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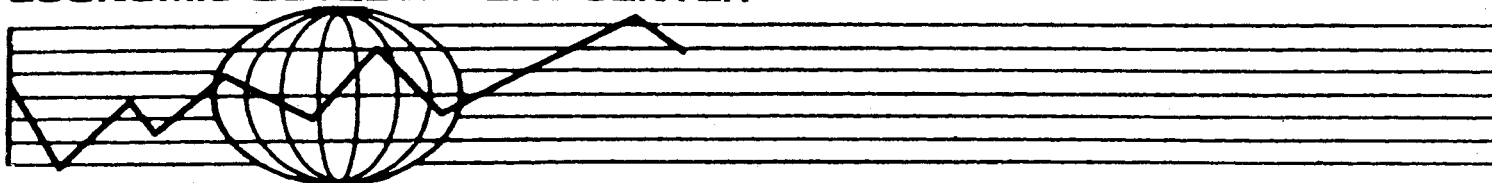
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**SPECIFIC EXPERIENCE, HOUSEHOLD  
STRUCTURE AND INTERGENERATIONAL  
TRANSFERS: FARM FAMILY LAND AND  
LABOR ARRANGEMENTS IN DEVELOPING  
COUNTRIES**

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SPECIFIC EXPERIENCE, HOUSEHOLD STRUCTURE  
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An overlapping generations model incorporating returns to specific experience is used to demonstrate how three salient phenomena in land-scarce developing countries--the predominance of inter-generational family extension, cost advantages of family relative to hired labor, and the scarcity of land sales--may be manifestations of an optimal implicit contract between generations which maximizes the gains from farm-specific, experientially obtained knowledge. A method for estimating the contribution to agricultural profits of the farm experience embodied in elderly kin based on a three-year panel of household data from India is proposed and implemented. Implications of the theory for market transactions in land and for family extension are also tested using individual farm data and time-series information on rainfall.



## I. Introduction

Three important characteristics of rural areas in many land-scarce developing countries are the prevalence of families which are extended across generations,<sup>1</sup> the profitability of family relative to hired labor, and the dearth of market transactions in land.<sup>2</sup> While a number of separate explanations for each of these phenomena have been offered in the literature, little attention has been paid to the possible interrelationships between family structure, family labor profitability and the land sales market. Most of these explanations, moreover, are based on the assumption of some market failure. In particular, the lower shadow value of family labor has been attributed to labor market imperfections [Mazumdar, 1959], while recent theories of the family have focused on the role of that institution as a substitute for absent capital or insurance markets. Willis [1979], for example, formulates a model which characterizes the intergenerationally extended family as an entity that, in the absence of asset markets, provides for elderly members whose subsistence requirements exceed their household and market productivity. This "old age security" model, however, takes as given rather than explains the absence of asset (land) markets. Moreover, since there are no private incentives for children to serve as the sole source of support for the unproductive elderly, it is necessary that the young be obligated in some ad hoc way to make such transfers.

Kotliff and Spivak [1981] provide a rationale for intergenerational transfers by demonstrating the optimality of mutual bequest-consumption arrangements when lifetimes are uncertain and annuities markets are incomplete. While it is shown that prospects of bequest may provide the incentives for the young to support the old in the absence of altruism or "norms", the annuities model must rely on "monitoring" costs to explain why such

arrangements are only made by co-resident agents and cannot readily explain the predominance of intergenerational extension over other family forms in South Asia or account for the absence of market transactions in the principal family asset, land. Cain's [1982] rationale for the existence of the extended (large) family, based on the advantages of intrafamily occupational diversification in economically risky environments, also fails to account for the dominance of the intergenerational extended form and assumes the absence of capital markets..

A second approach, analogous to Becker's theory of marriage [1973] , might base the coresidence of old and young workers on production complementarity in agriculture; thus the optimal sorting of the age-specific labor force across farms is one which matches elders with offspring. While one advantage of this hypothesis is that its assumption is testable in the context of agriculture, it does not fully explain why the labor force on farms, whatever its age composition, tends to consist of persons who are kin or why market land transactions are rare. None of these hypotheses about the family have seen empirical application.

In this paper we explore an alternative theory in which the predominance of intergenerational extension, family labor profitability and the scarcity of land sales are manifestations of an optimal implicit contract between generations which maximizes the gains from (farm) family-specific, experientially-obtained knowledge. In contrast to other theories,(1) no assumptions are required about capital or land market imperfections, (2) the economic basis for such family labor and land arrangements (the returns to specific experience) can be measured, and(3) testable implications are readily derived.

A traditional agricultural setting with constant technology is considered in which the experienced elderly can supply information about the most efficient techniques for coping with previously experienced varieties

of adverse weather, techniques which are likely to have a farm-specific component. The principal purpose of this paper is to obtain estimates of this component of the value of family specific experience and to test for its importance in explaining the incidence of land sales and the spatial variation in family structure. In section II we show how the existence of returns to specific experience creates incentives for intergenerational contractual arrangements among family members in developing country agriculture. In section III we propose and implement a method for estimating the contribution to agricultural profits of the farm-specific experience embodied in elderly kin based on a three-year panel of household data from India. The implications of the specific-experience theory as well as the income diversification theory for market transactions in land and for family extension are tested using individual farm data and time-series information on rainfall by district covering thirty years in section IV. Section V summarizes the results and discusses the implications of these findings for the relationship between family structure and economic development.

## II. Returns to Specific Experience and Family Arrangements in Agriculture:

### Theoretical Implications

To establish the linkage between intergenerational family extension, preferences for family over hired labor and intergenerational and intrafamily transfers of land, we incorporate specific experience into a simple overlapping generations framework.<sup>3</sup> Assume that each individual agent lives three periods, as a child "laborer" in a family that owns land of size  $A$  and as an adult laborer who lives two periods (young and old). In the first two life-cycle periods no land is owned by the individual but land may be purchased in the second period out of savings from which a return is earned in the third period.



Each parcel of land in the economy is sufficiently unique such that the value of output is incremented by  $\rho$  per unit of land for each period an adult works on that land and by  $\alpha\rho$  ( $0 < \alpha < 1$ ) after the first (child) period because of information accumulated through experience about that land. We assume that land is a non-depreciable asset and that there are perfect markets for the two factors of production, land and labor.<sup>4</sup> The latter assumption and the certainty of length of life are adopted, not because they are necessary for the model, but to demonstrate that the existence of returns to specific experience on land is sufficient to explain bequests (of land) to offspring and joint old-young production by kin. We also assume that relations among adult kin are non-altruistic and that ownership rights in land cannot be transferred involuntarily; they can be sold or left as bequests at death.

We now show that an implicit contract between generations of the same family involving transfers of land and use of family labor are Pareto efficient compared to anonymous (nonfamily) sales of land and labor. Consider first the life-cycle stream of income for adults who choose not to work on the family farm after period 1. In the first adult period (period 2), the incomes of the young, who work in the labor market for a wage  $W$  and purchase an amount of land  $A$  in the land market at per-unit price  $p$  (the price offered by agents without experience on that piece of land), are  $Y_2$ , where

$$(1) \quad Y_2 = W - pA.$$

In the next period, total income  $Y_3$  is

$$(2) \quad Y_3 = W + (r + \rho + p)A,$$

where  $r$  is the competitive per-unit return on land, equal to the rent for land offered by agents without experience on that land. The land is sold by the end of the period and the rate of return on the land transaction is thus  $(r+\rho)/p$ .

If the young work on the same land in period two on which they worked as a child in period 1 and purchase that land, income in the third period would be  $Y_3^f$ , where

$$(3) \quad Y_3^f = W + (r + \rho' + p)A$$

and  $\rho' = (1 + \alpha)\rho$ , since work experience on that specific parcel of land yields the return  $\rho'$ . As  $Y_3^f > Y_3$ , the farm family's offspring thus has an incentive to purchase the family's land, having accumulated experience during the first (child) period on the family farm.<sup>5</sup> Thus, as long as "own" children acquire specific experience on the family's land, that land is worth more to offspring than to any other agent in the economy. However, the maximum extra returns  $\rho(1 + \alpha)A$  to purchasing the family land will only be earned if the offspring also work on that land during the second period, prior to the time when land ownership is assumed; offspring will thus have an incentive to induce the owners of the land (parents) to employ them on the (family) farm and will accomplish this by entering into an agreement whereby an amount  $\epsilon$  above the per-unit market value of the land will be paid during period two conditional on their being employed on the land.

If such a contingent contract is made every period between each generation, the total income agents expect in the third period will be

$$Y_3^{f*} > Y_3^f > Y_3, \text{ where}$$

$$(4) \quad Y_3^{f*} = W + (r + \rho' + p + \epsilon)A$$

and net income in the second period will be

$$(5) \quad Y_2^{f*} = W - (p + \epsilon)A.$$

The rate of return to this transaction is  $(r + \rho')/(p + \epsilon)$  which will be higher than the market return to investments in nonfamily land as long as

$$(6) \quad \frac{p(\rho' - \rho)}{r + p} = \frac{p\rho\alpha}{r+p} \geq \epsilon.$$

The left-hand side of (6) sets the upper bound  $\epsilon^*$  on the additional payments made by the young to their old parents over and above the (anonymous) market value of the land  $p$  and equals the total "rents" to be shared intergenerationally as a consequence of the land-labor contract. These rents will be higher, and thus, the gains to such a contract greater, the higher are the returns to specific experience  $\rho$ , since

$$(7) \quad \frac{d\epsilon^*}{d\rho} = p\alpha r / (r + \rho)^2 > 0.^6$$

The existence of returns to specific experience thus creates incentives for farm offspring to work on the family land when young and to purchase that land; the older parents are provided a pecuniary incentive to employ their offspring and to transfer the family land to them. The net cost of family labor will always be lower than other laborers since, given the land-specific experience acquired by or provided to the (working) children, young offspring will always offer a higher-value contingent contract than young non-kin. The predominance of intergenerational familial (nonmarket) transactions in land and labor does not arise from imperfections in land, labor or information markets. Rather, the young are the highest market bidders for their parents' land.

The strength of the bonds linking selfish family members in production and in the transfer of land thus depend critically on the value of  $\rho$ . In contrast to such concepts as "norms" or "monitoring costs," however,

the returns to specific experience pertain to production and can in principle be measured given estimates of the production technology. In the next section we implement methods for estimating one component of the returns to experience in the context of agricultural production under adverse-weather conditions.

### III. Estimating the Returns to Specific Experience in Agriculture

#### A. The Data and Estimation Framework

The fundamental notion underlying the specific-experience hypothesis with respect to family structure and intergenerational transfers in a traditional agricultural setting is the accumulation of useful information or knowledge with age which is most valuable when applied continuously on particular parcels of land. In this section we attempt to estimate directly the returns to such specific experience in an environment with stagnant technology but where there are many "states of nature" which occur with some likelihood of repetition. In particular, we hypothesize that elders in 'traditional' agriculture can provide location-specific information about the allocation of resources which mitigates the effects on farm profits of adverse states of nature and which is superior to that provided by the young. Because of the shorter life spans of the young relative to the elderly, the latter are more likely to have directly observed, and thus to have acquired more information about, any currently experienced state of nature. To estimate the value of that information, we utilize a data set consisting of a three-year panel of 2900 Indian rural farm households surveyed by the National Council of Applied Economic Research, the Additional Rural Incomes Survey (ARIS). These data, covering the years 1968-71, provide household information for each of the three years on farm profits, agricultural inputs and demographic characteristics and indicate whether or not weather conditions adversely affected crops in the village in which each household resides.

To estimate the experiential value of the elderly in adverse weather, let profits for farm  $i$  in village  $k$  in a particular year be given by (1)

$$(8) \quad \pi_{ik} = e^{\gamma(Z_i, \lambda_k, \omega_k)} \left[ \prod_j X_{ij}^{\alpha_j} \right]^{(1-\theta\omega_k)}$$

where the  $Z_i$  are individual farm factors (including elders) and the  $\lambda_k$  are a set of village-level factors valuable in reducing the effects of adverse weather on farm profits. The  $X_{ij}$  are the set of all farm and location-specific fixed factors, including possibly some  $Z_i$ , which influence profits under all states of nature with  $\omega_k$  the index of adverse weather in the village. The  $\gamma$  function thus embodies the hypothesis that certain factors are especially useful in adverse weather; the parameter  $\theta$  represents the proportional decline in the contributions of the fixed factors to profits due to sub-optimal weather. Under good weather conditions  $\gamma = 0$ .

In estimating a profit function such as (8), a major problem is the presence of unobserved farm-specific fixed factors  $X_i$ , such as entrepreneurial ability, which may be correlated with the observed factors, such as the  $Z_i$  and  $\lambda_k$ . However, if we define, for convenience, good weather as  $\omega_k = 0$ , the profit function (8) in adverse weather can be written as

$$(9) \quad \pi_{ik}^B = e^{\gamma(Z_i, \lambda_k; \omega_k)} \left[ \pi_{ik}^G \right]^{(1-\theta\omega_k)}.$$

Given the panel nature of the data, since we know, for most farms, profits under good ( $\pi^G$ ) as well as adverse ( $\pi^B$ ) weather conditions it is thus not necessary to have information on or to specify the set of farm-specific fixed factors not in the  $\gamma$  function. The partial derivatives of the  $\gamma$  function are thus the effects of the  $\gamma$  inputs of profits in bad weather over and above good

weather profit effects. A limitation of the data, however, is that we do not have information on  $\omega_k$  beyond a dichotomous good-bad distinction.<sup>7</sup> We thus estimate (9), in which the  $\gamma$ -function, normalized at  $\omega = 1$ , is

$$(10) \quad \gamma_{ik} = \sum_{j=1}^6 \gamma_{Zj} Z_{ij} + \sum_{j=1}^2 \gamma_{kj} \lambda_{kj} + \sum_{j=1}^2 \gamma_{Tj} D_{tj} + u$$

where  $Z_1$  and  $Z_2$  are dummy variables representing the presence of elderly, defined as individuals aged 60 or over, and the presence of family members between the ages of 40 and 59 and  $Z_3$  is a dummy variable that takes on the value of one when both elders and non-elders are present.  $Z_4$  is the number of individuals aged 15 and above in the household,  $Z_5$  is the highest level of schooling attainment in the household,  $Z_6$  is gross cropped area and  $\lambda_{k1}$  and  $\lambda_{k2}$  are dummy variables indicating respectively the presence of an agricultural extension program in the village and whether or not the village is electrified, facilitating irrigation. The  $D_{Tj}$  are year dummies;  $u$  is a random error term.<sup>8</sup> Taking the log of (9) and substituting (10), we obtain the estimating equation (11)

$$(11) \quad \ln \pi_{ik}^B = \sum \gamma_{Zj} Z_{ij} + \sum \gamma_{kj} \lambda_{kj} + \sum \gamma_{Tj} D_{tj} + (1-\theta) \ln \pi_{ik}^G + u$$

To take into account variability in 'good' weather conditions and to reduce measurement error in  $\pi_i^G$ , we choose a subsample of households experiencing only one adverse weather year out of three sample years;  $\pi_i^G$  is thus the average of profits in the two 'good' years. Our sample thus consists of 895 farm households.<sup>9</sup> The first two columns of Table 1 provide descriptive statistics for this subsample.

If labor markets are such that workers of any age can be hired to perform manual <sup>agricultural</sup> labor, our hypothesis that farm-specific experience has a significant payoff in times of adverse weather, given the temporal heterogeneity of weather conditions, implies that

$$(12) \quad \gamma_{Z1} > \gamma_{Z2} > 0.$$

Thus, for given good weather profits, profits in bad weather will be higher when elders are present compared to when family members who are of lesser age without elders are present. Moreover, in addition to this ordering by age, our hypothesis implies that farm profits in bad weather when there are elder family members will be no greater when younger individuals are also present; with respect to the returns to specific experience, the young will be redundant when there are also old, i.e.,

$$(13) \quad \gamma_{Z1} \geq \gamma_{Z1} + \gamma_{Z2} + \gamma_{Z3}$$

or

$$(14) \quad -\gamma_{Z3} \geq \gamma_{Z2}.$$

Schooling, extension services and electrification are also included in the  $\gamma$ -functions to ascertain if formal education may also contribute to allocative efficiency under disequilibrium states [Schultz, 1975; Welch, 1970], in this case brought about by weather conditions, and to estimate the contributions to farm profits in adverse weather of extension services and of the availability of electricity.

There are three potentially important limitations of the data which may affect our measurement of the returns to specific experience. First,

the data contain no information on duration of land ownership or tenure. Age of family members, to the extent that there is land turnover, is thus only an imperfect proxy for land-specific experience. However, one implication of the specific experience hypothesis is that such turnover will be low and negatively correlated with age (experience). Evidence on the relationship between age and land turnover and on the incidence of land sales is discussed in Section IV. A second shortcoming of the data is that farm profits, while gross of home-consumed output, are also reported gross of the opportunity costs of family labor (net only of hired labor and other direct costs). Reported profits in bad weather relative to good weather could thus depend on the total number and age composition of the family members if there are differentials in good weather-bad weather levels of family labor time supplied on the farm. Moreover, if there are transaction costs associated with hiring labor, such differential family labor supply responses to adverse weather conditions could result in family labor force variables being correlated with bad-weather profits. As a consequence, we include the total number of adult (15+) family members as well as the age variables in (10) and (11). Rejection of the hypothesis that family size has no effect on profits in bad weather ( $\gamma_{z4} = 0$ ) would suggest that such differential family labor supply responses are important. Non-rejection, however, would not rule out the possibility that the higher level of farm profit returns associated with the old in bad weather reflect an increase in their on-farm labor effort during bad weather relative to younger family members, although this is not an obvious prediction of conventional labor supply theory.<sup>10</sup> Note that, if as assumed implicitly in old-age security models, the elderly are physically unproductive, then a positive age gradient for profits has only an informational interpretation.



A third potential data shortcoming is the absence of information on non-resident farm workers. If elderly kin were to reside nearby rather than within the farm household, a possibility not ruled out by the theory, then the number or presence of elderly in the household may understate the level of within-family experience supplied to farm production. However, as shown in Table I, elders (60+) residing outside of extended farm-households account for only five percent of all farm households with elders and less than a quarter of a percent of all farm households.

### B. Empirical Results

Table 2 reports the profit function estimates for variants of specification (11). Estimates for each  $\gamma$ -function specification excluding  $\ln \pi^G$  as a regressor are reported to illustrate the importance of utilizing the panel feature of the data. As can be seen, the estimates of all but the extension coefficients are quite sensitive to the exclusion of farm-specific, good weather profits. These results thus suggest that estimating a profit function under conditions of good weather from a single cross-section would be subject to significant bias due to omitted unobservables. This also means that we can only estimate the contributions to gross profits in bad weather associated with longevity, not the total contributions to farm profits of the experience embodied in the elderly. The results, from row 2, also indicate that when good weather profits are included, the number of family workers has no statistically significant or important effects on profits in bad weather. Accordingly, we discuss only those results which "control" for all unobserved fixed factors, as embodied in the  $\ln \pi^G$  term, and which exclude the family size variable.<sup>11</sup>

In the specification in row 4, which assumes that the contributions to profits of the young and the elderly are independent, the hypothesis embodied in (12) that elders contribute more than do the young to gross profits during bad weather conditions is supported. Coefficient  $\gamma_{Z1}$  is substantially greater than  $\gamma_{Z2}$ , although given the extremely larger standard error of  $\gamma_{Z2}$ , the hypothesis that  $\gamma_{Z1} = \gamma_{Z2}$  cannot be rejected. The point estimates indicate that when elders are present bad weather farm profits are higher by over 14 percent; the presence of younger family members aged 30-59 adds less than one-half of one percent to profits in bad weather.

The specification in row 6 permits interaction effects for the young and old and provides the test of the redundancy hypothesis, given by (14), that the experience-based contributions of the young are nullified when elders are also present. The estimates do not reject this hypothesis ( $t = .49$ ). The magnitudes of the coefficients in this less restrictive (and preferred) specification imply that profits in bad weather are augmented by 34 percent when there are only elderly, are higher by 14 percent when there are only persons above age 39 and less than 60, but are higher by 21 percent when both elders and the "young" aged 40-59 are together in the same household. Thus, farm profits in bad weather are 7 percent higher for joint (old-young) households compared to households without elders.

The age-structure parameter estimates suggest that the expected annual pecuniary contribution to farm profits derived from the experience of a family member over age 60, given the sample mean probability of adverse weather of one every three years, is, assuming no other productivity, approximately 81 to 230 rupees. Based on the total earnings of non-farm (wage-

earning) agricultural households with two adults and four children in the data set, this experiential contribution of an elder alone would represent a 37 to 99 percent offset to the annual average consumption of a rural, prime-aged adult.<sup>12</sup>

Of the other coefficients, the estimates of  $\theta$  suggest that on average adverse weather reduces the marginal contributions of fixed factors by approximately 19 percent. The specifications in row 4 and 6 also indicate that the payoffs to experience in bad weather are comparable to those associated with general training, as provided by formal schooling, and with infrastructural factors. A year of schooling appears to augment bad weather profits by 8.5 percent, while both the presence of an extension facility and of electrification which facilitates irrigation [Singh, 1977], independently increase profits by approximately 13 percent under adverse weather conditions.

Our method of estimating the weather-related payoffs to the farm-specific experience of the old, as was discussed, obviates the need for data on the complete set of farm-specific profit factors. The  $\gamma$ -function estimates will be biased, however, if there are any omitted variables that are particularly or differentially useful in bad weather and thus which affect adverse-weather farm profits relative to good weather profits. If such omitted factors are important, our results are open to an alternative interpretation which views the age-structure of the family as a function of bad-weather profits, given farm profitability in good weather. A reverse relationship might exist, given such omitted factors, if a) family-extension is a consumption good, subject to the usual income effects and/or b) the survival of elders is responsive to income levels (in bad weather).<sup>13</sup>

With respect to the income-effect hypothesis, the estimated family age-structure coefficients, given the reverse interpretation, would suggest that both family extension and elders living alone are "normal" goods, with the latter family type a superior good relative to family extension. In section IV, however, we present estimates of profit effects on family structure which show no significant relationships between the predicted level of profits and family extension.

The ordering of the age structure coefficients in the specification in row 6 may be supportive of a mortality hypothesis which assumes that, for given incomes, elders are more likely to survive when living with younger family members than when alone. While we could not reject our hypothesis that profits are identical in households consisting solely of elders and containing both elders and the young, the point estimates are consistent with the hypothesis that low bad-weather incomes select out more severely elders living alone compared to elders living with their offspring.

To reduce the likelihood of omitting other bad weather profit-augmenting factors, we added 58 district dummy variables to the specification in row 6. These will capture any district-specific differences in both contemporaneous weather conditions and factors which affect farm profits in bad weather, at the expense of degrees of freedom. Estimates from this regression are reported in row 7. As can be seen, while the age-structure parameter estimates are less precise, the point estimates now more closely conform to the experience hypothesis--profits in bad weather are higher by 12 percent when the "young" aged 40-59 are alone and are increased by 17 percent when there are family members over 60, regardless of whether or not elders are living alone or with younger kin. The approximate equality

of the bad-weather profit "effects" of experience in the joint and non-joint households containing elders is not an obvious implication of either the income or mortality-selection hypotheses.

#### IV. Specific Experience, Family Structure and Land Sales

##### A. Land Sales

In this section we test the implications of the existence of returns to specific experience for land market transactions. The land-based specificity of such returns implies that market turnover of land will be low (and thus age and specific experience highly correlated) even if there are no market barriers to land sales. Moreover, agents with experience on a given parcel of land will suffer greater capital losses from market sales of land (at price  $p$ ) than will agents with less experience on otherwise identical landholdings.<sup>14</sup> Elders owning land are thus likely to enter into long-term (lifetime) implicit contracts with the young to capitalize these experience gains, even when their offspring are unavailable (have died or migrated). If the experience returns are shared intergenerationally, both the younger and older generations in families whose members are joined in an implicit/land labor contract, whatever their experience or age-composition, will thus also suffer a capital loss from sales of land to non-family agents. As a consequence, we would expect that:

1. families with elder (experienced) members are less likely to sell land compared to families without elders;
2. few elders will be in non-intergenerationally extended households;<sup>15</sup>
3. intergenerationally extended families, independent of their age-composition, are less likely to sell land compared to non-intergenerationally extended families;

4. the age-composition of intergenerationally extended families does not influence the likelihood of selling land.

If the stock of land were a capital asset whose value did not have a specific experience component, we would expect that landholdings would be decumulated according to some life-cycle optimization scheme, with or without bequests. Thus, in the absence of a well-developed alternative model of savings providing a specific optimal age path for asset holdings, the non-rejection of hypothesis 1 is less conclusive than the non-rejection of hypotheses 2 through 4. However, whatever the size of the specific experience return, we would expect to observe evidence of asset behavior if a market for land exists, in particular, the decumulation of landholdings by households in response to sufficiently severe transitory declines in income caused by weather adversity or other exogenous factors.

Households faced with the prospect of experientially-related capital losses resulting from adverse weather will undertake risk-reducing measures and those more able to reduce income risk will also be less likely to sell land. One family extension hypothesis [Cain, 1981] emphasizes the superior ability of larger families to diversify sources of income and thus to reduce income risk arising from weather fluctuations without sacrificing the returns to individual occupational specialization. While this hypothesis is silent about the desirability of the prevalent vertical extended form or on age structure, it does imply that the number of adults, for given family structure, should also be associated negatively with the probability of land divestiture.

The ARIS data indicate whether or not owners of land have sold any land in the last survey round, 1970-1971. Because of the very low incidence of land sales (an implication of the theory) and the potential importance of weather adversity (confirmed below) and in order to control for good weather profits, we selected a subsample of land-owning households who had experienced adverse weather in either or both of 1969-1970 and 1970-1971, yielding a sample size of 1523. The third and fourth columns of Table I report the sample statistics for this group. Their comparability with those of the prior subsample is consistent with the lack of selection bias associated with weather-conditioned sampling, since the sub-sample overlap is small. As can be seen, in both samples less than 1.75 percent of land-owning farm families sold land in the sample year, and intergenerationally extended families (at least two generations of kin aged 20 and above) constitute about 60 percent of the farm households. Consistent with hypothesis two, almost all (99.5 percent) households with elders in both samples also contain members of the next generation of kin.<sup>16</sup>

To test the first, age-structure, hypothesis we estimate the equation

$$(15) \quad L_i = \alpha + \sum_{j=1}^2 \beta_{zj} Z_{ij} + \beta_w \omega_i + \sum_{j=1}^4 \delta_j k_{ij} + v_i,$$

where  $L_i$  takes on the value of one if there is any land sold in 1970-71,  $Z_1$  and  $Z_2$  are dummy variables corresponding respectively to the presence of elders over 60 and family members aged 40-59, and  $\omega$  is a dummy variable which takes on the value of one if the village experienced adverse weather in consecutive years 1969-70 and 1970-71. The 4  $k_j$  "control" variables (variables which may influence land sales but whose effects are not indicated by the specific experience theory) consist of the number of adults in the household, the log of adult per capita good weather farm

profits (1968-69 profits), the highest level of educational attainment in the household, and a village electrification dummy variable.

To test jointly hypotheses three and four, we estimate the equation:

$$(16) \quad L_i = a + \sum_{j=1}^3 b_{fj} f_{ij} + b_w \omega_i + \sum_{j=1}^4 d_j K_{ij} + v_2,$$

where  $f_1$ ,  $f_2$ , and  $f_3$  are dummy variables corresponding respectively to families with elders (60+) but which are not intergenerationally extended (one generation of adult kin only), families which are intergenerationally extended, and families which are both extended intergenerationally and contain elders. Hypothesis 1, 3, and 4 imply respectively that  $\beta_{f1} < 0$ ,  $\beta_{f2} < 0$ , and  $\beta_{f3} = 0$ .

Table III reports estimates of the land sales equations obtained using maximum likelihood logit, including and excluding the set of control variables. While the set of control variables are only marginally significant, the adverse weather coefficients are highly significant in all specifications, indicating that farm families experiencing two consecutive years of bad weather were 150 percent more likely than other families to sell their land (bad weather in either 1969-70 or 1970-71 alone, however, was not statistically significantly related to the probability of land sales). Thus, the land market appears to function, in the sense that households are able to liquidate holdings when incomes are low. However, relatively severe conditions are required before households will participate in the land market, consistent with the specificity of experience returns. <sup>17</sup>



In specifications 1 through 3, variants of equation (15), the results support the hypothesis that families with elders are significantly less likely than other households - by 90 to 97 percent - to transfer land through the market, whether or not per-capita profits or the number of household adults (specification 3), are held constant. Specifications 4 through 6 reveal, however, that, as implied by the specific experience model, the age-composition/land sales relationship is spurious, since almost all elders reside in intergenerationally extended families and intergenerationally extended families are significantly less likely to sell their land, whether or not elders are present. Indeed, intergenerational structure (but not age-composition), apart from transitory weather conditions, is the strongest correlate of land sales even when family size is included among the regressors -- at the sample means, a doubling of per-capita farm income and an increase in schooling by one year change the probability of a market sale of land by only 0.0031 (18 percent decrease) and 0.0021 (12 percent increase) respectively, while intergenerational extension, for given family size, is associated with a decrease of 0.0136 (80 percent) in the probability of a land sale. Family size also has a significant negative effect on the land sale probability, as hypothesized. The addition of one family member over age 15 reduces the probability of a land sale by 0.0052, or by 30 percent. Electrification, the strongest non-family, non-weather correlate reduces land sales as well, by 0.0047 or 28 percent.

While the negative and significant effects of age and intergenerational structure are supportive of the specific experience hypothesis, the negative and significant effect of family size on land sales, as was noted, also lends support to the occupational diversification explanation for extended families. This latter finding thus suggests the possibility that the intergenerational

structure effect may merely reflect the optimality of a diverse age-structure for intrafamily income diversification. To investigate more directly the independent roles of structure and size in diversification, we (arbitrarily) assumed that optimal diversification for farm households is characterized by one-half of total income having a non-agricultural source (salaries, non-farm self-employment, non-agricultural wages).<sup>18</sup> We regressed the absolute value of the deviation of the non-farm/ income ratio from 0.5 (dev) on family size (adults), intergenerational extension (extension), schooling, electrification and total land owned (land). Negative coefficients are thus associated with increased diversification. The coefficient estimates obtained were:

$$\begin{aligned}
 (17) \quad \text{dev} = & 0.590 - 0.0114 \cdot \text{adults} + 0.0121 \cdot \text{extension} + 0.0495 \cdot \text{schooling} \\
 & (18.3) \quad (2.69) \quad (0.79) \quad (11.6) \\
 & - 0.0632 \cdot \text{electrification} - 0.00353 \cdot \text{land} \quad F_2 = 27.12 \\
 & (4.45) \quad (6.88) \quad R^2 = .07
 \end{aligned}$$

where t-ratios are in parentheses. As can be seen, while family size has the hypothesized effect on income diversification and is statistically significant, intergenerational structure has no significant effect on the degree of diversification. The negative and significant family structure effect on the probability of a land sale thus does not appear to be due to structure facilitating income diversification.

#### B. Family Structure and Expected Weather Variability

In this section we devise a method to test the implications of the positive farm profit-age gradient during periods of adverse weather, estimated in section III, for the spatial variation in the prevalence of the intergenerational extension of families. In particular, if the returns to farm or

family-specific experience are augmented by weather variability, intergenerationally extended families should be more frequently observed where such variability is greatest. Implementation of this test is straightforward as long as the concept of weather variability can be operationalized. Unfortunately, weather has many characteristics, e.g., rainfall, temperature, and the relationship between the variability of weather and the distributional parameters of these individual characteristics is not known a priori.

To fix ideas, let weather variability be the only determinant of family structure in the sense that it is orthogonal to all other determinants. Thus

$$(18) \quad F = \alpha V + u$$

where  $F$  measures the prevalence of the extended family,  $V$  weather variability and  $u$  all other determinants. Further, let there be available a particular characteristic (or vector of characteristics) of weather, say rainfall, that measures weather variability with error, i.e.,

$$(19) \quad R = \gamma V + \epsilon$$

where  $R$  denotes rainfall and  $E(\epsilon u) = 0$ . Notice that the sign of  $\gamma$  may be unknown so that rainfall measures alone cannot be used above to identify the sign of  $\alpha$ . An additional relationship which can be exploited is that between profit variability and weather variability. Let

$$(20) \quad \pi' = \beta V + \delta \quad \beta > 0,$$

where  $\pi'$  is a measure of profit variability and the random component  $\delta$  contains, among other things, the fixed factors discussed in the preceding

section. The relationship between family structure and profit variability derived from this system is given by

$$(21) \quad F = \frac{\alpha}{\beta} \pi' - \frac{\alpha \delta}{\beta} + u.$$

Estimation of (21) by OLS clearly leads to biased and inconsistent estimates of  $\frac{\alpha}{\beta}$  since  $\pi'$  is correlated with  $\delta$ . However,  $\pi'$  may be written as

$$(22) \quad \pi' = \frac{\beta}{\gamma} R - \frac{\beta \epsilon}{\gamma} + \delta$$

from (19) and (20). As long as  $E(\epsilon\delta) = 0$ ,  $\alpha/\beta$  can be estimated consistently (though not efficiently) by a two stage procedure in which (22) is estimated by OLS and the predicted values of  $\pi'$  are then substituted into (21) in a second stage regression. Since  $\beta$  is positive, our hypothesis that  $\alpha > 0$  is confirmed if the second stage regression coefficient on  $\pi'$  is positive.

To implement this procedure, we again exploit the panel characteristic of the survey data, which provides farm profits for each of 3 years, and the availability of 30 years (1921-1950) of monthly data on days of rain and rainfall levels for each of 73 of 100 districts covered in the NCAER survey.<sup>19</sup> The first three central moments for each rain variable distribution were computed for the four critical planting and harvesting months, June, July, September, and October. There are thus a total of 24 rainfall variables for each district. The mean and (intertemporal) variance of farm profits over the three-year period 1969-1971 for each individual farm in the sample were also computed. Table IV provides the district-level sample characteristics for the means and variances of farm profits aggregated from the household survey data and for the rainfall characteristics. As can be seen from

the table, there is considerable interdistrict variation in both the characteristics of the rainfall distributions and in the within-farm variability and levels of profits across the Indian districts.

To test whether the level of wealth in addition to profit variability influences family structure, the predicted mean of farm profits  $\pi$ , predicted with the same rainfall instruments, is also included in (23). The two-stage least squares estimates, utilizing both the predicted mean and variance of profits are:<sup>20</sup>

$$(23) \quad F = 0.516 + 0.001\pi(x10^{-3}) + 0.002\pi'(x10^{-5}) \quad n = 73,$$

(8.26)    (0.10)                    (1.89)

where  $F$  = proportion of intergenerationally extended farm families.

The results indicate that there is a statistically significant positive relationship between predicted (or weather-induced) profit variance and intergenerational family extension, consistent with the implications of the specific experience hypothesis. There is also a positive but very imprecisely estimated effect of mean profits; the expected level of wealth does not appear to account for the variations in family structure.

## V. Conclusion

While there has been a recent growth in theoretical attention to economic relationships between generations and to family arrangements, there remains a paucity of empirical research on these important and universal phenomena. The major purpose of this paper has been to test the hypothesis that in a traditional agricultural setting family-specific information provides an explanation for the coexistence of intergenerationally extended

families, land transfers outside of impersonal markets and within families, and discrepancies between the cost of hired and family labor. We obtained evidence based on longitudinal household data from India that the gross returns from specific knowledge as embodied in older household members under conditions of adverse weather were greater than those associated with younger household members, economically significant, and comparable to those from schooling. We also found, consistent with the existence of returns to specific experience, that market sales of land were infrequent and significantly less likely among families with elders and intergenerationally extended families, and that the cross-sectional variation in the prevalence of intergenerationally extended farm families was significantly and positively related to weather-induced profit variability. These phenomena did not appear readily explicable by prior theories of the extended family, which take the absence of asset markets as given, although such models have not been rigorously formulated in terms of their testable implications.

In this paper we have focused narrowly upon a particular variant of the specific experience hypothesis in order to facilitate testing. Our empirical results, which lend support to the hypothesis that returns to specific experience associated with land make optimal intrafamily and intergenerational transfers of land and joint production of that land among farm families able to successfully allocate the rents from such implicit intergenerational contracts, thus help explain why the proportion of farm families who are intergenerationally extended is high and exceeds by 25 percent the proportion in the population of non-farm families residing in a country such as India. However, the relatively high incidence of intergenerational extension in the latter group suggests that the specific experience hypothesis is not sufficient

to explain all variations in family structure and size. Indeed, our empirical results also provide some support for the hypothesis that family extension (but not intergenerational extension) facilitates occupational diversification and thus serves to reduce income risk. Moreover, while sufficient to explain the optimality of the spatial proximity (and immobility) of family generations owning land, our theory is not sufficient to account for co-residence of those generations, although such co-residence evidently dominates. Theories of family extension based on the advantages of income pooling and intrafamily transfers in the presence of risk, however, are neither sufficient to explain the proximity of family members nor co-residence.

Attention to the returns to experience may also be useful, however, in understanding the broader issues of cross-cultural variation in family structure and transfers as they are related to industrialization and urbanization. For example, consider the impact on the family of introducing new technologies. Almost definitionally, the return to accumulated knowledge is reduced and the specific experience hypothesis would, therefore, predict a decline in extended family formation and an increase in market transfers of land.<sup>21</sup> The possibility of significant returns to experience which may be specific to land plots or areas in traditional agriculture may also have implications for the success of policies involving the redistribution or consolidation of land. First, farmers offered a "fair" market price or land of equal (market) value in exchange for their landholdings may be reluctant to participate where the specificity of their experience and the returns to such experience are high. Thus, non-coercive land consolidation schemes may be more successful when technological change has been significant. Second, any mandated land transfers, even if only among farmers, may be accompanied by losses in output resulting from the loss of (specific)

experience returns, especially if owners can no longer farm (as tenants or managers) their former landholdings. Thus, the short-run net gains from such schemes may differ from their long-run effects. The further study of the role of managerial experience and land turnover among farmers in traditional agricultural production would appear to have a high payoff.

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## Footnotes

\* Earlier versions of this paper were given at Yale University, the University of Chicago, the University of Minnesota, the University of Michigan; the National Council of Applied Economic Research, Delhi, and ICRISAT, Hyderabad. The authors learned much from these seminars as well as from the referees.

1. In rural India, for example, 62 percent of all farm households in 1970-1971 contained at least two generations of adult (over 20) kin, while adult siblings resided together in only 7.5 percent of all households (NCAER-ARIS survey, described below).
2. The cost advantage of family over hired labor has often been inferred from the well-documented labor intensity of small farms compared to larger farms in South Asia, and the predominance of intrafamily over market transactions in land, reflected in the immobility of farm households in these settings, has also been noted -- in 1971, only about 10 percent of all adult rural males in India did not live in the village in which they were born [Weiner, 1978].
3. The concept of specific training was originally used by Becker [1964] to explore firm-employee wage and employment relationships.
4. Our analysis thus clearly only pertains to land-scarce economies.
5. We assume that a child makes no decisions for himself; parents have incentives to retain their children's labor on the farm since this serves to perpetuate the intergenerational transfer scheme; thus  $\alpha > 0$ . For evidence that the off-farm (wage labor) participation rate of children in farm households is low and significantly less than that in landless households, while overall labor force participation rates are similar, see Rosenzweig [1981].

6. Note that the payment by the young  $\epsilon$  would only be bid up to  $\epsilon^*$  if parents not owning or working on plot A offered bribes to the adults residing on A to provide first-period "experience" and A, at price  $p$ , in period 3 to their children instead of to "own" children. Since the non-A parents could not capture any of the returns from this contract, such bidding would be purely altruistic. Moreover, as long as parents do derive utility from increasing the welfare of own children (as opposed to that of other children), the bribe offered would have to exceed  $\epsilon^*$ . Empirical evidence (see note 5) suggests that such interfamily transfers of young children are not prevalent, when there are any own offspring. When offspring are not available for or amenable to the contract, there are still incentives for the old landowner to enter into the labor-land arrangement with young who have had the most experience on the land. See note 16.

7. At the theoretical level, techniques might exist for augmenting the impact on profits of extraordinarily good weather as well, assuming a trichotomous variable, good, normal, bad. The modelling could be done in terms of deviations from normal weather in either direction, possibly with asymmetries in allocative gains. To the extent that good weather in the dichotomous case contains a component of good weather in the trichotomous case, the estimated contribution of elders in bad weather would be dependent upon the proportion of good weather years that are extraordinarily good, if there were payoffs to experience in those latter states of nature.

8. Year effects account both for differences in output price and in weather adversity that are related to calendar time.

9. Given the logarithmic representation, farms with negative or zero profits in any of the three years were excluded. Because, however, reported profits are gross of own labor input costs, only 30 households (about 3 percent of the sample) had to be excluded on this basis.
10. Whether or not any individual increases or decreases his/her on-farm labor supply under adverse weather conditions would depend on the direction of weather effects on on-farm returns to labor effort and on the covariation between such returns and those available off the farm. To predict age differences in such sectoral allocations across weather states would require hypotheses about age-specific differences in these return parameters and possibly in preferences.
11. None of the reported results are altered significantly when family size or the number of adults is included in the specifications; coefficient standard errors are slightly lower when this variable is excluded.
12. This computation is based on sample mean estimates of 248 and 143 days of market employment and daily agricultural wage rates of 2.5 and 2.0 rupees for adult males and females and assumes that children consume on average one-half the adult level of consumption. For details, see Rosenzweig [1980].
13. The results are also consistent, of course, with the hypothesis that individuals of higher ability (to cope with adverse weather) have greater life expectancies. This longevity-ability correlation, however, would not appear to account in any obvious way for the relationships between family structure, land sales and profit variance discussed in Section IV.

14. The specific experience framework suggests that if reductions in income make "necessary" the sale of the land to non-kin, both the buyer and seller of the land gain from the seller continuing to participate in the farming of that land. This would reduce the capital loss to the seller associated with his specific experience. However, only if the buyer agreed to allow the offspring and all future generations to continue to farm the land once the elder had died would there be no loss to the family (or society). Land ownership is not necessary for the optimality of intergenerational co-production and experienced-based intergenerational contracts.

15. The overlapping generations model with specific experience suggests only the optimality of generations working together on the same plots of land and thus of intergenerational proximity. Costs and benefits of co-residence, given the optimality of proximity, must be invoked to explain living arrangements. Note that theories of family extension which link family members by financial transfers (occupational diversification, old-age security) are not sufficient to explain either proximity or co-residence. Indeed, migration cum remittances pools risk efficiently but entails non-co-residence.

16. In 23 percent of intergenerationally extended families with elders, the young generation contained neither the elder's sons, daughters, grandsons or granddaughters (aged over 20). Of this group, the principal relationships of the young to the elders were niece/nephew and son or daughter-in-law. We have also categorized families as extended if there are adult kin of any "generation" who are 20 or more years younger than the eldest household member; 5 percent of the elder-extended households contain very much younger brothers or brother's-in-law of the elder. Exclusion of this set of families from this category makes the negative effect on land sales of elder-non-extended families slightly more significant ( $t = 0.98$ ) and does not reduce the magnitude or significance of the extended family effect.

17. Another testable implication of the profit-augmenting effects of (specific) experience in adverse weather is that the impact of adverse weather on the sale of land will be diminished among households with elders. Because there are only 31 households with elders who had experienced two consecutive years of adverse weather in our sample, however, no statistical test of this proposition is possible with our data. None of these households in fact sold any of their land.
18. The sample mean non farm/total income ratio is 0.37.
19. Rainfall is critical to agriculture in India, as over 75 percent of cultivated area is rainfed (see J. Singh, [1974]).
20. Results obtained for the first-stage profit mean and variance reduced-form equations involving the twenty-four rainfall distribution variables are available from the authors on request.
21. Societies characterized by "intensive agriculture with irrigation" have a lower incidence of extended family arrangements [Lee, 1977]. This is consistent with our profit function finding that electrification reduces the impact of adverse weather on profits and thus may substitute for the services of elders.

Table I  
Means and Standard Deviations: Farm Households in Weather-Based  
Subsamples, 1968-1971

Variable	Subsample			
	Adverse weather in one-year only		Good weather in 1968-69	
	Mean	S.D.	Mean	S.D.
Farm profits in good weather (rupees)	3970.9	3691.6	3543.4	2957.8
Farm profits in adverse weather (rupees)	3462.3	4106.8	-	-
Sold land in 1970-71	.0123	-	.0171	-
Presence of family members 60+	.418	-	.387	-
Presence of family members 60+, non-extended family	.0022	-	.0020	-
Presence of family members 40-59	.757	-	.765	-
Intergenerationally extended family	.635	-	.620	-
Intergenerationally extended family with elders (60+)	.415	-	.385	-
Number of family members 15+	4.04	1.92	4.03	2.01
Highest education	2.34	1.68	2.34	1.67
Village extension program	.546	.498	.541	.460
Village electrification	.364	.499	.170	.473
Adverse weather in 1968-69	.589	-	0	0
Adverse weather in 1969-71	.268	-	.198	-
Adverse weather in 1970-71	.142	-	.0871	-
Adverse weather in consecutive years (1969-71)	0		.0768	-
Number of households	895		1523	



Table II

## Contributions of Farm and Village Inputs to Agricultural Profits in Adverse Weather:

Farm Households 1968-1969, 1969-1970, 1970-1971

Variable/ Specification	Presence 60+	Presence 40-59	Presence of 60+ and 40-59	Number 15+	Highest Education	Village Extension	Village Electri- fication	Gross Cropped Area	Average ln Profits--Good Weather	R <sup>2</sup>	d.f.
(1)	.193 (2.22)	-.0438 (0.44)	-	.0397 (1.70)	.158 (6.51)	.125 (1.51)	.246 (2.90)	.0282 (10.91)	-	.244	886
(2)	.128 (1.84)	-.0130 (0.16)	-	.0120 (0.64)	.0841 (4.28)	.129 (1.95)	.133 (1.96)	.00641 (2.82)	.812 (22.57)	.520	885
(3)	.246 (3.02)	.0130 (0.13)	-	-	.163 (6.73)	.139 (1.68)	.255 (3.01)	.0289 (11.31)	-	.241	887
(4)	.143 (2.21)	.00418 (0.06)	-	-	.0853 (4.36)	.133 (2.03)	.135 (2.00)	.00658 (2.91)	.814 (22.67)	.520	888
(5)	.471 (2.93)	.174 (1.28)	-.301 (1.62)	-	.163 (6.75)	.132 (1.60)	.254 (3.01)	.0288 (11.29)	-	.244	886
(6)	.339 (2.64)	.143 (1.32)	-.260 (1.77)	-	.0858 (4.39)	.127 (1.93)	.135 (2.00)	.00655 (2.91)	.813 (22.67)	.522	885
(7)	.167 (1.43)	.116 (1.13)	-.111 (0.84)	-	.0641 (3.18)	-.150 (1.32)	.294 (2.55)	.00900 (3.92)	.717 (18.13)	.667	827

Notes: All specifications include year dummies. Specification (7) includes 58 district dummies. See text.  
t-values in parentheses.

Table III

Maximum Likelihood Logit Estimates of the Probability of a Land Sale in 1970-71:

Farm Households with Good Weather in 1968-69

Variable/ Specification	Adverse weather 2 consecutive years	Presence 60+	Presence 40-59	Extended family	Extended family with 60+	Presence 60+, no extension	Number of adults	Log farm profits-good weather	Highest education	Village elec- trification	Intercept	d.f.
(1)	1.554 (6.73)	-.9874 (3.74)	.09356 (0.36)	---	---	---	---	---	---	---	-4.088 (15.67)	1519
(2)	1.652 (7.00)	-.9275 (3.33)	.2031 (0.71)	---	---	---	---	.1368 (1.58)	.1043 (1.69)	-2.740 (1.32)	4.327 (7.04)	1516
(3)	1.615 (6.85)	-.7094 (2.47)	.3191 (1.13)	---	---	---	-.3468 (2.62)	-.1231 (0.86)	.1237 (2.00)	-.2554 (1.22)	-2.651 (2.86)	1515
(4)	1.546 (6.74)	---	---	-.6920 (2.60)	-.3002 (0.001)	-.5200 (1.58)	---	---	---	---	-3.794 (26.6)	1518
(5)	1.668 (7.04)	---	---	-.9075 (4.13)	---	-.08557 (0.07)	---	.1174 (1.49)	.1140 (1.88)	-.2976 (1.42)	-3.893 (7.75)	1516
(6)	1.650 (6.94)	---	---	-.8110 (3.57)	---	---	-.3116 (2.44)	-.1567 (1.13)	.1306 (2.14)	-.2827 (1.32)	-2.217 (2.61)	1516

Note: Asymptotic t-values in parentheses.

Table IV

Means and Standard Deviations: District Rainfall Levels and Variability From 1921 to 1950 For Selected Months and Annual Farm Profit Variability 1969-1971 (standard deviations in parentheses)

Variable	June	July	September	October
Mean Days of Rain 1921-1950	7.18 (4.22)	13.69 (4.55)	8.39 (3.42)	3.57 (3.63)
Mean Rainfall (cm) 1921-1950	150.0 (130.8)	301.2 (129.2)	175.3 (83.0)	64.3 (61.3)
Variance in Days of Rain 1921-1950	10.7 (5.0)	13.9 (5.7)	11.9 (3.8)	14.3 (7.8)
Variance in Rainfall 1921-1950	10710 (9299)	20006 (16561)	11887 (7012)	5288 (9400)
Skewness in Days of Rain 1921-1950	0.434 (0.497)	0.004 (0.432)	0.299 (0.651)	0.966 (0.657)
Skewness in Rainfall 1921-1950	1.26 (0.811)	0.788 (0.694)	1.07 (0.856)	1.66 (0.859)
Mean Farm Profits 1969-1971		3600 (1919)		
Variance in Farm Profits ( $\times 10^{-3}$ ) 1969-1971		11445 (13395)		
Number of Districts		73		