in terms of the severity of suffering, the latter had about 16 percentage points lower growth in the 1990s. The final specification, in which initial levels of consumption were unpacked in terms of assets and infrastructure using the Jalan–Ravallion estimator, provides generally unstable and imprecise estimates, and showed convergence problems. For example, note the different sign of the ratio of exogenous shifters of the fixed effects in column (10) compared to (9). In column (10), virtually all coefficients are now insignificant. Slightly different specifications provided substantially different, but equally insignificant point estimates, except for very different and significant

[10] In this model, lagged consumption, illness shocks, household demographics, the severity index, lagged livestock and education levels, and the presence of a road are all treated as endogenous, using community perceptions of the crisis in the mid-1980s, harvest failure shocks and pre-famine levels of livestock as additional instruments. The results are only marginally affected when using different partitioning and/or different additional instruments. Note that in principle, the partitioning of the time variant and time invariant matrices of variables provides enough restrictions to identify the endogenous variables.

[11] These estimates treat the initial level of consumption and the lagged changes in consumption as endogenous, using pre-famine assets, community level crisis perceptions and harvest failure in the mid-1980s as identifying instruments.

estimates of r. In short, with only three rounds, the model can in theory be estimated, but for the data set available, it proved difficult. Still, it is striking that the only strongly significant effect—and robust across different specifications—is the effect of the presence of roads, with a point estimate very close to other estimates using alternative models discussed before, with roads adding more than 15 percentage points to growth.

6. Conclusions

In this paper, I analysed the growth experience in a number of villages in rural Ethiopia using a household panel data set covering 1989 to 1997. The focus was on the persistent impact of shocks and the famine of the 1980s on growth rates in the 1990s. Using a concept of persistence as used in macroeconomic analysis, the evidence suggests that rainfall shocks are not just strongly affecting food consumption in the current period, but its impact lingers on for many years: the evidence suggests that a 10% lower rainfall about 4–5 years earlier had an impact of one percentage point on current growth rates. Furthermore, there is evidence linking the household-level severity of the crisis in the 1980s to the growth experience in the 1990s. Although it is difficult to disentangle the impact, estimates controlling for heterogeneity suggest a substantial impact of about 16 percentage lower growth in the 1990s, when comparing groups that suffered substantially compared to those only moderately affected. There appears to be evidence of some diminishing returns to livestock per adult, which may well help in explaining some of the convergence within villages observed in the data. No discernible effect from education could be detected, but significant externalities from road infrastructure, resulting in divergence across villages.

A word of caution is in order regarding the results from this paper. First, the sample is small, with only six villages and about 342 households available for (most of) the analysis, limiting power of the estimates. Secondly, the villages had been selected because of their suffering during the famine period, and the high observed growth rates are bound to be at least partly a recovery from earlier low levels, given that growth rates in the sample were well above national growth rates. It may well mean that the findings, including on the responsiveness of growth to particular assets and shocks, should be treated with caution and may not be easily generalisable. Still, the fact that the observed high growth may be partly a recovery is interesting as well, since it then lasted about 10 years for households to recover from the famine crisis—in line with a long persistence of the consequences of shocks.

This analysis does not allow us to fully understand the actual processes involved. Dercon and Krishnan (1996), looking at income portfolios in 1989 in this data set, found evidence of households sorting themselves into groups in which basic farming is combined with either low return, low risk or low entry cost activities on the one hand (weaving, firewood collection, dungcakes and charcoal production), and farming combined with more lucrative off-farm activities or livestock products related activities. Both risk considerations as well as entry constraints (the need to have skills or capital) appear to explain this sorting behaviour. Those entering into the low return activities are typically located in the more remote areas, or had extremely low livestock and other asset levels by

1989, partly linked to asset losses during the famine period. The evidence in the current paper is consistent with this process, since it would have resulted in lower returns to some groups compared to others, affecting growth subsequently. More work on the actual activity and asset portfolio behaviour, for example in line with Rosenzweig and Binswanger (1993), could shed more light on whether this is indeed the process involved.

If anything, this paper shows that risk and shocks may well be an important cause of poverty persistence. The evidence presented here suggests that more protection, in the form of ex-ante insurance and post-shock safety nets, would have substantial returns, not just in terms of the short run welfare gains, but also in terms of subsequent growth.

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