Vulnerability, Shocks and Persistence of Poverty - Estimates for Semi-Arid Rural South India

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Abstract

This paper focuses on vulnerability of rural households to poverty when a negative crop shock occurs. Of particular concern is the possibility of some sections experiencing long spells of poverty as a consequence of such shocks. The analysis is based on the ICRISAT panel survey of households in a semi-arid region in south India during 1975-84. Using alternative specifications that take into account direct effects of crop shocks as well as their indirect effects through asset adjustment, an assessment of vulnerability of different groups of households (e.g. classified on the basis of caste affiliation) is carried out. Whether transfers of land and non-land assets would reduce significantly their vulnerability is also examined. A reorientation of anti-poverty strategy is necessary to avoid welfare losses from negative crop shocks that are frequent and occasionally large.

Key words: shocks, dynamics, vulnerability, transfers, poverty.

JEL codes: H53, I32, Q15

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Raghav Gaiha and Katsushi Imai[1]

Introduction

Following the East Asian crisis in 1997, vulnerability to poverty, as distinct from deprivation, has assumed greater importance. In Indonesia, for example, even though the incidence of poverty was very low before the crisis, the proportion of vulnerable households (in retrospect) was very large, as evidenced by the large number of households that were pushed into poverty in the aftermath of the crisis.[2] Identification of vulnerable households is, however, more difficult than that of poor households, since a household's vulnerability depends in large measure on the severity of the shock to which it is exposed. The illness of a male wage earner lasting several days may push a few households into poverty for a short spell but in the event of a male earner dying many rural households are likely to slip into acute deprivation over a much longer period. Besides, usually households are able to cope well with household-specific shocks in the presence of well-functioning markets (e.g. credit or labour markets) and community support.[3] However, their ability to deal with community-wide shocks is much lower since these shocks affect everyone in the community.[4] What is worse, some of the poorest households may not be able to recover from such shocks, over an extended period of time.[5]

From a policy perspective, a distinction between persistent and transient poverty is of considerable importance, as large sections of rural populations in developing countries are exposed to community-wide shocks. Since persistently poor are not a negligible subset of the poor, it is important to identify who they are.[6] But more importantly careful attention must be given to identifying sections of the rural population that are likely to be persistently poor as a result of a community-wide shock. Failure to identify them may divert resources to those suffering only from temporary misfortunes (i.e. errors of inclusion) at the expense of those likely to be poor over the long-term but temporarily out of poverty due to favourable short-term circumstances (i.e. errors of exclusion). Apart from measures designed to reduce the

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2 See, for example, Deolalikar et al. (2002) and Dercon (2001).

3 See, for example, Gaiha (1993), and Kochar (1999).

4 For details, see Alderman and Paxson (1992).

5 Although evidence on the cumulative impact of shocks is limited and patchy, a series of short-lived shocks (e.g. illness followed by bad weather) is likely to propel the poorest into chronic poverty. See, for example, the rich and insightful analysis of Chile in Scott (2000).

6 For some sections of the rural population, poverty is more or less a permanent condition. Typically, these sections comprise people living in remote, resource-poor regions, without any infrastructure, and barely managing to survive; backward sections of society (euphemistically referred to as Scheduled Castes/ Scheduled Tribes (SCs/STs), debarred from owning assets, denied access to education and condemned to menial occupations; and the disabled and the aged, incapable of augmenting their incomes above a bare subsistence level (Gaiha, 2000).

severity of such shocks, a deeper understanding of the vulnerability of specific sections to them may also help design more effective safety nets for them. The present study is motivated by these considerations.

In an earlier study (Gaiha and Deolalikar, 1993), alternative measures of persistent poverty were computed, based on a panel survey of villages in semi-arid rural South India. This was followed by an examination of the factors that enabled a subset of the rural poor to escape poverty over time (or the obverse why some sections failed to overcome their poverty *despite* a rapid growth of farm and non-farm activities) (Gaiha, 1998). The present study seeks to build on these contributions in essentially three ways. First, as estimates of income mobility over time tend to be vitiated by measurement errors, the purging of income estimates of such errors and other random fluctuations warrants careful treatment.[7] This is done by refining the earnings function in Gaiha and Deolalikar (1993). Secondly, although a measure of weather fluctuations (i.e. coefficient of variation of monthly rainfall) was used in this study, it is not obvious whether such fluctuations necessarily translate into severe price and crop shocks. In the specification used here, the focus is on crop shocks. Thirdly, counterfactual simulations explore the vulnerability of various sections to poverty, and consequences of measures designed to reduce their vulnerability, using a range of poverty thresholds. Thus a richer set of policy insights is obtained.

The scheme is as follows. In section 1, salient features of the ICRISAT panel survey on which the analysis is based are described. This is followed by a brief discussion in section 2 of how the poverty cut-off point is determined. The next section is devoted to the specifications of the earnings function and related issues, followed by a discussion of the econometric estimation and simulation results in section 4. Some concluding observations from a broad policy perspective are made in section 5.

Section 1

Data

The analysis is based on (a sub-set) of the ICRISAT Village Level Studies (VLS) data sets that cover the semi-arid tract (SAT) in Maharashtra and Andhra Pradesh. Agroclimatologically, the SAT includes those tropical regions where rainfall exceeds potential evaporation four to six months in a year. Mean annual rainfall ranges from about 400 to 1,200 mm. India's SAT is vast and covers about 15 to 20 large regions, each embracing several districts. Based on cropping, soil and climatic criteria, three contrasting dryland agricultural regions were selected by ICRISAT: the Telengana region in Andhra Pradesh, the Bombay Deccan in Maharashtra, and the Vidarbha region also in Maharashtra. Three representative districts viz. Mahbubnagar in the Telengana region, Sholapur in the Bombay Deccan and Akola in the Vidarbha region were selected on rainfall, soil and cropping criteria. Next, typical talukas (i.e. smaller administrative units) within these districts were

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[7] Such errors tend to inflate the variance of the welfare metric, say, income, and may make households appear to enter or exit poverty when in fact their poverty status is unchanged. For an illustration, see McCulloch and Baulch (2000).

selected, followed by the selection of 6 representative villages within these talukas.[8] Finally, a random stratified sample of 40 households was selected in each village. This comprised a sample of 30 cultivator and 10 landless labour households. To ensure equal representation of different farm size groups, the cultivating households were first divided into three strata, each having an equal number of households. A random sample of 10 households was drawn from each tercile. 10 landless labour households were also randomly selected. Landless labour households were defined as those operating less than half an acre (0.2 ha) and whose main source of income was agricultural wage earnings. All households were interviewed by investigators who resided in the sample villages, had a university degree in agricultural economics, came from rural backgrounds, and spoke the local language.

A fixed sample size of cultivator and landless labour households in each village means that the sampling fractions and relative farm sizes that demarcate the cultivator terciles vary from village to village. The likelihood that a village household was in the sample ranged from about one in four in the smaller Akola villages to about one in ten in the larger Mahbubnagar villages. Landless labour households are somewhat underrepresented in the sample. On average across the 6 villages, they comprise about one-third of the households in the household population of interest, but their share in the sample is only one-quarter. However, since their mean household size is less than that of cultivator households, a one-quarter representation is a fair reflection of their presence in the individual population of interest (Walker and Ryan, 1990).

The data collected are based on panel surveys carried out at regular intervals from 1975 to 1984 covering production, expenditure, time allocation, prices, wages, and socio-economic characteristics for 240 households in 6 villages representing 3 agro-climatic zones in the semi-arid region in South India. A description of the agro-climatic and other characteristics of the sample villages is given in Table 1. Given the agro-climatic conditions and purposive selection of the villages, the VLS data are not representative of all of rural south India or, for that matter, even of its semi-arid region. Nevertheless, the longitudinal nature and richness in terms of variables included are what make the ICRISAT VLS data unique.

The present analysis is based on data for 183 households belonging to 5 sample villages (excluding Kinkheda), as continuous data are available on this subset of households over the period 1975-84.

Section 2

Poverty Cut-Off Point

The determination of a poverty line is the first task in analyzing the impact of a crop shock. Two alternative approaches have been adopted in the Indian literature in specifying the poverty cut-off point. The first is the direct approach which relies on a

[8] Two villages in each district were selected: Aurepalle and Dokur in Mahbubnagar, Shirapur and Kalman in Sholapur, and Kanzara and Kinkheda in Akola.

Table 1

Characteristics of Study Regions and Villages

Region and Village		
Mahbubnagar	Sholapur	Akola
Aurepalle Dokur	Shirapur Kalman	Kanzara Kinkheda
Rainfall unassured; Pronounced rainfall uncertainty at sowing	Rainfall unassured; frequent crop failure	Rainfall assured
Red soil; marked soil heterogeneity	Deep black soils in lowlands; shallower lighter soils in uplands	Black soils; fairly homogneous
Kharif, or rainy season, cropping	Rabi, or post-rainy season, cropping	Kharif cropping
Paddy, castor, and local kharif sorghum	Rabi sorghum	Upland cotton, mung bean, and hybrid sorghum
Agricultural intensification around dug wells and tanks	Some dug wells	Limited irrigation sources in 1970s and early 1980s
Neglect of dryland agriculture	Technologically stagnant	Sustained technical change in dryland agriculture
Harijans and caste rigidities; inequitable distribution of land ownership	Tenancy; dearth of bullocks; more equitable distribution of land	More educated

Source: Walker and Ryan (1990)

minimum calorie intake. If the average per capita calorie intake of a household is lower than or equal to a specified minimum, the household is classified as poor. There are three problems with this approach: first, poverty becomes synonymous with malnutrition; second, if nutrients are inferior goods, as income rises, the caloric value of a diet may fall and poverty as measured by this approach may show an increase; and, third, very few data sets collect information on individual calorie intakes.

The second approach is an indirect one in which the poverty cut-off point represents the minimum cost of a nutritionally adequate diet (which is not necessarily equivalent to the actual expenditure incurred by households consuming a nutritionally adequate diet). While there are several difficulties with this approach as well (e.g. its failure to account fully for food preferences), it has been widely used in the Indian context, largely owing to data considerations. A cut-off point of consumption/income of Rs 15 per capita per month (at 1960-61 prices) distinguishes poor households from non-poor households. [9]

We adopt the indirect approach in specifying the poverty cut-off point, largely for reasons of comparability of results with other studies. The cut-off point we use for the VLS sample villages is Rs 15 per per month (at 1960-61 prices). Poverty cut-off points for all subsequent years for all the sample villages are calculated using the Agricultural Labourers Consumer Price Index available for the two states- Andhra Pradesh and Maharashtra- that are represented in the VLS sample. As any poverty cut-off point has an element of arbitrariness in it, we consider a range of points.

Vulnerability to poverty is an *ex ante* measure, distinguishable from poverty which is essentially an *ex post* outcome.[10] The former is concerned with dynamics of poverty that take into account movements into and out of poverty in response to idiosyncratic and covariate shocks. These movements reflect the interactions of risks that households face and their ability to cope with them. Here we confine our analysis to the impact of crop shocks on the *number* of poor and the *duration* of their poverty. In modelling these impacts, an attempt is made to take into account both the direct impact on income and the indirect impact through asset adjustment. Also, alternative assumptions about the severity of crop shocks and their frequency help assess the likely impacts on various groups that are typically disadvantaged in terms of human and physical capital. In an extended framework, however, attention must also be given to other dimensions of poverty, such as severity of poverty.

Section 3

Specification

3.1 Income and Asset Dynamics

A reduced form earnings/income equation is used to predict per capita household income:

$$\text{Ln } Y_{it} = \alpha + \beta \text{Ln } Y_{i(t-1)} + \gamma' \mathbf{X_i} + ?S_t + \varepsilon_{it} \qquad (1)$$
$$\varepsilon_{it} = v_i + e_{it}$$

where i indexes the household, and t stands for time. Y is per capita annual household income from all sources (in constant prices). The vector **X** includes certain time invariant

[9] For details, see Gaiha (1989a).

[10] In a recent World Bank study (2001), vulnerability is defined as " the expected welfare loss above a socially accepted norm which is caused by uncertain events and the lack of appropriate risk management instruments" (p.5). For an exposition of econometric approaches and illustrative evidence, see Dercon (2001). A particularly interesting application is Dercon and Krishnan (1999) that allows for idiosyncratic shocks, common (aggregate) shocks and seasonal factors.

characteristics (e.g. the caste of a household), and S is a measure of crop shock that varies with time. v_i is ~ IID (0, s^2_v) and e_{it} is ~ IID (0, s^2_e).[11]

This specification involves some modifications to that used in Gaiha and Deolalikar (1993). First, the fixed - effects formulation in which the intercepts varied with the household is replaced by the error-components model in estimating the income equation. Second, a measure of production or crop shock is employed to focus on the vulnerability of different groups to persistent poverty. The production shock is measured in terms of a proportionate deviation from a semi-logarithmic trend in crop production at the village level.[12] As agriculture is often subject to frequent exogenous shocks (e.g. due to deficient or delayed rainfall), and some sections of the rural population fail to compensate fully for the loss of income from it, they are often propelled into long spells of poverty.[13] Although important contributions have been made focusing on household responses to such shocks, these fall short of assessing their adequacy in terms of enabling the households to escape poverty not just in the aftermath of the shock but also in subsequent years[14]. If, for example, a labour market response in terms of hours worked is not adequate and some assets are liquidated (e.g. sale of cattle, agricultural implements) in stabilising consumption at a minimum subsistence level, the effects of production shocks in subsequent years may not be unimportant.[15] Much of course will depend on the severity of production shocks. To explore their implications, we build on Gaiha and Deolalikar (1993) through a series of counterfactual simulations designed to assess the efficacy of specific policy interventions (e.g. transfer of land and other assets to some of the most deprived sections) when there is a range of production shocks.

As noted earlier, two alternative approaches are employed to assess the impact of crop shocks. One focuses on income dynamics and the other on asset dynamics. In equation (1), the lagged income variable is added to the explanatory variables to capture the impact of a crop shock on income over time. The presumption is that if there is a negative impact on income in a particular year, it has a ripple effect on the income stream in subsequent years. The exact mechanism (s) through which the ripple effect is transmitted is not specified. Given the collinearity between the lagged income variable and asset variables, the latter are omitted. Since asset dynamics matter too- bullocks, for example, are used as a buffer against negative income shocks in the ICRISAT villages- an alternative formulation is specified below.[16]

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11 Initially, a vector of time varying household characteristics (e.g. age of household head, household size), $\mathbf{K_{it}}$, was included in the specification. But these characteristics were dropped either because the changes were small (e.g. household size) or fixed increments (e.g. age of household head). In either case, there is little justification for retaining them in (the first differencing involved in) the Arellano-Bond estimation procedure used here for capturing the income dynamics.

12 This has close similarity to the measure of unanticipated inflation proposed by Bliss (1985). This was used to explain temporal changes in rural poverty in Gaiha (1989b, 1995).

13 Although average monthly rainfall and its coefficient of variation were used as explanatory variables in Gaiha and Deolalikar (1993), neither of them had a significant coefficient. There may be two reasons for it: failure to specify threshold levels of rainfall (i.e. when rainfall is lower than a certain minimum level) for specific crops, and timing of rainfall.

14 See, for example, Kochar (1999).

15 For a broadening of the focus of chronic poverty, see Hulme et al. (2001).

16 See, for example, the important contribution of Rosenzweig and Wolpin (1993).

Equation (1) is estimated using the Generalized Method of Moments (GMM) developed by Arellano and Bond (1991) for dynamic panel data models. First differencing of equation (1) is used to eliminate the v_i (as well as other time-invariant variables, $\mathbf{X_i}$), followed by an IV estimation.[17]

The effect on income of a crop shock through asset dynamics involves two stages. In the first stage, an asset equation is specified that takes into account various determinants including a crop shock, as shown below in equation 2.

$$N_{it} = \beta_0 \alpha + \beta_1 N_{i(t-1)} + \beta_2 S_t + b_3 \mathbf{X_i} + \varepsilon_{it} \qquad (2)$$

$$\varepsilon_{it} = v_i + e_{it}$$

where N is value of household non-land assets, and all other symbols have the same interpretation as before. As in equation 1, v_i is ~ IID (0, s^2_v) and e_{it} is ~ IID (0, s^2_e).

Note that this analysis is restricted to non-land assets as land transactions are typically under reported, if reported at all. This is an unavoidable data constraint. In the second stage, an income equation is specified that takes into account household characteristics and endowments, including predicted values of non-land assets, and a crop shock. This income equation differs in some important ways from equation (1). Given the static nature of the relationship in equation (3), both land and non-land assets are used as explanatory variables along with various household characteristics. The effect of a crop shock is transmitted in two ways. One is the direct effect of a crop shock on income in the same year. Another is through adjustment of non-land assets on income over time. If there is liquidation of assets in response to a negative crop shock, it impacts negatively on non-land assets in the next year and through that on income. But since this is a component of household assets, its effect on income and on vulnerability to poverty is not likely to be substantial.

$$\text{Ln } Y_{it} = \alpha + b' \mathbf{X_i} + g' \mathbf{K_{it}} + d\ N_{it} + ?\ S_t + \varepsilon_{it} \qquad (3)$$
$$\varepsilon_{it} = u_i + v_t + w_{it},$$

where $\mathbf{K_{it}}$ is a vector of time varying household characteristics (e.g. age of household head, household size), and u_i ~ IID (0, s^2_u), v_t ~ IID (0, s^2_v) and w_{it} ~ IID (0, s^2_w).

Equation (2) is estimated using the Arellano-Bond GMM procedure while equation (3) is estimated by the GLS. Given the differences in the specification of equations (1) and (3) and in their estimation procedures, their results are likely to vary.

3.2 Other Related Issues

[17] For a review of this and other more recent procedures, see Baltagi (2001).

Some refinements in measuring the persistence of poverty take into account a range of poverty cut-off points, a disaggregation of the rural population into sub-sets that lack physical capital, human capital and are socially disadvantaged, and consecutive spells of poverty.

Following recent contributions, an attempt is also made to compute the average exit time of sub-sets of the poor, taking into account their economic and social deprivation.[18] There are two options: one is to compute it on the basis of individual (household) poverty gaps of the poor, and the other is to rely on their average poverty gap (or, for that matter, on that of a particular sub-set). While the latter is computationally less demanding, it has the limitation that it does not take into account the distribution of incomes of the poor. But, given the large number of simulations, we have opted for it. The calculations are based on the procedure due to Kanbur (1987) given below:

$$t_g^{avg} \approx \frac{\ln(z)-\ln(y_p)}{g},$$

where y_p is the average income of a subset of the poor, say, the landless poor, in the initial year, z is the poverty cut off point and g is the average per capita income growth of this subset. Comparison of exit time of various sub-sets of the poor with and without crop shocks would give further insights into the persistence of poverty. Whether land and other asset transfers are likely to reduce the exit time will be assessed with the help of counterfactual simulations.

Section 4

Results

4.1 Income Dynamics

The GMM results of equation (1) are given in Table 2. Apart from the strong positive effect of lagged income variables- especially in the previous year- the crop shock also has a strong positive effect on current income i.e. the higher the positive deviation from the trend in crop production, the higher is the income.[19] The overall specification is validated by the Wald test.

As shown below in Figures 1 and 2, the deviations in the sample villages in Andhra Pradesh and Maharashtra over the period 1975-84 were large. Considering that large fractions of households depend on agriculture as the main source of livelihood, such shocks are bound to have significant effects on household incomes.

[18] See, for example, Kanbur (1987) and Morduch (1998).

[19] To be more precise, it is a logarithmic transformation of income.

Table 2
Arellano-Bond GMM Estimates of Income Dynamics

Explanatory Variables [a]	Coefficients (z value) [a]
D (Income (-1))	-0.36 (-4.38)**
D (Income (-2))	-0.14 (-4.32)**
D (Crop Shock)	2.35 (3.28)**
Constant	0.05 (3.94)
No. of observations	1258
R^2	0.15
Wald test of joint significance	? ^{2}(3)= 34.12**

a. ** = significant at the 1 % level. *= significant at the 5 % level.

4.2 Asset Dynamics

The results of the two step procedure discussed earlier are given in Tables 3 and 4. Table 3 shows that there is a strong positive relationship between non-land assets in t and t-2. Also, there is a strong positive relationship between a crop shock and non-land assets, implying that higher unanticipated crop output results in asset accumulation. The overall specification is validated by the Wald test.

Table 3

Arellano-Bond GMM Estimates of Asset Dynamics

Explanatory Variables [a]	Coefficient (z value) [a]
D (Non-land (-1))	-0.13 (-0.76)
D (Non-land (-2))	0.46 (4.12)**
D (Crop Shock)	22.21 (2.48)**
No. of observations	1270
R^2	0.08
Wald test of joint significance	$?^2(3)=$ 46.03**

a ** = significant at the 1 % level. *= significant at the 5 % level.

In the second stage, a GLS estimator is employed to estimate the income equation, taking into account the predicted value of non-land assets with the GMM. As shown in Table 4, a crop shock has a strong positive effect on income. Also, the interaction of crop shock with land owned has a positive effect on income. In other words, the higher the unanticipated increase in crop production, the higher is the per capita income; and, the increase in income is greater for those with higher land ownership. In general, other results have expected signs. While age of household head is positively linked to income, this effect is weaker among older groups. This points to a life-cycle pattern in the income-age profile. Household size diminishes income but economies of scale in production /income generation weaken this effect in larger households. Land owned has a strong positive effect but that of share of irrigated area is somewhat weak. Non-land assets have a positive effect on income. Human capital in the form of schooling years of household head also has a positive effect on income. Independently of human and physical capital, and other household characteristics, upper caste households earn higher incomes. The available data are not sufficiently detailed to identify the mechanisms but it is plausible that underlying this outcome are discriminatory practices in the labour, credit and output markets. The Breusch-Pagan test rejects the random error component specification while the Wald test confirms the joint significance of all the explanatory variables.

Table 4
GLS Estimates of Income

Explanatory Variables [a]	Coefficient. (t value) [a.]	Sample Statistics [b] Mean	S.D.
Crop Shock	4.16		
	(4.43)**	-0.00007	0.02
Crop Shock*x	0.29		
Owned Area (acres)	(2.12) *	0.001	0.12
Age of household head	0.06		
	(3.81)**	50.21	11.70
Age squared	-0.0005		
	(-3.35)**	2658.19	1242.37
Household size	-0.13		
	(-5.53)**	6.05	2.96
Household size squared	0.0033		
	(2.43)*	45.38	52.20
Owned Area (acres)	0.06	3.94	
	(7.85)**		5.11
	0.0008		
% Owned Area Irrigated	(1.47)	23.19	38.40
Non-land assets	0.008		
(predicted)	(2.98)**	12.53	8.92
	0.04		
Schooling years of head	(2.00)*	1.90	3.11
	-0.002		
Schooling years squared	(-1.40)	13.25	31.18
	0.33		
Whether high caste	(3.42)**	0.36	0.48
Whether medium-high caste	0.32		
	(3.17)**	0.21	0.41
Whether medium-low caste	0.12		
	(1.16)	0.23	0.42
Constant	5.15		
	(11.90)		-
No. of Observations	1300		
R^2	0.30		
Breusch -Pagan test for random effects	?^{2} (12)= 127.18**		
Wald test of joint significance	?^{2} (14)= 241.5**		

a. **= significant at 1 % level. *= significant at 5 % level. + = significant at 10 % level.
b. Some of the variables were normalised (e.g. non-land assets were divided by 1000).

4.3 Vulnerability

(a) Income Dynamics

The reference scenario is one in which crop production takes the trend value in each of the sample years and all other explanatory variables take their observed values. A range of poverty cut-off points is used, given the arbitrariness of the cut-off point used here (i.e Rs 15 per capita per month at 1960-61 prices). This helps assess the sensitiveness of the results to changes in it over the range in question. The results of the case without a crop shock are given in Table 5.

At 50 per cent of the poverty cut off point, the share of persistently poor is negligible, regardless of the duration, as most of the households are above it. However, as the cut-off point is raised, there is a sharp reduction in the share of never poor and a corresponding rise in that of persistently poor. What is indeed striking is the high share of persistently poor with 6-7 years of poverty (always poor).

Figure:1 Crop Shock in Aurepalle and Dokur in Andhra Pradesh

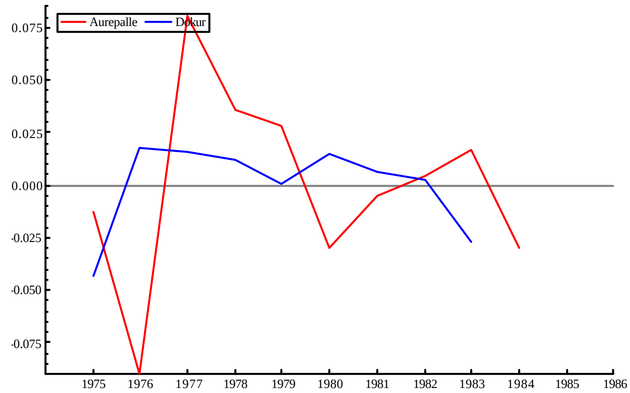
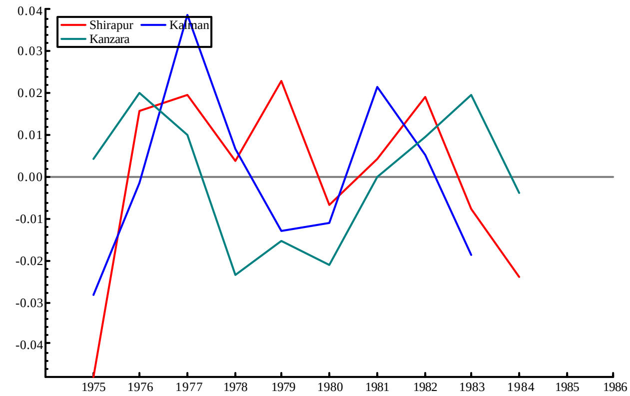


Figure: 2 Crop Shock in Shirapur, Kalman and Kanzara in Maharashtra



When the poverty cut-off point is 25 per cent higher than the commonly used one, for example, 48 percent of the households are always poor. What the results imply is that there is a high concentration of households around the commonly used poverty cut-off point (i.e. around 100 per cent of the poverty cut-off point) and limited income mobility in the reference case. As there are no crop shocks in this case, it follows that a large segment of the sample households is vulnerable to long spells of poverty due to household-specific characteristics- in particular, large household size, low schooling, limited land endowment, small share of irrigated land and low caste affiliation.

Let us now turn to the effects of negative crop shocks. Four variants are considered: (i) a negative crop shock of 10 per cent in the first year of the simulation (i.e. 1978), (ii) a negative crop shock of 10 per cent in the first two consecutive years of the simulation (i.e. 1978 and 1979), (iii) a negative crop shock of 25 per cent in the first year (i.e. 1978), and a negative crop shock of 25 per cent in the first two consecutive years (i.e.1978 and 1979). While a 10 per cent reduction from the trend value is not unusual, a 25 per cent reduction –especially in

Table 5 : Reference Case without a Crop Shock (Income Dynamics)

	Poverty Cut-Off Point[a]				
	125	**100**	**90**	**80**	**50**
Duration of Poverty (years)					
			(%)		
6 –7 years (always poor)	48	33	27	19	4
3-5 years	4	4	4	5	0
1-2 years	5	9	8	5	4
0 (never)	43	54	61	70	92

a The base poverty cut-off point is Rs 15 per capita per month at 1960-61 prices.

two consecutive years-is. The latter could be regarded as a period of drought the effects of which typically last 2-3 years. To avoid cluttering the text, the main findings of the simulations are summarised below.[20]

1. Under the first variant (i.e. a negative crop shock of 10 per cent in the first year), there is a sharp reduction in the proportion of never poor. At the reference poverty cut-off

[20] Details will be furnished on request.

point, the proportion falls from 54 per cent to 43 per cent; and at 125 per cent, it falls from 43 per cent to 33 per cent.

2. The proportion of those poor for 1-2 years rises. For these poverty thresholds, the proportions rise fom 9 per cent to 20 per cent, and from 5 per cent to 17 per cent, respectively.
3. Changes in the proportions of poor with longer duration are negligible.

Under a negative shock of 25 per cent in first year, there are a few striking differences. One is the markedly lower proportions of never poor- the proportion drops from 54 per cent to 25 per cent at the reference poverty cut-off point. Another difference is the much sharper rise in the proportions of poor for 1-2 years, from 9 per cent to 39 per cent at the same poverty cut-off point. Surprisingly, the differences in various categories of poor when the crop shock occurs in two consecutive years are negligible.

(b) Asset Dynamics

In Table 6, the reference scenario based on non-land asset dynamics is given. This differs from that in Table 5 because the specification and estimation procedures used are different. Briefly, the shares of never poor are higher, as also of those poor for 1-5 years in Table 6. However, the shares of always poor (i.e. those poor for 6-7 years) are much lower. Asset accumulation thus helps escape persistent poverty over a (relatively) long duration.

Table 6 : Reference Case without a Crop Shock (Asset Dynamics)

	Poverty Cut-Off Point[a]				
	125	**100**	**90**	**80**	**50**
Duration of Poverty (years)					
			(%)		
6 –7 years (always poor)	39	15	10	5	0
3-5 years	11	9	3	4	0
1-2 years	11	14	14	9	1
0 (never)	39	61	73	82	99

a The base poverty cut-off point is Rs 15 per capita per month at 1960-61 prices.

As in the previous case of income dynamics, we have carried out simulations incorporating four variants of negative crop shocks. Let us first consider the effects of a mild crop shock in the first year (i.e. 1978). As a result of a 10 per cent reduction in crop output, there is

1. a substantial reduction in the proportion of never poor- at the reference poverty cut-off point, for example, the reduction is from 61 per cent to 15 per cent;
2. there is a sharp increase in the proportion of poor for 1-2 years, from 14 per cent to 60 per cent at this poverty cut-off point;
3. however, the proportions of poor for longer spells remain largely unchanged regardless of the poverty cut-off point.

Under a drastic crop shock of 25 per cent lower production, the proportion of never poor is negligible for all poverty cut-off points (ranging from 7 per cent to 2 per cent). However, that of poor for 1-2 years is much higher, especially at low poverty cut-off points (at a poverty cut-off point of 80 per cent of the reference cut-off point, for example, the proportion rises from 9 per cent to 88 per cent). But the proportions of poor for three years or more change little across the range of poverty cut-off points considered. If a crop shock occurs in two consecutive years, say, a shortfall of 10 per cent in both years, there is a slightly larger reduction in the proportions of non-poor, and a slightly higher increase in the proportions of always poor- especially at high poverty cut-off points (e.g. at 125 per cent of the reference cut-off point).

4.4 Policy Interventions

First, an attempt will be made to assess vulnerability to persistent poverty of groups of households classified by caste affiliation, land ownership and educational attainment, under different assumptions of crop shocks. This is followed by an analysis of the potential of asset transfers- both land and non-land asset transfers- in protecting the vulnerable groups against income losses from such shocks. All the findings are based on the two-stage non-land asset adjustment specification.

(a) Caste Affiliation

Table 7 illustrates that among low caste households poverty tends to persist over long spells. Also, the higher

Table 7: Reference Case of Poverty by Caste Affiliation without Crop Shock

Duration of Poverty	Poverty Cut-off Point[a]				
	125	100	90	80	50
Lowest Caste		(%)			
6-7 years (always)	79	50	41	24	0
3-5 years	9	21	9	18	0
1-2 years	6	15	29	26	0
0 (never)	6	15	21	32	100
Mid-low Caste					
6-7 years	33	10	5	2	0
3-5 years	12	10	5	2	0
1-2 years	10	17	14	10	2
0 (never)	45	64	76	86	98
Mid-High Caste					
6-7 years	35	8	3	0	0
3-5 years	18	10	0	0	0
1-2 years	15	15	13	5	0
0 (never)	33	68	85	95	100
Highest Caste					
6-7 years	24	6	3	2	0
3-5 years	8	3	0	2	0
1-2 years	14	12	8	3	0
0 (never)	55	79	89	94	100

a.The base poverty cut-off point is Rs 15 per capita per month at 1960-61 prices.

the poverty cut-off point, the higher is the proportion of always poor, implying a high concentration of low caste households around the reference poverty cut-off point. On the other hand, while the proportion of never poor is small, it is higher at low poverty cut-off points. By contrast, upper caste households –especially highest caste households- have considerably smaller proportions of always poor and higher proportions of never poor.

Some insights into vulnerability of lowest caste households are obtained in an extreme case of a negative crop shock of 25 per cent in the first year. Under this variant,

1. their proportions of never poor become negligible (e.g. drop from 15 per cent to 3 per cent at the reference poverty cut-off point);
2. there is a more than moderate rise in the proportions of poor for 1-2 and 3-5 years (e.g. their combined share rises from 36 per cent to 50 per cent at the same poverty cut-off point); and
3. in one case (i.e at 125 per cent of the reference cut-off point), the share of always poor rises too (from 79 per cent to 82 per cent).

By contrast, among highest caste households, a marked reduction in the proportions of never poor (e.g. from 79 per cent to 3 per cent at the reference cut-off point) is accompanied by substantially higher proportions of poor for 1-2 years (e.g from 12 per cent to 88 per cent at the same cut-off point), while the shares of poor with longer spells of poverty remain unchanged. These results point to the greater vulnerability of lowest caste households to longer spells of poverty in the event of a severe crop shock.

(b) Landownership

Among the first three groups viz. the landless, small and middle farmers, the proportions of always poor are high. Also, the proportions of never poor are high- especially at low poverty cut-off points. By contrast, the proportions of always poor are considerably lower among large farmers while those of never poor are much higher.

Among the landless, the proportions of never poor drop sharply when there is a negative crop shock of 25 per cent in the first year (e.g. the proportion drops from 54 per cent to about 2 per cent at the reference poverty cut-off point); and, associated with that, there is a substantial increase in proportions of poor for 1-2 years. While a similar pattern is discernible among small farmers, one important difference is that the proportion of always poor also rises in one case (at 125 per cent of the poverty cut-off point, it rises from 62 per cent to 65 per cent). Their contrast with large farmers is confined to much larger increases in proportions of poor from 1-2 years (e.g.from 8 to 92 per cent at the reference cut-off point) and larger reductions in proportions of never poor (e.g. from 87 per cent to 3 per cent at the same cut-off point). These differences point to greater vulnerability of large farmers to short spells of poverty in the event of a drastic crop shock.

Table 8

Reference Case of Poverty by Landownership

	Poverty Cut-Off Point[a]				
	125	100	90	80	50
Duration of Poverty (years)					
Landless			(%)		
6-7 years (always)	43	20	14	7	0
3-5 years	16	14	2	5	0
1-2 years	13	13	18	16	0
0 (never)	29	54	66	71	100
Small Farmers					
6-7 years	62	29	24	15	0
3-5 years	3	12	3	9	0
1-2 years	6	12	18	6	3
0 (never)	29	47	56	71	97
Middle Farmers					
6-7 years	41	9	9	5	0
3-5 years	14	5	0	0	0
1-2 years	18	36	23	18	0
0 (never)	27	50	68	77	100
Large Farmers					
6-7 years	16	3	3	0	0
3-5 years	8	3	0	3	0
1-2 years	8	8	5	0	0
0 (never)	68	87	92	97	100

a.The base poverty cut-off point is Rs 15 per capita per month at 1960 -61 prices.

(c) Education

Education of household head and persistence of poverty are closely correlated in Table 9. As the educational level rises, the proportion of always poor falls while that of never poor rises.

Table 9

Reference Case of Poverty by Education of Household Head

Duration of Poverty (years)	Poverty Cut-Off Point[a] 125	100	90	80	50
Without education	(%)				
6-7 years	44	18	12	7	0
3-5 years	14	10	4	5	0
1-2 years	10	17	17	10	1
0 (never)	31	54	67	77	99
Schooling <5 years					
6-7 years	33	12	9	3	0
3-5 years	6	9	0	3	0
1-2 years	12	12	12	9	0
0 (never)	48	67	79	85	100
Schooling 5 years or More					
6-7 years	26	9	6	3	0
3-5 years	6	6	0	3	0
1-2 years	15	6	9	6	0
0 (never)	53	79	85	88	100

a.The base poverty cut-off point is Rs 15 per capita per month at 1960-61 prices.

Among those households with illiterate household heads, the proportions of never poor drops sharply when a negative crop shock of 25 per cent occurs in the first year. At the reference cut-off point, for example, the proportion drops from 54 per cent to 1 per cent. But there is a sharp rise in the proportion of poor for 1-2 years, from 17 per cent to 70 per cent. Moreover, in one case (i.e.at125 per cent of the reference poverty cut –off point), there is a slight increase in the proportion of always poor (from 44 per cent to 46 per cent). On the other hand, among those households with heads possessing 5 years or more of schooling, there is a sharper reduction in the proportions of never poor (at the reference cut-off point, for example, it falls from 79 per cent to 6 per cent), as also a sharper rise in the proportion of poor for 1-2 years (from 6 to 79 per cent), with negligible changes in proportions of poor with longer spells of poverty.

(d) Policy Impact

A selective summary of the simulation results is given below. The focus is on redistribution of land and on higher provision of non-land assets.[21] Note that the latter does not involve redistribution.

[21] Details will be furnished on request.

As pointed out earlier, two variants of land redistribution are considered. In both the ceiling is set at 15 acres of land per household, and the surplus is equally distributed among the landless in one and among the landless of the lowest caste group in the other[22]. As the results for the latter are more interesting, these are summarised below.[23]

When there is a crop shock of 10 per cent in two consecutive years, the proportions of never poor are slightly lower with redistribution (at the reference cut-off point, for example, it falls from 13 per cent to 11 per cent), as also of those poor for 3-5 years and always poor (the latter, for example, falls from 17 per cent to 16 per cent). In fact, the reduction in the latter is larger at the higher poverty cut-off point for all other variants of a crop shock. This reduction must be set against correspondingly higher proportions of poor for 1-2 years. So, while land redistribution reduces vulnerability to long spells of poverty, it increases vulnerability to short spells of poverty.

Out of the two variants of raising non- land assets of landless in the lowest caste category – by 50 and 100 per cent of the mean sample value, respectively- the latter yields a few interesting results.

When there is a negative crop shock of 10 per cent in two consecutive years, there is a slight reduction in the proportion of always poor (at 125 per cent of the cut-off point, it falls from 42 per cent to 40 per cent) and negligible changes in other categories of poor, as a result of provision of non-land assets. In other variants of a crop shock, there a few other significant changes. When there is a negative shock of 25 per cent in the first year, for example, there is a sharp drop in the proportion of poor for 1-2 years (from 73 per cent to 62 per cent at the reference cut –off point).

Although exit time calculations are based on simplifying assumptions (e.g. average income gap of a group), the results are suggestive and broadly consistent with the preceding findings.[24] Among the landless in the lowest caste group, for example, the average exit time rises from 5.6 years to 7.8 years when there is a negative crop shock of 10 per cent, and to 8.5 years under a shock of 25 per cent in the first year. With land redistribution, it reduces to 7 years and 8.1 years under these two cases of crop shocks, respectively. With provision of non-land assets, however, the reduction in exit time is slightly lower. If the lowest caste households are provided non-land assets equivalent to 100 per cent of the sample value, the exit time is 7.4 years in the event of a 10 per cent shock and 8.3 years when the shock is 25 per cent. Thus the potential of land redistribution in reducing vulnerability is slightly higher.

In sum, the potential of these interventions in reducing vulnerability of rural households to poverty seems limited. It is surmised that this reflects the need for substantially higher provision of land and non-land assets to highly vulnerable groups to protect them against crop

[22] 2 ½ acrea are roughly equivalent to a hectare.
[23] Note that the comparison here is with the reference scenario in Table 6 without a crop shock.
[24] The results reported below relate to lowest caste households, taking non-land asset dynamics into account.

shocks.[25] Also, since the equations estimated are reduced forms, no attention was given to coping mechanisms of these groups when a loss of income is imminent or actually occurs (e.g. whether some household members migrate in search of more remunerative employment opportunities, do women supplement household income by outside earnings, whether male members work longer hours). Finally, there is also a need to investigate how short-term income changes influence savings and liquidation of assets- including land. In the absence of these extensions, the findings of the present analysis must be treated as provisional.

5. Concluding Observations

Some observations are made below to put the main findings in a broad policy perspective.

Large segments of rural households experience long spells of poverty (over 3 years) even without negative crop shocks. As a consequence of such shocks – even large ones- there is a marked increase in proportions of households experiencing short spells of poverty (1-2 years). It is only when crop shocks occur in two consecutive years that there is an increase in proportions of always poor (6-7 years) in a few cases. The role of crop shocks in prolonging spells of poverty is thus limited.

A disaggregation of the sample households by caste affiliation, however, points to greater vulnerability of low caste households to long spells of poverty when a large or severe crop shock occurs. Also, small farmers are more vulnerable than large farmers to long spells of poverty.

Given the inadequacy of social insurance and community support in the event of a covariate production shock, an attempt was made to assess the potential of land redistribution (through, for example, a market-mediated scheme) and provision of non-land assets (through, for example, micro-credit) In general, the potential of asset transfers on the scale considered seems limited. Much larger transfers are required to enable vulnerable sections (e.g. landless households in the lowest caste category) to protect themselves better against production shocks. As such shocks are frequent and occasionally quite severe, the welfare losses may be substantial even if their effects are confined to larger numbers experiencing shorter spells of poverty. A reorientation of anti-poverty strategy in light of this concern is thus necessary.

[25] Among the landless in the lowest caste group, for example, the landowned was 0.45 acre without redistribution, and 2.89 acres with redistribution. (Note that the landless include nearly landless). The average non-land asset without any transfer was Rs 2038 and with a transfer equivalent to 100 per cent of the sample mean Rs 11800. While the increases in land and non-land assets were more than moderate, the point emphasised here is that in both cases additional incomes earned were small. Recall that the coefficient of (the predicted value of) non-land assets in Table 4 is quite small.

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