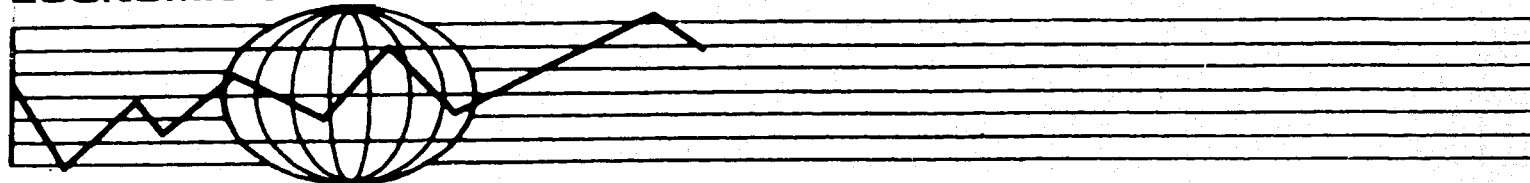


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AND MARRIAGE: EVIDENCE FROM RURAL INDIA**

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CONSUMPTION SMOOTHING, MIGRATION AND MARRIAGE:
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Abstract

Migration in India, particularly in rural areas, is dominated by the movements of women for the purpose of marriage. We seek to explain these mobility patterns by examining marital arrangements among Indian households. In particular, we hypothesize that the marrying out of daughters to locationally distant, dispersed yet kinship-related households, are manifestations of implicit inter-household contractual arrangements aimed at mitigating income risks and facilitating consumption smoothing in an environment characterized by information costs and spatially covariant risks. Analysis of longitudinal South Indian village data lends support to the hypothesis. Marriage cum migration contributes significantly to a reduction in the variability of household food consumption. Farm households afflicted with more variable profits tend to engage in longer distance marriage cum migration. The hypothesized and observed marriage cum migration patterns are in dissonance with standard models of marriage or migration which are concerned primarily with search costs and static income gains.

Studies of migration in low-income countries have been principally concerned with the flows of individuals and families from rural to urban areas. Such studies for the most part have been based on theories of migration in which agents seek income gains (or expected income gains), and migration is viewed as a wage (or expected wage) equilibrating mechanism. In a major low-income country, India, however, rural-to-urban migration is a relatively small component of total migration. Analyses of the 1981 Population Census of India (Surdaram, 1986; Skeldon, 1986) reveal that the net outflow from rural to urban areas represented only 2.2 percent of the total rural population, the gross outflow of migrants for reasons of employment represented only 1.6 percent of the rural population in 1971 and only a little more than eight percent of the urban workforce. Net rural-to-urban migration contributed less than 19 percent to the total growth in the Indian urban population between 1971 and 1981.¹

Overall geographical mobility and hence rural-to-rural migration in India, however, is not low. Almost 30 percent of the population in 1981 (196.3 million people) was composed of individuals who resided in a place other than their place of birth. Most importantly, almost 80 percent of these "lifetime migrants" were women who gave marriage as the principal reason for their move. Migration in India is thus predominantly a marital phenomenon, for which conventional employment-based explanations of migration, motivated by the incentives of spatial income differentials, would appear ill-suited.

In this paper, we develop and test, based on unique longitudinal data, a framework capable of explaining marriage-cum-migration patterns in the context of India. Our central hypothesis is that marital arrangements among Indian households, in particular, the "exchange" of individuals among

households, characterized by the distance between households and assortive mating patterns, are manifestations of implicit contractual arrangements serving to mitigate income risk and facilitate consumption smoothing under conditions in which there are informational costs and spatially covariant risks.² Problems of information asymmetries and returns to risk diversification have been fruitfully incorporated in models of such formal rural institutions as banks and sharecropping contracts and the landholding arrangements of cultivating households (e.g., McCloskey, 1976). While only recently have insurance considerations been brought to bear to the study of actual migration phenomena (Lucas and Stark, 1985), the pervasiveness of risk, and its important spatial character in rural agricultural societies, suggests that attention to consumption-smoothing arrangements and insurance mechanisms may be useful in understanding marriage-migration processes. Indeed, anthropological and econometric studies (Caldwell, et al., 1986; Rosenzweig, 1987) indicate that non-resident in-laws in India are the principal sources of income transfers for households experiencing income shortfalls associated with the exigencies of weather.³

In Section 1, we describe our framework for examining the locational and sorting patterns of marriages under a regime of spatially-covariant risks and compare the implications of the framework to those derived from models of marriage and migration that ignore payoffs to risk diversification. Section 2 provides a description of the sample used and statistics from it on mobility, marital arrangements and the extent of occupational, locational, landholding and marital diversification characterizing Indian farm households. In Section 3, an econometric analysis is performed to test directly the proposition that marital arrangements contribute to mitigating the influence of farm income

variability on household consumption. Section 4 tests the implications for how household wealth holdings and the degree of risk characterizing crop production jointly influence the mobility--via marriage and via migration--and occupational choices of household members. The results support the hypothesized consumption-smoothing role of marital arrangements and indicate, consistent with the insurance-theoretic framework, that the exogenous income riskiness faced by a household and its ability to self-insure via own wealth holdings jointly and in a similar way influence (i) the distance between it and the households with whom it is engaged in marital-cum-insurance contracts and (ii) the probability that the household has among its members temporary migrants or resident persons with non-volatile incomes. The wealth-contract-distance relationships estimated appear to be inconsistent, however, with models of marriage (or migration) concerned only with costs of search and static income gains.

1. Spatial Risk Patterns and the Gains from Marriage-Migration

A distinguishing feature of the agricultural sector is that income risk has a spatial dimension. As a consequence, the pooling of risks entails the transfer of funds and/or resources across space. The spatial separation (distance) of agents who might benefit from a risk-pooling arrangement, however, makes such arrangements difficult, given the need to monitor performance as a consequence of moral hazard. Thus, while the distance between contracting agents provides a risk-pooling benefit, it also increases costs of enforcement. The non-existence of competitively-provided crop insurance and the difficulties of credit provision in most low-income rural areas are in part consequences of the spatial character of

agricultural risks. Protection against risks, however, is an important need of households engaged in agricultural production.

Consider an economy consisting of households engaged in the production of a single good residing in spatially-separated villages. Each village has associated with it a stationary stochastic process generating in each period a production input (weather). Households in a single village are exposed to identical risks, while states of nature vary across villages. Assume that all households have identical endowments and that all parameters describing the village-specific risks are also identical across villages. Conventional migration theory would predict that there would be no migration in this environment. But consider a household in a village (A) that consists of two members. Suppose production in the household provides earnings per member of 100 in a good crop year and 25 in a bad crop year. If one-half of crop years are good and one-half are bad, the expected household earnings per crop year would be 125. However, since several bad crop years could come in a row, agricultural production is risky, especially when the capacity to transfer consumption across years is poor. Assume however, that in another village (B) a bad (good) crop year perfectly coincides with a good (bad) crop year in village A. Assume that a village A household sends one of its members to work for a village B household and the village B household sends one of its members to work for the village A household. Also assume that when working for the other household each household member will receive exactly the same earnings as at origin, contingent on the location-specific state of nature. In a good crop year in village A production for a village B household will result in earnings of 25, in a bad crop year in earnings of 100. Therefore, in a good year, the village A household's total return would be 125. And in a bad year, also 125.

We see that whatever happens to agricultural production in village A, by diversifying its labor resources the village A household is assured of earning 125 every year. Since the story for the village B household is perfectly symmetric, the village B household is also assured of earning 125 every year. With pooling by family members and the assumed perfect negative covariance between village-specific risks, diversification totally eliminates the household's risk.

Although by construction the expected wage differentials are zero, we nonetheless observe quite a great deal of migration. But this migration is of a certain type--we do not observe the migration of entire households, for example. Obviously, if the entire household were to move from Village A to village B and vice versa, risks will remain exactly as before. Note, furthermore, that to motivate the story, perfect negative correlation is sufficient but not necessary. If there is only some lack of parallelism, risk is reduced. For example, if crop productions in the two villages are statistically independent, the joint returns to a diversifying household will be 50, 125 and 200 with probabilities $\frac{1}{4}$, $\frac{1}{2}$, $\frac{1}{4}$ respectively. In comparison with the initial situation (50, 200 with probabilities $\frac{1}{2}$ each) this implies a mean preserving transfer of probability mass to the center, which to risk averse households is clearly desirable.

We see that for households to benefit from trade in risks, dissimilarity in household endowments is not required; that the absence of institutions that specialize in risk pooling and insurance does not preclude significant reduction of risks by direct exchange between the entities facing substantial risk; and that the very small size of households need not preclude a capacity to reduce risks (inability to realize scale economies can be ameliorated by ability to realize space or scope economies).

Of course, if each of the two households could establish a 50 percent claim with respect to the other household's earnings, the risk reduction result would still hold. But, (1) contractual arrangements require enforcement and (2) insurance contracts are susceptible to the well-known difficulty of moral hazard. It appears that both of these contractual costs are minimized by the "exchange" of household members, although the exchanged members need not be workers. Marriage across villages is one natural device conferring diversification benefits. Moreover, and as discussed below, in view of these considerations, a particular pattern of marriage appears socially optimal. The presence in household B of a member of household A not only supplies household A with a reinforcement device but also introduces a verification and monitoring capacity; it is harder for household B to deliberately undertake actions which require household A to deliver insurance payments when a member of household A is with household B. Dampening of performance incentives is less likely.

The virtually uniform practice of daughters migrating to the villages of their grooms appears to ensure that no household can escape being monitored; for if every household has both sons and daughters, every household ends up being monitored by daughters from other households, whereas if some households were to marry out all their children whereas others were to have the spouses of all their children coming in from other households, the former will not be monitored, whereas the latter will be "over-monitored". Although on the basis of this argument alone it is not possible to predict from which "side of the market" the movers will come, it is possible to predict that they will tend to come from one side--the uniformity by sex of marriage migration is socially optimal.⁴ Note that a pattern of marriage migration wherein given pairs of households are not

directly involved in the exchange of "hostages" yet are part of (and have a stake in) the "hostages" network confers high efficiency gains. After all, an exchange regime wherein the carpenter in need of shoes must search for a cobbler in need of a chair entails high transaction costs. Social gains are higher when the match technology allows the choice of spread to be fully determined by risk diversification considerations.

If households connected by marriage are also related due to some past marriages an additional layer of enforcement is enjoyed. Moreover, if kinship facilitates information flows, marital matches among partners already related by kinship will be desirable. Thus, risk considerations suggest that marriages will take place between partners in different rather than the same villages, but not in order to avoid marriages between close kin. Rather, marriages are likely to be among kin-groups because they take place across spatially-separated locations.

Information considerations would appear to suggest that marriages arranged by a household with, say, many daughters would often take place with multiple sons from another household, particularly given the desirability of matching households (see below). While multiple transactions with the same household do minimize transaction costs, gains from diversification are not fully exploited. If the village A household has more than one individual who can be transferred or who will migrate via marriage, say two, and if there are two other villages, B and C, such that crop outcomes are, say, statistically independent across all three villages, household A may prefer to marry out each one of its daughters into villages B and C (rather than both into any one of these two). The insurance conscientious village A household will best subdivide its risk by sharing it among different villages.

As to the direction of the flows between households, the point to notice is that it really does not matter. Take the case of perfect negative correlation between the earnings of a village A household, a daughter of whom marries into a village B household, and the earnings of the village B household. If the objective is to smooth the daughter's consumption, then clearly when she is most in need of support her parents are in the best position to provide it. When the parents are in the worst possible situation she is least in need of support. If the objective is to smooth parental consumption, then when the parents need support most, their daughter's household is in the best possible position to provide it, and when they need no support at all she is not in a position to provide it anyhow.

Considerations of the returns to risk via cross-household sharing arrangements and problems of incentives thus imply a particular assortive mating pattern--the origin and destination household's "permanent" characteristics or endowments influencing the level and variability in incomes will be similar (positive assortive mating with respect to the persistent attributes of agricultural incomes) but the correlation between income outcomes will be as low as possible. Close matching by endowments is desirable because a difference in endowments which determine susceptibility to risk (such as the size of irrigated landholdings) leaves the better endowed household poorly insured.

Table 1 summarizes the predictions of the risk-theoretic approach to marriage migration--households engaged in a marriage exchange will be (a) closely matched by the permanent traits of the members, (b) gains in income levels associated with the distances of marriage-migration moves will be small or nonexistent, (c) individuals from the same origin household will

Table 1

Predictions of Migration and Marriage Theories

Based on Income Gain and Risk Mitigation

Phenomenon	<u>Risk-Mitigation</u>	<u>Income Gain</u>	
	Marriage-Migration	Migration Theory	Marriage Theory
Correlation between persistent characteristics of partners (family background)	> 0	-	> 0
Correlation between scope (distance) of search (move) and income gain	≥ 0	> 0	> 0
Correlation in destinations among persons from same origin	< 0	> 0	> 0
Correlation between scope of move (distance) and wealth	< 0	> 0	> 0
Correlation between scope of search (distance) and income risk at origin	> 0	< 0	< 0

tend not to have the same destinations, (d) households with more wealth will invest less in marriage-migration--the distance between households linked by marriage will be less for the more wealthy, and (e) households facing greater income risk, for given wealth levels, will be more willing to finance moves of longer distance.⁵

To contrast the risk-theoretic framework with standard migration and marriage models, we place the predictions of those models alongside those of our framework in the second and third columns of Table 1. Economic models of marriage (Becker, 1973, 1974; Keeley, 1977) and of migration incorporate income gain and search cost considerations, with marriage models, unlike those of migration, concerned as well with the matching of the traits of individuals, although this is implicit in migration models where individuals find locations most complementary to their skills.

Positive assortive mating is predicted by income-gain marriage models based on the notion that individuals' traits are for the most part complementary. While this implication is the same for the risk-diversification framework, the existence of income gains from closely matching traits implies that those individuals with relatively rare traits will invest more in search. In a spatial context, therefore, we would expect using the income-gain framework that the more wealthy would tend to search over a greater area for a marital match and to be engaged on average in longer-distance marital arrangements, in contrast to the risk model in which the primary payoff to distance is the reduction in risk covariances, which is less valued by the wealthy who are better able to self-insure. The wealth-distance relationship provides a strong test of the two approaches to marriage in the Indian setting.

A well-known finding of migration studies is the high serial correlation in migration flows between specific origins and destinations. This finding is often attributed in the migration literature to the role of information (Greenwood, 1971). Such search-theoretic considerations, as noted, thus suggest that the correlation between the destinations of individuals from the same origin (household) will be positive; while risk diversification suggests the desirability of diversity among destinations. The sign of the correlation between the destinations of marital migrants thus discriminates between the risk and income gain approaches to migration. Finally, in contrast to the income-gain models applied to marriage-migration the risk framework suggests that (origin) income riskiness will increase the distances of marriage-migration linkages.

2. Mobility, Marital Arrangements and Spatial Risk Diversification Among Indian Farm Households

a. The Sample and Household Marital Arrangements

To examine marriage and migration patterns in the context of household arrangements facilitating the minimization of consumption risk requires information not only on the characteristics of household members and their origins and on household asset portfolios, but on income flows and consumption behavior over time. We use a unique longitudinal data set from Southern India that provides most of the necessary information. In 1975/76 the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) initiated a survey in six villages in three agroclimatic regions of the Indian semi-arid tropics. In each of three villages information on family membership, incomes, expenditures and production resources was collected continuously over a ten year period for 40 households in each

village. A supplementary retrospective questionnaire was employed in 1984 to elicit additional information on family background, marriages and inheritances for 400 households, those households in the original six villages and households in four additional villages that ICRISAT had begun to survey in 1979/80. In addition, more details were obtained in 1985 from households in the three "continuous" villages on the kinship relationships between marital partners and on the distances associated with marital migration.

In the analysis here, we will use data on farm households in the three villages (Aurepalle, Shirapur, and Kanzara) for which there is continuous information over the ten years on farm profits and food expenditures and the supplemental marital information. Each village represents a distinct agroclimatic area. Aurepalle village is located in a region marked by low levels of erratically distributed rainfall and by soils with limited water storage capacity. Shirapur village is characterized by soils having somewhat better water storage capacities, but is in an area with equally irregular and low levels of rainfall and little irrigation. Kanzara is also characterized by low levels of rainfall, but rainfall is somewhat more reliable and soils have storage capacities equal to that of Shirapur. The principal crops grown in the villages are sorghum, pigeonpea, pearl millet, chickpea and groundnuts--crops unaffected by the Indian "Green Revolution." Agricultural incomes are quite variable; the ten-year standard deviation in farm profits net of the value of family labor is 25 percent greater than mean profits for the average farm household.

The three villages appear to conform to the general Indian mobility pattern--only eight of 108 (male) heads of households (less than seven percent) were born outside the village, while almost 94 percent of married

women were not residents of the village prior to marriage. "Temporary" migration is more prevalent than male "permanent" migration but less pervasive than marital migration in the sample. Only 28 percent of the sample households reported having at least one migrant member, a person 18 years of age or over not resident in the village household nor residing in an independent household. While all of these household members were located outside of the sample villages, less than half of the migrants represented a potential steady source of income, as described below.

The sorting patterns of the marital partners appear to be consistent with search-theoretic approaches to marriage, whether based on income gain or risk mitigation. A supplementary retrospective survey on the kinship relations associated with all marriages in the sample households in one of the villages, Shirapur, indicates that despite geographical exogamy, or, more precisely because of it, almost all marital partners were also related by kinship--of the 115 marriages, only 14 (12.2 percent) involved partners who were not also relatives. Daughters-in-law of the head, for example, were most typically daughters of a sibling of either the head's father or the father of the head's wife. The ties between spatially separated households thus are typically reinforced by marriages, not just initiated by them.

The high degree of matching among marital partners in the village with respect to the mean income-generating characteristics of the parents of each partner, also conforms to the prediction of marriage models. In 82 percent of the marriages involving the heads of households, for whom this information is available, the head and his wife had parents with either the same (within one acre) dry or irrigated land-holdings or with the same parental schooling levels (in six categories); 41 percent had parents with

exactly (within one acre) the same parental amounts of dry and irrigated landholdings and fathers with identical levels of schooling.

b. Spatial Risk Diversification: Land Plots, Marriages and Migrants

A farm household may diversify its income sources and thus reduce the intertemporal variability in its income by cultivating plots of land differentiated by their sensitivities to given states of nature or by diversifying the geographical location of potential income sources in the face of spatially covariant income risks. The sample households appear to utilize both types of diversification; however, the portfolio of origin households connected via marriage/kinship appears to be the dominant form. Table 2 provides information characterizing the spatial diversification of the sample farm households in the three villages with respect to sources of income. While almost three-fourths of farm households own two or more plots of land, less than half own plots that are distant from each other in terms of either soil quality (among seven types), irrigation, or location. Moreover, the mean distance of each plot from the household is less than 1.5 kilometers; the mean maximum distance of each owned plot from another owned by the same household is only 1.7 kilometers.

Information on plot transactions obtained from the sample households suggests, moreover, that the households do not view plot fragmentation as advantageous. Of the 401 plots owned by the sample households in the three villages, 65.3 percent were inherited by the household head and still owned. While the major reason given for selling plots, "for the money" (85.7 percent), was not informative, of the plots purchased by the households since inheritance, 42 percent were done so in order to consolidate landholdings and/or because the plot was close to the household residence. Diversification was never mentioned as a reason for buying or selling plots.

Table 2

Diversification Characteristics of Farm Households:
Inherited Land Plots, Married Women and Migrants

Characteristic	Land Plots	Married Women	Migrants
Mean number	3.31	1.70	0.39
Percent of households with two or more	72.5	48.9	3.7
Percent locationally differentiated among households with two or more	62.5 ^a	93.7	100.0
Mean distance from household (Km) ^b	1.36	33.1	n.a.
Percent located, or from, outside village	0.0	92.2	100.0

- a. Differentiation defined for land by differences in either location (distance, direction), soil quality (seven types), or irrigation status; for married women by location of village of origin household.
- b. For married women, those with origin families within the village are coded as 0 kilometers from the village.

With respect to spatial diversification via marriage, the mean distance from a sample village to the origin villages of the daughters-in-law is 33 kilometers. The sample mean maximum distance between the origin villages of the married women within a household, inclusive of any women born in the same village, is 47.7 kilometers. The maximum distance between households connected by marriage in the sample is 750 kilometers. Among the 49 percent of households with two or more married women, almost 94 percent of the married women did not come from the source village. Most importantly, within almost all of these households, each married woman came from a different village. The farm households thus appear to be at least as diversified with respect to the households/villages connected to them by marriage as they are by their landholdings, but the origin villages of resident married women are spread over a considerably larger area. The within-household diversification of marriage partners by origin location appears to be inconsistent with pure search-theoretic income-gain theories of migration or marriage.

Table 3 provides a geographical/occupational breakdown of the household migrants by sex. All temporary migrants were located outside the village, as noted, and 38 percent of them were located outside the district of their home village. Only two of the 57 migrants worked in agriculture, with 26 (46 percent) holding jobs with regular, annual salaries (principally domestic service by women). While 40 percent of the migrants were attending school, migrants, as job-holders with regular salaries or with incomes almost independent of their origin households, are more prevalent than resident household members holding salaried jobs, who are found in only ten percent of the farm households.

3. Household Characteristics and Consumption Smoothing

Table 3
 Characteristics of Household Migrants
 by Sex

	Male	Female
Percent working outside district	42.9	22.2
Percent with regular salary ^a	37.8	0.0
Percent in agriculture	5.4	0.0
Percent in domestic service	0.0	70.0
Percent in school	46.0	30.0
Total Number	42	15

a. Includes "regular income" jobs with salaries and attached laborers, permanent servants. Excludes nonfarm casual laborers (8.1 percent of male migrants).

The close matching of marital partners with respect to origin household characteristics and the diversity and distance characterizing the ICRISAT households' marriage portfolios are consistent with the hypothesis that marital arrangements influence a household's ability to smooth its consumption when confronted with highly variable income streams. In this section we exploit the longitudinal feature of the ICRISAT data to estimate directly the contribution of marriage-migration, as well as of endowed wealth, to consumption smoothing.

Consider a household that in each year t produces a stochastically-determined amount of income π_t . Consumption c_{ti} for household i in year t is then

$$(1) \quad c_{ti} = \pi_{ti} + r_{ti}$$

where r_{ti} represents other sources of net income--from the sale or purchase of assets, from increasing or decreasing debt, from inter- and intra-household net transfers. The amount of other income r_t in period t used for consumption depends on the household's income at t , since how much the household would like to borrow (or repay) or how much transfer income is received (or sent out) will depend on its current income, on the household's expectations of future incomes, and on the availability of other income sources. Our hypothesis suggests that the sensitivity of other income to the household's current realization of π_t will depend not only on its owned stock of assets, but on its marital and migration arrangements. In particular, we assume that

$$(2) \quad r_{ti} = \alpha[w_{ti}](\pi_{ti} - \mu_{it}) + \sum_k \gamma_k (\pi_{ti} - \pi_{tk}),$$

where w_{ti} = household wealth at time t , μ_{it} = expected future incomes at time t , and π_{tk} is the income at time t of the k th potential transfer partner.

If households have an infinite horizon and the stochastic income process is characterized by stationarity, assumptions not unreasonable for the environment we are studying, we can treat μ_{it} as a constant for a given household i ; i.e., any current realization of income will not affect income expectations. Changes in consumption for a household i , given (1) and (2), are thus related to changes in its income, $d\pi_i$, by (3):

$$(3) \quad dc_i = (1+\alpha[w])d\pi_i + \sum \gamma_k (1 - d\pi_k/d\pi_i) d\pi_i$$

where $d\pi_k/d\pi_i$ expresses the intertemporal relationship between the incomes of household i and those of its transfer partners.

Two extreme views of low-income country environments are nested in (3). If there are perfect credit markets or all households are able to perfectly self-insure, then $\alpha = -1$ and $\gamma_k = 0$; for each household, consumption will be constant (given stationarity and an infinite horizon), independent of stochastic realizations of income. If, on the other hand, no household can "store" income, and there are no risk pooling arrangements, via credit markets or via implicit familial contracts, then $\alpha = 0$ and $\gamma_k = 0$; current consumption is then dependent solely on current income. We believe that neither of these extreme cases well characterizes the Indian setting; instead we expect that $-1 < \alpha < 0$ and $\gamma_k < 0$, that a household's ability to smooth consumption depends on its owned asset stock, $\alpha' > 0$, and on its ability to engage in risk pooling with partners with low covariant incomes.

We can use the ICRISAT data to estimate a variant of (3). Based on the ten year-time series, we computed intertemporal variances for both farm

profits (net of the value of family labor) and food expenditures for each farm household, in 1983 rupees. For the household's wealth stock, we used the value of the household head's inheritance, again in 1983 rupees, which we assume to be exogenous to the household's consumption-smoothing preferences. The most difficult component to measure in equation (3) is the covariation in incomes between the (potential) transfer partners and the farm household. To obtain such information would require a survey that followed over time all households or individuals potentially engaged in risk pooling/income sharing, not just the sampled (representative) households. We know of no such survey. However, as described in Table 3, the incomes of household migrants, almost none of whom are engaged in agricultural production, are unlikely to be correlated with the sample household's farm profits. With respect to the origin households of the resident married women, we can use the information on the distance between households. We assume that distance is negatively related to the correlations in agricultural incomes. We thus can test whether there is a payoff to increasing the distance between the households of marital partners in terms of the enhanced ability of the household to smooth consumption via income sharing.

Letting $d\pi_i/d\pi_k = \delta d_{ik}$, where d_k = the distance between household i and "partner" household k , $\delta < 0$, the basic equation we estimate is thus:

$$(4) \sigma_i^2(c) = \beta_0 + \beta_1 \sigma_i^2(\pi) + \beta_2 I_i \sigma_i^2(\pi) + \beta_3 W_i \sigma_i^2(\pi) + \beta_4 M_i \sigma_i^2(\pi) + \beta_5 D_i \sigma_i^2(\pi) + \epsilon_i,$$

where $\sigma_i^2(c)$ and $\sigma_i^2(\pi)$ are the ten-year food expenditure and profit variances, I = inherited wealth, W = number of resident married women, M = number of household migrants, D = mean distance between the sample household i and the origin households of the resident married women, ϵ_i = household-

specific error term, and $\beta_5 = -\gamma_k \delta$. Perfect intertemporal markets would imply all $\beta_k = 0$; alternatively, the absence of any mechanisms to transfer income either over time or contemporaneously across households implies $\beta_1 = 1$, and $\beta_\ell = 0$, $\ell = 2, \dots, 5$. With self-insurance and with spatial risk pooling associated with migrants and marriages, $0 < \beta_1 < 1$ and $\beta_\ell < 0$, $\ell = 2, \dots, 5$.

Table 4 provides descriptive statistics for the sample farm households and Table 5 reports estimates obtained from three specifications of equation (4), all of which additionally include village dummy variables.⁶ In the first column, we exclude the possibility of spatial income pooling. The results reject the hypotheses that households, independent of their endowed wealth, can perfectly smooth consumption or that households cannot smooth consumption at all via asset transactions. The joint hypotheses (i) that both the profit variance and inherited wealth-profit variance interaction coefficients equal 0 ($F(2,57) = 4.7$) and (ii) that the profit variance coefficient equals one while the wealth interaction coefficient equals zero ($F(2,47) = 5.3$) are rejected at the (.0001) level of significance. Indeed, inherited wealth significantly contributes to consumption smoothing--a one-standard deviation increase in wealth, at the sample means, reduces the impact of profit variance on the variance in food consumption by 12 percent.

In the second column of Table 5, we add the migration and marriage-profit variance interaction variables. These results indicate that both the number of married women and the distance between the origin households of the marital partners contribute significantly (statistically) to reducing the variability in household food consumption, for given variability in farm profits. The presence of household "temporary" migrants also reduces the impact of profit variability, but only marginally. The point estimates

Table 4

Descriptive Statistics: Farm Households; 1975-1984^a

	Mean	Standard Deviation
Mean food expenditure	3101	10.98
Intertemporal food expenditure variance ($\times 10^{-5}$)	15.1	20.5
Mean profits	3243	4137
Intertemporal profit variance ($\times 10^{-5}$)	86.6	162
Value of head's inheritance	78869	135905
Inherited dry land (acres)	12.7	19.1
Inherited wet land (acres)	1.82	3.47
Household migrants	.39	1.48
Permanent servants (attached laborers)	.10	.284
Male market workers	1.08	1.20
Female market workers	.65	.80

a. All values in 1983 rupees.

Table 5
 Determinants of Variability in Real Food Expenditures in
 Farm Households: 1975-1984

Variable	(1)	(2)	(3)
Profit variance	.114 (14.9) ^a	.229 (7.91)	.227 (7.18)
Inherited wealth x profit variance ($\times 10^{-6}$)	-.147 (4.08)	-.107 (4.97)	-.197 (4.53)
Number of married women x profit variance	-	-.0346 (2.82)	-.0340 (1.97)
Marriage distance x profit variance	-	-.000228 (4.31)	-.000231 (4.33)
Number of migrants x profit variance		-.00719 (1.32)	-.00695 (1.03)
Number of adult male market workers x profit variance	-	-	-.0003 (0.24)
Number of adult female market workers x profit variance	-	-	-.0708 (1.34)
Shirapur village ($\times 10^5$)	11.0 (4.29)	11.1 (3.75)	11.4 (3.50)
Kanzara village ($\times 10^5$)	3.37 (1.39)	6.18 (2.10)	6.89 (2.14)
Constant ($\times 10^5$)	1.10 (0.59)	-1.64 (0.64)	-1.20 (0.44)
R ²	.764	.846	.852
F	63.3	43.4	33.9

a. t-ratios in parentheses beneath coefficients.

indicate that, at the sample means, the (positive) effect of profit variability on the variability in food expenditures is reduced by 15 percent when the number of resident married women increases by one and by six percent for each one standard deviation (60 kilometers) increase in the mean distance between the farm household and the origin households of the resident married women. The addition of a household migrant has a weaker effect, reducing the effect of profit variance by three percent.

In the last column of Table 5, we assess the robustness of our results to the addition of variables representing the number of resident adult male and female market (off-farm) workers. The presence of such workers may reduce the effects of profit variability on the variability in household consumption, to the extent that off-farm labor supply responds flexibly to own farm profits and off-farm earnings opportunities in the village are not perfectly correlated with own farm profits. The estimates indicate that the null hypothesis that the number of off-farm workers does not reduce consumption variability among farm households cannot be rejected ($F(2,53) = 0.91$). Moreover, the influence of marriage/migration in reducing the impact of profit variability on consumption variability is essentially unchanged when the family worker variables are included. It is not the presence of adult women (or men) in the household willing or able to work but their marital status, with its associated inter-household bonds, that contributes to income risk mitigation.

4. The Determinants of Spatial Income Diversification

The preceding results suggested that the distance between the origin locations of marital partners contributes to the mitigation of consumption variability, as does the household's asset holdings, and, marginally,

household migrants. In this section we test the hypothesis that farm households facing exogenously riskier incomes associated with spatially covariant risks will be more likely to invest in spatial risk diversification. We also examine the influence of endowed wealth on such arrangements.

A difficulty in relating variability in incomes to household arrangements is that income volatility can in part be influenced by household resource allocations. Even fluctuations in farm profits, net of family labor costs and thus net of family labor supply decisions, can be modified by households, e.g., via crop and/or plot diversification strategies and/or investments in water control mechanisms. Both farm profit variability and arrangements facilitating ex post income transfers may thus reflect a household's attitudes toward risk. The covariation between profit variance and ex post insurance arrangements does not necessarily provide, therefore, evidence on the appropriate experiment, which would alter exogenously the riskiness of incomes for a given household, when households are heterogeneous in risk preferences.

The ICRISAT data provide information on daily rainfall for the ten-year period. We constructed monthly rainfall variances for each of the critical agricultural months (July-October) for each of the villages. We used as instruments these weather variables interacted with each household's inherited dry and wet landholdings to predict each household's mean and variance in profits for the ten years. Under the assumption that village rainfall and inheritances do not reflect household risk preferences, these predicted measures of household income risk should be orthogonal to preferences.⁷

To test the influence of wealth on marriage/migration, we used the

value of the head's inheritance, again because a household's post-inheritance wealth state will reflect in part its desire for self-insurance and thus its attitudes toward risk, while the head's inheritance is less likely to be correlated with preferences. We expect, as noted, that households with more variable profits, for given mean profits, and households with less endowed wealth, ceteris paribus, will be more likely to invest in temporary migration, to have some of its members participate as regular salary workers, and to invest in marriages among partners whose origin households are separated by greater distances. Riskiness in incomes raises the return to such investments, while wealth is a substitute for such income insurance mechanisms, as evident in Table 5.

Table 6 reports estimates of the effects of profit variability and endowed wealth on the number of migrants, on whether or not a household contains a worker with a regular salaried job (assured yearly income), and on the mean distance between the origin village of the resident daughters-in-law and the sample household, based on two-stage tobit, two-stage probit, and two-stage least squares procedures, respectively. The estimating procedures take into account both the possible endogeneity of the profit variables and the specific properties of the dependent variable, i.e., no households had more than one salaried worker or a member who was a farm servant and 76 percent of the households had no temporary migrant.⁸ In all cases, we could reject the hypothesis that the variance in profits is orthogonal to the error terms. Heterogeneity in risk preferences does appear to jointly influence both realized profit variability and ex post income insurance arrangements.

Two specifications are reported for each dependent variable, one with and one without (predicted) mean profits for the household. Only in the

Table 6

Effects of Agricultural Profit Levels and Profit Variability on
Household Labor Force and Marital Arrangements

Variable/ Estimation Procedure	Number of Migrants		Attached Laborer/ Salary Worker		Mean Marriage Distance	
	Two-Stage ML	Tobit	Two-Stage ML	Probit	TOLS	
Profit variance ^a	1.32 (5.26) ^b	4.67 (2.60)	-.0381 (1.85)	.137 (2.05)	.707 (2.98)	54.8 (0.52) ^c
Profit mean ^a (x10 ⁻⁵)	-	-.152 (0.33)	-	-7.40 (2.66)	-	2.98 (0.15) ^c
Value of inheritance (x10 ⁻⁴)	-2.57 (2.20)	-.0356 (0.21)	.0286 (0.59)	-.134 (1.41)	-2.21 (1.85)	-2.03 (1.32)
Constant	-.280 (1.51)	-6.42 (3.23)	.287 (0.37)	5.94 (2.41)	-10.31 (0.47)	-7.71 (0.30)
χ^2 , F	37.8	32.9	10.2	21.0	4.45	3.87
Hausman-Wu	9.93	7.08	2.46	13.1	19.4	10.6

a. Endogenous variable. Instruments include village-level means and variances of rainfall in July through October 1975-84, and interactions between the rainfall statistics and head's dry and irrigated landholdings at inheritance.

b. Asymptotic t-ratio in parentheses beneath coefficient.

c. Jointly significant: $F(2,59) = 5.78$.

salary worker profit equation, however, did the mean of profits contribute significantly to the sample likelihood. The results for all dependent variables appear to support the view that exogenously-imposed income variability induces households to alter the sources of their incomes. In particular, among farm households with equal endowments of wealth, those afflicted with more variable profits from cultivation are more likely to initiate arrangements conducive to income-risk pooling that encompass greater distances, via both "temporary" migrants and longer-distance migration associated with marriage. Moreover, the negative wealth coefficients conform to the risk-insurance model of marriage cum migration rather than to the conventional theory of marriage, in which families with greater wealth are predicted to search for marital partners over a larger area. Indian farm families with greater wealth, among those households facing the same income risk, are less likely to be characterized by marriages extending over long distances, despite their enhanced ability to finance a search over a wider area and their greater difficulty in finding a marital match.⁹ As is consistent with the results in Table 5, the usefulness of asset holdings for reducing consumption volatility, for given income variability, appears to be reflected in households' decisions about migration and marriage cum migration arrangements. Wealth is thus not merely a matching trait or a source of investment funds, and marriage and migration are not merely mechanisms for increasing income levels.

5. Conclusion

In this paper we have examined the major component of migration in rural India, that associated with the movement of women for the purpose of marriage, from a risk-theoretic perspective. In particular, we have

hypothesized that the spatial distribution and characteristics of matches associated with the marriage of daughters from rural Indian households are manifestations of implicit interhousehold contractual arrangements facilitating consumption smoothing in an environment characterized by information costs and spatially covariant risks. Analysis of longitudinal data from villages in South India provided support for the hypothesis, indicating that marriage cum migration contributes to a reduction in the variability in consumption, for given variability in income from crop production, and that households exposed to higher income risk are more likely to invest in longer-distance migration-marriage arrangements.

The hypothesized and observed patterns of migration and marriage do not appear consistent with standard models of marriage or migration which are concerned primarily with search costs and differentials in expected income levels. They thus suggest that spatial differences in the average returns to skills (or wage levels) may not importantly account for population movements within rural India. However, our framework also implies that agricultural technical change may significantly alter spatial marriage patterns, if not the stability of the marriage institution, as such change not only alters the spatial covariances and levels of risk but renders the assessment of risk, and thus the establishment of implicit risk arrangements, more difficult. Conversely, improvements in formal institutional arrangements (e.g., credit markets) that facilitate consumption-smoothing may reduce the role played by risk considerations in marital arrangements and rural migration, perhaps resulting in diminished spatial wage differentials in rural India and increased rural-to-urban migration.

Footnotes

1. Urbanization in India appears particularly slow in the context of the productivity gains in the urban sector (Mills and Becker, 1986).
2. We do not investigate the role of dowry payments in marital arrangements. Such payments are part of the set of intergenerational relationships, along with inheritances, whose study we are pursuing in other work.
3. Caldwell, et al. (1986) found in their study of nine villages in Karnatka in South India that 56 percent of the relatives providing aid during droughts were either relatives of the head's wife or those of the husbands of the head's daughters. None of these relatives were located within the study villages. Rosenzweig (1987), using a subset of the data described below, found that almost 60 percent of income transfers (in value terms), representing ten percent of agricultural profits on average, originated outside the village, that such transfers moved inversely with agricultural profits, and that the inverse association between net transfers (exclusive of marriage-related gifts and dowry) and profits was stronger among households with greater numbers of resident daughters-in-law.
4. Rosenzweig and Wolpin (1986) formulate and test a model that explains the immobility of farm household males as a consequence of land-specific returns to experience associated with weather variability.
5. Cooper (1987) demonstrates that in a model in which agricultural income is uncertain nondecreasing relative risk aversion with a value less than or equal to one or nonincreasing absolute risk aversion are sufficient conditions for a mean-preserving increase in risk to increase

a household's demand for insurance via the allocation of additional household time (migration) to riskless activities.

6. The village dummy variables pick up all permanent characteristics of villages inclusive of the means and variances of village-level aggregate incomes.
7. The estimates from the first-stage regressions are available from the authors.
8. The two-stage maximum likelihood tobit and probit procedures are described in Smith and Blundell (1986).
9. The location of the wealthy households is not the reason for this result. While there is a tendency for wealthier households to cluster among themselves within villages, the sample villages are not situated in "wealthy" areas, i.e., in closer proximity to villages with higher proportions of wealthy households.

References

- Becker, Gary S., "A Theory of Marriage: Part I," Journal of Political Economy 81, (July/August 1973): 813-814.
- _____, "A Theory of Marriage: Part II," Journal of Political Economy 82, (March/April 1974): S11-S26.
- Caldwell, John C., P. H. Reddy, and Pat Caldwell, "Periodic High Risk as a Cause of Fertility: Decline in a Changing Rural Environment: Survival Strategies in the 1980-83 South Indian Drought," Economic Development and Cultural Change 34, (July 1986): 677-701.
- Cooper, Joyce M. R., "A Note on the intersectoral Allocation of Agricultural Household Labour Under Uncertainty," University of Iowa, (May 1987).
- Greenwood, Michael, "A Regression Analysis of Migration to Urban Areas of Less Developed Countries: the Case of India," Journal of Regional Science 11, 253-262.
- Keeley, Michael C., "The Economics of Family Formation," Economic Inquiry 15, (April 1977): 238-250.
- Lucas, Robert E. B. and Oded Stark, "Motivations to Remit: Evidence from Botswana," Journal of Political Economy 93, (October 1985): 901-918.
- Mills, Edwin S. and Charles M. Becker, Studies in Indian Urban Development, Oxford: Oxford University Press, 1986.
- Rosenzweig, Mark R., "Risk, Implicit Contracts and the Family in Rural Areas of Low-Income Countries," University of Minnesota, mimeo, (August 1987).
- Rosenzweig, Mark R., and Kenneth I. Wolpin, "Specific Experience, Household Structure and Intergenerational Transfers: Farm Family Land and Labor Arrangements in Developing Countries," Quarterly Journal of Economics 100, (Supplement 1986).

- Skeldon, Ronald, "On Migration Patterns in India During the 1970s,"
Population and Development Review 12, (December 1986): 759-779.
- Smith, Richard J. and Richard W. Blundell, "An Exogeneity Test for a
Simultaneous Equations Tobit Model with an Application to Labor
Supply," Econometrica 54, (May 1986): 679-688.
- Sundaram, K., "Agricultural-Industry Inter-Relations: Issues of
Migration." Paper presented at the Eighth World Congress of the
International Economic Association, New Delhi, December 1-5, 1987.

