Risk Sharing Arrangements and the Structure of Risk and Time Preferences: Theory and Evidence from Village India *

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Abstract

This paper investigates the extent to which rural households in developing countries are able to smooth consumption, using a model of full risk sharing, in which participating households have different risk and time preferences. A resulting rule of resource allocation is characterized in an intuitive way, clarifying the effects of diverse preferences. Empirical models are applied to a household panel data collected from rural India. Estimation results strongly support the heterogeneity of risk preferences. In contrast, only a weak evidence is found in favor of the intertemporal resource allocation across households according to differences in time preferences.

Keywords: insurance, consumption smoothing, risk attitudes, discount rates.

JEL classification codes: O12, D12, Q12.

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1 Introduction

In this paper, implications of full risk sharing among low income households are investigated for the case with households having heterogeneous preferences. Following Townsend (1994), the extent of risk sharing among villagers in developing countries has been investigated for various regions and with various methods in the recent literature (Townsend (1995a, 1995b); Ravallion and Chaudhuri (1997); Fafchamps (1997); Udry (1994); Ligon (1998); Ligon et al. (1999)). Although the underlying theoretical model and empirical models based on it mirror similar work for developed countries (Mace (1991); Cochrane (1991); Hayashi (1997); Crucini (1999)), testing full insurance implications as a benchmark is especially important for low income countries because risk is expected to affect people's welfare more in an economy where farming is the main economic activity and markets are underdeveloped over space.

A relatively unexplored issue in that investigation is the effect of heterogeneity in risk and time preferences among villagers on risk sharing arrangements. Most of the studies for developing countries mentioned above implicitly or explicitly assume homogenous preferences in their empirical tests. This is unsatisfactory considering the accumulation of theoretical work on rural institutions to cope with risk, where difference in risk attitudes plays an important role in allocating risk (Bardhan (1989); Stiglitz (1988)). Especially, the assumption that tenants are more risk averse than landlords has been employed often to explain sharecropping arrangements (Stiglitz (1974); Hayami and Otsuka (1993)). Furthermore, considering the prevailing poverty and the paucity in risk mitigating arrangements in rural economies in developing countries, incorporating heterogeneous risk preferences is especially relevant from development perspective.

A related issue in economic development is discount rates. If the future is heavily discounted, households may behave in a myopic way, resulting in lower savings, lower investment, and less sustainable long-term cooperation. Following the usage by Pender (1996), who implemented a rare empirical study on discount rates in developing countries, "discount rate" in this paper refers to "a measure of the intertemporal rate of substitution, which may be affected by either diminishing marginal utility of consumption or pure time preference" (p.259). The former is closely related with the curvature of the utility function, i.e., risk preference, which is one of the key elements investigated in this paper. The effects of diversity in the latter is another key issue explored in this paper. Pure time preference might differ among households, according to their differences in demographic structure, education level, etc.

In the following, the basic model of full-information intra-village risk sharing is extended to a case where participating households may have different risk and time preferences. Among the existing studies, Townsend (1994) only partially examined the effects of heterogeneous risk attitudes in its empirical part, without considering the possibility of heterogeneous time preferences; Cochrane (1991) gave brief discussion on heterogeneous preferences with respect to both risk and time in its theoretical part, without deriving its full implications to empirical work. A distinctive feature of this paper is that, first, a rule of risk allocation is characterized explicitly when preferences are heterogeneous and its empirical implications are explored for testing full insurance and the structure of risk/time preferences. Another feature of this paper is application of the empirical model to a popular data set on this subject, i.e., the ICRISAT (International Crops Research Institute for the Semi-Arid Tropics) household panel data from rural India. This application not only generalizes Townsend's (1994) tests but also is expected to shed light on the relationship between households' time preference and their actual economic behavior, for which there are few empirical studies.[1]

The paper is organized as follows. In Section 2, a theoretical model is introduced to investigate the effects of heterogeneous preferences. In Section 3, its empirical implications are explored to derive testable hypotheses regarding the structure of risk/time preferences. Econometric results based on the ICRISAT household data are reported in Section 4. The final section concludes the paper, comparing our results with those from the recent literature.

2 Theoretical Model

2.1 Basic Settings

Basic settings of the theoretical model in this paper follow a simple model of full-information intra-village risk sharing, adopted in Mace (1991), Cochrane (1991), Townsend (1994), and Fafchamps (1997). We consider a rural economy of N infinitely-lived households. Household i is faced with uncertainty denoted by the state of nature s in period t that occurs with probability π_{st}. The household is endowed with stochastic income y_{ist} and consumes c_{ist} from which it obtains von Neumann-Morgenstern utility denoted by $u_i(c_{ist})$ with $u_i' > 0, u_i'' < 0$.

[1] Some of the existing studies have inferred risk and time preferences from experiments (Binswanger (1981); Pender (1996)) and others have estimated risk preferences from observed economic behavior (see references in Kurosaki (1998) and Fafchamps (1997)), but very few have investigated time preference for developing countries based on observed economic choices.

With an assumption of separability between consumption and leisure, the Pareto optimal resource allocation is obtained by solving the social planner's problem:

$$\max_{\{c_{ist}\}} \quad \sum_{i=1}^{N} \lambda_i \sum_{t=1}^{\infty} \rho_i^t \sum_{s} \pi_{st} u_i(c_{ist}) \tag{1}$$

subject to the feasibility constraint

$$\sum_{i=1}^{N} c_{ist} \leq \sum_{i=1}^{N} y_{ist}, \qquad \forall (s,t), \tag{2}$$

and a set of non-negativity constraints for c_{ist}, where λ_i is a Pareto-Negishi weight for household i and ρ_i is a subjective discount factor of household i corresponding to the pure time preference of each household.[2]

Assuming an interior solution, the Pareto optimal allocation requires that:

$$\lambda_i \rho_i^t u_i'(c_{ist}) = \mu_{st}, \qquad \forall i, \tag{3}$$

where μ_{st} is the Lagrange multiplier associated with the feasibility constraint (2) in period t with state s divided by its probability π_{st}. Equation (3) simply states that λ-weighted marginal utility is equalized among villagers. Its important implication is that idiosyncratic income shocks should not affect individual consumption. What matters is the aggregate income shock in t that is completely represented by μ_{st}. This implication constitutes the basis of the existing empirical studies. Although the condition (3) is derived from the social planner's optimization problem, the same rule of resource allocation can be derived as a result of competitive equilibrium within a decentralized framework as long as there is no private information and markets for state-contingent claims are complete.

2.2 Constant Risk Aversion Cases

In empirical tests, most of the existing studies assume in addition homogenous preferences among households with respect to risk and time. This additional assumption results in an empirically testable hypothesis that the level of consumption change should be the same

[2]In this specification, it is implicitly assumed that the social planner maximizes the sum over households, of each household's intertemporal utility that is individually evaluated using each household's subjective discount factor. It is not assumed that the planner maximizes the sum over periods using his own subjective discount factor, of each period's utility sum in the village. The former assumption is adopted because it allows a consistent mapping between the social planner's solution and a competitive equilibrium solution under complete markets, even when households have heterogeneous time preferences, while the latter does not.

among villagers and it should not be affected by shocks idiosyncratic to individual income levels, when utility function u exhibits constant absolute risk aversion (CARA). When u exhibits constant relative risk aversion (CRRA), the log consumption growth should be the same among villagers and it should not be affected by the idiosyncratic shocks.

In this paper, the assumption of homogenous risk/time preferences is relaxed. For simplicity, subscript s is dropped below, since the focus is on *ex post*, observable allocation of consumption.

First, consider a case where households have CARA preferences, i.e.,

$$u_i(c_i) = -\frac{1}{A_i}\exp[-A_i c_i], \tag{4}$$

where A_i is an Arrow-Pratt coefficient of absolute risk aversion. An explicit solution to equations (3) and (2) is obtained as

$$c_{it} = -\frac{1}{A_i}\ln\mu_t + \frac{1}{A_i}\ln\lambda_i + \frac{1}{A_i}t\ln\rho_i = \alpha_i\bar{c}_t + \beta_i + \gamma_i t, \tag{5}$$

where

$$\alpha_i \equiv \frac{1}{A_i}\left[\frac{1}{N}\sum_j \frac{1}{A_j}\right]^{-1}, \tag{6}$$

$$\beta_i \equiv \frac{1}{A_i}\left[\ln\lambda_i - \frac{1}{N}\sum_j \alpha_j \ln\lambda_j\right], \tag{7}$$

$$\gamma_i \equiv \frac{1}{A_i}\left[\ln\rho_i - \frac{1}{N}\sum_j \alpha_j \ln\rho_j\right], \tag{8}$$

and $\bar{c}_t$ is the village mean of consumption levels. Equation (5) intuitively shows that the optimal consumption consists of a variable part proportional to the village mean consumption at the rate of α_i and a fixed part $\beta_i + \gamma_i t$.

As a special case of $\rho_i = \rho$ for all i, γ_i term disappears, resulting in an expression analogous to the standard notation in the sharecropping literature. Definition (6) implies that when a household is more risk averse than the village average in the sense that $\frac{1}{A_i} \leq \frac{1}{N}\sum_j \frac{1}{A_j}$, α_i becomes smaller than unity, i.e., the household's share in variable consumption is smaller than the village average. This implication is similar to the one derived for sharecropping arrangements. For example, when there is only one tenant and one landlord and when enforcement of labor or effort is perfect (i.e., without moral hazard), the tenant's crop share rate is larger (smaller) than the landlord's share when the tenant is more (less) risk averse than the landlord (Stiglitz (1974), p.231; Hayami and Otsuka (1993), p.47).

Definition (7) implies that the village economy allocates more consumption to those households with higher λ_i. For instance, wealthier households who can contribute more to the village income on average is assigned higher consumption.

Regarding the effects of diversity in time preferences, when a household is more myopic, i.e., ρ_i is smaller, γ_i becomes more negative. The fixed consumption of such a household should be decreasing over time. This allocation is efficient since more myopic households evaluate consumption in the immediate period more highly than less myopic households do.

An intertemporal change of consumption associated with equation (5) is characterized as

$$c_{i,t+1} - c_{it} = -\frac{1}{A_i}[\ln \mu_{t+1} - \ln \mu_t - \ln \rho_i] = \alpha_i(\bar{c}_{t+1} - \bar{c}_t) + \gamma_i. \tag{9}$$

An important implication of this expression to empirical works is that, even when the first difference of consumption is used as the dependent variable to test the full risk sharing hypothesis, it should vary among households in a systematic way. In other words, household specific effects remain as a slope effect on the village average consumption as well as an intercept effect.

When households have CRRA preferences, i.e.,

$$u_i(c_i) = \frac{1}{1 - R_i} c_i^{1-R_i}, \tag{10}$$

where R_i is an Arrow-Pratt coefficient of relative risk aversion, similar results can be obtained. An optimal consumption is defined as

$$\ln c_{it} = -\frac{1}{R_i} \ln \mu_t + \frac{1}{R_i} \ln \lambda_i + \frac{1}{R_i} t \ln \rho_i = \alpha_i' \bar{\ln c_t} + \beta_i' + \gamma_i' t, \tag{11}$$

where α_i', β_i', and γ_i' are the same as in definitions (6), (7) and (8) except that A_i is replaced by R_i, and $\bar{\ln c_t}$ is the village mean of log consumption. As before, the log of the optimal consumption consists of a variable part proportional to the village mean and a fixed part. An intertemporal change associated with equation (11) is characterized as

$$\ln c_{i,t+1} - \ln c_{it} = -\frac{1}{R_i}[\ln \mu_{t+1} - \ln \mu_t - \ln \rho_i] = \alpha_i'(\bar{\ln c_{t+1}} - \bar{\ln c_t}) + \gamma_i', \tag{12}$$

which implies that the log consumption growth should vary among villagers. This CRRA case is of special interest because definition (10) together with (1) implies that the intertemporal elasticity of substitution, which is one of the factors determining discount rates, is constant for each household but varies across households taking the value $1/R_i$.

3 Implications to Empirical Tests

3.1 An Empirical Model

Based on the theoretical model above, we now propose an empirical model to examine the sensitivity of consumption changes (or log consumption growth) with respect to aggregate and idiosyncratic shocks. A straightforward way of implementing this examination based on equation (9) is to estimate

$$\Delta c_{it} = b_i + a_i \Delta \bar{c}_t + \zeta_i X_{it} + u_{it}, \qquad i = 1, ..., N, \quad t = 1, ..., T, \tag{13}$$

where $\Delta c_t = c_t - c_{t-1}$, b_i, a_i, and ζ_i are parameters to be estimated, X_{it} denotes idiosyncratic income shocks to household i, and u_{it} is an error term with zero mean. Parameter ζ is allowed to vary among households since functionings of risk sharing arrangements may differ from household to household. The consumption variable c_t should be replaced by $\ln c_t$ for a CRRA specification based on equation (12). If the null hypothesis of $\zeta_i = 0$ is accepted for all i, the village economy is considered to achieve efficient risk allocation with respect to idiosyncratic shocks. If not, the magnitude of parameter ζ_i will tell us how sensitive a household's consumption is to unpredicted, idiosyncratic events.

An important empirical implication from the previous section is that, even when a first difference is used as the dependent variable, household specific effects remain. Parameters a_i and b_i correspond to these effects due to heterogeneity in risk and time preferences respectively. In addition, when households' preferences and the economy's welfare weights change over time, for instance, due to changes in demographic composition (Townsend (1994); Cochrane (1991)), the parameters should reflect these changes also. However, a crucial point is that even when these changes are absent or controlled in different ways,[3] heterogeneity in time-invarying preferences with respect to risk or with respect to time necessitates the use of panel methods.

An obvious way to estimate equation (13) is a time series regression for each household. This is feasible when the time horizon of panel data is sufficiently long. Townsend (1994) applied this approach though he estimates a model using levels, not the first difference, without γ_i term in equation (5), implicitly assuming homogenous time preference.

Alternatively, equation (13) could be estimated by a "fixed-effects" panel method with slope dummies on consumption changes and intercept dummies. When all parameters to

[3] For example, Townsend (1994) explicitly derived an expression for changes in age-sex composition and added its term to his empirical model.

estimate are allowed to have household fixed effects, the panel estimation becomes equivalent to the first method, or the "BYID" option in econometric packages for panel analysis.

3.2 Bias from Incorrectly Imposing Homogeneity

Will a bias occur in testing the hypothesis $\zeta_i = 0$ if homogeneity in risk and time preferences is incorrectly assumed for heterogeneous households? In the fixed-effects framework, it is clear from equation (13) that a typical omitted-variable bias could occur if the magnitudes of a_i and b_i are correlated with X_{it} and if the true value of ζ_i is not equal to zero. With respect to a_i, more risk averse households with lower a_i would prefer to have lower variability of X_{it} if $\zeta_i > 0$ and if some income smoothing measures such as crop diversification are available. Even in such a case, however, as long as X_{it} is measured properly, a highly positive value and a highly negative value of X_{it} are equally likely to occur for household i, canceling each other. Therefore, no bias is expected with respect to the mean of parameter estimates for ζ_i or a_i from incorrectly assuming homogeneity in a_i.

Similarly, as long as X_{it} is defined in a way to exclude the variability due to household-specific income growth that is completely predicted by households, no bias for the mean of ζ_i and a_i is expected. In addition, if X_{it} and (a_i, b_i) are uncorrelated, a "random-effects" panel method can be applied also (Hsiao (1986), Chap.7).

This argument may allow us to incorporate the idea asserted by Ravallion and Chaudhuri (1997) that the village mean consumption change $\Delta\bar{c}_t$ in the right hand side of equation (13) should be replaced by village-year dummies d_t that approximate village level shocks.[4] Such a specification allows a complete separation of the aggregate risk from idiosyncratic income effects, with the latter being captured by X_{it}.

Estimating such a model directly is, however, not straightforward because unobserved individual effects (a_i) and unobserved time effects (d_t) enter in a multiplicative way, while they enter in an additive way in most of the panel methods available. The model is not identified with no further assumption.

Nevertheless, if no bias is expected with respect to the mean of parameter estimates for ζ_i and a_i from incorrectly assuming homogeneity, we might be able to estimate d_t under the

[4]Ravallion and Chaudhuri (1997) showed that this specification is preferable because specification (13) is likely to yield a downward bias in estimating ζ when there is a common aggregate component in income changes and the true value of ζ is not zero. See also Cochrane (1991) for other reasons why this specification might be more appropriate.

assumption of homogenous risk attitude (i.e., $a_i = 1$ for all i) in the first stage. Then using the estimates of $\hat{d}_t$ in place of $\Delta \bar{c}_t$, we can estimate a revised version of equation (13) in the second stage.

3.3 Empirically Testable Hypotheses

Through these estimations, we can expect to obtain insightful inference on the structure of time and risk preferences among sample households and the nature of consumption smoothing. If parameter b_i is positive (negative), such a household has time preference with a higher (lower) discount factor ρ_i than the village average. By testing whether $b_i = b$ for all i, we can investigate whether households have the same time preference.

Similarly, if parameter a_i is greater (smaller) than one, such a household bears more (less) of the common shock than the village average. By testing whether $a_i = a$ for all i, we can investigate the hypothesis of homogenous risk preferences. If it is rejected, we will proceed to the identification of those with higher risk attitudes.

Finally, if parameter ζ_i is positive, such a household is vulnerable to idiosyncratic income risk. A difference in magnitudes of ζ_i would show which households are more vulnerable.

In the next stage, we investigate whether parameters b_i, a_i, and ζ_i are related with households' social positions in a systematic way. By "social positions," we mean inherent characteristics of households that determine preferences toward consumption. However, one fundamental question is that most of the proxies for the social positions, such as wealth, education, and demographic structure are endogenous to household decisions in the long run. We partially reduce this problem by taking the initial values of these variables. Furthermore, we include in the empirical model a variable for caste ranking, which could be safely treated as exogenous. Nevertheless, the fundamental problem of endogeneity should be taken care of in interpreting the empirical results in the next section.

To undertake this investigation, we adopt two approaches. First, we estimate equation (13) through "BYID" method to obtain a set of parameter estimates $(\hat{b}_i, \hat{a}_i, \hat{\zeta}_i)$. Then we estimate correlation coefficients between them and households' initial characteristics Z_i. By testing the statistical significance of the coefficients, we can test homogeneity as well as infer the structure of risk and time preferences.

If we find particular household characteristics to be related with the estimates $(\hat{b}_i, \hat{a}_i, \hat{\zeta}_i)$ in the first approach, we may be able to replace household dummies in (13) by a function of those characteristics. This is the second approach in which we estimate an empirical model

$$\Delta c_{it} = (b_0 + Z_i b_1) + (a_0 + Z_i a_1)\Delta \bar{c}_t + (\zeta_0 + Z_i \zeta_1) X_{it} + u_{it}, \qquad i = 1, ..., N, \quad t = 1, ..., T. \quad (14)$$

Again, we can examine how risk and time preferences vary among households by testing the statistical significance of b_1, a_1, and ζ_1. Specification (14) has a much higher degree of freedom than equation (13), a great advantage considering the short time horizon of household panel data available from developing countries.

4 Application to ICRISAT Households in Village India

4.1 Data

In this section, the empirical model above is applied to the ICRISAT household data from rural India. Characteristics of the study villages and the sample households were fully described by Walker and Ryan (1990). The data set used in this paper is composed of household information spanning the ten-year period from 1975 to 1984, collected from three villages of Aurepalle (Andhra Pradesh), Shirapur, and Kanzara (Maharashtra), all of which belong to the semi-arid regions of Peninsular India. Forty households (ten each from farming categories of landless, small farms, medium farms, and large farms) were surveyed each year. Due to attrition and household division, the complete panel of ten years is composed of 35 households in Aurepalle, 33 in Shirapur, and 36 in Kanzara.

This data set has been used extensively to investigate consumption smoothing mechanisms (Townsend (1994); Ravallion and Chaudhuri (1997); Ligon (1998); Ligon et al. (1999); Kochar (1999); Jacoby and Skoufias (1998); Morduch (1991); etc. to name a few). Empirical results from these studies have shown that consumption of the sample households was insulated from fluctuations in individual income much better than initially expected but the hypothesis of efficient risk sharing was rejected in many cases. This paper re-investigates this issue with an extended model that allows heterogeneous preferences with respect to risk and time.

Definition and statistics of empirical variables are shown in Table 1. The consumption variable c_{it} in equation (13) is defined as the total household consumption expenditure in real Indian Rupees (1983 Rs.) divided by the total adult equivalent units of household members.[5]

[5] Adult equivalent units used in this section are: 1.0 for adult male, 0.9 for adult female, and 0.52 for children up to 12 years old.

It is called per-capita consumption for short below and used in estimating level (first difference) regressions derived from a CARA specification. Its natural log (first difference) is used in log regressions derived from a CRRA specification. The total consumption expenditure is defined in a way similar to Townsend (1994), based on "observed transactions." Ravallion and Chaudhuri (1997) criticized this measure since its measurement errors are likely to be correlated with those of income measures, suggesting an alternative measure based on "flow accounting." We leave for further study the sensitivity of our results to this alternative measure of consumption.

In estimating equation (13), the right hand side variable of village average consumption change (or village average log consumption change) is approximated by the average of all households except for the specific household under scrutiny (i.e., the average of thirty-nine neighbor households), to minimize the possibility of spurious correlation. X_{it} in equation (13), whose coefficient ζ_i represents excess sensitivity, is defined as $X_{it} \equiv y_{it} - y_{i,t-1}$ for the CARA case and $X_{it} \equiv \ln y_{it} - \ln y_{i,t-1}$ for the CRRA case, where y_{it} denotes the total household income in real Rs. divided by the total adult equivalent units of household members. The total income is a sum of crop income, labor income, and profits from other self-employed activities.

The maximum estimation period is ten years from 1975 to 1984. The quality of some data for the first year and the last three years may not be as high as that for other years.[6] However, if the six-year panel from 1976 to 1981 is used, the degree of freedom becomes too low when b_i, a_i, and ζ_i are specific to each household. Therefore, the longest panel available is used in estimating equation (13). Then the sensitivity of our results to the choice of sample period is examined in estimating equation (14), in which the problem of the degree of freedom is less acute.

4.2 Estimation Results from "BYID" Regressions

First, equation (13) is estimated for each household as a time series regression by the OLS. Summary results for b_i, a_i, and ζ_i are shown in Table 2 (see Appendix Table 1 for details). Most of b_i are insignificant, a result inconsistent with intertemporal redistribution according

[6] Production input data were not collected as frequently in 1984 as in previous years, while consumption data were not collected as in detail in 1975 and 1982-84 as in other years (Walker and Ryan (1990), p.67). In this paper, consumption data for these years were adjusted proportionally using the village average ratio of non-covered items in the period 1976-81.

to differences in time preference. Both the CARA specification (level-change regressions) and the CRRA specification (log-change regressions) reject the null hypothesis that $b_i = 0$ at 5% level only in two percent of the sample.

In contrast, the null hypothesis that $a_i = 1$ and the null that $\zeta_i = 0$ are rejected more frequently. The former is rejected at 5% level in 16% (CARA specification) and in 11% (CRRA) of the total households. The rejection rates were higher in village Shirapur. The null hypothesis that $\zeta_i = 0$ is rejected at 5% level in 18% of the total households in both specifications. The rejection rates were lower in village Kanzara.

Second, the joint significance of heterogeneous b_i, a_i, and ζ_i is tested, using panel methods. The plain OLS estimation (so-called "total" estimators in panel methods) corresponds to a restriction that $b_i = b$, $a_i = a$, and $\zeta_i = \zeta$ for all i. The fixed or random effects estimation corresponds to a restriction that $a_i = a$ and $\zeta_i = \zeta$ for all i. Results from the three restricted versions are reported in "B," "C," and "D" in Appendix Table 1. F test for Model B against Model A, i.e., a joint significance test for heterogeneous households, accepts the homogenous assumption in Aurepalle and Kanzara but rejects it in Shirapur. However, the failure to reject in Aurepalle and Kanzara is mostly due to the insignificance of intercept household effects. F test for Model C against Model A, i.e., a joint significance test for heterogeneous a_i and ζ_i, rejects the homogenous assumption in Aurepalle (CRRA) and Kanzara (CARA) in addition to Shirapur (both CARA and CRRA).

Therefore, some evidence has been found for the heterogeneity among households in their sensitivity to common and idiosyncratic shocks. In contrast, little evidence has been found in favor of intertemporal resource allocation.

Before proceeding to the investigation of risk and time preference structure, we need to show that a relation $a_i + \zeta_i = 1$ does not exist. If this relation holds, it might be better to interpret parameter a_i in equation (13) as the fraction of innovations to households' permanent income that is pooled in the risk sharing arrangement (Crucini (1999)). However, sample correlation coefficients between $\hat{a}_i$ and $\hat{\zeta}_i$ calculated from Appendix Table 1 are all statistically non-significant.[7] Therefore, it could be safe to interpret the distribution of a_i independent of that of ζ_i in the following subsections.

[7] Sample correlation coefficients were as follows and not statistically significant even at 10% level. Three villages pooled = -0.061 (CARA), -0.055 (CRRA); Aurepalle = 0.118 (CARA), 0.192 (CRRA); Shirapur = -0.196 (CARA), -0.209 (CRRA); Kanzara = 0.011 (CARA), -0.098 (CRRA).

4.3 Relationship between "BYID" Estimates and Households' Social Positions

Are parameter estimates for b_i, a_i, and ζ_i from equation (13) structurally related with households' social positions? Five variables that represent households' initial characteristics are used for Z_i: a dummy variable for ownership of agricultural land in 1975 (LANDD), its value per capita (LANDPC), education status of the household head (SCHOOL), demographic characteristics approximated by the share of children in household size (CHILDR), and caste rank (JGRRANK) (see Table 1). The marginal effect of land for owners is represented by LANDPC and its threshold effect for a landless to become a landed household is represented by LANDD. As discussed in the previous section, all these variables except JGRRANK are endogenous to household decisions in the long run. Therefore, we cannot interpret the relation as the one showing any causality.

Another practical issue is that the land variables (LANDD and LANDPC), SCHOOL, and CASTE are highly correlated. In rural India, land ownership, education, and high caste ranking are all a typical signal for a high social position. On the other hand, the demographic variable could represent other aspects that directly affect households' preferences. From our data set, correlation coefficients between LANDPC and other four variables are: LANDD= 0.418 ***, CHILDR=0.0531, JGRRANK=-0.503 ***, and SCHOOL=0.588 *** (all three villages pooled), where *** shows that the coefficient is statistically significant at 1%. Therefore, although LANDD, LANDPC, SCHOOL, and CASTE may capture different aspects of household characteristics, we do not attempt multiple regressions but instead report bivariate correlation coefficients between each of the "BYID" estimates $\hat{b}_i$, $\hat{a}_i$, and $\hat{\zeta}_i$, and one of the shifters in Z_i. Table 3 shows that $\hat{a}_i$ is most significantly related with these variables, followed by the idiosyncratic sensitivity parameter $\hat{\zeta}_i$. The relation is almost nil for the time preference parameter $\hat{b}_i$.

Among the household characteristics, land ownership per capita (LANDPC) is most strongly associated with $\hat{a}_i$ with positive coefficients. This is consistent with the risk sharing interpretation that more landed households tend to bear more of the common risk. Land variables are related with $\hat{\zeta}_i$ negatively as is found by Townsend (1994) but they are significant only in Shirapur, CRRA model. Lower caste households (higher JGRRANK) tend to respond less to common risk (lower $\hat{a}_i$) but more to idiosyncratic risk (higher $\hat{\zeta}_i$). Demographic character does not seem to be related with $\hat{a}_i$ and $\hat{\zeta}_i$ but its relationship with $\hat{b}_i$ is as expected. In several cases, households with more children (higher CHILDR) enjoyed increased consumption in later years (higher $\hat{b_i}$) after controlling for innovations in their individual income.

4.4 Estimation Results with Structural Preference Shifters

Although the patterns found above are consistent with our expectations, the significance levels of correlation coefficients are not high and show a wide difference across villages. Therefore, equation (14) with structural shifters is estimated to investigate whether all these parameters become significantly heterogeneous among households with more degrees of freedom. In Table 4, estimation results are reported in detail when the three villages are pooled, followed by Table 5 in which summary results are reported when the model is estimated separately for each village (see Appendix Table 2 for details).

These results show that, first, none of these shifters are significant in affecting b_i. Since we found only a weak and patchy evidence of demographic variables' relation with $\hat{b_i}$ in Table 3, we conclude that no strong evidence is found in support of the intertemporal redistribution according to differences in time preferences within each village.

Second, land variables significantly increases a_i and significantly decreases ζ_i in many cases. Therefore, Townsend's (1994) claim that landless households are more risk averse and more vulnerable to income shocks has been verified in our results also. He, however, showed this result by estimating sub-samples of landless and landed class separately, without formally testing the statistical significance of the difference. Our results are based on formal tests and show further that, among the landed class, more landholding (i.e., higher LANDPC) implies less risk aversion and more insulation from income shocks.

Third, although education, land variables, and caste are correlated, their effects are not the same. For example, in Shirapur, SCHOOL has the opposite sign of LANDD in shifting parameter ζ_i. The significance of the relationship for land variables varies substantially from village to village. The same is true for the significance for caste ranking. Correlation among landholding, education, and caste ranking exists but not to the extent that the three can be regarded as equivalent.[8]

[8]However, regression results did not improve much when we included *several* of these shifters *simultaneously*. Inclusion of two or more of the four variables of LANDD, LANDPC, SCHOOL, and JGRRANK yielded very unstable results due to multicollinearity. On the other hand, when we included CHIDLR and one of the other four variables together, the results were simply the combination of those reported in Table 5. For example, in the CRRA regression for Shirapur with two shifters of LANDPC and CHILDR simultaneously included, the effect of LANDPC was "+++" on a_i, that of CHILDR was "- - -" on ζ_i, and the homogeneity

Fourth, village-by-village estimation results (Table 5) show an interesting contrast regarding the non-significant variables among the four correlated shifters of LANDD, LANDPC, SCHOOL, and JGRRANK. In Shirapur, caste effects are nil. In Kanzara, land effects and education effects are nil. These patterns seem consistent with the contrast among the villages with respect to social and economic infrastructure. In Aurepalle, where both land and caste variables are important determinants of consumption smoothing, cooperative credit schemes were less active, private moneylending was more important, and caste restriction was observed in the strongest way (Walker and Ryan (1990), pp.27-28, pp.199-200). Education was most widely spread in Kanzara and most unequally diffused in Aurepalle (Walker and Ryan (1990), p.29).

4.5 Robustness of the Results

We investigate the robustness of the estimation results above in two ways. First, borrowing the idea of Ravallion and Chaudhuri (1997) discussed in the previous section, we attempt a two stage estimation of equation (13) with $\Delta\bar{c}_t$ replaced by $\hat{d}_t$, to assess the robustness of our results to the specific choice of common shock measures.

Summary results are reported in Table 6, which is compiled from detailed information in Appendix Table 3. The first stage estimation results (not shown) indicate that household consumption was sensitive to idiosyncratic income shocks except for Aurepalle, CARA, but the absolute value of $\hat{\zeta}$ is small, confirming the results from the earlier studies (Townsend (1994); Morduch (1991)). As Ravallion and Chaudhuri (1997) demonstrated, the absolute value of $\hat{\zeta}$ becomes larger but only slightly in our case. The second stage estimation results are remarkably similar to those described already — the most significant shifters of household risk preferences and vulnerability to risk are land related variables (LANDD and LANDPC). In several cases, the significance level is enhanced but qualitatively the results remain the same.

Second, equation (14) is re-estimated for a shorter period of 1976-81, for which data are the most reliable. Summary results from this exercise are reported in Table 7, which is compiled from detailed information in Appendix Table 4. The overall pattern is similar, yielding qualitatively the same findings. The relationship between land related variables and parameters a_i and ζ_i is now more significant, reinforcing the previous results. Even in

test with F(6,288) statistics rejected the null at 1%. In both cases, the results are not worth reporting.

Kanzara, more landed households are found to have higher a_i although the significance level is not high. In contrast, the effects of CHILDR are now less significant. Since Table 5 shows conflicting signs of the effects of CHILDR on ζ_i, the results in Table 7 seem to be more reasonable.

5 Summary and Discussion

In this paper, a model of full-information intra-village risk sharing is extended to the case where participating households have different risk and time preferences. The resulting rule of risk allocation is characterized through the decomposition of individual consumption into fixed and variable parts. The degree of bearing common risk should decrease with households' risk aversion relative to other households in the village economy, a result analogous to what the sharecropping literature predicts. Those households with stronger preferences for immediate consumption should be allocated a higher consumption in earlier periods as a fixed part. An empirical implication of the allocation rule found in this paper is that, even when first difference variables are used in testing the full insurance hypothesis, household specific effects remain as intercept dummies under the assumption of heterogeneous time preferences and as household slope dummies under the assumption of heterogeneous risk preferences.

As an illustrative application, the empirical models proposed in this paper are applied to the ICRISAT household panel data from rural India. Since the empirical model applied in this paper generalizes Townsend's (1994) framework, it is not surprising that our major findings regarding the extent of households' vulnerability to idiosyncratic shock and who are more vulnerable are similar to his findings. What is more important is that this paper shows that allowing heterogeneity improves the explanatory power of the model in a statistically significant way. Statistical tests based on BYID regressions are found to reject the homogeneity assumption in every village at least one version of the model. Regression results with structural shifters show that land or caste characteristics are significantly related with model parameters. Especially, estimation results strongly support the heterogeneity of risk preferences and their distribution is consistent with households' social positions in the village.

In contrast, only a weak evidence is found in favor of the hypothesis that consumption is reallocated among households intertemporally according to differences in time preferences. This finding seems to contradict experimental results from Pender (1996), who found significant heterogeneity in discount rates among households from semi-arid Indian villages including Aurepalle, which is also covered in this paper. Since what he elicited is discount rates, which are affected both by pure time preference and by the curvature of utility functions, heterogeneity in discount rates and homogeneity in pure time preference could co-exist in theory. Furthermore, Pender (1996) implemented his experiments in 1989, implying a time lag from the period covered in this paper, which could be a reason for the difference.

However, as Pender (1996) vividly demonstrated, credit markets in the study area are highly incomplete. Given such an environment, our results might suggest that the existing risk sharing mechanisms are not effective in smoothing consumption intertemporally over the long run, even they are able to achieve some inter-state consumption smoothing over the short run, reflected in the lower value of the excess sensitivity parameter of individual consumption to idiosyncratic income shocks. Since the intertemporal resource allocation according to differences in time preferences is very long-run by nature, its enforcement might face more difficulty. It is possible that, because of this shortcoming of risk sharing mechanisms, heterogeneity in time preferences were not reflected in the actual allocation of consumption we observed. If this is the case, more myopic households with an investment opportunity that yields higher return after a long gestation period such as education (see Jacoby and Skoufias (1997)) cannot utilize the opportunity because they want to consume more today.

This possibility leads us to compare our results with recent literature of risk sharing with limited information (Ligon (1998)) and limited commitment (Ligon et al. (1999)). Both of these important studies generalized Townsend's model in ways different from this paper. Both of them applied their theoretical models to the ICRISAT data to show that their models explain the data better. However, since the directions of generalization differ completely, these studies and the current paper are complementary. This applies especially to the limited commitment model of Ligon et al. (1999). Ligon et al. (1999) showed a different mechanism in which household characteristics are related with consumption response to aggregate and idiosyncratic income shocks. In their framework, if a household is hit by an extremely positive income shock, it should be provided a reasonably large consumption in that time to avoid reneging the contract. Therefore, consumption responds to idiosyncratic components more closely in such cases. Since this paper does not offer theoretical explanations regarding the sensitivity to idiosyncratic shocks, incorporating the idea of limited commitment could be a fruitful extension.

Depending on the assumptions made, the limited commitment theory could predict that consumption response to idiosyncratic component is higher for large farmers than small farmers, which is the opposite of what is found in this paper. To theoretically justify the findings of this paper that consumption of households with larger assets responds less to idiosyncratic shocks and responds more to aggregate shock, explicit incorporation of liquidity constraints into our model might be necessary, such as the one modeled by Deaton (1990). These theoretical extensions are left for further research.

It is left for future research also to investigate the robustness of our empirical results and to relate them to detailed, actual functionings of rural credit and insurance institutions. This paper shows that, by allowing heterogeneous consumption smoothing parameters and by combining estimation results with information on household characteristics, rich insight can be obtained. It is worthwhile to apply the extended model in this paper to recent panel data sets from developing countries, some of which are with longer time horizon and well controlled quality (Udry (1997); Grosh and Glewwe (1998)).

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Table 1: Definition and Summary Statistics of Empirical Variables

		mean	std.dev.	minimum	maximum
c_{it}	Real household consumption per capita = household consumption expenditure in real Indian Rupees (1983 Rs.) divided by the total adult equivalent units of household members	1109.1	563.7	112.4	5384.2
y_{it}	Real household income per capita = total household income (a sum of crop income, labor income, and profits from other self-employed activities) in real Rs. divided by the total adult equivalent units of household members	1498.6	1267.4	2.4	10098.8
Z_i	A vector of variables that approximate households' social positions, including:				
LANDD	A dummy variable for ownership of agricultural land in 1975	0.788	0.410	0	1
LANDPC	The value of owned agricultural land in 1975 per capita (10,000 Rs.)	0.339	0.422	0	1.857
CHILDR	The share of children in household size using adult equivalents in 1975	0.289	0.147	0	0.622
SCHOOL	Education status of the household head in years of complete education	2.519	3.312	0	12
JGRRANK	Caste rank index compiled by J. G. Ryan with 1 for the socially highest castes and 4 for the lowest ones	2.356	1.173	1	4

Note: The number of observations (NOB) is 1040 (=104 households x 10 years) for c_{it} and y_{it}, and 104 for Z_i.

Table 2: Summary of Estimation Results of Time Series Estimation for Each Household

CARA Models

	Distribution of coefficient estimates for b_i				Rejection ratio for $H_0 : b_i = 0$	
Village	mean	std.dev.	minimum	maximum	@10%	@5%
Total	-7.4	87.9	-396.3	301.3	2.9%	1.9%
Aurepalle	-8.1	118.9	-396.3	301.3	5.7%	2.9%
Shirapur	0.2	72.1	-196.9	163.7	0.0%	0.0%
Kanzara	-13.7	61.0	-112.3	149.7	2.8%	2.8%

	Distribution of coefficient estimates for a_i				Rejection ratio for $H_0 : a_i = 1$	
Village	mean	std.dev.	minimum	maximum	@10%	@5%
Total	0.735	1.238	-2.544	4.173	23.1%	16.3%
Aurepalle	0.900	1.000	-0.526	3.484	22.9%	14.3%
Shirapur	0.413	1.385	-2.544	3.222	27.3%	21.2%
Kanzara	0.870	1.246	-1.981	4.173	19.4%	13.9%

	Distribution of coefficient estimates for ζ_i				Rejection ratio for $H_0 : \zeta_i = 0$	
Village	mean	std.dev.	minimum	maximum	@10%	@5%
Total	0.203	0.448	-1.050	1.344	24.0%	18.3%
Aurepalle	0.169	0.459	-0.932	1.287	22.9%	22.9%
Shirapur	0.313	0.440	-0.488	1.149	30.3%	18.2%
Kanzara	0.134	0.424	-1.050	1.344	19.4%	13.9%

CRRA Models

	Distribution of coefficient estimates for b_i				Rejection ratio for $H_0 : b_i = 0$	
Village	mean	std.dev.	minimum	maximum	@10%	@5%
Total	-0.013	0.078	-0.325	0.196	1.9%	1.9%
Aurepalle	-0.030	0.110	-0.325	0.196	2.9%	2.9%
Shirapur	0.001	0.058	-0.184	0.111	0.0%	0.0%
Kanzara	-0.008	0.049	-0.139	0.083	2.8%	2.8%

	Distribution of coefficient estimates for a_i				Rejection ratio for $H_0 : a_i = 1$	
Village	mean	std.dev.	minimum	maximum	@10%	@5%
Total	0.558	0.802	-1.258	2.609	18.3%	10.6%
Aurepalle	0.942	0.801	-0.318	2.609	8.6%	2.9%
Shirapur	0.196	0.686	-1.258	1.500	36.4%	24.2%
Kanzara	0.517	0.733	-0.947	2.083	11.1%	5.6%

	Distribution of coefficient estimates for ζ_i				Rejection ratio for $H_0 : \zeta_i = 0$	
Village	mean	std.dev.	minimum	maximum	@10%	@5%
Total	0.233	0.439	-0.906	1.607	28.8%	18.3%
Aurepalle	0.213	0.433	-0.906	1.607	31.4%	20.0%
Shirapur	0.314	0.434	-0.491	1.172	42.4%	27.3%
Kanzara	0.178	0.438	-0.851	0.941	13.9%	8.3%

Notes: 1) Compiled from Appendix Table 1.

2) The estimated equation is (13).

Table 3: Bivariate Correlation Coefficients between Parameter Estimates and Household Characteristics

All three villages pooled (NOB=104), CARA model

	LANDD	LANDPC	CHILDR	JGRRANK	SCHOOL
$\hat{b}_i$	-0.018	-0.058	0.153	0.065	-0.010
$\hat{a}_i$	0.118	0.182 *	-0.072	-0.128	0.093
$\hat{\zeta}_i$	0.021	-0.049	0.032	0.086	-0.067

All three villages pooled (NOB=104), CRRA model

	LANDD	LANDPC	CHILDR	JGRRANK	SCHOOL
$\hat{b}_i$	0.009	-0.057	0.181 *	0.065	0.034
$\hat{a}_i$	0.099	0.216 **	-0.037	-0.106	0.079
$\hat{\zeta}_i$	-0.056	-0.104	0.078	0.126	-0.048

Aurepalle (NOB=35), CARA model

	LANDD	LANDPC	CHILDR	JGRRANK	SCHOOL
$\hat{b}_i$	-0.007	-0.147	-0.016	0.160	-0.160
$\hat{a}_i$	0.194	0.314 *	-0.237	-0.345 **	0.162
$\hat{\zeta}_i$	0.124	-0.198	0.076	0.097	-0.187

Aurepalle (NOB=35), CRRA model

	LANDD	LANDPC	CHILDR	JGRRANK	SCHOOL
$\hat{b}_i$	0.041	-0.161	0.122	0.201	-0.104
$\hat{a}_i$	0.093	0.337 **	-0.197	-0.351 **	0.111
$\hat{\zeta}_i$	0.051	-0.275	0.121	0.206	-0.320 *

Shirapur (NOB=33), CARA model

	LANDD	LANDPC	CHILDR	JGRRANK	SCHOOL
$\hat{b}_i$	0.083	0.063	0.321 *	-0.076	-0.021
$\hat{a}_i$	0.158	0.197	0.004	-0.060	-0.006
$\hat{\zeta}_i$	-0.257	0.005	0.142	0.356 **	-0.107

Shirapur (NOB=33), CRRA model

	LANDD	LANDPC	CHILDR	JGRRANK	SCHOOL
$\hat{b}_i$	-0.052	-0.030	0.213	0.006	-0.063
$\hat{a}_i$	0.383 **	0.429 **	0.164	-0.243	0.084
$\hat{\zeta}_i$	-0.383 **	-0.013	0.109	0.361 **	-0.072

Kanzara (NOB=36), CARA model

	LANDD	LANDPC	CHILDR	JGRRANK	SCHOOL
$\hat{b}_i$	-0.152	-0.026	0.287 *	0.095	0.221
$\hat{a}_i$	0.020	0.112	-0.036	-0.167	0.110
$\hat{\zeta}_i$	0.197	0.043	-0.099	-0.106	0.093

Kanzara (NOB=36), CRRA model

	LANDD	LANDPC	CHILDR	JGRRANK	SCHOOL
$\hat{b}_i$	-0.054	0.006	0.324 *	0.075	0.240
$\hat{a}_i$	-0.066	0.119	-0.047	-0.085	0.166
$\hat{\zeta}_i$	0.155	-0.031	0.020	-0.123	0.178

Note: Significant at 1% = ***, 5% = **, and 10% = *.

Table 4: Estimation Results with Household Structural Shifters

All three villages pooled (NOB=936), CARA model

	LANDD		LANDPC		CHILDR		SCHOOL		JGRRANK	
b_0	-11.16		-5.92		-27.21		-6.05		-18.32	
	(0.30)		(0.27)		(0.72)		(0.28)		(0.47)	
b_1	6.48		-2.99		73.42		0.17		5.16	
	(0.15)		(0.07)		(0.63)		(0.03)		(0.35)	
a_0	0.498	**	0.589	***	0.928	***	0.692	**	1.098	***
	(0.88)		(4.61)		(4.10)		(5.49)		(4.72)	
a_1	0.269		0.552	**	-0.562		0.030		-0.137	
	(1.10)		(2.25)		(0.80)		(0.96)		(1.60)	
ζ_0	0.236	**	0.151	***	0.079	*	0.119	*	0.091	**
	(2.09)		(4.20)		(1.90)		(3.58)		(2.08)	
ζ_1	-0.136		-0.081	*	0.105		-0.003		0.008	
	(1.18)		(1.72)		(0.73)		(0.53)		(0.38)	
R^2	0.087		0.091		0.086		0.085		0.087	
$\bar{R}^2$	0.082		0.087		0.081		0.081		0.082	
Homog. test	0.795		2.423	*	0.473		0.373		0.886	

All three villages pooled (NOB=936), CRRA model

	LANDD		LANDPC		CHILDR		SCHOOL		JGRRANK	
b_0	-0.021		-0.011		-0.041		-0.012		-0.020	
	(0.76)		(0.66)		(1.46)		(0.77)		(0.72)	
b_1	0.011		-0.007		0.103		0.000		0.004	
	(0.36)		(0.23)		(1.20)		(0.08)		(0.33)	
a_0	0.417	***	0.392	***	0.578	***	0.483	***	0.672	***
	(2.73)		(4.34)		(3.60)		(5.48)		(4.30)	
a_1	0.170		0.534	***	-0.055		0.032		-0.052	
	(0.99)		(3.02)		(0.11)		(1.39)		(0.88)	
ζ_0	0.308	***	0.188	***	0.115	***	0.178	***	-0.009	
	(4.46)		(6.46)		(2.84)		(6.27)		(0.25)	
ζ_1	-0.229	***	-0.217	***	-0.079		-0.026	***	0.056	***
	(3.20)		(4.14)		(0.59)		(3.79)		(3.45)	
R^2	0.110		0.121		0.101		0.114		0.111	
$\bar{R}^2$	0.105		0.116		0.097		0.109		0.107	
Homog. test	3.499	**	7.473	***	0.604		4.965	***	4.054	***

Notes: 1) "Homog. test" gives $F(3,\ 930)$ statistics for testing the joint hypothesis that $b_1 = a_1 = \zeta_1 = 0$.

2) Significant at 1% = ***, 5% = **, and 10% = * (2-sided test for t statistics whose absolute value is shown in parenthesis).

3) The estimated equation is (14).

Table 5: Summary Estimation Results with Household Structural Shifters

	LANDD	LANDPC	CHILDR	SCHOOL	JGRRANK
Three villages pooled (NOB=936), CARA model					
b_1	n.s.	n.s.	n.s.	n.s.	n.s.
a_1	n.s.	++	n.s.	n.s.	n.s.
ζ_1	n.s.	-	n.s.	n.s.	n.s.
Homogeneity test	n.s.	*	n.s.	n.s.	n.s.
Three villages pooled (NOB=936), CRRA model					
b_1	n.s.	n.s.	n.s.	n.s.	n.s.
a_1	n.s.	+++	n.s.	n.s.	n.s.
ζ_1	- - -	- - -	n.s.	- - -	+++
Homogeneity test	**	***	n.s.	***	***
Aurepalle (NOB=315), CARA model					
b_1	n.s.	n.s.	n.s.	n.s.	n.s.
a_1	n.s.	n.s.	n.s.	n.s.	n.s.
ζ_1	n.s.	- -	n.s.	- -	+
Homogeneity test	n.s.	*	n.s.	n.s.	n.s.
Aurepalle (NOB=315), CRRA model					
b_1	n.s.	n.s.	n.s.	n.s.	n.s.
a_1	n.s.	++	n.s.	n.s.	-
ζ_1	-	- - -	+++	- - -	+++
Homogeneity test	n.s.	***	**	***	***
Shirapur (NOB=297), CARA model					
b_1	n.s.	n.s.	n.s.	n.s.	n.s.
a_1	n.s.	n.s.	n.s.	n.s.	n.s.
ζ_1	- -	n.s.	n.s.	+++	n.s.
Homogeneity test	n.s.	n.s.	n.s.	*	n.s.
Shirapur (NOB=297), CRRA model					
b_1	n.s.	n.s.	n.s.	n.s.	n.s.
a_1	++	+++	n.s.	n.s.	n.s.
ζ_1	- - -	n.s.	- - -	n.s.	n.s.
Homogeneity test	***	*	***	n.s.	n.s.
Kanzara (NOB=324), CARA model					
b_1	n.s.	n.s.	n.s.	n.s.	n.s.
a_1	n.s.	n.s.	n.s.	n.s.	-
ζ_1	n.s.	n.s.	++	n.s.	-
Homogeneity test	n.s.	n.s.	n.s.	n.s.	*
Kanzara (NOB=324), CRRA model					
b_1	n.s.	n.s.	n.s.	n.s.	n.s.
a_1	n.s.	n.s.	n.s.	n.s.	n.s.
ζ_1	n.s.	n.s.	n.s.	n.s.	n.s.
Homogeneity test	n.s.	n.s.	n.s.	n.s.	n.s.

Notes: 1) "n.s."=statistically non-significant; "+++" significant at 1% with positive coefficient; "++" at 5%, "+" at 10%; and "- - -" significant at 1% with negative coefficient; "- -" at 5%, "-" at 10%. Significant at 1% = ***, 5% = **, and 10% = * (F test). 2) Compiled from Appendix Table 2.

Table 6: Summary Estimation Results with Alternative Common Shock Measures

Three villages pooled (NOB=936), CARA model					
	LANDD	LANDPC	CHILDR	SCHOOL	JGRRANK
b_1	n.s.	n.s.	n.s.	n.s.	n.s.
a_1	++	+++	n.s.	+	- - -
ζ_1	n.s.	-	n.s.	n.s.	n.s.
Homogeneity test	n.s.	***	n.s.	n.s.	**
Three villages pooled (NOB=936), CRRA model					
	LANDD	LANDPC	CHILDR	SCHOOL	JGRRANK
b_1	n.s.	n.s.	n.s.	n.s.	n.s.
a_1	n.s.	++	n.s.	n.s.	- -
ζ_1	- - -	- - -	n.s.	- - -	+++
Homogeneity test	***	***	n.s.	***	***
Aurepalle (NOB=315), CARA model					
	LANDD	LANDPC	CHILDR	SCHOOL	JGRRANK
b_1	n.s.	n.s.	n.s.	n.s.	n.s.
a_1	+	+++	-	+	- - -
ζ_1	n.s.	- -	n.s.	- -	+
Homogeneity test	n.s.	***	n.s.	**	**
Aurepalle (NOB=315), CRRA model					
	LANDD	LANDPC	CHILDR	SCHOOL	JGRRANK
b_1	n.s.	n.s.	n.s.	n.s.	n.s.
a_1	n.s.	++	- -	n.s.	-
ζ_1	n.s.	- - -	+++	- - -	+++
Homogeneity test	n.s.	***	***	***	***
Shirapur (NOB=297), CARA model					
	LANDD	LANDPC	CHILDR	SCHOOL	JGRRANK
b_1	n.s.	n.s.	n.s.	n.s.	n.s.
a_1	n.s.	n.s.	n.s.	n.s.	n.s.
ζ_1	-	n.s.	n.s.	+++	n.s.
Homogeneity test	n.s.	n.s.	n.s.	*	n.s.
Shirapur (NOB=297), CRRA model					
	LANDD	LANDPC	CHILDR	SCHOOL	JGRRANK
b_1	n.s.	n.s.	n.s.	n.s.	n.s.
a_1	+	++	n.s.	n.s.	n.s.
ζ_1	- - -	n.s.	- - -	n.s.	n.s.
Homogeneity test	***	n.s.	**	n.s.	n.s.
Kanzara (NOB=324), CARA model					
	LANDD	LANDPC	CHILDR	SCHOOL	JGRRANK
b_1	n.s.	n.s.	n.s.	n.s.	n.s.
a_1	n.s.	n.s.	n.s.	n.s.	- -
ζ_1	n.s.	n.s.	+	n.s.	-
Homogeneity test	n.s.	n.s.	n.s.	n.s.	**
Kanzara (NOB=324), CRRA model					
	LANDD	LANDPC	CHILDR	SCHOOL	JGRRANK
b_1	n.s.	n.s.	n.s.	n.s.	n.s.
a_1	n.s.	n.s.	n.s.	n.s.	n.s.
ζ_1	n.s.	n.s.	n.s.	n.s.	n.s.
Homogeneity test	n.s.	n.s.	n.s.	n.s.	n.s.

Notes: 1) See Table 5.

2) Compiled from Appendix Table 3.

Table 7: Summary Estimation Results with Household Structural Shifters, 1976-81

	LANDD	LANDPC	CHILDR	SCHOOL	JGRRANK
Three villages pooled (NOB=520), CARA model					
b_1	n.s.	n.s.	n.s.	n.s.	n.s.
a_1	+++	+++	n.s.	+	-
ζ_1	n.s.	n.s.	n.s.	n.s.	n.s.
Homogeneity test	**	***	n.s.	n.s.	n.s.
Three villages pooled (NOB=520), CRRA model					
b_1	n.s.	n.s.	n.s.	n.s.	n.s.
a_1	++	+++	n.s.	+	n.s.
ζ_1	- - -	- - -	n.s.	- - -	+++
Homogeneity test	***	***	n.s.	***	***
Aurepalle (NOB=175), CARA model					
b_1	n.s.	n.s.	n.s.	n.s.	n.s.
a_1	n.s.	+++	n.s.	++	- -
ζ_1	-	- - -	n.s.	- - -	++
Homogeneity test	n.s.	***	n.s.	**	***
Aurepalle (NOB=175), CRRA model					
b_1	n.s.	-	n.s.	n.s.	n.s.
a_1	n.s.	+++	n.s.	+	- - -
ζ_1	- - -	- - -	n.s.	- - -	+++
Homogeneity test	**	***	n.s.	***	***
Shirapur (NOB=165), CARA model					
b_1	n.s.	n.s.	n.s.	n.s.	n.s.
a_1	+++	+++	+	+	n.s.
ζ_1	n.s.	++	n.s.	++	n.s.
Homogeneity test	**	***	n.s.	*	n.s.
Shirapur (NOB=165), CRRA model					
b_1	n.s.	n.s.	n.s.	n.s.	n.s.
a_1	+++	+++	+	n.s.	n.s.
ζ_1	-	n.s.	-	- -	n.s.
Homogeneity test	***	***	*	n.s.	n.s.
Kanzara (NOB=180), CARA model					
b_1	n.s.	n.s.	n.s.	n.s.	n.s.
a_1	n.s.	+	n.s.	n.s.	n.s.
ζ_1	n.s.	n.s.	n.s.	n.s.	n.s.
Homogeneity test	n.s.	n.s.	n.s.	n.s.	n.s.
Kanzara (NOB=180), CRRA model					
b_1	n.s.	n.s.	n.s.	n.s.	n.s.
a_1	n.s.	++	n.s.	n.s.	n.s.
ζ_1	n.s.	n.s.	n.s.	n.s.	n.s.
Homogeneity test	n.s.	n.s.	n.s.	n.s.	n.s.

Notes: 1) See Table 5.

2) Compiled from Appendix Table 4.

Appendix Table 1: Estimation Results of Extended Townsend Model
Village=Aurepalle, Model=CARA

	b_i		a_i		ζ_i	
A. Time series estimation for each household ("BYID" estimation)						
HID						
101	29.79	(0.35)	0.244	(0.57)	0.089	(0.19)
102	-219.04	(4.68)	1.330	(5.36)	0.445	(6.00)
103	-81.21	(1.20)	0.979	(2.30)	0.453	(1.50)
105	79.76	(0.35)	0.671	(0.58)	-0.932	(1.08)
107	-0.37	(0.01)	0.483	(1.66)	0.713	(3.28)
108	11.38	(0.12)	-0.069	(0.14)	0.489	(1.04)
109	46.30	(1.67)	0.587	(4.15)	-0.021	(0.19)
110	-2.60	(0.10)	0.281	(2.20)	0.048	(0.53)
130	-2.93	(0.05)	0.943	(3.01)	0.016	(0.17)
131	17.94	(0.19)	0.927	(1.91)	0.361	(2.72)
132	118.51	(0.90)	0.909	(1.18)	1.287	(2.73)
133	-2.17	(0.02)	0.469	(0.90)	0.170	(0.68)
134	40.14	(0.57)	-0.063	(0.18)	0.087	(0.20)
135	76.05	(1.85)	0.622	(3.13)	-0.629	(2.74)
136	154.62	(1.07)	0.397	(0.40)	0.352	(0.75)
137	27.74	(0.83)	0.372	(2.13)	0.107	(0.56)
138	-17.66	(0.24)	0.431	(1.21)	0.962	(1.72)
140	-103.85	(0.85)	0.149	(0.24)	-0.047	(0.23)
141	-396.26	(1.95)	3.484	(3.09)	0.715	(2.73)
143	-65.86	(0.64)	1.142	(2.11)	0.190	(0.87)
144	-114.35	(0.96)	1.453	(2.34)	0.179	(0.95)
145	-39.33	(0.21)	1.630	(1.61)	-0.048	(0.31)
146	88.61	(1.79)	-0.306	(1.24)	-0.889	(5.35)
148	-86.23	(1.19)	0.386	(1.10)	0.336	(1.73)
149	-91.49	(0.69)	1.021	(1.52)	1.212	(2.84)
150	-196.28	(0.90)	3.240	(2.59)	0.148	(0.66)
151	301.31	(0.78)	2.660	(1.15)	-0.124	(0.30)
152	3.42	(0.01)	2.943	(1.18)	-0.124	(0.70)
153	194.25	(0.38)	1.051	(0.36)	-0.014	(0.02)
154	31.66	(0.16)	-0.223	(0.22)	0.143	(0.67)
155	-68.69	(0.42)	1.055	(1.29)	0.068	(0.29)
156	-9.86	(0.01)	-0.526	(0.12)	-0.072	(0.19)
157	2.85	(0.03)	0.340	(0.78)	0.052	(0.54)
158	-42.28	(0.11)	2.710	(1.14)	0.119	(0.45)
159	31.34	(0.30)	-0.212	(0.40)	0.087	(0.83)
B. Plain OLS	-0.29	(0.01)	0.800	(4.36)	0.041	(0.99)
C. Fixed Effects	(omitted)		0.809	(4.23)	0.039	(0.91)
D. Random Eff.	-0.31	(0.01)	0.802	(4.46)	0.040	(1.00)
F test for Model B against Model A: F(102,210)=			0.501	P-value=	[.9999]	
F test for Model C against Model A: F(68,210)=			0.630	P-value=	[.9864]	
Hausman test of H_0:RE vs. FE: Chisq(2)=			0.017	P-value=	[.9917]	

Notes: 1) See Leamer (1978, p.114) for the critical F values for diffuse prior.
2) NOB is 9 (= 1 household x 9 year changes) for "BYID" estimation, NOB is 315 (= 35 households x 9 year changes) for other panel estimations.
3) Absolute values of t statistics are indicated in parentheses.

Appendix Table 1 (continued)

Village=Aurepalle, Model=CRRA

	b_i		a_i		ζ_i	
A. Time series estimation for each household ("BYID" estimation)						
HID						
101	0.030	(0.22)	0.371	(0.52)	0.244	(0.75)
102	-0.325	(2.54)	1.807	(2.60)	0.603	(2.55)
103	-0.177	(1.65)	1.906	(3.09)	0.532	(2.62)
105	0.040	(0.21)	0.315	(0.32)	-0.149	(0.35)
107	-0.023	(0.26)	0.575	(1.11)	0.532	(3.05)
108	0.021	(0.16)	-0.133	(0.20)	0.398	(1.50)
109	0.031	(0.60)	0.876	(3.08)	-0.008	(0.07)
110	-0.018	(0.53)	0.575	(3.05)	0.041	(0.60)
130	-0.022	(0.23)	0.916	(1.89)	0.020	(0.06)
131	0.022	(0.24)	0.781	(1.62)	0.605	(2.23)
132	0.031	(0.36)	1.710	(3.32)	0.394	(2.42)
133	-0.009	(0.07)	0.569	(0.74)	0.534	(1.90)
134	0.065	(0.58)	-0.318	(0.55)	0.101	(0.24)
135	0.079	(1.51)	1.046	(3.94)	-0.615	(2.69)
136	0.196	(1.31)	0.229	(0.25)	0.361	(1.43)
137	0.036	(0.57)	0.527	(1.54)	0.121	(0.77)
138	-0.082	(0.77)	0.418	(0.74)	1.607	(2.56)
140	-0.090	(0.80)	0.334	(0.57)	-0.026	(0.09)
141	-0.280	(1.36)	1.684	(1.47)	0.405	(1.96)
143	-0.112	(1.06)	1.357	(2.40)	0.344	(0.97)
144	-0.211	(1.22)	2.379	(2.39)	0.841	(2.42)
145	-0.088	(0.66)	2.158	(2.79)	-0.132	(0.69)
146	0.118	(1.90)	-0.264	(0.82)	-0.906	(4.81)
148	-0.096	(0.86)	0.698	(1.17)	0.281	(1.13)
149	-0.088	(0.61)	0.994	(1.32)	0.828	(2.85)
150	-0.182	(0.88)	2.609	(2.28)	0.042	(0.09)
151	0.084	(0.44)	2.130	(1.84)	0.239	(1.12)
152	-0.057	(0.23)	1.866	(1.21)	-0.049	(0.58)
153	0.107	(0.34)	1.418	(0.72)	-0.287	(0.49)
154	0.071	(0.43)	-0.311	(0.34)	-0.095	(0.47)
155	-0.051	(0.37)	0.736	(1.05)	0.133	(0.34)
156	-0.022	(0.07)	0.315	(0.19)	-0.185	(0.19)
157	-0.014	(0.16)	0.706	(1.44)	0.160	(0.65)
158	-0.081	(0.48)	1.950	(2.04)	0.467	(1.08)
159	0.036	(0.26)	0.040	(0.06)	0.081	(0.35)
B. Plain OLS	-0.019	(0.76)	0.820	(6.06)	0.092	(2.81)
C. Fixed Effects	(omitted)		0.826	(5.88)	0.091	(2.67)
D. Random Eff.	-0.019	(0.67)	0.822	(6.23)	0.092	(2.87)
F test for Model B against Model A: $F(102,210)=$			0.987	P-value=	[.5234]	
F test for Model C against Model A: $F(68,210)=$			1.293	P-value=	[.0869]	
Hausman test of H_0:RE vs. FE: Chisq(2)=			0.011	P-value=	[.9945]	

Notes: 1) and 3) See the first page of Appendix Table 1.

2) NOB is 9 (= 1 household x 9 year changes) for "BYID" estimation, NOB is 315 (= 35 households x 9 year changes) for other panel estimations.

Appendix Table 1 (continued)

Village=Shirapur, Model=CARA

	b_i		a_i		ζ_i	
A. Time series estimation for each household ("BYID" estimation)						
HID						
301	-42.78	(0.13)	-0.955	(0.35)	0.970	(1.33)
302	19.70	(0.22)	0.366	(0.64)	1.132	(2.40)
303	-3.48	(0.02)	1.762	(1.50)	-0.091	(0.22)
304	49.30	(0.68)	-0.752	(1.46)	0.949	(3.91)
305	76.26	(1.67)	-0.370	(1.10)	0.566	(2.85)
306	-38.28	(1.01)	0.371	(0.88)	0.654	(1.76)
307	-196.93	(1.06)	3.222	(2.37)	0.192	(2.16)
309	-30.58	(0.77)	0.438	(1.48)	0.643	(5.65)
310	-139.88	(0.81)	-0.494	(0.47)	-0.467	(0.89)
331	-39.33	(0.26)	1.645	(1.24)	0.698	(1.35)
333	-59.65	(0.70)	-0.358	(0.52)	0.038	(0.12)
334	45.28	(0.57)	-0.919	(1.77)	1.149	(3.67)
335	-35.41	(0.26)	0.003	(0.00)	0.072	(0.40)
336	-105.00	(1.07)	1.882	(2.84)	0.048	(1.10)
337	38.82	(0.78)	0.116	(0.33)	0.015	(0.09)
338	58.90	(0.36)	2.801	(2.46)	-0.481	(2.89)
339	108.79	(0.98)	1.040	(0.96)	0.349	(1.49)
340	87.18	(0.69)	-0.881	(1.08)	-0.039	(0.17)
341	-19.74	(0.25)	1.282	(2.37)	0.449	(1.93)
342	8.26	(0.09)	0.002	(0.00)	-0.488	(0.82)
343	19.09	(0.16)	-0.136	(0.17)	0.279	(1.07)
344	-47.67	(0.45)	-1.041	(1.57)	0.466	(3.31)
345	-26.96	(0.20)	1.680	(1.88)	-0.058	(0.41)
348	23.02	(0.19)	-0.598	(0.71)	-0.129	(0.63)
349	163.72	(0.88)	-2.067	(1.65)	0.276	(0.65)
350	9.98	(0.07)	0.642	(0.64)	0.945	(2.05)
351	-79.45	(0.38)	2.135	(1.28)	0.753	(2.31)
352	-53.50	(0.55)	1.686	(2.54)	0.006	(0.06)
353	107.14	(0.64)	-2.544	(2.11)	0.605	(1.03)
354	53.38	(0.30)	-0.911	(0.72)	-0.028	(0.14)
355	23.97	(0.18)	2.257	(2.45)	0.260	(1.78)
356	36.07	(0.45)	-0.085	(0.11)	0.345	(0.91)
358	-3.16	(0.01)	2.403	(1.12)	0.249	(1.42)
B. Plain OLS	2.06	(0.08)	0.531	(3.01)	0.153	(4.78)
C. Fixed Effects	(omitted)		0.536	(2.90)	0.151	(4.44)
D. Random Eff.	2.04	(0.07)	0.532	(3.06)	0.153	(4.83)
F test for Model B against Model A: F(96,198)=			1.468		P-value=	[.0125]
F test for Model C against Model A: F(64,198)=			2.119		P-value=	[.0000]
Hausman test of H_0:RE vs. FE: Chisq(2)=			0.037		P-value=	[.9818]

Notes: 1) and 3) See the first page of Appendix Table 1.

2) NOB is 9 (= 1 household x 9 year changes) for "BYID" estimation, NOB is 297 (= 33 households x 9 year changes) for other panel estimations.

Appendix Table 1 (continued)

Village=Shirapur, Model=CRRA

	b_i		a_i		ζ_i	
A. Time series estimation for each household ("BYID" estimation)						
HID						
301	-0.044	(0.28)	-1.258	(1.20)	1.121	(3.20)
302	0.011	(0.09)	0.115	(0.20)	1.172	(2.57)
303	0.014	(0.12)	0.499	(0.88)	0.018	(0.05)
304	0.067	(0.88)	-0.772	(1.83)	0.789	(3.55)
305	0.080	(1.84)	-0.178	(0.82)	0.410	(3.38)
306	-0.027	(0.52)	-0.083	(0.19)	0.835	(1.93)
307	-0.184	(0.88)	0.415	(0.39)	0.409	(2.33)
309	-0.033	(0.78)	0.417	(1.83)	0.446	(5.41)
310	-0.052	(0.39)	-0.496	(0.79)	0.095	(0.28)
331	-0.035	(0.53)	0.827	(2.13)	0.598	(1.84)
333	-0.032	(0.52)	-0.360	(0.81)	0.076	(0.22)
334	0.054	(0.69)	-0.460	(1.16)	1.000	(4.35)
335	-0.028	(0.28)	0.091	(0.18)	0.004	(0.11)
336	-0.057	(0.96)	0.569	(1.97)	0.067	(0.91)
337	0.035	(0.72)	0.135	(0.54)	0.022	(0.12)
338	0.052	(0.47)	1.032	(1.75)	-0.449	(2.70)
339	0.087	(0.97)	1.116	(1.63)	0.149	(0.89)
340	0.039	(0.29)	-0.253	(0.28)	0.116	(0.38)
341	-0.037	(0.53)	1.285	(3.64)	0.470	(3.60)
342	-0.003	(0.03)	0.243	(0.43)	-0.491	(0.99)
343	0.021	(0.18)	0.019	(0.03)	0.279	(0.90)
344	-0.066	(0.40)	-0.724	(0.91)	0.313	(2.02)
345	-0.020	(0.16)	0.702	(1.14)	-0.067	(0.39)
348	0.031	(0.31)	-0.480	(0.94)	-0.148	(0.79)
349	0.089	(0.48)	-0.141	(0.15)	-0.137	(0.33)
350	0.027	(0.18)	-0.473	(0.65)	0.812	(2.51)
351	-0.055	(0.37)	0.809	(0.90)	1.091	(2.00)
352	-0.068	(0.57)	1.331	(2.29)	0.040	(0.17)
353	0.111	(0.65)	-0.318	(0.34)	-0.105	(0.18)
354	0.040	(0.25)	-0.156	(0.19)	-0.011	(0.21)
355	-0.007	(0.12)	1.392	(4.64)	0.254	(2.06)
356	0.037	(0.39)	0.110	(0.22)	0.772	(1.66)
358	-0.010	(0.09)	1.500	(2.54)	0.415	(2.14)
B. Plain OLS	-0.003	(0.12)	0.362	(3.35)	0.084	(3.51)
C. Fixed Effects	(omitted)		0.367	(3.26)	0.080	(3.19)
D. Random Eff.	-0.003	(0.11)	0.363	(3.44)	0.083	(3.54)
F test for Model B against Model A: F(96,198)=				1.570	P-value=	[.0042]
F test for Model C against Model A: F(64,198)=				2.179	P-value=	[.0000]
Hausman test of H_0:RE vs. FE: Chisq(2)=				0.126	P-value=	[.9389]

Notes: 1) and 3) See the first page of Appendix Table 1.

2) NOB is 9 (= 1 household x 9 year changes) for "BYID" estimation, NOB is 297 (= 33 households x 9 year changes) for other panel estimations.

Appendix Table 1 (continued)

Village=Kanzara, Model=CARA

	b_i		a_i		ζ_i	
A. Time series estimation for each household ("BYID" estimation)						
HID						
501	149.68	(0.97)	-0.399	(0.42)	-0.333	(1.04)
502	-23.33	(0.15)	2.297	(2.34)	-1.050	(1.45)
503	-64.35	(0.41)	-0.052	(0.06)	0.356	(0.68)
504	-20.72	(0.30)	0.278	(0.65)	0.464	(1.27)
505	-63.14	(0.78)	0.299	(0.51)	0.472	(1.97)
510	63.40	(0.59)	2.469	(3.68)	-0.222	(0.68)
530	-24.26	(0.28)	0.599	(1.14)	0.003	(0.04)
531	8.45	(0.17)	0.641	(1.82)	0.426	(1.26)
532	100.61	(0.44)	0.389	(0.29)	-0.625	(0.69)
533	-106.12	(0.57)	2.216	(1.68)	-0.007	(0.02)
534	-25.82	(0.20)	1.538	(1.71)	0.275	(0.98)
535	-30.72	(0.63)	0.825	(2.80)	0.280	(2.86)
536	25.84	(0.19)	0.021	(0.02)	0.043	(0.16)
537	-57.31	(0.58)	1.535	(2.53)	0.232	(1.22)
538	11.66	(0.21)	-0.187	(0.54)	0.418	(1.67)
539	-0.19	(0.00)	0.174	(0.22)	0.345	(1.44)
540	-66.87	(0.32)	2.404	(1.81)	0.420	(1.71)
541	-12.64	(0.10)	0.154	(0.21)	-0.083	(0.38)
542	96.38	(0.42)	0.134	(0.07)	0.166	(0.24)
543	-112.32	(0.55)	1.086	(0.77)	0.112	(0.29)
544	-85.24	(1.10)	-0.263	(0.58)	-0.040	(0.24)
545	-69.90	(0.28)	-0.473	(0.28)	1.344	(2.43)
546	22.63	(0.09)	-0.122	(0.08)	-0.231	(0.44)
547	-4.21	(0.06)	-0.494	(1.11)	0.210	(0.78)
548	37.30	(0.30)	1.985	(2.49)	-0.309	(0.84)
549	-5.41	(0.18)	0.974	(5.00)	0.846	(5.06)
550	-88.99	(2.96)	0.769	(4.08)	-0.308	(2.56)
551	-56.76	(0.36)	3.563	(3.29)	0.341	(1.65)
552	-11.10	(0.18)	0.430	(1.07)	0.607	(4.90)
553	12.73	(0.22)	-0.500	(1.41)	-0.042	(0.29)
554	-14.03	(0.05)	1.076	(0.58)	-0.161	(0.62)
555	-28.56	(0.11)	-1.981	(1.26)	-0.279	(0.69)
556	-80.36	(0.49)	1.360	(1.11)	0.228	(0.88)
557	0.11	(0.00)	2.211	(3.48)	-0.016	(0.14)
558	-78.90	(0.34)	2.182	(1.50)	0.256	(1.11)
559	107.91	(0.58)	4.173	(3.34)	0.681	(3.64)
B. Plain OLS	-12.13	(0.47)	0.861	(5.35)	0.162	(3.67)
C. Fixed Effects	(omitted)		0.865	(5.12)	0.161	(3.42)
D. Random Eff.	-12.13	(0.44)	0.861	(5.43)	0.162	(3.71)
F test for Model B against Model A: $F(105,216)=$				1.088	P-value=	[.3012]
F test for Model C against Model A: $F(70,216)=$				1.551	P-value=	[.0090]
Hausman test of H_0:RE vs. FE: Chisq(2)=				0.006	P-value=	[.9971]

Notes: 1) and 3) See the first page of Appendix Table 1.

2) NOB is 9 (= 1 household x 9 year changes) for "BYID" estimation, NOB is 324 (= 36 households x 9 year changes) for other panel estimations.

Appendix Table 1 (continued)

Village=Kanzara, Model=CRRA

	b_i		a_i		ζ_i	
A. Time series estimation for each household ("BYID" estimation)						
HID						
501	0.079	(0.87)	0.691	(1.09)	-0.204	(0.91)
502	-0.014	(0.11)	1.617	(1.77)	-0.851	(1.25)
503	-0.051	(0.38)	-0.947	(1.01)	0.530	(1.02)
504	-0.015	(0.19)	0.240	(0.45)	0.320	(0.97)
505	-0.054	(0.78)	0.861	(1.22)	0.437	(1.72)
510	0.042	(0.40)	1.294	(1.82)	-0.070	(0.17)
530	-0.009	(0.17)	0.460	(1.23)	-0.053	(0.53)
531	0.030	(0.37)	0.364	(0.68)	0.075	(0.22)
532	0.079	(0.55)	0.157	(0.16)	-0.385	(0.55)
533	-0.069	(0.52)	0.036	(0.03)	0.390	(0.67)
534	0.036	(0.48)	2.083	(3.38)	0.751	(2.77)
535	-0.035	(0.39)	0.730	(1.22)	0.399	(1.38)
536	0.028	(0.22)	-0.256	(0.26)	0.138	(0.37)
537	-0.035	(0.29)	0.952	(1.11)	0.130	(0.36)
538	0.008	(0.18)	-0.549	(1.71)	0.568	(2.06)
539	-0.004	(0.06)	0.189	(0.28)	0.498	(1.48)
540	-0.050	(0.26)	0.996	(0.71)	0.471	(1.54)
541	-0.010	(0.11)	-0.481	(0.70)	-0.057	(0.18)
542	0.083	(0.57)	-0.388	(0.31)	0.553	(0.79)
543	-0.058	(0.48)	0.791	(0.93)	0.199	(0.82)
544	-0.139	(1.26)	-0.321	(0.44)	-0.042	(0.14)
545	0.006	(0.03)	0.147	(0.12)	0.809	(1.28)
546	0.024	(0.14)	0.495	(0.40)	-0.264	(0.59)
547	-0.012	(0.14)	-0.539	(0.95)	0.145	(0.53)
548	0.040	(0.21)	0.586	(0.44)	-0.152	(0.28)
549	-0.004	(0.05)	1.365	(2.24)	0.941	(2.16)
550	-0.117	(2.51)	1.093	(2.85)	-0.707	(2.73)
551	-0.020	(0.15)	1.674	(1.79)	0.580	(1.14)
552	-0.021	(0.27)	-0.102	(0.17)	0.727	(4.64)
553	0.020	(0.19)	-0.098	(0.13)	-0.229	(1.00)
554	-0.007	(0.06)	1.151	(1.21)	-0.662	(0.80)
555	-0.018	(0.10)	0.622	(0.45)	-0.092	(0.07)
556	-0.031	(0.21)	-0.116	(0.08)	0.448	(0.85)
557	0.009	(0.11)	1.599	(2.77)	-0.072	(0.60)
558	-0.055	(0.30)	0.705	(0.54)	0.358	(0.75)
559	0.060	(0.48)	1.512	(1.69)	0.793	(1.50)
B. Plain OLS	-0.011	(0.61)	0.483	(3.70)	0.164	(3.13)
C. Fixed Effects	(omitted)		0.491	(3.57)	0.154	(2.78)
D. Random Eff.	-0.011	(0.57)	0.484	(3.75)	0.162	(3.15)
F test for Model B against Model A: F(105,216)=				0.640	P-value=	[.9947]
F test for Model C against Model A: F(70,216)=				0.885	P-value=	[.7217]
Hausman test of H_0:RE vs. FE: Chisq(2)=				0.151	P-value=	[.9274]

Notes: 1) and 3) See the first page of Appendix Table 1.

2) NOB is 9 (= 1 household x 9 year changes) for "BYID" estimation, NOB is 324 (= 36 households x 9 year changes) for other panel estimations.

Appendix Table 2: Estimation Results with Household Structural Shifters

2.0.1: Three villages pooled (NOB=936), CARA model

	LANDD			LANDPC			CHILDR			SCHOOL			JGRRANK		
b_0	-11.16	(0.30)		-5.92	(0.27)		-27.21	(0.72)		-6.05	(0.28)		-18.32	(0.47)	
b_1	6.48	(0.15)		-2.99	(0.07)		73.42	(0.63)		0.17	(0.03)		5.16	(0.35)	
a_0	0.498	(0.88)	**	0.589	(4.61)	***	0.928	(4.10)	***	0.692	(5.49)	**	1.098	(4.72)	***
a_1	0.269	(1.10)		0.552	(2.25)	**	-0.562	(0.80)		0.030	(0.96)		-0.137	(1.60)	
ζ_0	0.236	(2.09)	**	0.151	(4.20)	***	0.079	(1.90)	*	0.119	(3.58)	*	0.091	(2.08)	**
ζ_1	-0.136	(1.18)		-0.081	(1.72)	*	0.105	(0.73)		-0.003	(0.53)		0.008	(0.38)	
R^2		0.087			0.091			0.086			0.085			0.087	
$\bar{R}^2$		0.082			0.087			0.081			0.081			0.082	
F		0.795			2.423	*		0.473			0.373			0.886	

2.0.2: Three villages pooled (NOB=936), CRRA model

	LANDD			LANDPC			CHILDR			SCHOOL			JGRRANK		
b_0	-0.021	(0.76)		-0.011	(0.66)		-0.041	(1.46)		-0.012	(0.77)		-0.020	(0.72)	
b_1	0.011	(0.36)		-0.007	(0.23)		0.103	(1.20)		0.000	(0.08)		0.004	(0.33)	
a_0	0.417	(2.73)	***	0.392	(4.34)	***	0.578	(3.60)	***	0.483	(5.48)	***	0.672	(4.30)	***
a_1	0.170	(0.99)		0.534	(3.02)	***	-0.055	(0.11)		0.032	(1.39)		-0.052	(0.88)	
ζ_0	0.308	(4.46)	***	0.188	(6.46)	***	0.115	(2.84)	***	0.178	(6.27)	***	-0.009	(0.25)	
ζ_1	-0.229	(3.20)	***	-0.217	(4.14)	***	-0.079	(0.59)		-0.026	(3.79)	***	0.056	(3.45)	***
R^2		0.110			0.121			0.101			0.114			0.111	
$\bar{R}^2$		0.105			0.116			0.097			0.109			0.107	
F		3.499	**		7.473	***		0.604			4.965	***		4.054	***

2.1.1: Aurepalle (NOB=315), CARA model

	LANDD			LANDPC			CHILDR			SCHOOL			JGRRANK		
b_0	-20.40	(0.29)		7.16	(0.17)		-10.94	(0.13)		8.63	(0.21)		-39.79	(0.44)	
b_1	25.61	(0.32)		-51.60	(0.56)		37.42	(0.14)		-8.28	(0.59)		12.65	(0.42)	
a_0	0.528	(1.47)		0.613	(2.77)	***	1.279	(2.80)	***	0.741	(3.44)	***	1.483	(3.13)	***
a_1	0.367	(0.88)		0.775	(1.58)		-1.660	(1.15)		0.041	(0.56)		-0.242	(1.55)	
ζ_0	0.254	(1.13)		0.207	(2.46)	**	0.035	(0.40)		0.175	(2.28)	**	-0.090	(1.14)	
ζ_1	-0.221	(0.97)		-0.226	(2.34)	**	-0.002	(0.01)		-0.027	(2.10)	**	0.087	(1.88)	*
R^2		0.067			0.084			0.065			0.076			0.079	
$\bar{R}^2$		0.051			0.069			0.050			0.061			0.064	
F		0.590			2.526	*		0.444			1.634			1.980	

2.1.2: Aurepalle (NOB=315), CRRA model

	LANDD			LANDPC			CHILDR			SCHOOL			JGRRANK		
b_0	-0.044	(0.89)		-0.014	(0.49)		-0.067	(1.10)		-0.019	(0.67)		-0.064	(1.03)	
b_1	0.032	(0.56)		-0.045	(0.70)		0.147	(0.76)		-0.004	(0.46)		0.014	(0.66)	
a_0	0.745	(2.81)	***	0.638	(4.01)	***	1.162	(3.52)	***	0.786	(5.12)	***	1.418	(4.17)	***
a_1	0.100	(0.32)		0.705	(1.99)	**	-1.164	(1.12)		0.024	(0.47)		-0.212	(1.89)	*
ζ_0	0.261	(2.49)	**	0.314	(5.52)	***	-0.065	(0.99)		0.341	(5.82)	***	-0.154	(2.62)	***
ζ_1	-0.187	(1.70)	*	-0.370	(4.83)	***	0.813	(2.69)	***	-0.062	(5.06)	***	0.139	(4.88)	***
R^2		0.147			0.202			0.161			0.204			0.204	
$\bar{R}^2$		0.133			0.189			0.148			0.191			0.191	
F		1.053			8.298	***		2.896	**		8.592	***		8.557	***

Notes: 1) F gives test statistics F(3, NOB-6) for the joint hypothesis that $b_1 = a_1 = \zeta_1 = 0$ (homogeneity test). 2) Significant at 1% = ***, 5% = **, and 10% = * (2-sided test for t statistics whose absolute value is shown in parenthesis).

Appendix Table 2 (continued): Estimation Results with Household Structural Shifters

2.2.1: Shirapur (NOB=297), CARA model

	LANDD			LANDPC			CHILDR			SCHOOL			JGRRANK		
b_0	3.51	(0.06)		-2.84	(0.08)		-30.86	(0.51)		0.28	(0.01)		18.22	(0.35)	
b_1	-1.16	(0.02)		16.26	(0.22)		111.47	(0.60)		0.69	(0.07)		-8.39	(0.37)	
a_0	0.040	(0.10)		0.301	(1.24)		0.436	(1.09)		0.554	(2.52)	**	0.366	(1.06)	
a_1	0.546	(1.21)		0.668	(1.30)		0.308	(0.25)		-0.021	(0.31)		0.091	(0.61)	
ζ_0	0.520	(2.95)	***	0.101	(2.10)	**	0.133	(2.46)	**	0.091	(2.33)	**	0.220	(3.38)	***
ζ_1	-0.378	(2.11)	**	0.145	(1.40)		0.093	(0.43)		0.034	(2.73)	***	-0.038	(1.19)	
R^2		0.122			0.123			0.110			0.130			0.113	
$\bar{R}^2$		0.107			0.108			0.095			0.115			0.098	
F		1.582			1.655			0.235			2.507	*		0.564	

2.2.2: Shirapur (NOB=297), CRRA model

	LANDD			LANDPC			CHILDR			SCHOOL			JGRRANK		
b_0	0.012	(0.27)		0.001	(0.02)		-0.023	(0.46)		0.001	(0.04)		-0.001	(0.03)	
b_1	-0.019	(0.37)		-0.010	(0.17)		0.081	(0.54)		-0.002	(0.19)		-0.001	(0.03)	
a_0	-0.185	(0.77)		0.099	(0.67)		0.057	(0.24)		0.263	(1.92)	*	0.438	(2.06)	**
a_1	0.618	(2.32)	**	0.789	(2.58)	***	0.967	(1.30)		0.045	(1.10)		-0.039	(0.42)	
ζ_0	0.591	(4.70)	***	0.109	(2.11)	**	0.319	(4.15)	***	0.116	(3.03)	***	0.078	(1.60)	
ζ_1	-0.525	(4.10)	***	-0.078	(0.53)		-0.695	(3.22)	***	-0.013	(1.04)		0.004	(0.16)	
R^2		0.137			0.105			0.120			0.090			0.084	
$\bar{R}^2$		0.123			0.090			0.105			0.074			0.069	
F		6.038	***		2.288	*		4.040	***		0.649			0.068	

2.3.1: Kanzara (NOB=324), CARA model

	LANDD			LANDPC			CHILDR			SCHOOL			JGRRANK		
b_0	1.68	(0.03)		-20.65	(0.60)		-28.65	(0.54)		-25.86	(0.71)		-28.10	(0.44)	
b_1	-15.57	(0.22)		21.28	(0.40)		58.91	(0.37)		3.67	(0.56)		7.54	(0.30)	
a_0	0.845	(2.16)	**	0.763	(3.65)	***	1.011	(3.12)	***	0.801	(3.54)	***	1.499	(3.78)	***
a_1	0.013	(0.03)		0.242	(0.73)		-0.533	(0.55)		0.018	(0.44)		-0.270	(1.73)	*
ζ_0	-0.023	(0.12)		0.152	(2.22)	**	0.024	(0.30)		0.093	(1.33)		0.320	(3.43)	***
ζ_1	0.195	(1.01)		0.012	(0.17)		0.534	(2.04)	**	0.014	(1.29)		-0.074	(1.91)	*
R^2		0.131			0.130			0.140			0.134			0.148	
$\bar{R}^2$		0.117			0.116			0.126			0.121			0.134	
F		0.346			0.253			1.503			0.810			2.501	*

2.3.2: Kanzara (NOB=324), CRRA model

	LANDD			LANDPC			CHILDR			SCHOOL			JGRRANK		
b_0	-0.009	(0.19)		-0.016	(0.65)		-0.030	(0.78)		-0.022	(0.85)		-0.015	(0.32)	
b_1	-0.003	(0.05)		0.011	(0.29)		0.064	(0.56)		0.003	(0.59)		0.002	(0.08)	
a_0	0.676	(2.09)	**	0.391	(2.29)	**	0.506	(1.89)	*	0.303	(1.63)		0.612	(1.89)	*
a_1	-0.230	(0.65)		0.231	(0.84)		-0.074	(0.09)		0.045	(1.35)		-0.057	(0.43)	
ζ_0	0.088	(0.57)		0.171	(2.22)	**	0.206	(2.05)	**	0.201	(2.58)	***	0.158	(1.39)	
ζ_1	0.086	(0.52)		-0.022	(0.16)		-0.155	(0.50)		-0.008	(0.60)		0.003	(0.07)	
R^2		0.085			0.086			0.085			0.090			0.084	
$\bar{R}^2$		0.071			0.071			0.071			0.075			0.069	
F		0.193			0.264			0.193			0.736			0.065	

Notes: 1) F gives test statistics $F(3, \text{NOB-6})$ for the joint hypothesis that $b_1 = a_1 = \zeta_1 = 0$ (homogeneity test). 2) Significant at 1% = ***, 5% = **, and 10% = * (2-sided test for t statistics whose absolute value is shown in parenthesis).

Appendix Table 3: Estimation Results with Alternative Common Shock Measures

3.0.1: Three villages pooled (NOB=936), CARA model

	LANDD			LANDPC			CHILDR			SCHOOL			JGRRANK		
b_0	-7.34	(0.20)		-2.48	(0.12)		-19.79	(0.54)		-2.18	(0.10)		-12.27	(0.33)	
b_1	8.42	(0.21)		3.42	(0.09)		66.42	(0.58)		0.87	(0.17)		4.82	(0.34)	
a_0	0.636	(3.09)	***	0.765	(6.35)	***	1.201	(5.64)	***	0.881	(7.33)	***	1.673	(7.39)	***
a_1	0.468	(2.01)	**	0.738	(3.31)	***	-0.677	(1.03)		0.050	(1.72)	*	-0.268	(3.25)	***
ζ_0	0.246	(2.25)	**	0.157	(4.49)	***	0.085	(2.10)	**	0.123	(3.82)	***	0.093	(2.19)	**
ζ_1	-0.143	(1.28)		-0.084	(1.85)	*	0.095	(0.68)		-0.004	(0.59)		0.009	(0.44)	
R^2		0.136			0.143			0.132			0.134			0.141	
$\bar{R}^2$		0.131			0.139			0.128			0.129			0.136	
F		1.810			4.520	***		0.599			1.074			3.570	**

3.0.2: Three villages pooled (NOB=936), CRRA model

	LANDD			LANDPC			CHILDR			SCHOOL			JGRRANK		
b_0	-0.013	(0.49)		-0.003	(0.20)		-0.029	(1.09)		-0.003	(0.18)		-0.009	(0.32)	
b_1	0.015	(0.51)		0.004	(0.16)		0.102	(1.24)		0.001	(0.24)		0.003	(0.30)	
a_0	0.792	(4.57)	***	0.870	(8.52)	***	1.145	(6.22)	***	0.926	(9.15)	***	1.335	(6.92)	***
a_1	0.254	(1.29)		0.414	(2.14)	**	-0.510	(0.89)		0.026	(1.03)		-0.138	(1.99)	**
ζ_0	0.309	(4.73)	***	0.186	(6.69)	***	0.112	(2.90)	***	0.171	(6.34)	***	-0.006	(0.19)	
ζ_1	-0.229	(3.38)	***	-0.206	(4.13)	***	-0.062	(0.49)		-0.023	(3.58)	***	0.056	(3.59)	***
R^2		0.182			0.189			0.174			0.183			0.185	
$\bar{R}^2$		0.178			0.185			0.169			0.179			0.181	
F		4.120	***		6.617	***		0.862			4.445	***		5.283	***

3.1.1: Aurepalle (NOB=315), CARA model

	LANDD			LANDPC			CHILDR			SCHOOL			JGRRANK		
b_0	-17.67	(0.26)		7.67	(0.19)		-10.65	(0.13)		10.01	(0.25)		-41.09	(0.47)	
b_1	22.40	(0.29)		-52.03	(0.58)		37.56	(0.14)		-8.86	(0.66)		13.39	(0.46)	
a_0	0.481	(1.47)		0.688	(3.44)	***	1.668	(4.11)	***	0.807	(4.14)	***	2.077	(4.94)	***
a_1	0.694	(1.83)	*	1.209	(2.80)	***	-2.324	(1.81)	*	0.121	(1.86)	*	-0.389	(2.79)	***
ζ_0	0.246	(1.12)		0.216	(2.66)	***	0.035	(0.42)		0.177	(2.38)	**	-0.079	(1.04)	
ζ_1	-0.209	(0.94)		-0.233	(2.50)	**	0.005	(0.02)		-0.027	(2.15)	**	0.083	(1.86)	*
R^2		0.120			0.145			0.117			0.131			0.139	
$\bar{R}^2$		0.105			0.131			0.103			0.117			0.125	
F		1.397			4.428	***		1.088			2.730	**		3.727	**

3.1.2: Aurepalle (NOB=315), CRRA model

	LANDD			LANDPC			CHILDR			SCHOOL			JGRRANK		
b_0	-0.025	(0.53)		0.000	(0.00)		-0.040	(0.70)		-0.001	(0.03)		-0.029	(0.49)	
b_1	0.032	(0.58)		-0.025	(0.42)		0.121	(0.67)		-0.004	(0.40)		0.008	(0.41)	
a_0	0.776	(3.06)	***	0.807	(5.31)	***	1.594	(5.17)	***	0.948	(6.45)	***	1.556	(4.87)	***
a_1	0.293	(1.00)		0.685	(2.08)	**	-2.054	(2.10)	**	0.024	(0.49)		-0.205	(1.93)	*
ζ_0	0.253	(2.50)	**	0.313	(5.69)	***	-0.063	(1.00)		0.336	(5.92)	***	-0.131	(2.33)	**
ζ_1	-0.173	(1.62)		-0.353	(4.80)	***	0.824	(2.84)	***	-0.059	(5.01)	***	0.130	(4.76)	***
R^2		0.202			0.254			0.224			0.254			0.254	
$\bar{R}^2$		0.189			0.242			0.211			0.242			0.242	
F		1.202			8.449	***		4.140	***		8.444	***		8.432	***

Notes: 1) F gives test statistics F(3, NOB-6) for the joint hypothesis that $b_1 = a_1 = \zeta_1 = 0$ (homogeneity test). 2) Significant at 1% = ***, 5% = **, and 10% = * (2-sided test for t statistics whose absolute value is shown in parenthesis).

Appendix Table 3 (continued): Estimation Results with Alternative Common Shock Measures

3.3.1: Shirapur (NOB=297), CARA model

	LANDD			LANDPC			CHILDR			SCHOOL			JGRRANK		
b_0	-0.71	(0.01)		-5.37	(0.15)		-33.61	(0.57)		-0.70	(0.02)		15.87	(0.31)	
b_1	1.16	(0.02)		17.62	(0.24)		114.28	(0.63)		0.16	(0.02)		-8.18	(0.37)	
a_0	0.349	(0.66)		0.653	(2.12)	**	0.915	(1.79)	*	0.971	(3.48)	***	0.718	(1.63)	
a_1	0.729	(1.25)		0.990	(1.55)		0.274	(0.17)		0.001	(0.01)		0.152	(0.80)	
ζ_0	0.481	(2.75)	***	0.102	(2.16)	**	0.135	(2.53)	**	0.089	(2.33)	**	0.222	(3.46)	***
ζ_1	-0.343	(1.93)	*	0.126	(1.23)		0.061	(0.29)		0.032	(2.62)	***	-0.041	(1.33)	
R^2		0.150			0.154			0.140			0.159			0.145	
$\bar{R}^2$		0.136			0.139			0.125			0.145			0.130	
F		1.374			1.784			0.187			2.402	*		0.739	

3.3.2: Shirapur (NOB=297), CRRA model

	LANDD			LANDPC			CHILDR			SCHOOL			JGRRANK		
b_0	0.002	(0.05)		-0.003	(0.10)		-0.028	(0.60)		0.001	(0.03)		0.006	(0.13)	
b_1	-0.004	(0.08)		0.008	(0.14)		0.108	(0.74)		0.000	(0.03)		-0.003	(0.16)	
a_0	0.145	(0.29)		0.573	(1.93)	*	0.514	(1.05)		0.872	(3.16)	***	0.924	(2.18)	**
a_1	0.911	(1.65)	*	1.271	(2.09)	**	1.464	(0.98)		0.054	(0.67)		0.041	(0.22)	
ζ_0	0.544	(4.24)	***	0.102	(1.99)	**	0.298	(3.91)	***	0.101	(2.66)	***	0.087	(1.81)	*
ζ_1	-0.482	(3.69)	***	-0.075	(0.52)		-0.649	(3.04)	***	-0.009	(0.75)		-0.005	(0.22)	
R^2		0.153			0.127			0.145			0.116			0.114	
$\bar{R}^2$		0.139			0.112			0.130			0.101			0.098	
F		4.590	***		1.538			3.529	**		0.284			0.032	

3.3.1: Kanzara (NOB=324), CARA model

	LANDD			LANDPC			CHILDR			SCHOOL			JGRRANK		
b_0	11.20	(0.18)		-10.31	(0.31)		-16.18	(0.32)		-14.48	(0.41)		-9.27	(0.15)	
b_1	-12.77	(0.19)		25.08	(0.48)		57.38	(0.37)		3.87	(0.60)		4.55	(0.19)	
a_0	0.894	(2.60)	***	0.866	(4.77)	***	0.949	(3.38)	***	0.928	(4.76)	***	1.711	(5.03)	***
a_1	0.119	(0.31)		0.327	(1.15)		0.148	(0.17)		0.019	(0.54)		-0.306	(2.28)	**
ζ_0	0.036	(0.19)		0.172	(2.61)	***	0.049	(0.63)		0.114	(1.71)	*	0.329	(3.67)	***
ζ_1	0.146	(0.77)		0.001	(0.01)		0.486	(1.92)	*	0.013	(1.18)		-0.073	(1.96)	*
R^2		0.184			0.186			0.192			0.188			0.205	
$\bar{R}^2$		0.171			0.173			0.179			0.175			0.193	
F		0.224			0.507			1.304			0.728			3.122	**

3.3.2: Kanzara (NOB=324), CRRA model

	LANDD			LANDPC			CHILDR			SCHOOL			JGRRANK		
b_0	-0.001	(0.02)		-0.005	(0.20)		-0.020	(0.57)		-0.012	(0.49)		-0.003	(0.06)	
b_1	0.001	(0.02)		0.010	(0.29)		0.069	(0.65)		0.003	(0.69)		0.001	(0.06)	
a_0	1.011	(3.29)	***	1.035	(6.39)	***	0.863	(3.43)	***	0.889	(5.12)	***	1.327	(4.34)	***
a_1	-0.010	(0.03)		-0.070	(0.27)		0.475	(0.63)		0.028	(0.90)		-0.142	(1.17)	
ζ_0	0.221	(1.56)		0.219	(3.10)	***	0.234	(2.56)	**	0.208	(2.98)	***	0.187	(1.80)	*
ζ_1	-0.033	(0.22)		-0.061	(0.50)		-0.154	(0.54)		-0.004	(0.30)		0.002	(0.06)	
R^2		0.206			0.207			0.209			0.209			0.210	
$\bar{R}^2$		0.194			0.195			0.196			0.197			0.197	
F		0.016			0.152			0.341			0.412			0.466	

Notes: 1) F gives test statistics F(3, NOB-6) for the joint hypothesis that $b_1 = a_1 = \zeta_1 = 0$ (homogeneity test). 2) Significant at 1% = ***, 5% = **, and 10% = * (2-sided test for t statistics whose absolute value is shown in parenthesis).

Appendix Table 4: Estimation Results with Household Structural Shifters, 1976-81

4.0.1: Three villages pooled (NOB=520), CARA model

	LANDD			LANDPC			CHILDR			SCHOOL			JGRRANK		
b_0	-11.95	(0.30)		11.40	(0.49)		-30.44	(0.75)		-2.16	(0.09)		-1.94	(0.05)	
b_1	13.31	(0.30)		-35.76	(0.84)		97.99	(0.79)		0.55	(0.10)		0.26	(0.02)	
a_0	0.067	(0.23)		0.383	(2.25)	**	0.755	(2.56)	**	0.600	(3.48)	***	1.267	(4.01)	***
a_1	0.921	(2.79)	***	1.204	(3.89)	***	0.109	(0.12)		0.069	(1.78)	*	-0.200	(1.69)	*
ζ_0	0.210	(1.80)	*	0.106	(2.97)	***	0.093	(2.35)	**	0.104	(3.27)	***	0.033	(0.79)	
ζ_1	-0.129	(1.09)		-0.038	(0.83)		-0.030	(0.22)		-0.005	(0.81)		0.032	(1.48)	
R^2		0.103			0.113			0.086			0.092			0.094	
$\bar{R}^2$		0.094			0.104			0.077			0.083			0.085	
F		3.378	**		5.439	***		0.234			1.263			1.743	

4.0.2: Three villages pooled (NOB=520), CRRA model

	LANDD			LANDPC			CHILDR			SCHOOL			JGRRANK		
b_0	-0.013	(0.40)		0.019	(1.01)		-0.021	(0.62)		0.009	(0.46)		-0.014	(0.41)	
b_1	0.020	(0.54)		-0.044	(1.24)		0.083	(0.81)		-0.002	(0.38)		0.008	(0.60)	
a_0	0.114	(0.57)		0.148	(1.27)		0.376	(1.80)	*	0.317	(2.73)	***	0.711	(3.36)	***
a_1	0.445	(1.97)	**	0.979	(4.41)	***	0.303	(0.47)		0.054	(1.91)	*	-0.115	(1.44)	
ζ_0	0.333	(4.15)	***	0.142	(4.44)	***	0.097	(2.10)	**	0.177	(5.45)	***	-0.053	(1.42)	
ζ_1	-0.287	(3.47)	***	-0.186	(3.18)	***	-0.114	(0.80)		-0.034	(4.37)	***	0.069	(3.70)	***
R^2		0.093			0.113			0.067			0.102			0.092	
$\bar{R}^2$		0.084			0.105			0.058			0.093			0.083	
F		5.333	***		9.420	***		0.520			7.136	***		5.193	***

4.1.1: Aurepalle (NOB=175), CARA model

	LANDD			LANDPC			CHILDR			SCHOOL			JGRRANK		
b_0	-42.50	(0.59)		22.05	(0.55)		-84.70	(0.99)		2.13	(0.05)		-60.24	(0.69)	
b_1	45.73	(0.56)		-137.50	(1.58)		296.67	(1.09)		-8.46	(0.62)		18.93	(0.65)	
a_0	0.705	(1.32)		0.298	(1.03)		1.386	(2.21)	**	0.600	(2.05)	**	2.419	(3.75)	***
a_1	0.310	(0.51)		2.594	(3.92)	***	-1.922	(0.97)		0.221	(2.12)	**	-0.541	(2.55)	**
ζ_0	0.398	(2.02)	**	0.248	(3.70)	***	0.086	(1.29)		0.204	(3.18)	***	-0.069	(1.12)	
ζ_1	-0.350	(1.75)	*	-0.253	(3.40)	***	-0.092	(0.42)		-0.029	(2.75)	***	0.092	(2.30)	**
R^2		0.104			0.197			0.086			0.129			0.140	
$\bar{R}^2$		0.077			0.173			0.059			0.104			0.115	
F		1.661			8.380	***		0.534			3.371	**		4.126	***

4.1.2: Aurepalle (NOB=175), CRRA model

	LANDD			LANDPC			CHILDR			SCHOOL			JGRRANK		
b_0	-0.075	(1.17)		0.026	(0.71)		-0.066	(0.83)		0.004	(0.12)		-0.114	(1.47)	
b_1	0.085	(1.15)		-0.142	(1.76)	*	0.216	(0.86)		-0.011	(0.93)		0.037	(1.43)	
a_0	0.788	(2.23)	**	0.307	(1.51)		0.947	(2.16)	**	0.528	(2.65)	***	1.838	(4.23)	***
a_1	-0.098	(0.24)		1.483	(3.28)	***	-1.014	(0.73)		0.120	(1.77)	*	-0.405	(2.83)	***
ζ_0	0.415	(3.59)	***	0.261	(4.25)	***	-0.037	(0.50)		0.310	(4.73)	***	-0.172	(2.75)	***
ζ_1	-0.395	(3.26)	***	-0.333	(4.08)	***	0.512	(1.51)		-0.062	(4.57)	***	0.134	(4.27)	***
R^2		0.140			0.211			0.103			0.195			0.208	
$\bar{R}^2$		0.114			0.188			0.076			0.171			0.185	
F		3.732	**		9.195	***		1.265			7.862	***		8.952	***

Notes: 1) F gives test statistics F(3, NOB-6) for the joint hypothesis that $b_1 = a_1 = \zeta_1 = 0$ (homogeneity test). 2) Significant at 1% = ***, 5% = **, and 10% = * (2-sided test for t statistics whose absolute value is shown in parenthesis).

Appendix Table 4 (continued): Estimation Results with Household Structural Shifters, 1976-81

4.4.1: Shirapur (NOB=165), CARA model

	LANDD			LANDPC			CHILDR			SCHOOL			JGRRANK		
b_0	-36.29	(0.49)		-4.23	(0.09)		-41.52	(0.53)		1.94	(0.05)		6.58	(0.10)	
b_1	37.40	(0.45)		1.63	(0.02)		116.71	(0.49)		-2.72	(0.22)		-6.97	(0.24)	
a_0	-1.424	(2.03)	**	-0.698	(1.53)		-0.972	(1.22)		-0.081	(0.19)		0.328	(0.48)	
a_1	2.308	(2.88)	***	3.140	(3.23)	***	4.292	(1.76)	*	0.241	(1.82)	*	0.009	(0.03)	
ζ_0	0.125	(0.54)		-0.027	(0.49)		0.008	(0.12)		0.038	(0.84)		0.091	(1.15)	
ζ_1	-0.033	(0.14)		0.301	(2.62)	***	0.293	(1.17)		0.029	(2.01)	**	-0.003	(0.07)	
R^2		0.083			0.117			0.059			0.074			0.034	
$\bar{R}^2$		0.054			0.089			0.030			0.045			0.003	
F		2.843	**		5.017	***		1.449			2.304	*		0.021	

4.4.2: Shirapur (NOB=165), CRRA model

	LANDD			LANDPC			CHILDR			SCHOOL			JGRRANK		
b_0	-0.021	(0.37)		0.000	(0.01)		-0.045	(0.73)		0.006	(0.18)		-0.005	(0.09)	
b_1	0.026	(0.41)		-0.007	(0.09)		0.149	(0.79)		-0.005	(0.54)		0.001	(0.06)	
a_0	-0.771	(1.98)	**	-0.232	(0.93)		-0.356	(0.85)		0.131	(0.55)		0.402	(1.07)	
a_1	1.408	(3.19)	***	1.791	(3.39)	***	2.503	(1.94)	*	0.074	(1.04)		-0.043	(0.26)	
ζ_0	0.391	(2.21)	**	-0.004	(0.06)		0.216	(2.22)	**	0.145	(3.05)	***	0.025	(0.45)	
ζ_1	-0.337	(1.88)	*	0.204	(1.24)		-0.445	(1.71)	*	-0.031	(2.12)	**	0.023	(0.77)	
R^2		0.118			0.114			0.091			0.079			0.050	
$\bar{R}^2$		0.090			0.086			0.062			0.050			0.020	
F		4.321	***		4.030	***		2.599	*		1.901			0.212	

4.3.1: Kanzara (NOB=180), CARA model

	LANDD			LANDPC			CHILDR			SCHOOL			JGRRANK		
b_0	-10.25	(0.14)		8.75	(0.23)		-15.51	(0.26)		-12.46	(0.31)		-14.79	(0.21)	
b_1	9.68	(0.12)		-25.72	(0.44)		45.28	(0.25)		2.67	(0.36)		5.29	(0.18)	
a_0	0.370	(0.83)		0.651	(2.73)	***	1.009	(2.70)	***	0.794	(3.09)	***	1.335	(2.92)	***
a_1	0.662	(1.35)		0.667	(1.76)	*	-0.341	(0.30)		0.031	(0.67)		-0.180	(0.99)	
ζ_0	0.159	(0.77)		0.129	(1.77)	*	0.190	(2.25)	**	0.155	(2.17)	**	0.134	(1.24)	
ζ_1	-0.019	(0.09)		0.018	(0.21)		-0.213	(0.76)		-0.003	(0.26)		0.003	(0.06)	
R^2		0.164			0.171			0.158			0.158			0.160	
$\bar{R}^2$		0.140			0.147			0.134			0.134			0.136	
F		0.612			1.104			0.231			0.210			0.351	

4.3.2: Kanzara (NOB=180), CRRA model

	LANDD			LANDPC			CHILDR			SCHOOL			JGRRANK		
b_0	-0.014	(0.24)		-0.001	(0.02)		-0.006	(0.13)		-0.015	(0.46)		0.002	(0.04)	
b_1	0.012	(0.19)		-0.009	(0.19)		0.011	(0.08)		0.003	(0.51)		-0.004	(0.16)	
a_0	0.189	(0.48)		0.042	(0.22)		0.337	(1.10)		0.101	(0.48)		0.443	(1.22)	
a_1	0.160	(0.38)		0.717	(2.37)	**	-0.024	(0.03)		0.056	(1.50)		-0.056	(0.38)	
ζ_0	0.209	(1.15)		0.165	(1.90)	*	0.217	(1.92)	*	0.182	(2.13)	**	-0.096	(0.70)	
ζ_1	-0.120	(0.62)		-0.152	(0.98)		-0.414	(1.22)		-0.018	(1.21)		0.083	(1.61)	
R^2		0.053			0.081			0.059			0.069			0.064	
$\bar{R}^2$		0.025			0.055			0.032			0.042			0.037	
F		0.144			1.964			0.525			1.170			0.869	

Notes: 1) F gives test statistics F(3, NOB-6) for the joint hypothesis that $b_1 = a_1 = \zeta_1 = 0$ (homogeneity test). 2) Significant at 1% = ***, 5% = **, and 10% = * (2-sided test for t statistics whose absolute value is shown in parenthesis).