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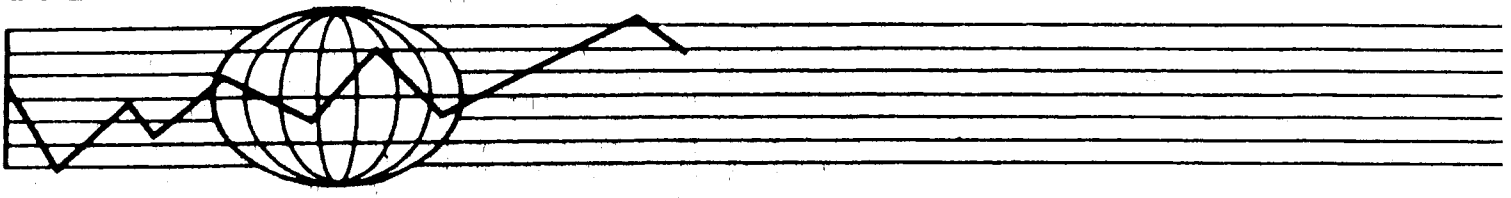

RISK, IMPLICIT CONTRACTS AND THE FAMILY IN RURAL AREAS OF LOW-INCOME COUNTRIES

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Abstract

In this paper the role of family structure in mitigating income volatility in the absence of income insurance in low-income agricultural environments is discussed. Hypotheses concerning the relationship between the membership, size and composition of households and insurance-based income transfers are tested using longitudinal data from India. A test is also performed of whether a household's ability to reduce risk ex post via family arrangements affects its willingness tobear risk ex ante through its selection of formal tenancy contracts. The results support these hypotheses concerning the risk-mitigating roles of both household structure and share contracts, and indicate as well the importance of heterogeneity in risk-aversion across households.

In recent years our understanding of rural institutions in low-income settings has been increased substantially by the application of modern micro-analytic models and methods to such environments. Two strands of literature have emerged. One has focused on the econometric modeling of household "institutions" as the loci of economic activities, in the theoretical tradition of Chayanov (1925). This literature (e.g., Lau, Lin and Yotopoulos (1978), Barnum and Squire (1978) and Rosenzweig (1980), summarized in Singh et al. (1986)), has employed static, utility-maximizing models of households simultaneously engaged in production and consumption decisions to provide rigorous (i.e., theoretically-grounded) and informative econometric analyses of the interplay between food prices, wage rates, agicultural profits, food consumption and labor supply.

A second, contemporaneous literature highlights two other important aspects of low-income rural environments, their riskiness and the absence of, or limitations on, insurance and other intertemporal markets. These environmental characteristics and the assumption of risk-averse agents are shown to account for the existence of such important formal rural institutions as share tenancy and permanent servant contracts as well as contractual interlinking. All of these institutions are viewed at least in part as ex ante means of reducing the riskiness of agricultural production for rural agents.

These two parallel approaches are characterized by complementary shortcomings. The household enterprise literature ignores market problems, indeed explicitly assuming the existence of all markets and full information, and thus is silent on intertemporal aspects of consumption and production under risk. Moreover, the approach takes for granted rather than explains the structure of households--their size and membership. The studies concerned with contractual forms, on the other hand, have seen little empirical application or testing, in

part because of the difficulty of extracting interesting testable implications, and in part due to data limitations. Moreover, almost all of these models are of single-person agents engaged in only one contractual arrangement despite the fact that almost all households in the settings to which the models apply contain multiple workers who are often engaged in different activities under multiple contract arrangements. And such models assume that households have no means of smoothing ex post income fluctuations.

In recent years it has been argued that the "transaction costs" framework (Williamson (1979)) which seeks to explain the existence of particular institutional forms can be fruitfully applied to the family as an organization, particularly in low-income settings when such costs may render informal arrangements more efficient than formal markets (Ben-Porath (1980), Pollak (1985)). This approach to the family has seen little or no empirical verification, however, as the environment in which the household or family arrangements substitute for formal market arrangements has not been adequately specified. Precise implications are thus lacking for how households smooth their consumption in the face of residual income variability, that which is not eliminated by formal risk-mitigating contractual arrangements. In part, the theoretical neglect of household behavior with respect to risk and the dearth of empirical work on contractual arrangements also stems from the absence of longitudinal data on households, which would document the importance of income fluctuations. Indeed, this salient attribute of agriculture, income volatility, is completely hidden in the cross-section household data which have made an important contribution the to recent advances in our understanding of rural institutions.

This paper is concerned with exploring the role of the household as a risk-mitigating institution in low-income rural settings, with particular attention to the relationship between the structure of households and ex ante and ex post income (consumption) smoothing. In Section 1, some perspectives on the

household are set out, with experientally-obtained information on risk patterns and spatially-spread intrafamily transfers highlighted. In Section 2, longitudinal data from six villages in the semi-arid tropics of India are described and fluctuations in agricultural incomes and in household transfer income over nine years are documented. Section 3 contains an econometric analysis of the relationships among family and household arrangements, income fluctuations and intrahousehold transfers. The results indicate that income transfers play a role in smoothing consumption. Moreover, the degree to which households succeed in mitigating risk ex post via transfers depends importantly on household structure. In Section 4, the proposition is tested that the household's ability to smooth consumption ex post, through household arrangements, is manifested in its formal contractual arrangements aimed at reducing exposure to income risk ex ante. The econometric prolems inherent in testing propositions about institutions serving risk-mitigating functions when there is heterogeneity among agents in risk-aversion is discussed and a test of the risk-reducing motive for sharecropping is implemented. Section 5 contains a summary and discussion of how viewing the household as a risk-reducing institution has implications for the means by which economic development may transform the structure and stability of households.

1. The Technology of Agricultural Production and Family Structure

There are six important environmental and technological characteristics of many rural areas of low-income countries that must be incorporated in any useful analysis of institutions in such settings: A. An important production input (weather) is stochastic, its realizations during the course of production being unpredictable and exogenous. B. The intertemporal distribution of weather outcomes is characterized by stationarity. C. Weather outcomes are serially (positively) correlated across space. D. Another important production input,

land, is immobile. E. The technology of production is stable. F. Production (crop) insurance is absent.

As long as agents in rural areas prefer to smooth their consumption over time and/or are (relatedly) risk-averse, condition A implies that resources will in part be allocated to minimize the riskiness of income and/or to smooth consumption. Condition F implies that individuals will look for alternatives to direct income insurance. Note that the absence of crop insurance itself must be explained in any analysis of rural institutions. In Binswanger and Rosenzweig (1986), it is shown how information and moral hazard problems inherent to agricultural production combined with condition C make the provision of crop insurance by private, profit-seeking agents unlikely (see below). Finally, conditions B and E imply that the institutions that are developed to cope with risk and fluctuating incomes will be stable, will be persistent features in the rural environment.

The modern contractual arrangements literature has focused on how production risk, combined with the absence of crop insurance, spills over into the land rental and wage labor markets, manifesting itself in share tenancy and permanent servant contracts with their attendant social (in terms of static efficiency criteria) and personal costs (Bardhan, 1984). Such rural institutions reduce fluctuations in income for given intertemporal patterns of states of nature. However, it is likely that the structure of rural households is also conditioned by risk and consumption smoothing problems.[1] Indeed, the structure of households in the low-income settings described above appears to differ distinctly from that of high-income industrialized countries characterized by more organized markets, governmental social insurance schemes, more predictable income sources, and technological change, where the dominant household form is the nuclear family.

We will examine one empirical setting that conforms to assumptions A through F--India prior to 1971 and post 1970 areas of India not importantly and directly touched by technological change (described in the next section). As discussed in Rosenzweig and Wolpin (1985), over 70 percent of rural farm households in India in 1971 were intergenerationally extended. That is, two adult generations related by kinship were residing in the same household, chiefly father and adult (married) sons. Almost no households were horizontally extended; adult siblings did not co-reside in the same household when their father was absent. In addition, almost no intergenerationally extended households contained married daughters of the head. Daughters of the head married and resided with their husbands outside of their village of origin.

a. Specific Experience, Weather Variability and Intergenerational Extension

Rosenzweig and Wolpin (1985) used assumptions A through F (the AF environment), combined with the additional assumptions that land plots are heterogeneous and interact with weather outcomes in production, to argue that (i) there would exist important payoffs to farming experience (given stationarity and the absence of technological change) in terms of the ability to mitigate profit losses associated with bad weather and (ii) such experience would be specific to plots of land. Given the specificity to the returns to experience, they showed that the children of the (experienced) farm head would have an incentive to remain on their family's land; that is, such family members, given their family-farm-specific experience, would be the highest "bidders" for that land. Fathers and children (sons) would then farm together, with the sons benefitting from the experience of the elder and gaining experience on the family plots of land. The sons would inherit the family land at the death of the head, since the sale of the land by the elder to any other anonymous agent would result in a capital loss (the value of experience) to the

family. The model thus simultaneously accounts for why land sales (and mobility among landholders) are low even in settings in which property rights are well-defined and the particular intergenerational structure of the households in the AF setttings, given the gender-based division of labor. Note that in this framework the experience of siblings, given the proximity of their age, is (almost) redundant; there are no "rents" associated with sibling co-residence.

Rosenzweig and Wolpin used a national longitudinal probability sample of Indian farm households to test the proposition that more experienced farmers suffered less in terms of farm profitability under adverse weather conditions. Their results were consistent with this hypothesis. They also showed that (i) sales of land were significantly less likely when the family was intergenerationally extended, for given weather conditions, mean farm profitability and the schooling attainment of the head, and (ii) the intergenerational family structure was more prevalent in areas subject to greater weather-induced profit fluctuations.

b. Spatial Covariances in Weather and Household Transfer-Insurance Arrangements

The Rosenzweig-Wolpin specific experience model suggests that the problem of stochastic weather variability combined with land specificities binds the intergenerationally-extended family to their family plot. Ex ante consumption smoothing represents a centripetal force bonding (certain) family members together. The concentration of family members in one location (even if plots of land are diversified and fragmented), however, makes it difficult for the household to smooth consumption either ex post or ex ante, given environmental characteristics C and D. Diversifying the household's portfolio of income sources would require less spatial concentration, given the spatial covariance of weather patterns and the immobility of land. The desire for consumption

smoothing thus represents a centrifugal force spreading out the family's members across space in the AF environment.

The diversification of family income sources combined with intrafamily (and interhousehold) income sharing is a means of smoothing consumption given imperfect covariances between kin-related households' stochastic realizations of income. The positive association be-tween risk-spreading and locational diversity, however, is precisely the reason for the failure of a crop insurance market--the information costs associated with monitoring exogenous shortfalls in incomes across many locations are pro-hibitively high. Thus it is not surprising that anonymous agents spread far apart cannot undertake implicit insurance agreements. If kinship and common (family) experiences induce trust, knowledge and altruism among family members, such income-pooling implicit insurance contracts may be feasible even if spread across wide areas. The spatially diversified, income-pooling family represents another institution arising from or influenced by the hazardous nature of rural production and the difficulties of self-insurance in low-income, rural settings.

The stationarity conditions B and E are very important for the feasibility of these long-term, implicit family insurance contracts. If the distribution of states of nature is unknown, or if the technology of production is changing unpredictabably, the information accumulated by family membes is obsolesced and and an important precondition for insurance contracts is absent--knowledge of the risks (expected liabilities). Technical change thus is likely to alter both the stability and the structure of households, even if such change neither exacerbates nor mitigates directly income risk. In contrast, risk-neutral technical change may not significantly alter directly the demand for more formal contractual forms such as share tenancy, which rely less on trust, altruism or knowledge of risk.

Are spatially-spread, family income-pooling arrangements important in low-income environments? Caldwell et al. (1986) report that in their study of households in nine villages in Karnataka in South India provision for income shortfalls was a "dominant" consideration in family life. Moreover, they found that a principal reason that household consumption did not fall severely during drought conditions (inclusive of complete crop failures) in their study area was the ability of the households to obtain resources from relatives. Moreover, they found that 87 percent of the relatives providing aid were located outside the study villages. Caldwell et al. also found that an important source of these compensatory transfers was the family of the head's wife. This latter finding implies that the bringing in of a new family member from another environment via marriage adds to the family's ability to smooth consumption; exogamy may reflect the spatial nature of risk patterns.

Lucas and Stark (1985) also showed that rural households in Botswana who were residing in areas subject to drought received more remittances from migrant family members, for given wealth, compared to households in non-drought areas. However, a problem with both the Caldwell and Lucas and Stark studies is that, because they are based on data from one point in time, they do not really demonstrate that net transfers fluctuate (inversely) with the origin households' economic conditions. In a true (fair) insurance contract, resources must flow out of such households in good times. It is impossible to know from these cross-sectional studies whether the poorer households were receiving higher transfers temporarily or were, for other reasons, net recipients of aid.

2. Variability in Agricultural Profits, Wage Rates and Transfer Income in Six Indian Villages

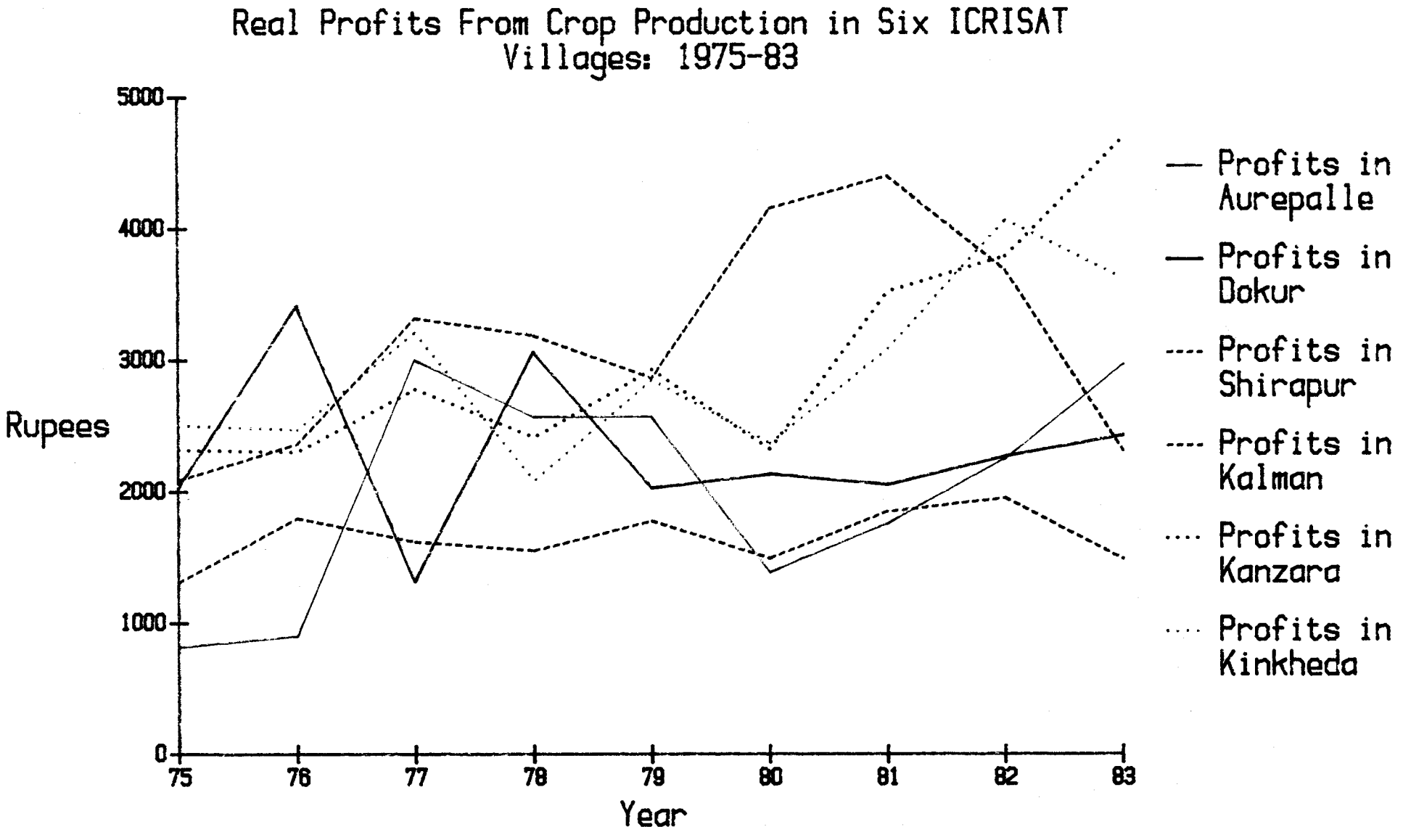
To document the hazards of agricultural production and the importance of household transfers in smoothing consumption poses severe data requirements, as longitudinal information over an extensive period on income by source, on costs

of production and on family structure are needed. In 1975/76 the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) began a survey in six villages in each of three agroclimatic regions in the semi-arid tropics of India. Information on income, expenditures, production resources, assets and family membership was collected at intervals of 3-4 weeks for 40 households per village in each of 10 years for three of the villages (one in each region), and for 7 years (the first 5 and the last 2) for the three others. In 1984 a retrospective questionnaire, designed by Hans Binswanger and Mark Rosenzweig, was employed to obtain information on additional family details, including inheritances and marriage information, and on incomes for the missing three years for the three villages for which this information was absent. At the time of the writing of this paper, data for nine consecutive cropping years (1974/75 through 1983/84) for 201 households in the six villages were available for analysis.

Two of the villages, Aurepalle and Dokur, are in a region characterized by soils with limited water storage capacity and by low levels and erratically distributed intra-and across-year rainfall. Irrigation is also not extensive. Two other villages, Shirapur and Kalman, are in an area with soils having superior water storage capacities, but with irregular rainfall and little irrigation. The final two villages, Kanzara and Kinkheda, have soils with medium storage capacity but experience significantly more reliable, but low, levels of rainfall compared to the other regions.

Figure 1 plots real mean agricultural profits (gross income from crop production less all costs inclusive of family labor, in 1975 rupees) by village for the 201 households in existence for all nine crop years. The three line patterns conform to the three regions, being identical within each region to facilitate comparisons of intra- and across-region heterogeneity. As can be seen, profits fluctuated considerably in all villages over the period--indeed, the

Figure 1


Real Profits From Crop Production in Six ICRISAT Villages: 1975-83
Rupees
5000
4000
3000
2000
1000
0
75
76
77
78
79
80
81
82
83
Year
Profits in Aurepalle
Profits in Dokur
Profits in Shirapur
Profits in Kalman
Profits in Kanzara
Profits in Kinkheda

sample mean coefficient of variation is 139. Correlations across regions moreover, are small, and in all but the third region (Kanzara and Kinkheda), within-region correlations in profits across years are also relatively low, but higher than those across regions--the regional correlations are -.060, .15 and .24; the cross-village, within-region correlations for the Aurepalle-Dokur, Shirapur-Kalman, and Kanzara-Kinkheda pairs are .32, .43, and .84 respectively. The less-than-perfect positive correlations across regions and villages in profit variability suggests that there is potential for consumption smoothing via cross-region and cross-village income sharing.

Figure 2 displays plots of real daily agricultural wages for males for each of the six villages across the nine years. Here, within-region similarity in intertemporal wage patterns is high (the correlations are .48, .98 and .49) and wage levels are more similar across villages than are levels of mean agricultural profits, as might be expected given the relative degrees of mobility of land and labor. However, wage volatility is also pronounced and wage fluctuations are not perfectly correlated across regions. Thus, there is considerable instability in the returns to labor as well as in the residual returns to crop production, and the co-movements in these returns suggest scope for transfer-based insurance arrangements.

Table 1 reports descriptive statistics for 186 of the sample households in the six villages for which all family structure and income information is available. Mean gross transfer income (defined net of dowry payments in or out) over the nine years was about 10 percent of mean agricultural profits, with mean net transfer income (gross transfer income less transfer expenditures excluding dowry receipts and payments) almost nil--there is thus an overall balance of gross inflows and outflows over the period, to be expected in a stationary environment if transfers have a strong insurance component. Are the sources of transfers mostly within or outside the village economies? Do net transfers

Figure 2

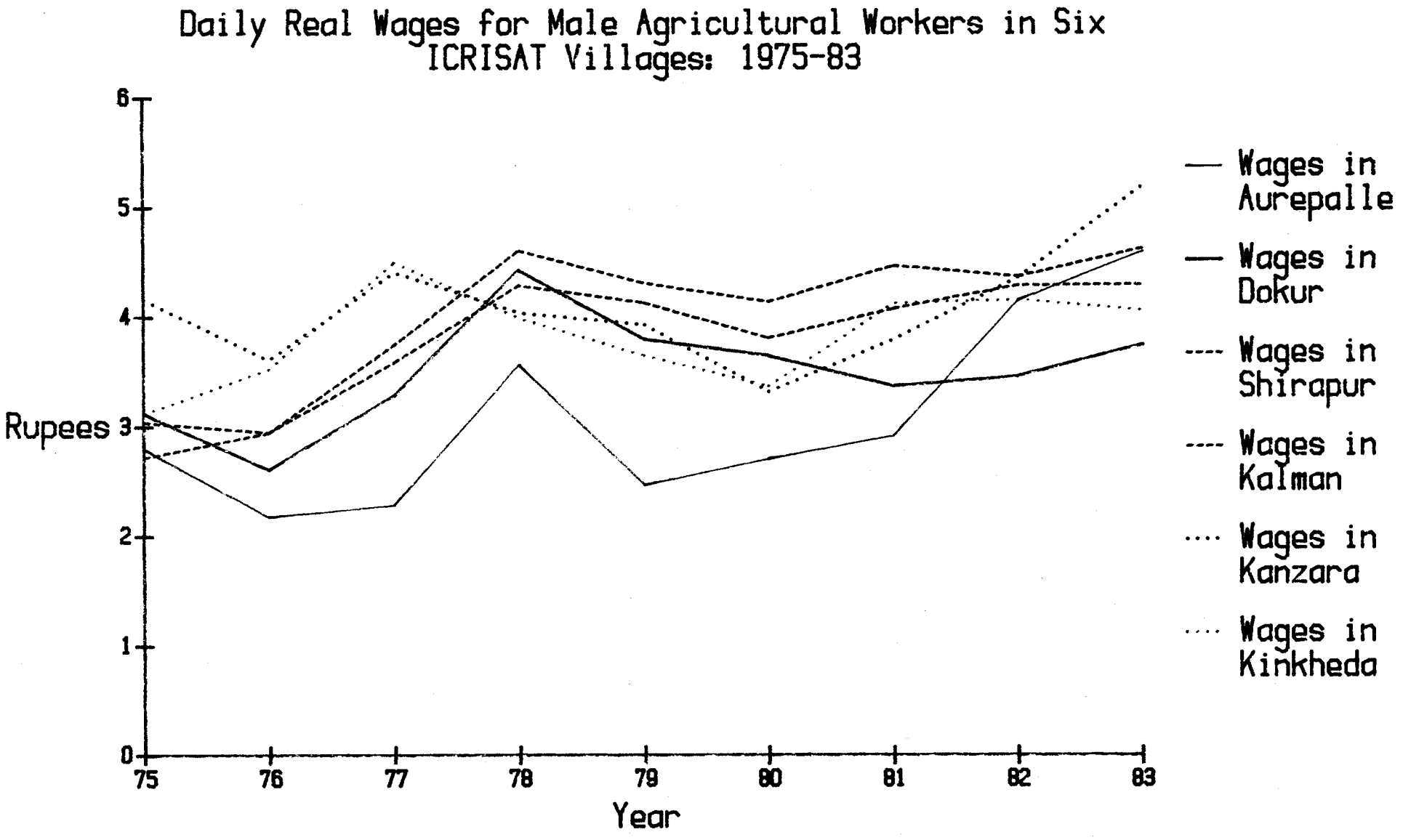

Daily Real Wages for Male Agricultural Workers in Six ICRISAT Villages: 1975-83
Rupees
0
1
2
3
4
5
6
75
76
77
78
79
80
81
82
83
Year
Wages in Aurepalle
Wages in Dokur
Wages in Shirapur
Wages in Kalman
Wages in Kanzara
Wages in Kinkheda

Table 1

Characteristics of Households in Six ICRISAT Villages: 1975-83

Characteristic	Mean	Standard Deviation
Real gross transfer income[a]	213	1000
Real net transfer income[a]	-18.0	1509
Real profits from crop production[a]	2221	3660
Nine-year coefficient of variation, real profits	136	454
Value of owned land[a]	26161	43000
Village daily wage, males[a]	3.70	0.68
Surviving siblings of head	3.32	2.05
Number of co-resident daughters-in-law of head	0.39	0.80
Number of household migrants	0.22	0.97
Number of co-resident adult males	1.87	1.15
Number of co-resident adult females	1.83	1.06
Age of head	47.9	12.3
Percent of operated acres shared-in, cultivating households	7.37	-
Number of households	186	

a. 1975 rupees.

fluctuate and respond in a compensating manner to profit fluctuations? Figure 3 displays graphically by year the deviations from village-specific means for net transfer income and for farm profits in the six villages. If transfers were solely intravillage, deviations from (village) means would be zero in each year. They are not; moreover, across the whole sample, net transfer income tends on average to be high (relative to its village mean) when profits are relatively low, and vice versa, suggesting that such transfers do contribute on net to inhibiting consumption variability due to income fluctuations.

3. Estimates of the Net Transfer Rate and Its Relationship to Family Structure and Endowments

a. Specification and Estimation Procedure

To more rigorously test the hypothesis that net transfers are compensatory with respect to income shortfalls and to examine the role of family structure in facilitating such transfers, we estimate the following model using the ICRISAT household data:

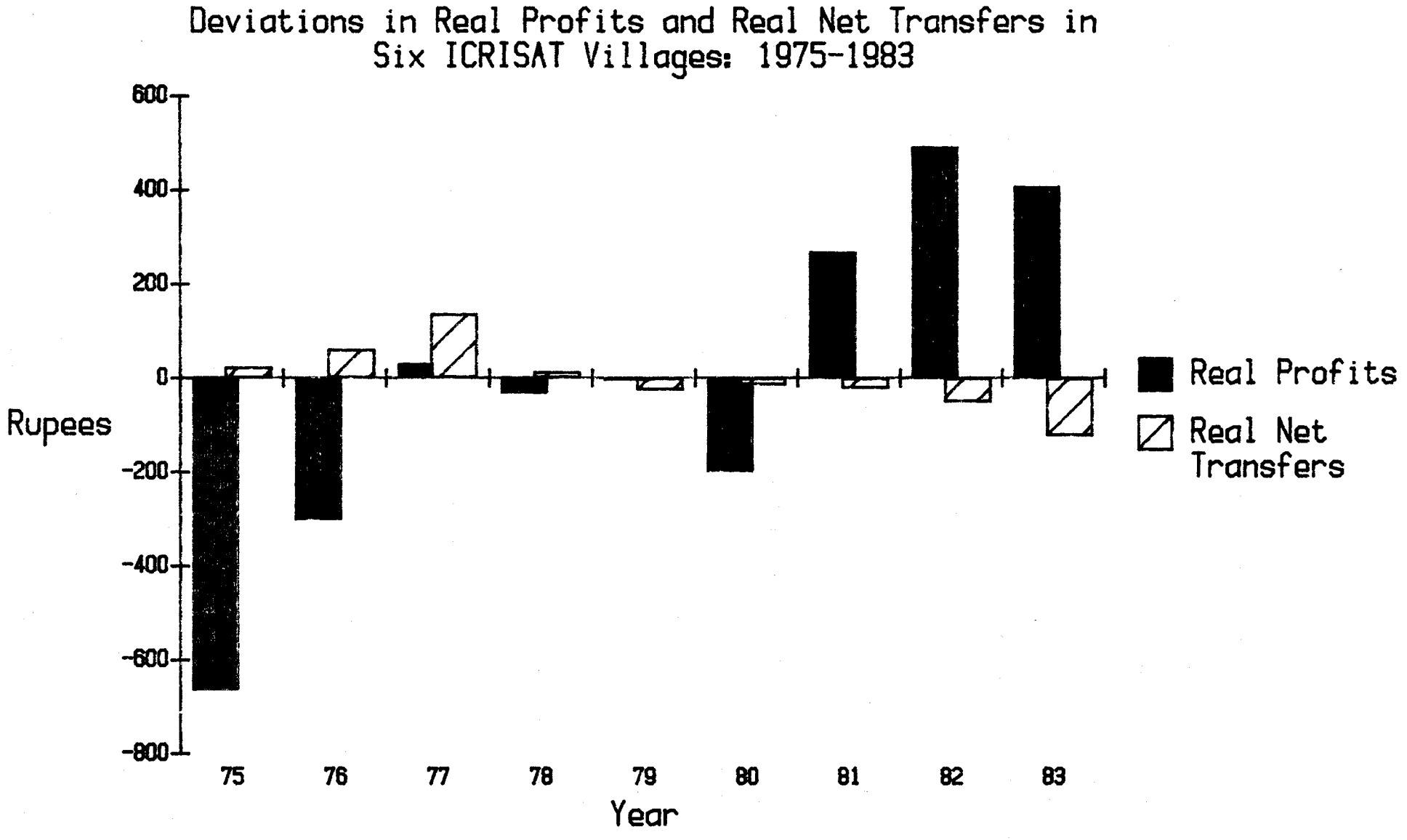
$$(1)\quad \tau_{tj} = \beta_0 + \beta_1 \tilde{\pi}_{tj} + \beta_2 \bar{\pi}_j + \sum_{i=1}^{n} \gamma_i F_{ij} \tilde{\pi}_{tj} + \sum_{i=1}^{n} \delta_i F_{ij} + \mu_j + \varepsilon_{tj},$$

where τ_{tj} is net transfer income in the tth year for the jth household, $\tilde{\pi}_{tj} = \pi_{tj} - \bar{\pi}_{tj}$ is the jth household's profit deviation in year t from its mean profit $\bar{\pi}_j$ and the F_{ij} are the set of n characteristics of the household that influence the rate at which net transfer income responds to profit deviations, the "transfer rate." We define the transfer rate for the jth household, R_j as the absolute value of the derivative of (1) with respect to $\tilde{\pi}_{tj}$;

$$(2)\quad R_j = \text{abs}[\beta_1 + \sum_{i=1}^{n} \gamma_i F_{ij}],$$

where $\gamma_i < 0$ for any household attribute facilitating transfers; that is, net transfers should be inversely related to profit fluctuations in any quasi-

Figure 3


Deviations in Real Profits and Real Net Transfers in Six ICRISAT Villages: 1975-1983
600
400
200
0
-200
-400
-600
-800
Rupees
75
76
77
78
79
80
81
82
83
Year
Real Profits
Real Net Transfers

insurance arrangement and the transfer rate should be greater for households with higher levels of F_{ij}.

Our discussion in Section 2 suggested that the composition of the family and the co-residential household will influence the transfer rate. In particular, those family members able to participate in the mutual insurance contract should be included among the F_{ij}. These would include relatives of the head (or spouse) resident outside the household and co-resident members with attachments to (family) resources external to the household. Accordingly, we include among the F_{ij} (i) the number of siblings of the household head, who are not co-residing with the head,[2] (ii) the number of "migrant" household members, defined in the survey as household members with no other established household, and (iii) the number of daughters-in-law of the head. The "migrants" are principally sons of the head serving in the military, but include as well daughters in "domestic" service. The majority of migrants reside outside of the district in which their home village is located. Note that military (and domestic) service implies an assured income that is not covariant with agricultural income. As noted, co-resident daughters-in-law of the household head are members as well of families residing outside the household's village. The number of daughters-in-law thus represent the number of potential arrangements with external resources, tied via matrimony.[3]

In addition to the family and household membership variables, the household's endowments may be important in influencing the household's transfer rate. If greater resources enable the household to self-insure through savings or are associated with less aversion to risk, well-endowed households may be less willing to invest in family-based transfer <u>cum</u> insurance arrangements (although better able to finance them). The age of the head may also influence R_j, to the extent that transfer arrangements require time to establish. Such schemes, for

example, require information about the distribution of risks, which is only revealed over time.

Omitted from (1) are the circumstances of those agents external to the household who are potential participants in the implicit insurance arrangements. Theory suggests, of course, that the arrangements are symmetric--the direction and magnitude of net transfers in period t depends on the relative transitory outcomes characterizing all parties in the "contract" in t. To the extent, however, that incomes are not highly correlated--a desired attribute of such arrangements, this omission should not result in any significant bias in the household transfer coefficients (in any case, positive correlations in transitory incomes imply a positive bias, against the theory). For example, the earnings of migrants in military service should be uncorrelated with the household's farm profits. The absence of information on the incomes of all contractual parties associated with each household in the sampling frame is common to almost all surveys.[4] Future work on contracts, either implicit or explicit, may require new thinking about optimal sampling procedures.

A serious econometric problem, for which corrective action can be taken, arises because of potential heterogeneity among households in abilities or in preferences for risk-taking. Since profit levels will reflect the unmeasured abilities and skills of the household head (a common problem in estimating production functions), and contracted transfers may also reflect abilities, estimates of (1) by least-squares will yield biased coefficients. More importantly, the head's willingness to bear risk may influence the extent to which he engages in ex ante measures to minimize profit variability as well as in ex post consumption smoothing arrangements (such as investing in migration)--transfers, family membership and ex post profit variability will jointly reflect unobserved risk preferences.

To eliminate the biases associated with these unmeasured attributes of the household, we can exploit the longitudinal nature of the ICRISAT village data. If the unmeasured risk preference and ability characteristics are time-invariant, as depicted by the μ_j term in equation (1), then a fixed effect procedure will yield unbiased estimates of all of the transfer rate coefficients in (2); i.e., β_1 and the γ_i, without the necessity of imposing any distributional assumptions on the omitted time-persistent characteristics (although we must assume the error term is additive). A cost of this procedure is that the influence of measured time-invariant variables (such as mean profits) on net transfer levels will not be estimable, but these are of secondary interest here.

b. Results

Table 2 reports the results obtained for two specifications of equation (1). The first two columns are GLS (random coefficients) and fixed effect estimates, respectively, of equation (1) that exclude the family-member interaction terms. The first set of estimates thus do not take into account the possible correlation of the right-hand side variables with the error terms, although the procedure does allow household-specific persistence in errors as well as for time-invariant village-level effects (captured by the five dummy variable coefficients with village names). The specification also ignores the role of the family in facilitating transfers. The second specification also omits family considerations, but the estimates are free of any biases due to omitted, time-invariant errors. Both sets of estimates, however, indicate that net transfers respond inversely, on average, to farm profit deviations and to village-level agricultural wage rates. The fixed effect estimates are not very precise, as is common with this procedure if there is measurement error in the variables (the profit-deviation and wage coefficients are jointly significant at the .05 level in that equation, however). On average, transfers reduce the variability in

Table 2

Determinants of Household Net Transfer Income:
GLS and Fixed Effect Estimates

Variable	Specification and Estimation Procedure (1) GLS	(1) Fixed Effect	(2) Fixed Effect
Profits from crop production	-.00987	-.00760	.0908
	(1.56)	(1.48)	(2.08)
Village daily wage rate	-68.5	-21.4	-30.4
	(3.47)	(1.09)	(1.45)
Mean profits	-.0246	-	-
	(5.72)		
Siblings x profits	-	-	-.00895
			(3.33)
Migrants x profits	-	-	-.00611
			(1.77)
Daughters-in-law x profits	-	-	-.00632
			(1.62)
Inheritance x profits ($X10^{-6}$)	-	-	.391
			(1.98)
Head's age x profits	-	-	-.00122
			(2.44)
Head's age	4.80	-34.3	-39.5
	(0.83)	(2.36)	(2.57)
Head's age squared	-.0224	.194	.287
	(0.40)	(1.34)	(1.81)
Head's schooling	-38.8	-	-
	(3.56)		
Daughters-in-law	-	-	25.5
			(0.67)
Adult males	-	-	-47.2
			(2.42)
Adult females	-	-	-22.1
			(1.17)
Aurepalle	-38.0	-	-
	(0.82)		
Dokur	71.2	-	-
	(1.65)		
Shirapur	195.0	-	-
	4.60		
Kalman	106.8	-	-
	(2.42)		
Kanzara	196.7	-	-
	(4.77)		
Constant	102.5	-	-
	(0.62)		
F_2	14.2	8.99	5.76
R^2	.080	.020	.095
n	1674	1674	1674

profits by less than one percent, but the rate increases significantly for those households with more family "ties" (see below).

The GLS estimates also indicate that households with higher mean levels of profits are net providers of transfers, suggesting that there is some private and (but persistent) redistribution of resources across households. However, Hausman tests reveal that the set of variables in specification (1) are significantly correlated with the residuals; thus the estimates in column one are biased.

The third column of Table 2 reports the (appropriate) fixed effect estimates of equation (1) inclusive of interaction (γ_i) terms. The set of family/profit deviation interaction estimates are consistent with the hypothesis that the transfer rate, the degree to which transfers compensate for profit shortfalls (and require outflows in "good" times), depends on the "structure" of the household. In particular, households whose head has a greater number of siblings (who reside outside the household), that have more migrant members and have more daughters-in-law are characterized by greater transfer rates, controlling for all fixed attributes of the households.[5] In contrast to the Caldwell et al. finding that daughters-in-law are the most important means through which insurance transfers come, Table 2 indicates that it is the siblings of the head who provide (receive) the most support in response to income flucations. The point estimates suggest that a household with a 50-year old head having 4 siblings, 2 married daughters and one migrant would have a transfer rate of 2.5 percent (the maximum rate in the sample is 5.3 percent).

The results in column three also suggest that households whose heads are older are also characterized by greater compensatory transfers. Moreover, as expected, those households with greater endowments, as represented by the value of the head's inheritance, have a lower transfer rate; insurance-based, household transfers decline with household resources.

4. The Relationship Between Ex Ante and Ex Post Insurance Arrangements: Family Structure, the Transfer Rate, and Sharecropping

An important implication of the insurance-theoretic approach to institutions is that one risk-reducing institution should substitute for another. Thus, for example, households better able to engage in ex post consumption smoothing would presumably allocate less resources, ceteris paribus, to ex ante insurance arrangements, and vice versa. In this section we further test the hypothesis that family structure mitigates consumption volatility via transfers by testing whether households more successful in their ex post transfer contracting are less willing to share risk ex ante via share tenancy. Note that we are also testing a central propositon of the sharecropping literature, that share contracts serve an important risk-mitigating role.[6] Our discussion suggests that family structure and share contracting are importantly linked.

Heterogeneity among contractual agents in attitudes towards risk renders tests of institutional or contractual "substitution" difficult. Theory suggests (or defines) that if an agent of given characteristics finds it cheaper to insure via one contract, he will substitute resources from other, substitute contracts. A comparison of contractual choices among heterogeneous agents, however, confounds this (attitudes-constant) substitution with the variability across agents in willingness to bear risk. Thus, more risk-averse agents may choose to intensively insure ex ante as well as ex post; less risk-adverse agents may do little of either. Heterogeneity thus biases positively the hypothesized negative association between substitute contractual institutions.

To assess the importance of heterogeneity in risk attitudes, both the GLS and fixed effects procedures are employed to estimate, among the 153 cultivating households in the ICRISAT sample, the relationships between family structure, the transfer rate and the proportion of cultivated acres that are shared in. Table 3 reports estimates of these relationships. In the first

Table 3

Determinants of Proportion of Operated Acres Sharecropped by Cultivating Households: GLS and fixed Effect Estimates

Variable	GLS	Two-Stage GLS	Fixed Effect
Transfer rate	-	-1.41	-3.83
		(2.01)	(1.82)
Value of owned land ($X10^{-6}$)	-.274	-.395	-.285
	(2.02)	(2.12)	(1.48)
Siblings of head	-.00252	-	
	(0.92)		
Daughters-in-law	-.00917	-	-
	(1.11)		
Migrants	-.0144	-	-
	(2.58)		
Head's age	.000327	.00123	.00997
	(0.12)	(0.47)	(1.58)
Head's age squared ($X10^{-5}$)	.965	-1.56	.630
	(0.37)	(0.61)	(0.07)
Head's schooling	-.00751	-.0103	-
	(1.46)	(2.08)	
Adult males	.0257	.0225	-.00421
	(4.22)	(3.83)	(0.52)
Adult females	-.0156	-.0135	.00284
	(2.56)	(2.10)	(0.38)
Aurepalle	-.0768	-.0852	-
	(3.59)	(4.26)	
Dokur	0.0513	0.0680	-
	(2.50)	(3.32)	
Shiraper	.0453	.0399	-
	(2.29)	(1.94)	
Kalman	.0566	.0552	-
	(2.93)	(2.86)	
Kanzara	-.0178	-.0208	-
	(0.92)	(1.12)	
Constant	.0703	.0253	-
	(0.93)	(0.32)	
F_2	8.74	10.40	3.05
R^2	.088	.085	.013
n	1377	1377	1377

column, the GLS estimates indicate that sharecropping intensity is negatively related to the presence of family members (co-resident or not) shown in Table 2 to facilitate ex post consumption smoothing, for given family size. While only the migrant variable coefficient is statistically significant by conventional standards, the three family variables are jointly significant at the .01 level. The GLS estimates also indicate, as is conventionally found, that households owning greater land resources engage less in sharecropping, for given family size; a result consistent with the hypothesis that risk aversion decreases with wealth.

One convenient way to summarize the influence of the family, endowment and age variables on sharecropping arrangements is to use the estimated transfer rate coefficients (equation (2)) from Table 2 to construct household-specific (and time-varying) transfer rates. Since these rates are measured with error, the relevant family and endowment variables can be used as instruments in a two-stage procedure. The second column of Table 2 reports the sharecropping-transfer rate estimate, which confirms the findings of column 1--those households with greater ex post insurance purchase significantly less ex ante risk protection via sharecropping.

Column 3 reports the corresponding fixed effect estimate. While the transfer rate coefficient is slightly less precisely measured than its GLS counterpart, it is notable that its magnitude (in absolute value terms) increases by 270 percent. The presence of heterogeneity in risk preferences evidently substantially biases, in a predictable direction, the estimated substitution between the two insurance-based contracts. The (consistent) fixed effect point estimate indicates that households that send out one member as a migrant, with no change in household membership size, would reduce their proportion of acreage cultivated under share tenancy by 32 percent; the marriage of a

co-resident son (the addition of a daughter-in-law) decreases share tenancy intensity by 33 percent.

5. Conclusion

In low-income countries, the family is a critical institution which serves many of the roles carried out by formal organizations in high-income societies. Aside from the family's preeminent role in determining population growth and human capital investment, two key development factors, the ties of common experience, altruism and heritage among family members mitigate the inefficiencies associated with the absence of impersonal markets, a salient characteristic of low-income environments. In this paper we have highlighted the problem of income volatility and the absence of income insurance in low-income environments and have discussed how the membership, size and composition of households and cross-household kinship ties can be at least partly understood in terms of risk-mitigation. Evidence from a set of villages in India suggested that kinship in a risky world not only tends to bond family members in a single location (in a particular way) but kinship ties are able to be sustained over space and over time in implicit insurance-based transfer schemes. While such arrangements evidently play only a small role in enabling a household to smooth its intertemporal consumption paths, a household's success in reducing risk ex post via its family ties importantly affects its willingness to bear risk ex ante through the organization of productive resources.

The ability of the family as a collective institution to protect its individual members from severe risks and to efficiently utilize empirically-ascertained knowledge in productive activities appears to rest importantly on the stationarity of the low-income-setting. Technical change within the rural sector, which alters the distribution of risks, thus may erode the comparative advantage of the elderly--their knowledge of optimal productive practices under differential varieties of states of nature--and make difficult long-term impli-

cit contracts among individuals based on assumptions about the future. Thus, resources may be transferred from the old to the young in the form of loss of "respect" for elders or the break-up of intergenerationally-extended families. Agricultural technical change may thus lead to new family structures, to changes in marital customs, to increased mobility, to increased ex ante risk protection measures, and to more conservative attitudes and to resistance to change, at least in the short term, even if such advances lower overall risk levels.

In contrast to the effects of agricultural technical change, urban industrialization may facilitate risk-taking within the agricultural sector and increase the spatial extension of families or households. The increased availability of income sources whose risks are not highly covariant with those in agriculture may create incentives for households to invest in the migration of its members. If income pooling with migrants can be sustained, reductions in ex ante production-related risk-avoidance measures may ensue.

Finally, the emergence, establishment or improvement of formal institutions which more efficiently perform some of the functions taken on by families will also tend to transform the structure of households and affect family relationships. Designers of such institutions should be cognizant of their impact on the household organization, which so directly affects the welfare of individuals. Improved models of family interactions may be helpful in anticipating the welfare effects of both economic development generally and the development of specific institutions designed to facilitate growth.

Footnotes

1. Becker (1981) in his concise, but speculative, discussion of families in "traditional" societies also highlights the riskiness and stationarity properties of such environments in accounting for household functions. However, the problems associated with the spatial nature of agricultural risk patterns are given less attention. Ben-Porath (1980) ignores stationarity but suggests the importance of risk-covariances in the ability of the family to cope with income risks.
2. Consistent with the specific experience framework, in only 4 of the 201 households did a sibling of the head reside in the same household as the head.
3. Married daughters of the household head, who reside outside the household, also represent external, kinship ties and were included in preliminary empirical investigations. However, the number of married daughters did not affect the extent to which net transfers responded to the (origin) household's income fluctuations. It is likely that the origin household's transfers would be affected by the transitory incomes of the household in which the married daughter resides, but information on this variable is absent from the survey data (see below).
4. Neither the Caldwell et al. (1986) nor the Lucas and Stark (1985) studies incorporated the incomes of the transfer-source households.
5. Note that the finding that co-resident daughters-in-law are associated with greater (origin) income-responsive transfers (net of dowry) while married daughters are not (see Note 2) implies that transfers, on net, flow from the household of origin to the new household of the daughter in response to the daughter's transitory welfare level and that the covariation between head's

and daughter's household incomes is not high. Parental altruism dominates in-law altruism.

6. Other non-risk-based explanations of sharecropping emphasize the absence of markets for and the unequal distribution of farming experience (e.g., Eswaran and Kotwal (1985)) and the incentives problems associated with asset maintenance (Datta and Nugent (1986)).

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