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

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Abstract

This paper focuses on the vulnerability of rural households to poverty when a negative crop shock occurs. The analysis is based on the ICRISAT panel survey of households in a semi-arid region in south India during 1975-84. Using a dynamic panel data model that takes into account effects of crop shocks, an assessment of vulnerability of different groups of households is carried out. What is somewhat surprising is that even sections of relatively affluent households are highly vulnerable to long spells of poverty when severe crop shocks occur. As such crop shocks are frequent in a harsh production environment, there must be a shift of emphasis in anti-poverty measures from meeting income shortfalls among the poor to enabling the vulnerable to protect themselves better against these shocks.

Key words: shocks, dynamics, vulnerability, poverty.

JEL codes: H53, I32, Q15

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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. 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 severity of such shocks, a deeper understanding of the vulnerability of specific sections to them may

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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 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).

also help design more effective safety nets for them (World Bank, 2001). 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 crop shocks. In the specification used here, the focus is on a direct measure of 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

[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.

(Table 1 to be inserted)

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

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 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 Consumer Price Index for Agricultural Labourers 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. Since a range of poverty thresholds is considered, an assessment of how the poorest fare is feasible. Besides, alternative assumptions about the severity of crop shocks and their frequency yield insights into the likely impacts on various groups that are typically disadvantaged in terms of human and physical capital.

[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 (2000) that allows for idiosyncratic shocks, common (aggregate) shocks and seasonal factors.

Section 3

3.1 Income Equations-Specification and Estimation

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

$$\ln Y_{it} ? ? \ln Y_{i(t?1)} ? X_{it}'?_1 ? L_{it}'?_2 ? S_{it}'?_3 ? (L_{it}'? S_{it}')'?_4 ? D_t ?_5 ? v_i ? ?_{it} \quad (1)$$

where i indexes the household, and t stands for time. Y_{it} is per capita annual household income from all sources (in constant prices). The vector X_{it} is a vector of certain time invariant characteristics (e.g. the caste of a household). L_{it} is owned land of household, S_{it} is a measure of crop shock, and D_t is a vector of time dummies. Interaction of L_{it} and S_{it} is included to allow for crop shock effects to vary with land owned. v_i is an individual unobservable effect which is independent, and identically distributed (~IID (0, s^2_v)). e_{it} is an error term which is also independent, and identically distributed (~ IID (0, s^2_e)).[11]

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 through which this effect is transmitted is not specified. Given the collinearity between the lagged income and asset variables, the latter are omitted.[12]

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 for each household in the village is measured in terms of a deviation from a semi-logarithmic trend in crop production at the village level *minus* household's own crop income.[13] Village crop income (minus own crop income) at time t, C_{it}, is

$$C_{it} ? \sum_{j?1}^{n, j? i} c_{jt}$$

[11] A vector of time-varying household characteristics (e.g. age of household head, household size), K_{it} 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. However, landowned is included since households occasionally buy or sell land.

[12] Asset dynamics matter too- bullocks, for example, are used as a buffer against negative income shocks in the ICRISAT villages (Rosenzweig and Wolpin, 1993). However, it is difficult to capture asset dynamics in the income equation, as it is not obvious whether there are instruments that are specific to assets but do not affect income.

[13] This has close similarity to the measure of unanticipated inflation proposed by Bliss (1985). For an application in the context of temporal changes in rural poverty, see Gaiha (1989b, 1995).

where c_{jt} is crop income of household j at t, and n is the number of households in each village. A time trend is fitted to ln (C_{it}), as shown below.

$$\ln(C_{it}) ? b_0 ? b_1 T \qquad (2)$$

A measure of crop shock is then the deviation of the ln (C_{it}) from its trend value, ln ($\hat{C}_{it}$), as shown in equation (3).

$$S_{it} ? \ln(C_{it}) ? \ln(\hat{C}_{it}) \qquad (3)$$

Although income dynamics along the lines of equation (1) are central to the present analysis, we supplement it through a static panel data model specified in equation (4). This model helps understand better why the poverty outcomes differ among households disaggregated by landownership, education and caste affiliation.

$$\ln Y_{it} ? X_{it}'?_1 ? L_{it}'?_2 ? S_{it}'?_3 ? (L_{it}'? S_{it}')'?_4 ? K_{it}?_5 ? D_t ?_6 ? ?_{it} \qquad \textbf{(4)}$$

$$?_{it} ? u_i ? v_t ? w_{it}$$

where 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 (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, X_i), followed by an IV estimation.[14] Equation (3), on the other hand, is estimated using the GLS Random-Effects procedure.

3.2 Shocks

As shown below in Figures 1 and 2, the crop shocks in the sample villages in Andhra Pradesh and Maharashtra over the period 1975-84 were frequent and large. What is also striking is that, while these shocks were similar in the Maharashtra villages, this was not the case in the Andhra Pradesh villages. In the latter, not just the intensity but also the pattern varied significantly. For example, a large negative shock in one village coincided with a large positive shock in another. 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.

(Figure 1 and Figure 2 to be inserted)

3.3 Simulations

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

As illustrated above, agriculture in a semi-arid region is subject to frequent and severe crop 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. Consequently, they are propelled into long spells of poverty.[15] What is worse, occasionally they may be subject to a series of such shocks, making it harder for them escape persistent poverty. Although important contributions have been made focusing on household responses to such shocks, these fall short of assessing their adequacy in terms of enabling them to escape poverty not just in the aftermath of the shock but also in subsequent years.[16] 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.[17] 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 effects of crop shocks of different intensity and duration on households disaggregated by landownership, education and caste affiliation. As elaborated below, some useful insights into the vulnerability of these groups of households to poverty emerge.

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 in the previous year- the crop shock also has a strong positive effect on current income.[18] Land is associated with higher income. What is perhaps of greater interest in the present context is the strong positive effect of land interacted with a crop shock, implying greater vulnerability of large landowners. The overall specification is validated by the Wald test.

(Table 2 to be inserted)

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15 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.

16 See, for example, Kochar (1999).

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

18 To be more precise, it is a logarithmic transformation of income. Since the GMM estimation involves first differencing of variables, the coefficients of right side variables must be interpreted accordingly.

4.2. Supplementary Results

A GLS estimator is employed to estimate the static income equation (4). As shown in Table 2, a crop shock has a strong positive effect on household 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 and share of irrigated area have a strong positive effect. 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 hypothesis that the variance of individual effects is zero, thus favouring the random error component specification[19]. The Wald test, on the other hand, confirms the joint significance of all the explanatory variables.

5. Simulations

Since the focus of the paper is on the effect of a crop shock on poverty over time, we will base the simulations on the Arellano-Bond GMM estimates. 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. This is Case 1 in Table 3. 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.

5.1 Aggregate Results

(Table 3 to be inserted)

At 50 per cent of the poverty cut off point, the share of persistently poor is small or negligible, depending on 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 6-8 years of poverty (always poor).When the poverty cut-off point is 25 per cent higher than the commonly used one, for example, 52.5 percent of the households are always poor. What these 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

[19] For details of the Lagrange multiplier test, see Baltagi (2001).

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.[20]

Let us now turn to the effects of negative crop shocks. Four variants are considered: (i) a small negative crop shock[21] in the first year of the simulation (i.e., 1977, Case 2 in Table 3), (ii) a small negative crop shock in the first three years of the simulation (i.e. 1977 to 1979, Case 3), (iii) a large negative crop shock[22] in the first year (i.e. 1977, Case 4), and (iv) a large negative crop shock in the first three years (i.e.1977 to 1979, Case 5). While the small shock corresponds to the 'usual' bad year which is frequently experienced by households in this region, the large negative shock would approximate a drought, the effects of which typically last 2-3 years. The main findings of the simulations are summarised below.

1. Under the first variant (i.e. a small negative crop shock in the first year), neither the proportion of never poor nor that of always poor is substantially changed. Only a small increase is observed for always poor and poor for '3-5 years' when the 100 per cent poverty cut-off point is used (Case 2).
2. In Case 3 where a small shock continues for three years, the share of 'always poor' is slightly higher at the 100 and 125 per cent cut-off points, as compared with the previous case. That of 'never poor', on the other hand, falls.
3. If households experience a large negative shock only for a year, the shares of poor for '1-2' and '3-5 years' is generally much higher –especially the former- while that of 'never poor' is markedly lower (Case 4). While these results hold for all poverty cut-off points, some of the changes are more pronounced at higher poverty cut-off points. Also, somewhat surprisingly, the large reduction in the share of 'never poor' is associated with higher shares of those poor for '1-2' and '3-5 years' with only a slightly higher share of 'always poor', as compared with the reference case. In fact, the share of 'always poor' is identical between Case 2 (i.e with a small shock in one year) and Case 4 (i.e. with a large shock in the first year), implying that the effects of a severe crop shock resulted mostly in poverty that persisted for a few years.
4. If, however, a severe crop shock lasts three years (Case 5), all categories of poor-including 'always poor' at higher poverty cut-off points-are adversely affected by it. In all cases, there is a marked reduction in the share of 'never poor'. Also, the shares of poor for '1-2' and '3-5 years' rise sharply. Even at 50 per cent of the cut-off point, the share of poor for '3-5 years' is much higher. By contrast, that of ' never poor' is slightly higher at 100 and 125 percent of the poverty cut-off points, relative to Case 1, but identical to Case 3 (i.e. with a small shock for three years). This is yet another confirmation of an earlier finding that the adverse effects of crop shock do not generally extend beyond '3-5 years'.

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[20] For corroboration of this observation, see the GLS results in Table 2. Note that schooling has a weak effect on household income. This is in part attributable to its specification-, in some cases, household head's education may not be a good proxy for educational attainments of other household members.

[21] A small negative crop shock is defined as the mean of annual negative crop shocks for all sample households.

[22] A large negative crop shock is defined as the largest value of the village-level negative crop shocks (i.e., the mean of household-level crop shocks (i.e. S_{it} in equation (3)) in a village in a particular year).

5.2 Disaggregated Results

Let us first consider the results based on a classification of households by land owned in Table 4.[23] Some of these results are surprising.

(Table 4 to be inserted)

The share of 'always poor' is highest among the landless when there is no crop shock. Large but lower shares of 'always poor' are found among small and middle farmers as well. Even among large farmers, the corresponding proportion is moderately high.

With a small crop shock in the first year, there is a small increase in the proportion of 'always poor' among the landless. Surprisingly, with the same shock continuing for three years or a more severe shock in the first year or the same shock continuing for three years, there is no further increase in this share. However, in a few cases, the shares of poor for '1-2' or '3-5 years' increase sharply. To illustrate, with a large crop shock continuing for three years, the share of poor for 3-5 years is more than three times larger than the corresponding share without a crop shock. Among small farmers, on the other hand, the share of 'always poor' rises sharply when a small or large crop shock continues for three years while the shares of poor for shorter spells exhibit a mixed pattern of small changes or no change at all. Among middle farmers, an unchanged share of 'always poor' is combined with markedly higher shares of poor for 3-5 years, especially when small or large shocks continue for three years. Finally, while there is no change in the proportion of 'always poor', that of poor for 3-5 years is five times greater when there is a large crop shock that continues for three years.

In short, these results illustrate that not just the landless but also those owning more than moderate quantities of land are vulnerable to poverty that persists for a few years when large crop shocks occur.

The next disaggregation is in terms of educational attainments.[24] The results are given in Table 5.

(Table 5 to be inserted)

The highest proportion of 'always poor' is among those without any education, followed by those with less than 5 years of education, and those with more than 5 years of education. Among those without any education, a small uniform increase in the share of 'always poor' is associated with a somewhat sharp increase in the shares of poor for 1-2 or 3-5 years- especially when there is a large crop shock that lasts three years. Among those with less than 5 years of education, the share of 'always poor' remains unchanged while that of poor for 3-5 years rises abruptly when there is a large crop shock for three years. The share of poor for 1-2 years, however, remains unchanged under such a shock, relative to the case without a crop shock. Those with more than 5 years of education record increases in shares of 'always poor' and

[23] To avoid cluttering the text with results, the disaggregated results are based on 100 percent of the poverty cut-off point.
[24] It may be recalled that the classification of households is based on the head's educational attainments.

those poor for 1-2 years and 3-5 years when a severe crop shock persists for 3 years, relative to the case without any shock.
In sum, while those without any education are vulnerable to persistent poverty when a severe crop shock occurs, others with some education are also likely to be affected in a similar way.

The third disaggregation is in terms of caste affiliation. The simulation results are given in Table 6.

(Table 6 to be inserted)

Among the lowest caste households, the share of 'always poor' is highest, followed closely by mid-low caste households when there is no crop shock. Among other higher caste groups the corresponding shares are much lower.

When there is a large crop shock for three years, the proportion of 'always poor' among the lowest caste households remains unchanged while the proportions of poor for 1-2 and 3-5 years rise- especially the latter. Among the mid-low caste households, on the other hand, there is a small increase in the share of 'always poor' and a doubling of the share of poor for 3-5 years when there is a large crop shock for three years, relative to the case of no crop shock. The share of poor for 1-2 years, however, falls sharply. Among the mid-high caste households, there is no change in the share of 'always poor' but a sharp rise in the shares of poor for 1-2 and 3-5 years- especially the latter. A similar pattern is observed among the highest caste households as well except that the share of 'always poor' also rises when a severe crop shock continues for three years.

In sum, while segments of low caste households are vulnerable to persistent poverty when a severe crop shock occurs, upper caste households are highly vulnerable too.

6. Policy Options

With a view to a selective but focused review of policy options, three specific goals must be distinguished. These are risk reduction, risk mitigation and risk coping.[25] Risk reduction refers to measures that reduce the probability of a crop shock (in the context of the semi arid region, digging of wells, for example, could reduce the risk of a crop failure from deficient rainfall). Risk mitigation, on the other hand, involves measures in anticipation of a crop shock that offset at least partly its impact (e.g. diversification of crops and plots, combining farm and non-farm sources of income, developing buffer stocks, crop insurance and so on). As these measures may fall considerably short of protecting the vulnerable against severe shocks, it is often imperative to supplement them through risk coping measures such as workfare programmes designed to provide emergency income and cash transfers.[26]

[25] This follows the approach of World Bank (2001).
[26] Note that workfare programmes could be classified as both risk mitigating and risk coping. Programmes such as the Employment Guarantee Scheme in Maharashtra, for example, is widely believed to be a credible fall-back option in a drought. In this sense, it is a risk mitigating measure. On the other hand, income stabilisation of the unemployed through participation in it during a period of drought illustrates its risk coping potential.

Some features of the semi arid region, and the findings of the simulations are summarised first to impart a contextual flavour to the review of policy options.[27]

What distinguishes the semi-arid region from more humid environments is the high incidence of rainfall-related production risk. Such risks are a serious concern in a region characterised by incomplete insurance markets, fragmented financial markets and rudimentary futures price markets.

Crop revenue risk is the main source of income variability among farm households in this region. A decomposition of revenue variability into price, yield and price-yield interaction components suggests that yield stabilisation of the dominant crop is more effective in reducing revenue variability in the unirrigated districts, while it is the price of the dominant crop that has a stronger dampening effect on revenue variability in the irrigated districts.[28] So the relative importance of measures that reduce crop variability varies even within the semi-arid region.

An important finding of the simulations in the preceding section is that sections of even relatively affluent households (i.e. households owning large quantities of land, possessing more than 5 years of education and belonging to upper castes) are highly vulnerable to persistent poverty when a severe crop shock lasts three years. Even though this is a somewhat extreme case, it is not unusual for the effects of a drought to be spread over 2-3 years.[29] So whatever the policy mix it must address the vulnerability of not just the poor but also the relatively affluent as the line of demarcation between them in a harsh production environment with fluctuating yields may be somewhat arbitrary or easily blurred.[30]

In what follows, we shall comment on a few risk mitigating and coping measures, emphasising that this distinction is not a rigid one in so far as some measures may arguably belong to both groups.

(a) Crop Management Strategies

In consecutive drought years, farm management options viz. crop diversification and intercropping have limited potential. But during milder shocks these measures may help mitigate some adverse effects.

Available evidence suggests that crop diversification both within and across villages in this region is influenced by several factors besides variation among farm households in risk attitudes. Amongst these factors, differences in resource endowments has a key role. Thus large farms are more diversified. Crop diversification is effective in reducing variability of household

[27] In reviewing the policy options, we shall draw upon Walker and Ryan (1990), Sinha and Lipton (1999) and World Bank (2001).
[28] For details, see Walker and Ryan (1990).
[29] See, for example, the rich and insightful analysis in Jodha (1975).
[30] This is presumably the reason why with a ceiling of 15 acres of land per household and equal redistribution of the surplus among the low caste landless households there is a weak or negligible effect on chronic poverty (i.e. poverty persisting over 6 years). Details will be furnished on request.

crop income.[31] The potential risk mitigating benefits of crop diversification may thus be greater for large landowners.

Row intercropping and, to some extent, mixed cropping are a feature of cropping systems in this region. Two reasons are cited for yields being less variable in intercropping: (i) lower disease and insect pest incidence, and (ii) greater potential for yield compensation. The evidence on disease and insect pest incidence is inconclusive. Yield compensation effects, on the other hand, tend to be location and system-specific. As in the case of crop diversification, the yield compensating effect of intercropping is likely to be greater in the higher rainfall assured areas. Also, intercropping is often a response to resource endowments, particularly to their quality. Thus, the risk mitigating benefits of intercropping may accrue more to large landowners.[32]

To sum up, these measures have greater risk mitigating potential for large landowners in higher rainfall assured areas.

(b) Non-farm Activities

Expansion of non-farm activities has some potential for income smoothing. However, when there is a covariate crop shock, the income smoothing potential may be substantially reduced as a result of strong backward and forward linkages of non-farm activities with agriculture.[33] Moreover, opportunities for diversification are limited for poor households due to their lack of assets required to start a new activity and lack of entrepreneurial ability.

(c) Crop Insurance

Public crop insurance schemes have been largely ineffective and unsustainable.[34] The reasons include lack of institutional capability, information problems that lead to moral hazard and adverse selection among clients, and distorted incentives for insurers due to the cushion of public funds. While some public subsidies will be required for successful crop insurance, it must operate on a commercial basis- focusing on insurable risks and premiums based on actuarial data- and deny insurers automatic access to funds to cover losses. An innovative solution is area-based index insurance contracts, dealing with specific perils or events such as average yield in the area, drought or flood, that are defined and recorded at a regional level. Insurance is sold as standard contract for each unit purchased, and the buyer has the freedom to purchase any number of units. Some advantages of this scheme are: low administrative cost, ease of marketing, affordability for the poor, and low moral hazard problem. But above all it is financially viable. However, a covariant risk may expose the insurer to huge indemnities. International financial markets could be tapped for reinsurance to hedge against such risks.

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[31] It was three times more effective in stabilising net returns in rainfall-assured Akola than in drought-prone Sholapur (both in Maharashtra). For details, see Walker and Ryan (1990).

[32] For details, see Walker and Ryan (1990).

[33] Hazell and Haggblade (1990), for example, report that on average a 100 rupee increase in agricultural income is associated with a 64 rupee increase in rural non-farm income, with 25 rupees in rural areas and 39 in rural towns. In another study, a 1 per cent increase agricultural output was associated with a 0.9 per cent growth in non-farm employment (IFPRI, 1985).

[34] For a review of crop insurance schemes in India, see Walker and Ryan (1990).

While private sector should be encouraged to participate in crop insurance, the impetus must come from the government in monitoring natural events, financing and in evolving a regulatory framework (World Bank, 2001).[35]

(d) Rural Public Works

Since a large number of risks cannot be wholly eliminated, risk coping options must be carefully considered. This is particularly important in the case of severe covariant shocks such as droughts and floods, where most insurance mechanisms- both formal and informal- fail. There are two priorities in such a situation: provide immediate and extensive relief, and help the affected communities rebuild their homes and livelihoods. Rural public works (RPW) have a potentially important role in both cushioning incomes against such shocks and in rebuilding communities and infrastructure.[36] The experience of the Employment Guarantee Scheme from this perspective reviewed below.

One merit of the EGS is its self-targeting nature. Early studies confirm this. Walker and Ryan (1990), for example, show that participation in the EGS was strongly and inversely related to the wealth of a household. Between Shirapur and Kanzara –the two villages in which it operated- the effect of wealth on participation was stronger in the latter, where farm employment opportunities were stronger. With the hike in the EGS wage rate in 1988, however, the targeting accuracy of the EGS weakened considerably.[37]

Walker and Ryan (1990) also confirm the income stabilising benefits of the EGS. This finding is based on a comparison of levels of household income variability in villages with and without the EGS. Landless labour households that relied largely on earnings in the daily agricultural labour market in Shirapur and Kanzara, where the EGS operated, had about 50 per cent less variable incomes than those in Aurepalle, where rural public works facilities were not locally available. Since there is no control for contemporaneous changes in the sample villages, this evidence must be interpreted with some caution. In a more detailed econometric investigation relying on an option value framework, participation in the EGS has a strong negative effect on measures of uncertainty based on monthly household income (Scandizzo et al., 2003).[38] [39]

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[35] In simulations carried out by Walker and Ryan (1990), it was found that crop insurance would have conferred little if anything in the way of risk benefits on the cultivator households in the study villages. What comes in the way of crop insurance in the semi-arid region is area variability. Indeed, crop insurance was most effective in reducing income variability among well-irrigated paddy producers in Aurepalle. Well-irrigated paddy was not characterised by as marked year-to year fluctuations in area as were the common dryland crops. So the potential benefits of this scheme may vary within the semi-arid tract.

[36] Other forms of famine relief were tried in the 19th century and found wanting compared to public works schemes. They included (i) the distance test: relief is provided in far-apart places, on the assumption that only those greatest need will take the trouble of travelling long distance to avail of it; (ii) the residence test: beneficiaries are required to reside at the place of relief; (iii) the test of cooked food: relief is based on the distribution of cooked meals (dreze, 1988).

[37] For details, see Gaiha (2001).

[38] Scandizzo et al. (2003) derive a measure of uncertainty, based on a GARCH (1, 1) model of monthly household income. This is a more definitive assessment of the income stabilising role of the EGS as it is based on mo nthly data, while Walker and Ryan (1990) base their conclusion on annual data; the GARCH (1, 1) measure is more appropriate than the CV of household income as the latter tends to overestimate the risk faced by a household if

A concern, however, is the budget constraint that may not permit the EGS to expand when a drought occurs in this region. Also, some changes in the composition of EGS projects in recent years may dilute provisioning of local public goods (e.g. roads, percolation tanks) and promote activities (e.g. horticulture) catering to specific groups of individuals (Gaiha, 2001).

7. 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 negative crop shocks – including large ones- there is an increase in proportions of households experiencing short and relatively longer spells of poverty (1-2 years and 3-5 years). It is only when crop shocks occur in consecutive years that there is an increase in proportions of always poor (6-7 years). As large negative shocks with a duration of 2-3 years (e.g. droughts) in this region are not unusual, their role in prolonging poverty of some sections raises a serious concern. What is somewhat surprising is that even relatively affluent sections i.e. households owning large amounts of land, possessing a few years of education and affiliated to upper castes are highly vulnerable to persistent poverty under such shocks.

There are two important implications of the preceding analysis. One is that, in the context of the semi-arid region with a harsh production environment characterised by large fluctuations in yields, the focus of an anti-poverty strategy must be broadened to include those who might not be poor but highly vulnerable to it when a production shock occurs. A related point is that, if the simulations are anything to go by, such a strategy must also address the vulnerability of those who might be considered relatively affluent in terms of land owned, human capital and caste affiliation.

As risk reduction measures may involve large investments over a long period of time (e.g. development of irrigation potential), risk mitigating and coping measures assume greater importance in the short or medium-term. Among risk mitigating measures, the potential of crop diversification and intercropping is likely to be limited when a covariate crop shock occurs. Nor would diversification of village economies through non-farm activities help much, given that many of these are closely linked to agriculture. Crop insurance, on the other hand, is a promising option provided it is affordable, easily administered, and financially viable. Area-based insurance contracts are a case in point. Since few risks can be mitigated- if at all- there is a case for combining risk mitigating measures with risk coping measures. From this perspective, rural public works- or, more specifically-a scheme such as the EGS- can play an important role in reducing economic hardships and in rebuilding communities and infrastructure in the aftermath of a drought. But a major concern is whether such schemes have

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there is a time trend in household income or it rises steadily; and the model used controls for the effects of other contemporaneous events.

[39] See also in this context Kochar (1995, 1999) illustrating the importance of labour market adjustments in response to idiosyncratic crop and other shocks, as an alternative to liquidation of assets and borrowing at exorbitant rates.

the flexibility to expand quickly to ensure immediate and extensive relief, given the budgetary constraints.

In conclusion, what is needed in a harsh production environment is a shift of emphasis in anti-poverty measures from meeting income shortfalls of the poor to enabling the vulnerable to protect themselves better against severe crop shocks that occur frequently.

References

Alderman, H. and C. Paxson (1992) "Do the Poor Insure? A Synthesis of the Literature on Risk and Consumption in Developing Countries", Washington DC: Policy Research Working Paper 1008, World Bank, mimeo.

Arellano, M. and S. Bond (1991) "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations", *Review of Economic Studies*, vol. 58.

Baltagi, B.H. (2001) *Econometric Analysis of Panel Data*, New York: John Wiley and Sons.

Bliss, C.J. (1985) "A Note on the Price Variable", in J.W. Mellor and G.M. Desai (eds.) *Agricultural Change and Rural Poverty: Variations on a Theme by Dharm Narain*, Baltimore: Johns Hopkins University Press.

Deolalikar, A., A. Brillantes, R.Gaiha, E. Pernia and M. Racelis (2001) *Poverty Reduction and the Role of Institutions,* Manila, mimeo.

Dercon, S. (2001) "Assessing Vulnerability to Poverty", Oxford: Department of Economics, University of Oxford, draft.

Dercon, S., and P. Krishnan (2000) "Vulnerability, Seasonality and Poverty in Ethiopia", *Journal of Development Studies*, August 2000, pp.25-53.

Dreze, J. (1988) *Famine Prevention in India,* London: STICERD Discussion Paper 3, London School of Economics.

Gaiha, R. (1989a) "Rural Poverty in India: An Assessment", *Asian Survey*, vol. 29.

Gaiha, R. (1989b) "Poverty, Agricultural Production and Prices in Rural India - A Reformulation", *Cambridge Journal of Economics*, vol. 13.

Gaiha, R. (1993) *Design of Poverty Alleviation Strategy in Rural Areas,* Rome: Food and Agriculture Organisation of the United Nations.

Gaiha, R. (1995) "Does Agricultural Growth Matter in Poverty Alleviation?", *Development and Change*, vol. 26.

Gaiha, R. (1998) "On the Persistence of Poverty in Rural India", *Canadian Journal of Development Studies,* vol .xix.

Gaiha, R. (2000) "Do Anti Poverty Programmes Reach the Rural Poor in India?", *Oxford Development Studies*, vol. 28.

Gaiha, R. (2001) "Rural Public Works and the Poor- A Review of the Employment Guarantee Scheme in Maharashtra", Washington DC: IFPRI, mimeo.

Gaiha, R. and A.Deolalikar (1993) "Persistent, Expected and Innate Poverty: Estimates for Semi Arid Rural India, 1974-1984", *Cambridge Journal of Economics*, vol.17, no.4.

Hazell, P. and S.Haggblade (1990) " Rural-Urban Growth Linkages in India", Washington DC: PRE Working Paper Series 430, Agriculture and Rural Development Department, World Bank, mimeo.

Hulme, D., K. Moore and A. Shepherd (2001) " Chronic Poverty: Meanings and Analytical Frameworks", Manchester: CPRC Working Paper 2, IDPM, University of Manchester.

IFPRI (1985) *International Food Policy Research Institute Report, 1984*, Washington DC: IFPRI.

Jodha, N.S. (1975) "Famine and Famine Policies- Some Empirical Evidence ", *Economic and Political Weekly*, vol. 10.

Kochar, A. (1995) " Explaining Household Vulnerability to Idiosyncratic Income Shocks", *American Economic Review*, May.

Kochar, A. (1999) " Smoothing Consumption by Smoothing Income: Hours-of-Work Responses to Idiosyncratic Agricultural Shocks in Rural India", *The Review of Economics and Statistics*, vol.81.

McCulloch, N. and B. Baulch (2000) "Simulating the Impact of Policy upon Chronic and Transitory Poverty in Rural Pakistan", *Journal of Development Studies*, vol. 36.

Rosenzweig, M. and K. Wolpin (1993) "Credit Market Constraints, Consumption Smoothing, and the Accumulation of Durable Production Assets in Low Income Countries: Investments in Bullocks in India", *Journal of Political Economy*, vol. 101.

Scandizzo, P., R. Gaiha and K.Imai (2003) "Income Stabilisation Benefits of the Employment Guarantee Scheme in an Option Value Framework", draft.

Scott, C. (2000) "Mixed Fortunes: A Study of Poverty and Mobility amongst Small Farm Households in Chile, 1968-86", *Journal of Development Studies*, vol. 36.

Sinha, S. and M. Lipton (1999) " Damaging Fluctuations, Risk and Poverty: A Review", , Washington DC: WDR 2000/2001 Background Paper, mimeo.

Walker, T.S. and J.G. Ryan (1990) *Village and Household Economies in India's Semi-Arid Tropics*, Baltimore: Johns Hopkins University Press.

World Bank (2001) *Risk Management in South Asia: A Poverty Focused Approach,* Washington DC: Report No. 23509-SAS.

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)

Table 2
Household Income Equations

Independent Variables	Arellano-Bond GMM Estimates of Household Income Dynamics [a b] (all variables in first differences) Coef. (t value) [c]			GLS Random-Effects Estimates of Household Income (all variables in levels) Coef. (t value)		
ln (household Income)i(t-1)	**0.113**	**(2.36)**	*****	**-**	**-**	
(Crop Shock) t [e]	**0.241**	**(3.67)**	******	**0.323**	**(7.06)**	******
(Crop Shock*Owned Area)it [e]	**0.017**	**(2.39)**	*****	**0.000**	**(1.22)**	
(Owned Area) it [e]	**0.061**	**(2.06)**	*****	**0.060**	**(10.96)**	******
(Age of household head) it	-	-		0.026	(2.25)	*
(Age Squared) it	-	-		0.000	(-1.91)	†
(Household Size) it	-	-		-0.173	(-9.62)	**
(Household Size Squared) it	-	-		0.005	(5.52)	**
(% Owned Area Irrigated) it	-	-		0.003	(6.85)	**
(Schooling Years of Head)it	-	-		0.026	(1.66)	
(Schooling Years Squared) it	-	-		-0.001	(-0.89)	
(Whether Highcast) it	-	-		0.321	(3.90)	**
(Whether Medium Highcast) it	-	-		0.308	(3.61)	**
(Whether Medium Lowcast) it	-	-		0.097	(1.12)	
Whether in Year 1975	-	-		-0.488	(-8.44)	**
Whether in Year 1976	-	-		-0.310	(-5.42)	**
Whether in Year 1977	0.046	(1.00)		-0.212	(-3.44)	**
Whether in Year 1978	0.080	(1.83)	†	-0.126	(-2.22)	*
Whether in Year 1979	0.045	(1.05)		-0.136	(-2.44)	*
Whether in Year 1980	-0.103	(-2.06)	*	-0.276	(-5.12)	**
Whether in Year 1981	-0.129	(-2.35)	*	-0.273	(-4.98)	**
Whether in Year 1982	-0.010	(-0.25)		-0.105	(-1.90)	†
Whether in Year 1983	-0.057	(-1.50)		-0.084	(-1.58)	
Constant	0.031	(3.55)		6.497	(20.37)	
Wald Chi^2 for Joint significant Tests	155.90 (11) **			673.46 (22)**		
Test for 1st Order Autocorrelation: m_1	Z=-2.92**			-		
Test for 2nd Order Autocorrelation: m_2	Z=1.04			-		
Sargan test (Chi^2 Test) [d]	60.38 (38)**			-		
Breusch-Pagan Test for Random Effects	-			$Chi^2(1)$= 1379.42**		
Number of observations	1447			1868		

Notes: [a] One–step estimators are used to estimate Arellano-Bond Model. Note that Arellano and Bond (1991) recommend using the one-step results for inference on the coefficients. We adopt the one-step estimator as the precise estimates of coefficients are needed for simulations.

[b d] Because an error term is potentially heteroscedastic, the robust estimator of the variance-covariance matrix of the parameter is calculated to derive standard errors. The Sargan Test is based on the homoscedastic estimator, as this cannot be calculated in the heteroscedastic case. Though the null-hypothesis that over-identifying restrictions are valid is rejected, this is likely due to the heteroscedasticity.

[c] ** = significant at 1 % level. *= significant at 5 % level. †= significant at 10 % level.

[e]. Level of Crop Shock, Owned Land, and their interactions are added to the matrix of instruments.

Table 3
Simulation Results –Effects of Crop Shocks on Chronic Poverty

Duration of Poverty (years)	**Poverty Cut-Off Point** [a]				**(%)**
Case 1: Reference Case (without any crop shock)	**125**	**100**	**90**	**80**	**50**
6 –8 years (always poor)	52.5	34.4	29.0	25.7	10.4
3- 5 years	4.9	5.5	4.9	1.1	1.1
1-2 years	8.2	12.6	10.9	8.2	6.6
0 (never)	34.4	47.5	55.2	65.0	82.0
Case 2: With a small shock for the first year	**125**	**100**	**90**	**80**	**50**
6 –8 years (always poor)	52.5	***35.5***	29.0	25.7	10.4
3- 5 years	***6.0***	***7.1***	***6.0***	***2.7***	***2.2***
1-2 years	7.7	9.8	9.8	6.6	5.5
0 (never)	33.9	47.5	55.2	65.0	82.0
Case 3: With a small shock for the first 3 years	**125**	**100**	**90**	**80**	**50**
6 –8 years (always poor)	***55.2***	***36.1***	29.5	25.7	10.4
3- 5 years	4.9	7.1	6.0	***3.8***	***3.3***
1-2 years	7.7	10.9	12.0	7.1	6.0
0 (never)	***32.2***	***45.9***	***52.5***	***63.4***	***80.3***
Case 4: With a large shock for the first year	**125**	**100**	**90**	**80**	**50**
6 –8 years (always poor)	52.5	***35.5***	***29.5***	***26.2***	10.4
3- 5 years	***8.2***	***8.2***	***7.1***	***2.2***	***2.7***
1-2 years	10.4	16.4	17.5	14.2	9.3
0 (never)	***29.0***	***39.9***	***45.9***	***57.4***	***77.6***
CASE 5: With a large shock for the first 3 years	**125**	**100**	**90**	**80**	**50**
6 –8 years (always poor)	***55.2***	***36.1***	***30.6***	26.2	10.4
3- 5 years	***9.8***	***14.8***	***10.9***	***6.0***	***7.7***
1-2 years	13.7	15.3	18.6	20.8	7 .7
0 (never)	***21.3***	***33.9***	***39.9***	***47.0***	***74.3***

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

Table 4
Simulation Results Disaggregated by Landownership with and without Crop Shocks

	Poverty Cut-Off Point = 100 [a]				
Duration of Poverty (years)	**Without Shock**	**With Small Shock for the first year**	**With Small Shock for the first 3 years**	**With Large Shock for the first year**	**With Large Shock for the first 3 years**
Landless:					
6 –8 years (always poor)	44.6	***46.4***	***46.4***	***46.4***	***46.4***
3- 5 years	5.4	5.4	5.4	***7.1***	***16.1***
1-2 years	12.5	***10.7***	***10.7***	***17.9***	***14.3***
0 (never)	37.5	37.5	***37.5***	***28.6***	***23.2***
Small Farmers:					
6 –8 years (always poor)	35.3	***38.2***	***41.2***	***38.2***	***41.2***
3- 5 years	8.8	8.8	***5.9***	8.8	8.8
1-2 years	8.8	5.9	5.9	***14.7***	***11.8***
0 (never)	47.1	47.1	47.1	***38.2***	***38.2***
Middle Farmers:					
6 –8 years (always poor)	36.4	36.4	36.4	36.4	36.4
3- 5 years	4.5	***9.1***	***13.6***	***13.6***	***27.3***
1-2 years	22.7	***18.2***	***18.2***	***18.2***	***18.2***
0 (never)	36.4	36.4	***31.8***	***31.8***	***18.2***
Large Farmers:					
6 –8 years (always poor)	23.7	23.7	23.7	23.7	23.7
3- 5 years	2.6	***5.3***	***5.3***	***5.3***	***13.2***
1-2 years	13.2	***10.5***	***10.5***	***15.8***	***13.2***
0 (never)	60.5	60.5	60.5	***55.3***	***50.0***

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

Table 5
Simulation Results Disaggregated by Education of Household Head with and without Crop Shocks

	Poverty Cut-Off Point = 100 [a]				
Duration of Poverty (years) ***Without Education:***	**Without Shock**	**With Small Shock for the first year**	**With Small Shock for the first 3 years**	**With Large Shock for the first year**	**With Large Shock for the first 3 years**
6 –8 years (always poor)	40.0	*41.7*	*41.7*	*41.7*	*41.7*
3- 5 years	3.5	*4.3*	*5.2*	*6.1*	*14.8*
1-2 years	13.0	*10.4*	*11.3*	*18.3*	*16.5*
0 (never)	43.5	*43.5*	*41.7*	*33.9*	*27.0*
Schooling < 5 Years					
6 –8 years (always poor)	27.3	27.3	27.3	27.3	27.3
3- 5 years	12.1	12.1	12.1	12.1	*18.2*
1-2 years	9.1	9.1	9.1	*15.2*	*9.1*
0 (never)	51.5	51.5	51.5	*45.5*	*45.5*
Schooling 5 Years or longer					
6 –8 years (always poor)	23.5	23.5	*26.5*	23.5	*26.5*
3- 5 years	5.9	*11.8*	*8.8*	*11.8*	*11.8*
1-2 years	14.7	*8.8*	*11.8*	*11.8*	*17.6*
0 (never)	55.9	*55.9*	*52.9*	*52.9*	*44.1*

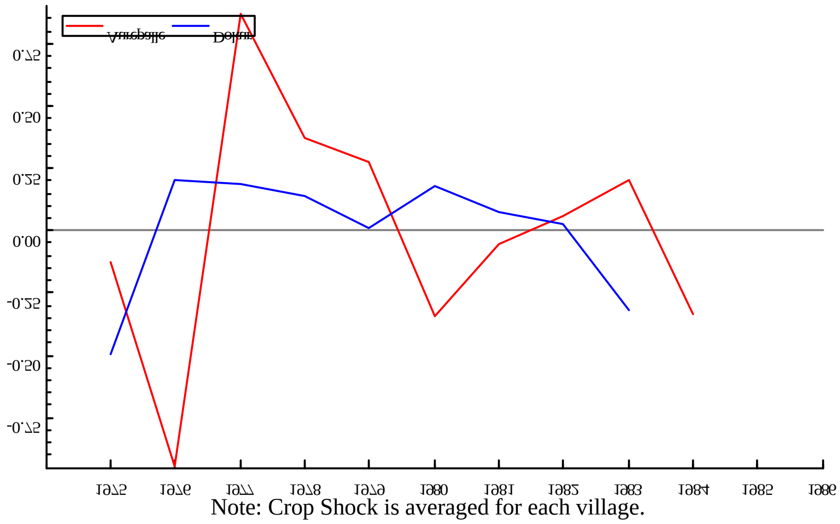
Note: [a] The base poverty cut-off point is Rs 15 per capita per month at 1960-61 prices.

Table 6
Simulation Results Disaggregated by Caste Affiliation with and without Crop Shocks

	Poverty Cut-Off Point = 100 [a]				
Duration of Poverty (years)	**Without Shock**	**With Small Shock for the first year**	**With Small Shock for the first 3 years**	**With Large Shock for the first year**	**With Large Shock for the first 3 years**
Lowest Caste:					
6 –8 years (always poor)	58.8	58.8	58.8	58.8	58.8
3- 5 years	2.9	*5.9*	*8.8*	*8.8*	*8.8*
1-2 years	5.9	*2.9*	0.0	*2.9*	*8.8*
0 (never)	32.4	32.4	32.4	*29.4*	*23.5*
Mid-low Caste:					
6 –8 years (always poor)	50.0	*54.8*	*54.8*	*54.8*	*54.8*
3- 5 years	9.5	*4.8*	*4.8*	*7.1*	*19.0*
1-2 years	14.3	14.3	14.3	11.9	4.8
0 (never)	26.2	26.2	26.2	26.2	*21.4*
Mid-high Caste:					
6 –8 years (always poor)	17.5	17.5	17.5	17.5	17.5
3- 5 years	2.5	*5.0*	*5.0*	*5.0*	*17.5*
1-2 years	15.0	*12.5*	*15.0*	*25.0*	*22.5*
0 (never)	65.0	65.0	*62.5*	*52.5*	*42.5*
Highest Caste:					
6 –8 years (always poor)	22.7	22.7	*24.2*	22.7	*24.2*
3- 5 years	6.1	*10.6*	*9.1*	*10.6*	*13.6*
1-2 years	13.6	*9.1*	*12.1*	*21.2*	*21.2*
0 (never)	57.6	57.6	*54.5*	*45.5*	*40.9*

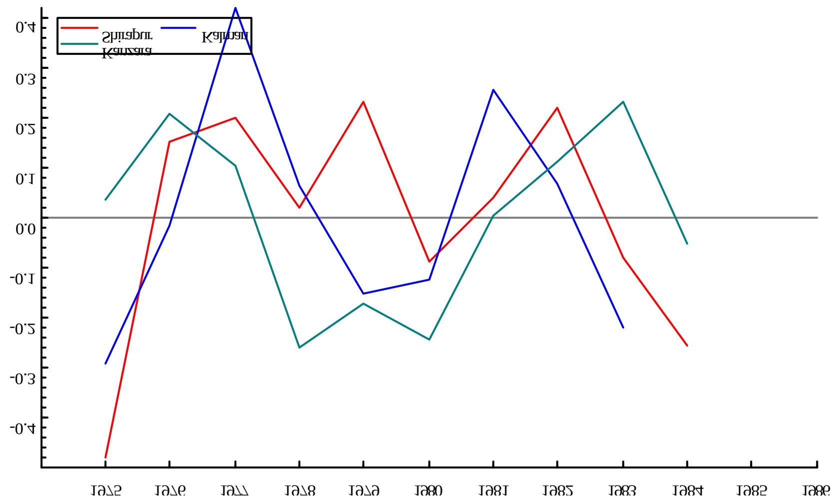
Note: [a] The base poverty cut-off point is Rs 15 per capita per month at 1960-61 prices.

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



Note: Crop Shock is averaged for each village.

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



Note: Crop Shock is averaged for each village.