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"RURAL LABOUR MARKETS, TRANSACTION COST AND FERTILITY"

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Abstract

The implications of differences in transaction cost environments on the fertility and nutrition decisions of rural households are analyzed. Losses from shirking and the supervision cost incurred create a wedge between the marginal revenue product of hired labour and the offered wage and the difficulty of monitoring and enforcing labour contracts leads to a premium on family labour. Differences in enforcement difficulty is related to the transaction cost in varying environments. Thus, differences in transaction cost environments should have different effects on fertility and labour supply. Using data from Laguna province in the Philippines, the study finds some support for the hypothesis that transaction cost has a strong influence on labour supply and fertility.

Introduction

Modern studies of institutions and markets have shown the importance of transaction cost in individual decisionmaking and its effect on the type of arrangements that evolve [Alchian and Demsetz (1972), Williamson (1975) and Pollak (1985)]. Recent papers have applied the concept to such areas as tenancy choice [Alston, Datta and Nugent (1984)] and intra-household relationships [Ben-Porath (1980) and Pollak (1985)]. These studies have examined the effect of transactions cost on the shape and evolution of economic organizations and the production and labour decisions of firms and individuals. A natural extension of these concerns is the examination of how the long-term supply of labour in the form of number of children and human capital investment would be influenced.

In this paper we examine the impact of differences in transaction cost environments on fertility and labour supply decisions of households. Two issues are explicitly considered in our analysis. First, recent studies have demonstrated the importance of the contribution of children to family incomes [Rosenzweig and Evenson (1977), White (1980) and Cain (1980)]. This emphasizes the importance of expected wages of children and spouses to the overall planning and decision making of the household. This in turn shows how sensitive we may expect household fertility and labour supply is to the expected wages of children and adult females. Second, studies of institutions and markets have shown that high transaction costs produce 'excess burdens' on farm production that is reflected in the wages offers that household members receive. In a high transaction cost environment the

differential between the excess burdens of family and hired labour can be quite large. As a result, demand for family labour increases, with consequences on fertility and labour supply.

Transaction Cost and Rural Wages

In the transaction cost literature institutions arise in order to minimize the burden imposed by difficulties in the wage labour contract. In the household these problems of negotiating, writing, monitoring, and enforcing contracts are mitigated by the extra-economic relationships present [Pollack (1985)]. The advantages of a family organization -- incentives, monitoring, altruism and loyalty -- are magnified in more traditional societies. There enforcement is difficult because the threat of firing is less credible in an environment where nonlabor relationships abound. The labour market may be characterized as premodern, as opposed to the "modern" market where impersonal relationships enable employers to recruit and maintain workers more easily. In this same environment we can expect the familial bonds to be stronger because of strong social support. The drawbacks to the family organization will, therefore, have less impact than the blessings. In this setting the expected net marginal revenue product (net of transaction cost, that is) of household labour is higher than hired labour. This implies a premium for household labour. As the society becomes more impersonal, the advantages of the family organization shrink; the disadvantages grow. Thus, we expect to find a decrease in the rural farm's dependence on family labour as society is "modernized."

The advantages from using family labour arise because the farm manager expects production losses or inefficiences due to the lack of care and diligence of the workers. These added costs, called shirking costs, represent the lost profits because labour of a certain skill is less than perfect. When supervision is provided, those shirking costs fall as the SH curve shows. The SC curve shows the costs of supervision and the curve b shows the sum of supervision and shirking costs.[1] The farm manager minimizes the total excess burden by choosing the optimal supervision per workers.

Figure 1 also illustrates the premium attached to family labour. The advantages of household labour arise in two ways. Altruism, loyalty and the stronger incentive caused by family membership is expected to decrease the cost of shirking in production. Secondly, more familiarity and more frequent contact effectively decrease the monitoring costs in the case of family labour. These two advantages are shown by the lower shirking costs and supervision costs for family labour, SH_f and SC_f, respectively. The corresponding curves for hired labour are denoted by the subscripts h. The two advantages for family labour are manifested in both lower supervision time and total burden, b.

If Figure 1 is applicable to each unit of labour time, the real cost to the employer of labour time is the wage rate plus the excess burden. This "wedge" between the real cost of labour and the wage rate in effect causes a reduction in the demand for hired labour. At the same time, this wedge will give family enterprises a cost advantage. In the absence of important scale economies in the farming enterprise and with significant transaction cost burdens we would expect most farm production to be organized in small family

enterprises. Owners of large plots of land would find that tenancy arrangements are superior to owner-cultivation with hired labour. In cases, however, where scale economies are such that family enterprises do hire in labour, the economic contribution of a family member includes an excess burden saving providing an implicit premium to family size. As the labour market becomes more impersonal and the enforcement costs become lower, this advantage is expected to shrink. In Figure 1, this may be illustrated as a movement of the SH_h curve downwards toward the SH_f curve. The differential in supervision costs may remain because of the inherent advantages to monitoring family members. Therefore, an advantage to family labour may persists, no matter how small. Thus, households are expected to behave differently between high and low transaction cost environments.

Figures 2 and 3 illustrate the central conclusion of this argument. In Figure 2 average excess burden is shown as a function of farm size for small and large families at two different transaction cost regimes. An increase in family size saves excess burden by substituting family workers for hired workers. These savings and hence the effect of family size on average costs for the farm are greater the worse the transaction cost environment.

Figure 3 shows the relationship between costs and benefits and family size. Marginal benefits from children are depicted as being derived from a household utility function. These decline with family size. Marginal costs are depicted as rising because of diminishing marginal productivity of home production inputs (although they could fall because of scale economies over a certain range). The curve MB incorporates the present value of child work at observed market wages (valued at the time of conception). The curves NB_a,

MB_b and MB_c show how the excess burden savings and job costs affect this calculation. Optimal family size would be C*. For large farms MB_a depicts the premium associated with the opportunity to save on excess burden by using family workers. For small or landless farmers, the curve MB_c holds showing the discount on wages they must bear. MB_b shows the self-sufficient farm.

Transaction Cost and Fertility Decisions

The implications of different transaction environments on wages and implicit valuation of family labour is incorporated in family decisions on health, nutrition, schooling and the number of children desired. Using the economic model of the household (Becker, 1965 and Willis, 1974), we analyze the effects of varying levels of transaction cost on these family decisions. The household is assumed to have a utility function with household satisfaction a function of the number of children (N), the health of these children (H), leisure (L) and other consumption goods (Z).

(1) $$U = U(N,H,M,L,Z)$$

The arguments are 'produced' within the household according to the following technical relationships:

$$N = N(X_N,T_N,K,S,C)$$

(2) $$H = H(X_H,T_H,K,S)$$

$$Z = Z(X_Z,T_Z,K,S)$$

Household goods are produced from market goods, time inputs, capital stock (K) and from basic skills (S) of the manager of these producing activities (usually the mother). In the case of family size, the contraceptive effect (C) also enters the relationship. In addition, an agricultural product, X_a, is produced on the farm.

(3) $$X_a = X_a(Z_a,T_a,K_a,S)$$

The effective constraints facing the rural household are time and budget. The time constraint for each member is written as

(4) $L + \sum T_i + T_w = T$ i = home activities

The total income constraint for the household is the sum of the nonlabor income of the household plus the total of the labour incomes of all the household members.

(5) $Y + WT_w = \sum_i p_i X$

where $T_w = \sum_j T_{w_j}$ j = household members

Leisure plus time spent in household production plus time spent working must add to a constant for all family workers. Money income from labour WT and nonlabor sources (Y) must equal spending on market goods. Households maximize (1) subject to conditions (2) to (4). Assuming an interior solution for simplicity, the first-order conditions for a household maximum dictate that the following condition be fulfilled (where marginal utility of income, λ, equals 1).

(6) $p*MPT_f = MU_{Z_i} * MPT_{Z_i} = MU_L = W$ for all j

where T_f = farm time

T_{Z_i} = time spent on home activity i

L = leisure

This condition merges separate decisions on labour market participation, farm production, fertility, nutrition and schooling into one joint decision. For the participation decision for example, the reservation wage is determined by the marginal utility of leisure and marginal productivity in home production, whichever is higher. It also emphasizes the basic interrelatedness of the farm, household and labour market decisions.

These interrelationships are illustrated in Figure 4. The diagram shows the choices that are open to a member of the rural household who can decide to work in the labour market, work on the family farm or stay at home. Because of the inability of the data at our disposal to distinguish between home production and leisure this delineation was not included in the modelling. These multiple possibilities are represented by the overlapping possibility frontiers. Ab depicts the possibilities of a person who works only in home production. The tradeoff is between using up all of a person's time in leisure or expending some of it in the production of home goods (Z's).

The curve Adc represents the production possibilities of a person who has a choice of working on the farm or at home. Suppose his equilibrium position is at d. The person's possibility frontier has now expanded to Ad'dc', composed of the original (home production) possibility frontier, Ab, and a superimposed farm production possibility frontier, d'dc'. The curve Adc is the envelope of all such combinations of optimal farm and home production as d and d'. With d as the equilibrium point, the amount of home production is represented by the point d' on his original possibility frontier. Marginal revenue product from working on the farm (equal to the slope at point d) is equal to the marginal utility of production at home (equal to the slope of the home possibility frontier at d'). Under these circumstances the member will devote OM hours to leisure, MH hours to farm work and HA hours to home production.

The introduction of a labour market with competitive wages expands the possibility frontier to Adef. The labour market possibility frontier, represented by the line df, has been superimposed on the previous one. This is the situation represented in equation (6). Supposing that e is the

equilibrium point gives the following optimal allocation of time: OL = leisure, LM = market time, MH = farm time, HA = home production.

The relationship between transaction cost environments and household decisions on nutrition, fertility and schooling takes form within the framework specified above. Given it's preferences and resources the household decides on the allocation of its total time to the different activities. Its decision on the number and quality of children is embodied in its allocation of time to home production; the more time it plans to allocate to home production, the more and better children it will decide to have. Thus, decreases in fertility have been associated with rising wage rates for women because this implies higher 'prices' for children and child quality. In the present formulation, the general productivity of the farm has a negative impact on fertility by increasing the marginal revenue product of the mother. Offsetting this, in rural Philippines children contribute a significant portion of the household's income. An increase in farm productivity will, therefore, increase their expected marginal benefit. Finally, to the extent that farm production time is compatible with child rearing, we expect fertility to be higher the more opportunities there are for women to work productively on farms. Farm time here is broadly defined to include nonfarm activities like handicraft making.

THE DATA

Data for the study came from a group of households that have been surveyed over a number of years, primarily by Evenson. Located in the province of Laguna (close to Metro Manila) in the Philippines, a core of households are continuously represented in the survey from 1963 to the latest panel in 1982. The set of continuous households increases as one starts with a

later series, say 1975 when Evenson continued the systematic data gathering. The data set, therefore, contains information that is potentially useful for longitudinal changes interacting with cross-section effects. For this particular study two subsets of the whole information pool are utilized.

The two separate data sets are required because the hypothesis maintains that transaction cost environments have significant implications on household labour supply and production decisions. The first set collected information that are strong proxies for supervision effort while the second set has better data on farm production and labour supply. Since the model postulates community specific transaction cost environments, the first data set is used to estimate mean household supervision effort as a function of various community characteristics. These functions are then used to predict mean community level supervision efforts in the second data set. This variable is the proxy for a community specific transaction cost environment variable used in the second set of regressions.

Set 1 covers approximately 175 households surveyed in 1975, 1977, 1979 and 1982. We are using only the data for 1979 and 1983. This data survey was almost unique in that it collected data on supervision time by the farm manager. Supervision was defined as time devoted to supervising both family and hired workers. These data allowed a direct estimate of transaction cost environments by barrio.

Our procedure with Set 1 was as follows: We were not attempting to obtain individual wage predictions in this step. Instead, our effort was simply to measure mean wages at the barangay (community) level but controlling for schooling and age. The logic behind this step is that the labour markets are to some degree segmented or localized. The meaningful wage to households

in a given barrio is then the local offer wage. At this stage we did not judge that selectivity bias was serious (it would, of course, be serious if we were predicting individual wages--we are pursuing this direction at present).

Table 1 reports the results of the first stage. Wage regressions are estimated for men, women and children. Education and age of adult men and women were included in the regressions with barrio dummy variables. We note that education is a significant explanatory variable for men. For children we also included a sex dummy (female wages are lower than male child wages) and height and weight of the children.

Our second step was to estimate a supervision regression. For farming households we had data on the supervision and labour recruiting time of the father and the mother (mothers reported a negligible amount) for each major agricultural task. We also had observations on the days of family work by men (FAMM), women (FAMW) and children and exchange workers (EXCT) and on hired days of work by men (HIREDM) and women (HIREDW) and children (HIREDC).

Table 2 reports these regressions. Regression 1 shows quite clearly that hired workers require more supervision than family workers. It does not matter whether hired worker days are for males, females or children. Family workers on the other hand appear to require little supervision. Thus we have support for the proposition that family ties and interests enable savings on supervision costs. The dummy variables for barrios in regression 1 could be interpreted as relative levels of transaction cost environments (see E_{b1} and E_{b2} in Figure 1). Regression 2 provides another measure of transaction cost by introducing hired labour (male, female and child) barrio dummy interaction terms. The coefficients on these variables (HIREI-2 through HIRE920) can be interpreted as supervision time requirements per day of hired labour. (The

barrio intercepts are generally not significant and this supports this interpretation). We also included predicted wages from step 1 in other versions of regressions 1 and 2 to contend for simultaneity bias. They did not change the results.

The third step in our analysis entailed regressions of fertility and contraception on variables measuring the economic and institutional environment impacting on rural households. These variables included predicted wages (NCWAGE, MMWAGE, NFWAGE) and the transaction cost environment variables. We have two measures of transaction cost from Table 2, regressional, dummy variables SUPRSP1 and regression 2 variables SUPRSD3. Recall that our theory discussion showed that the effect of transaction cost levels impacted differently on households according to whether they hired in labour or hired our labour. If the household had little land, hence hired out labour, high transaction cost constitute high economic burdens and should reduce fertility and increase contraception. Conversely, for households hiring labour we would expect high transaction cost not to be a burden. In fact, we would expect relative premiums in the form of savings in supervision costs.

We present results for a transaction cost specification in Table 3. We interact SUPRSD1 with net cropped area farmed (LANDSUP) to test the proposition that as farm size increases the premium to family workers, hence fertility increases. We report regressions for children ever born (CEB), children born before the mother is 25 (CHBF25), children born after the mother is 25 (CHAPS25), use of family planning methods (FPMTH, where no family planning method = 0, informal rhythm = 1 and pills and condoms = 2).

Other independent variables in the regressions include:

MORTCEB:	The rate of child deaths to children ever born. (There is, of course, some part of this that may be endogenous.)
PRICE:	The price of rice in the barrio.
LAND:	Not cropped or farmed.
YRUSED:	The number of years a family planning centre exists in the barrio.
INWEALTH:	Wealth of the household.
DISTFP:	Distance to the nearest family planning centre.
MAGE:	Mother's age.
FED:	Father's schooling.
MED:	Mother's schooling.
MABSC:	Mother's score on a general ability test.

The results, while not exceptional, do bear out the hypotheses presented in the earlier discussion and from other studies.

The mortality ratio has the expected positive effect on children over born. The fact that mortality has little effect on contraceptive use suggests that much of its effect may occur through a curtailment of breast feeding and that some part of it may be endogenous.

It appears that the provision of family planning services is important. The shorter the distance to a family planning centre the fewer children ever born particularly before the mother is 25. This effect occurs even though contraceptive use or its effectiveness is not affected.

The level of schooling of the mother has a negative impact on children ever born and a positive impact on contraceptive use. The ability of the mother as measured in the ability test score has the same impact though it is not statistically significant.

Wage levels of mothers, fathers and children do not have large effects except that high wages to fathers have the expected positive effect on children ever born. It must be noted, however, that we are not finding large wage, income and wealth effects.

The transaction cost hypothesis does receive support in the data. High transaction cost environments impact negatively on fertility and positively on contraceptive use when the family has little land. When farm size increases these effects are mitigated. At high farm size they are reversed although at the mean farm size the net effect of transaction cost on fertility is negative.

We also report the results of analysis of changes in health status of children in Table 4. The dependent variables are the change in height (CHANGEHT) and the change in weight (CHANGEWT) from 1979 to 1982. The variables A2 - A6 are dummy variables for age in 1979. The results indicate that labour market regimes are important. In those barrios with high wages for parents, child health improved more rapidly. High child wages retarded health improvement. High transaction cost environments appear not to retard health improvement.

Data Set II

In order to fully incorporate the effects of transaction cost into human capital decisions, a second data set is used. This is a survey of 555 households undertaken in 1976 in the same area as that of set I. A considerable (but incomplete) amount of overlapping of households is present. As mentioned earlier, this data set has more information on farm activities and time allocation. In particular, information has been collected on time allocation by family member and on more types of rural economic activities. An effort was also made to estimate the value of a family member's time contribution to the farm. All these enable us to examine the labour supply and fertility decisions within a framework that includes farm and home production activities. The estimates of mean supervision time by barrio were used as proxy and were then incorporated into the analysis using the second data set.

Because the labour participation and wage functions were now on an individual basis, sample selection became a crucial issue. To allow for this, the estimation proceeded in three steps. First, probit analysis was used to estimate the probability of participation in a particular activity. The second step involved the estimation of the wage equations using the estimated parameters of the probit equations to construct the sample selection correction variable (Heckman, 1976 and 1978). The third step involved using the estimated wages from the second phase as well as the correction for sample selection from the first stage to estimate the hours of work devoted to each activity. The fertility equations used the estimated wages from the second phase.

Participation Equations

The participation decision depends on two underlying functions: the offered wage and the reservation wage functions. The offered wage is determined by individual characteristics which are perceived to affect the worker's productivity (in each activity). It also depends on the level of local effective demand. It is, therefore, strongly influenced by the transaction cost environment and will generally differ by village (even for the same quality labour). The asking wage (W^*) on the other hand, depends on the individual's expected return in alternative activities and implicit valuation of leisure. An individual will participate in a particular activity, j, if the offered wage exceeds the asking wage, $W > W^*$. Formally we have the following structure.

(6) Offered wage: $W_{ji} = P_{1i} \alpha_1 + U_{1i}$

Asking wage: $W_{ji} = P_{2i} \alpha_{2i} + T_{ji} \delta + U_{2i}$

(7) $P_{ji} = 1$ if $W > W^*$
$= 0$ otherwise.

where: P_{1i} - vector of variables affecting offered wage including location, age, education and experience.

P_{2i} - vector of variables affecting asking wage. (P_1 and P_2 may overlap).

T_{ji} - hours of work in activity j by family member i.

The probability of participation reduces to the probability that a given individual's offered wage will be greater than his reservation wage both of which are influenced by two sets of (not necessarily exclusive) variables. With this added structure, probit analysis is used to estimate the probability of participation.

The data set provides information on the participation of the mother, father and child in labour market, farm production and home activity (which includes leisure). Data on labour market wages are also available for each family member. An imputed value for the time spent on farm production by both the mother and the father was gathered. (This consisted of asking the respondent how much they would have had to pay somebody to do the same job performed by the particular family member). Hours devoted to the different activities are available for both parents. Unfortunately, this information is unavailable for the child. Preliminary estimates of child participation on the basis of crude proxies were generally unsuccessful and child activity was dropped from further analysis for the present. Three activities were

analyzed: formal labour market work; farm work and the combination of home work and leisure. Home production and leisure could not be successfully disentangled and had to be combined.

Illustrative examples of the two types of variables are listed below. The first set primarily influences the offered wage; the second set, the asking wage. Considerable overlapping between the two sets is probable. For these variables, the estimated coefficient would represent the net effect of those variables on the probability of participation.

Variables Affecting the offered wage:

1. EDF and EDM — years of schooling of mother and father
2. MEXPER — mother's labour market experience
3. FHLTH68, MHLTH68 — health rating for father and mother, 1968
4. FAGE, MAGE — father's age; mother's age
5. SUPHIRE1 — average supervision cost of hired workers (used as an indicator of transaction cost)
6. NHHS — number of households in the village.

Variables affecting the reservation wage:

1. PROPCH3 — proportion of children below 3 years
2. PROPCH15 — proportion of children above 15
3. LAND — land operated by the household
4. FY68, MY68 — income of the husband and wife, 1968.

Some variables, like education and age, are common to both groups. A more comprehensive list of variables is given in the appendix.

The results for the participation equations are shown in Table 5. These estimates serve two purposes. They are used to correct for sample selectivity

in the later stages of estimation. They also tell us the main variables that explain labour market participation within the sample area.

Mother's labour market participation responds positively to her own and negatively to her husband's earning history. Some of the variables which may be expected to increase the asking wage like proportion of children three years old or below (PROPCH3), LAND, and home technology (HMTCH68) have the right signs but are statistically insignificant.

Mother's farm participation on the other hand, is influenced positively by distance from town (DISTPOB), income from the sale of livestock and the transaction cost variable. DISTPOB reflects both a weaker attraction of the labour market and increasing cost of market participation. The former reduces the offered wage and the latter increases the asking wage. The expected sign on the probability of farm participation is positive in both cases. The positive effect of income from the sale of livestock reflects the role of women and children in Philippine farms in the raising of livestock and poultry. The coefficient on the supervision of hired workers (SUPHIREI), our proxy for transaction cost, has the expected positive sign and is statistically significant. As transaction cost increases, so does the demand for family labour and the expected farm participation of family members.

The father's labour market participation is influenced positively by age (FAGE). Age is a proxy for experience which is not available directly. Father's occupation (FOCC) which indicates a skill rating has a positive effect. Both variables raise the offered wage and, therefore, increases the probability of participation in the labour market. On the other hand, increases in his marginal revenue product on the farm and nonlabour income increases the reservation wage. Thus, the coefficients for farm size (LAND)

and the wife's earning history (MY68) are negative. The proxy for transaction cost, SUPHIRE1, shows no significant impact on labour market participation. As mentioned below, transaction cost may not have a big impact on male farm participation. This in turn may also diminish the influence of transaction cost on the father's labour market participation.

The regression on father's farm participation show complementary results. Land size, distance from the town centre, the mother's earning history and the level of home technology all have a positive influence on participation in farm production. Distance from the town centre indicates diminishing labour market demand (and lower wage offers) while land size indicates higher land/labour ratios, increasing the partial productivity of labour. SUPHIRE1 does not show a statistically significant effect on fathers' farm work participation. This may be attributable to the role of the father as the primary family farm worker which makes his participation vary much less in response to transaction cost.

Wage Equations

The second step involved the estimation of expected wages. For the study market wages are actual payment in cash and in kind while farm "wages" for household members are estimates made by the respondent of what it would cost to hire someone to do what the household member is doing. We tried to incorporate the estimates from the first stage into the wage equations in order to correct for the sample selection bias (Heckman, 1974 and 1978). The correction involved the computation of the variable λ defined as

$$\lambda = \frac{f(Z_{ji})}{1 - F(Z_{ji})} = \frac{f(Z_{ji})}{F(-Z_{ji})} .$$

where f( ) and F( ) are the probability density and cumulative distribution functions for a standard normal variable.

Z is the vector of explanatory variables from the first stage.

The current estimates did not result in statistically significant coefficients for the sample selection correction for fathers' wages. Therefore, results reported here are for those runs where the sample selection correction is carried out only for mothers' wages. These are reported in Table 6.

Expected market wages for mothers (MWAGE) are positively influenced by her educational level (EDM) and experience $(MEXPER)^2$. The mother's age (MAGE) has a negative influence and may be capturing some cohort effect in the market (i.e. once education is controlled for the obsolescence of skills over time may more than offset the productivity enhancing effect of experience). Our proxy for the size of the market, number of households in the village (NHHS), has a negative effect on the mothers' expected wages. SUPHIRE1 also has an unexpected positive coefficient but is statistically insignificant. The sample selection correction seems significant although stronger statements have to await more precise estimates of the errors.

The regressions on mothers' expected farm wages show complementary results. The effect of land size (LAND) on mothers' farm wage is positive at a decreasing rate. Surprisingly, the amount of farm capital (FAMCAP68) has a negative influence on wages. The percentage of farms in the village but is irrigated (IRRO) has a negative effect on women's wages. The other irrigation variable (IRRO, the percentage of farm area irrigated), is positive and marginally significant. Mother's age and education have no significant effect. Again, SUPHIRE1 and an interaction term with land, LANDSUP, are not significant.

The regression on fathers' market wages (FWAGE) shows similar results. The father's education has a strongly positive effect on his market wage. His age (FAGE), a proxy for experience since a direct measure is not available, is positive and significant. The number of households in the village also increase his expected wage. The transaction cost variable, SUPHIRE1, has the expected negative sign i.e. the higher the transaction cost in a village, the lower will be the wage offer. However, it is significant only at the 10% level.

The results for the regressions on fathers' farm wages (FFARMVAL) complement the previous findings. LAND and the irrigation variable, IRRG, have the expected positive signs even though the former is not statistically significant. Farm capital, FAMCAP68, has a negative coefficient which is surprising. The transaction cost variable (SUPHIRE1) is insignificant.

Hours of Work

The results in the wage equations provide expected market wages which are utilized in the third stage. The hours of work are run on variables that determine the asking wage and on the expected offered wage. The results are shown in Table 7.

The results in the third stage provide corraborating though still weak evidence for the transaction cost hypothesis. For both the mothers and fathers, the transaction cost variable, SUPHIRE1, has a negative effect on the hours of market work. This is an indirect effect of the increase in premium of family labour over hired labour in high transaction cost environments.

Other variables affecting the mothers' hours of market work are expected market wages (MMARKWAG), mother's age, and education. The first two tend to increase the hours of work, while the last has a negative effect. Mothers'

hours of work on the farm, on the other hand, responds postively to her husband's income history (FY68). However, given the poor explanatory power of this equation, this result has to be taken as very tentative.

Results for the fathers' hours of work regressions show the same general trend. Fathers' market work respond negatively to SUPHIRE1 and HMTCH68, a measure of intensity of home activities, although the coefficient on transaction cost has a level of significance just below 5%. The sign on SUPHIRE1 is expected and the level of home technology raises the asking wage by increasing the productivity of household members' home time. Expected market wages, father's age and father's education are statistically insignificant. The regression on father's farm time (FFARMTIM) has the lowest explanatory power of the four. Home technology is significantly positive. This may be due to complementarities in home and farm time but the result is highly tentative because of the poor explanatory power of this equation.

Fertility Equation

The last portion of Table 7 reports the results of a regression on the number of children ever born (CEB). The coefficients are encouraging even though the explanatory power is rather low. Since the cohort effect had not been directly controlled for, mother's age (MAGE) has a positive effect on CEB. Mother's education (EDM) and labour force experience (MEXPER) are both expected to raise the asking wage and, therefore, increase the implicit price for children. Their influence on fertility are negative. The mother's expected market wage (MMARKWAG)'s negative effect is then understandable in this milieu. With EDM and MEXPER controlling for the increase reservation wage, the net effect capture by MMARKWAG may be the income effect which is positive for normal goods like children. With these controlling effects, the

transaction cost variable, SUPHIRE1, has a negative effect on fertility. This is consistent with the first-round result in the analysis of data set I. Recall that transaction cost operates in opposite directions depending on whether a household was hiring in workers (positive effect) or hiring out members as landless laborers (negative effect). This result may be showing that the negative effect was swamping the positive influence in our sample -- as may be the case when hiring out households are much more numerous. In data set 1, once the analysis distinguished between hiring in and hiring out workers, the expected signs emerged. This may also be what is happening with data set II. Unfortunately, in the form that data set II is coded, the distinction between households is not clear. A follow-up of the households is expected to result in a more precise result.

SUMMARY AND CONCLUSION

This paper documents initial results of an investigation of the effect of transaction cost on household labour supply decisions. The model has been specified, hopefully, in a manner that clearly indicates the process by which this influence is carried out. Our results are encouraging in that the coefficients on the transaction cost indicator have the right signs inspite of the number of equations that were estimated. While the explanatory power of some regressions were quite low, especially in the second data set, the results are robust in the sense that findings in the two data sets used reinforce and complement each other. This lack of power in the findings, of course, precludes any strong statements from this single exercise. However, we regard these initial findings as allowing us to use the transaction cost aspect as a working framework while further evidence is accumulated.

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1. We assume constant returns to scale in supervision.
2. MEXPER measures the number of years the mother has been in the labor force in the last seven years.

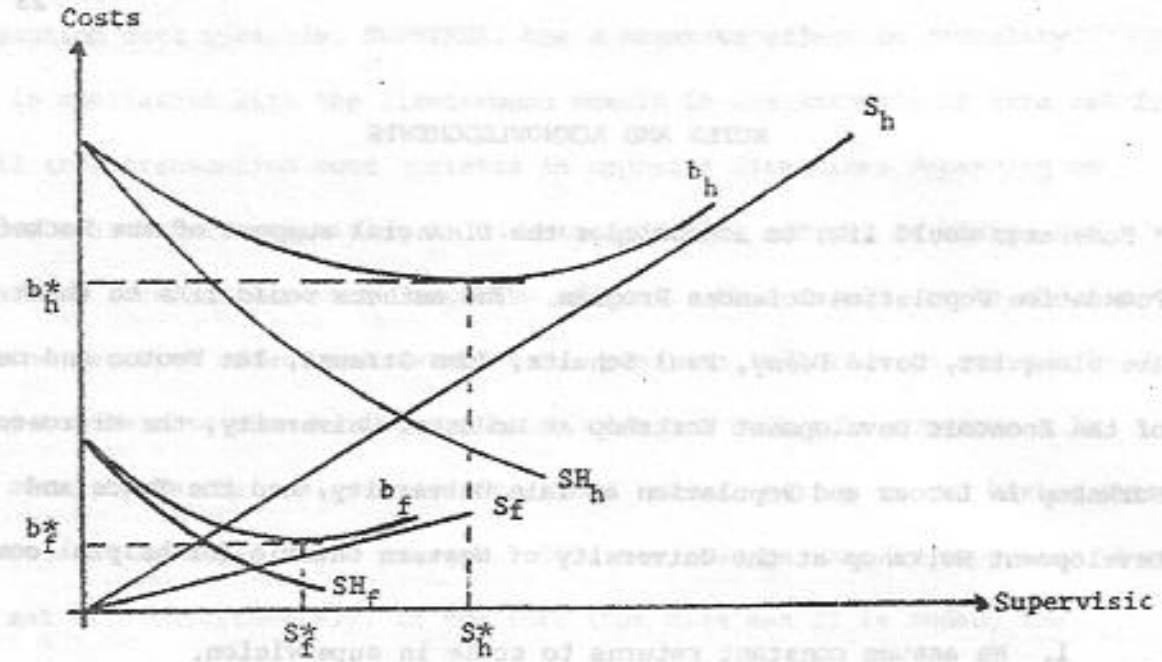

Figure 1

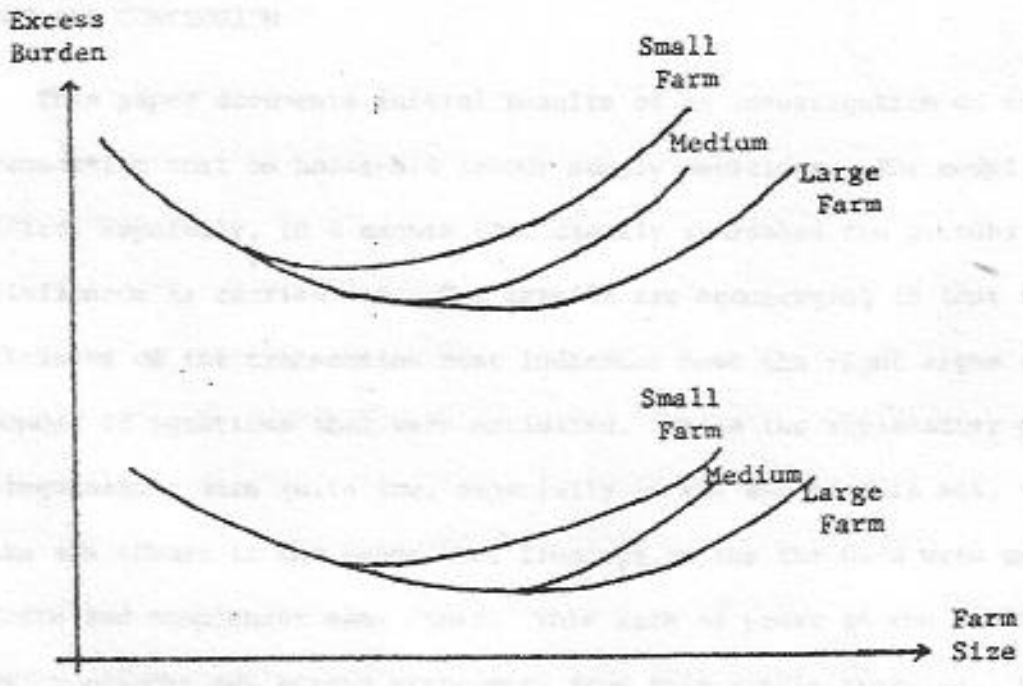

Figure 2

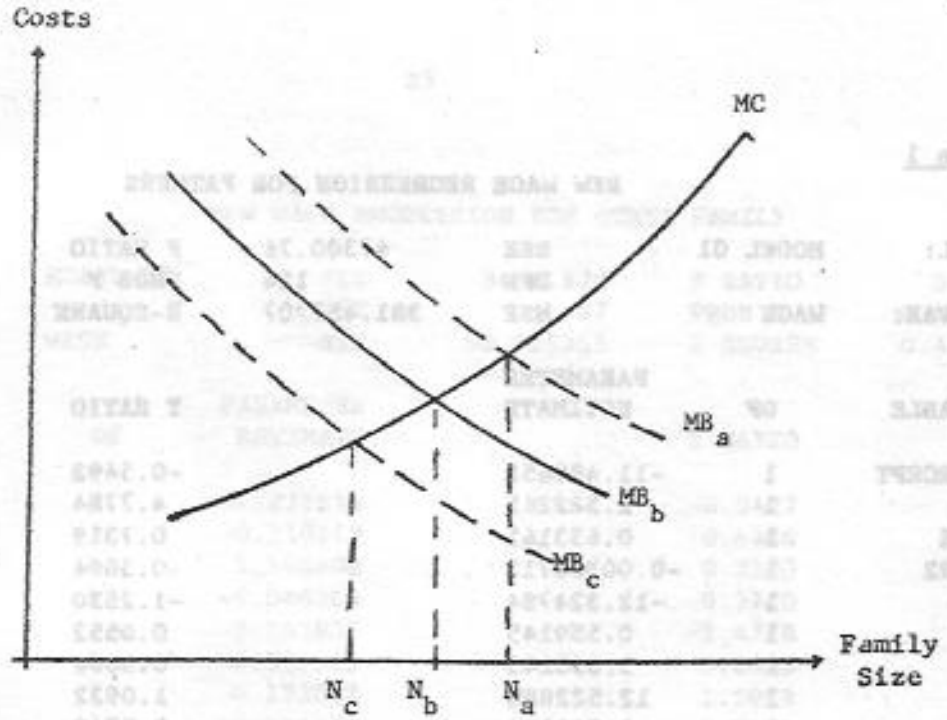

Figure 3

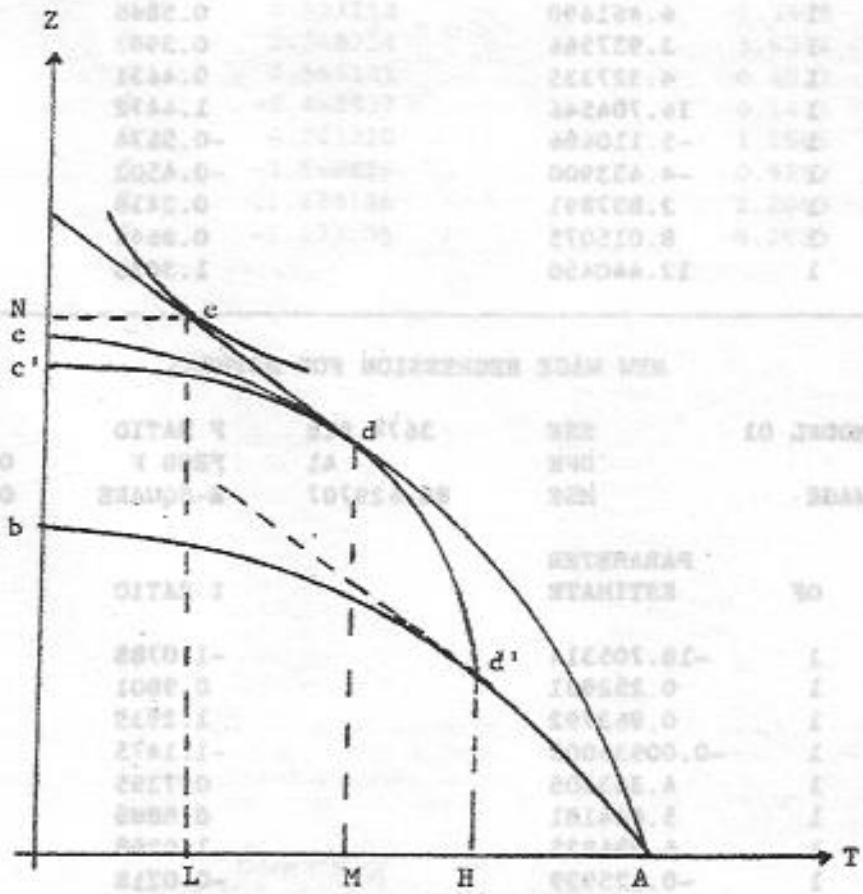

Figure 4

Table 1

NEW WAGE REGRESSION FOR FATHERS

MODEL:	MODEL 01	SSE	47300.76	F RATIO	3.00
		DFE	124	PROB F	0.0001
DEP VAR:	WAGE	MSE	381.457707	R-SQUARE	0.3151

VARIABLE	DF	PARAMETER ESTIMATE	T RATIO
INTERCEPT	1	-11.498652	-0.5492
EDUC	1	1.522265	4.7784
AGEYR	1	0.633161	0.7319
AGEYR2	1	-0.00360713	-0.3894
B1 2	1	-12.324784	-1.2530
B3	1	0.559145	0.0552
B4	1	3.858243	0.3666
B5	1	12.522888	1.0932
B6	1	-9.860719	-0.9742
B7	1	-7.263258	-0.6300
B8	1	1.404966	0.1333
B9	1	6.461690	0.5865
B10	1	3.937566	0.3903
B11	1	4.327335	0.4631
B12	1	16.704546	1.4472
B1314	1	-5.110686	-0.5674
B1516	1	-4.433900	-0.4502
B17	1	2.837891	0.2419
B18	1	8.015075	0.8646
B19	1	12.440450	1.3070

NEW WAGE REGRESSION FOR MOTHERS

MODEL:	MODEL 01	SSE	3674.818	F RATIO	2.70
		DFE	41	PROB F	0.0104
DEP VAR:	WAGE	MSE	89.629707	R-SQUARE	0.4200

VARIABLE	DF	PARAMETER ESTIMATE	T RATIO
INTERCEPT	1	-18.705314	-1.0788
EDUC	1	0.252931	0.9801
AGEYR	1	0.963792	1.2935
AGEYR2	1	-0.00935005	-1.1475
B1 2	1	4.343305	0.7395
B34	1	5.644181	0.8888
B56	1	6.096825	1.0298
B78910	1	-0.125929	-0.0218
B11	1	8.582253	1.7100
B12	1	6.796107	1.0137
B13 16	1	9.464950	1.7088
B1718	1	21.006039	3.7811

NEW WAGE REGRESSION FOR OTHER FAMILY

MODEL:	MODEL 01	SSE	3404.629	F RATIO	3.12
		DFE	67	PROB F	0.0005
DEP VAR:	WAGE	MSE	50.815354	R-SQUARE	0.4417

VARIABLE	DF	PARAMETER ESTIMATE	T RATIO
INTERCEPT	1	-1.271816	-0.0427
EDUC	1	-0.110110	-0.6336
AGEYR	1	1.168609	0.3323
AGEYR2	1	-0.040364	-0.3730
SEX	1	-3.103837	-1.4778
HEIGHT	1	0.027525	0.0958
WEIGHT	1	0.123089	1.5058
B1 2	1	-5.414471	-0.9601
B34	1	11.382817	2.8935
B56	1	0.685504	0.1778
B78910	1	4.627152	1.3908
B11	1	5.268754	1.6396
B12	1	2.566301	0.4517
B13	1	-0.448937	-0.1471
B14	1	4.251310	1.1566
B15	1	-3.688886	-0.9292
B16	1	11.179126	2.2043
B1718	1	-1.673205	-0.3933

TABLE 5

PROBABILITY OF WORK PARTICIPATION

Dependent Variable: MPROB (Mother's Probability of Market Work)

	Maximum Likelihood Estimates ESTIMATES	ASYMPTOTIC T-RATIOS
DISTPOB	-.778480-02	-.32212
MAGE	.281670-02	.850480-01
MHLTH68	-.995070-01	-.74796
PROPCH5	-.61445	-.42999
PROPCH15	-.77281	-1.2760
LAND	-.797540-01	-1.1658
CAP68	-.280160-05	-.87786
HMTCH68	-.236190-02	-.57007
EDM	.639250-02	.57962
MAGESQ	-.689230-04	-.15493
SALIV63	-.225810-03	-.49392
FY68	-.134290-03	-2.0099
MY68	.288310-03	2.4457
FAMCAP68	.101080-05	.32477
SUPHIREI	.16155	1.5604
BINAN	.37838	1.4724
SAN PEDRO	1.0816	3.2627
CONSTANT	.45739	-.44696

LIKELIHOOD RATIO TEST 42.9984 with 17 D.F.

DURBIN-WATSON = 2.0428 VON NEUMAN RATIO = 2.0465
FIRST-ORDER RHO = 0.0218 RESIDUAL SUM = -.555850-01
RESIDUAL VARIANCE = .764350-01 SUM OF ABSOLUTE ERRORS = 85.735
R-SQUARE BETWEEN OBSERVED AND PREDICTED = 0.1178
LOG-LIKELIHOOD FUNCTION = -.153.3654

Dependent Variable: MPROBF (Mother's Probability of Farm Work)

	Maximum Likelihood Estimates ESTIMATES	ASYMPTOTIC T-RATIOS
DISTPOB	.34244D-01	2.0337
MAGE	.208970-01	1.3864
MHLTH68	.476070-01	.54635
LAND	.15316D-01	.47576
CAP68	.55748D-06	.25903
HMTCH68	-.172790-02	-.64504
EDM	-.346520-02	-.31558
MAGESQ	-.23064D-03	-1.0982
SALIV63	.480930-03	1.6107
FY68	.78426d-04	.79170
MY68	.265660-05	1.1816
SUPHIREI	.68570	2.4346
BINAN	.27689	1.3781
SAN PEDRO	-.54577	-1.7641
CONSTANT	-.53147	-1.6659

DURBIN-WATSON = 1.9545 VON NEUMAN RATIO = 1.9580
FIRST-ORDER RHO = 0.0216 RESIDUAL SUM = .969130-01
RESIDUAL VARIANCE = .23092 SUM OF ABSOLUTE ERRORS = 255.87
R-SQUARE BETWEEN OBSERVED AND PREDICTED = 0.0451
LOG-LIKELIHOOD FUNCTION = 361.8100

Dependent Variable: FPROB (Father's Probability of Market Work)

	Maximum Likelihood Estimates ESTIMATES	ASYMPTOTIC T-RATIOS
DISTPOB	.25933D-02	.14172
FAGE	.70485D-01	3.7192
FHLTH68	-.13807	-1.4885
MPOPCH5	1.5183	1.1958
PROPCH15	-.979920-01	-.22832
LAND	-.27806	-4.5510
CAP68	-.867290-06	-.35757
HMTCH68	.99533D-03	.31184
EDF	.238000-02	.20310
FAGESQ	-.852630-03	-5.4031
SALIV63	-.323050-03	-1.0256
FY68	-.330170-04	-.66630
MY68	-.540360-05	-2.1546
FOOD68	.32299	2.8827
SUPHIRE1	.10891	.75631
BINAN	.24254	1.1408
SAN PEDRO	.88364	2.5827
CONSTANT	-1.4406	-2.0893

LIKELIHOOD RATIO TEST 126.851 with 17 D.F.

DURBIN-WATSON = 2.0021 VON NEUMAN RATIO = 2.0058
FIRST-ORDER RHO = -0.0015 RESIDUAL SUM = .23489
RESIDUAL VARIANCE = .17212 SUM OF ABSOLUTE ERRORS = 190.77
R-SQUARE BETWEEN OBSERVED AND PREDICTED = 0.2090
LOG-LIKELIHOOD FUNCTION = -284.0451

Dependent Variable: FPROBF (Father's Probability of Farm Work)

	Maximum Likelihood Estimates ESTIMATES	ASYMPTOTIC T-RATIOS
DISTPOB	.340180-01	1.5341
FAGE	.48317D-02	.37822
FHLTH68	.447020-02	.438590-01
LAND	.48965	5.4343
CAP68	.141880-05	.55339
HMTCH68	.110440-01	2.4528
EDF	.756470-02	.56110
FAGESQ	-.129510-03	-.91182
SALIV63	.674030-03	1.5344
FY68	.768160-04	1.1682
MY68	.596030-05	2.1138
SUPHIRE1	.767510-01	.22468
BINAN	.664740-01	.22896
SAN PEDRO	-.75554	-2.2887
CONSTANT	-.30586	-.83419

DURBIN-WATSON = 2.0050 VON NEUMAN RATIO = 2.0126
FIRST-ORDER RHO = -0.0052 RESIDUAL SUM = .65736
RESIDUAL VARIANCE = .11385 SUM OF ABSOLUTE ERRORS = 131.38
R-SQUARED BETWEEN OBSERVED AND PREDICTED = 0.2414
LOG-LIKELIHOOD FUNCTION = -206.0181

TABLE 6
REGRESSIONS FOR WAGE EQUATIONS

REGRESSION ON MOTHER'S WAGE

DEPENDENT VARIABLE.. MWAGE

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T
MAGE	-82.884429	24.753920	-3.3483355
ELECTRIC	-349.54949	483.99892	-.72221131
SUPHIRE1	203.53356	176.48866	1.1532388
MEXPER	351.16077	110.00909	3.1921067
NWHS	-3.1275966	1.8997182	-1.6463477
EDM	157.51979	62.764332	2.5097023
LAMBDAM1	1001.6373	252.12668	3.9727540
CONSTANT	-183.16885	1111.0067	-.16486746

MULTIPLE R	.64431	ANALYSIS OF VARIANCE	DF
R SQUARE	.41514	REGRESSION	7.
ADJUSTED R SQUARE	.32416	RESIDUAL	45.
STD DEVIATION	1482.57003	COEFF OF VARIABILITY	158.5 PCT

	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFICANCE
REGRESSION	70207272.45183	10029610.35026	4.56303	.001
RESIDUAL	98910625.62364	2198013.90275		

REGRESSIONS ON MOTHER'S IMPUTED FARM WAGE

DEPENDENT VARIABLE.. MFARMVAL

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T
MAGE	-.34590600E-01	.68026595E-01	-.50848643
LANDSQ	-.22890920	.77682656E-01	-2.9467222
IRRG	.21885825	.14625104	1.4964560
SUPHIRE1	.51607250	2.1078326	.24483562
FAMCAP68	-.37762919E-04	.20832213E-04	-1.8127176
IRRO	-1.9727929	.84178731	-2.3435765
EDM	-.45214569E-01	.11991354	-.37705975
LAMBDAM2	.40178752	3.0728888	.13075238
LAND	2.8225971	.73838773	3.8226489
LANDSUP	-.45584008	.88878756	-.51287855
CONSTANT	8.4262421	3.2136931	2.6219810

MULTIPLE R	.30719	ANALYSIS OF VARIANCE	DF
R SQUARE	.09436	REGRESSION	10.
ADJUSTED R SQUARE	.06579	RESIDUAL	317.
STD DEVIATION	10.78174	COEFF OF VARIABILITY	110.8 PCT

	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFICANCE
REGRESSION	3839.59449	383.95945	3.30299	.000
RESIDUAL	36849.94201	116.24587		

REGRESSION ON FATHER'S MARKET WAGE

DEPENDENT VARIABLE.. FWAGE

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T
FAGE	.19447055	.88466389E-01	2.1982422
BINAN	3.9969621	2.7128329	1.4733536
NHHS	.12077834E-01	.73073486E-02	1.6528340
EDF	.34277650	.16378520	2.0928417
SUPHIRE1	-2.5705560	1.7721642	-1.4505180
CONSTANT	-.38087484	3.3388828	-.11407254

MULTIPLE R	.31702	ANALYSIS OF VARIANCE	DF
R SQUARE	.10050	REGRESSION	5.
ADJUSTED R SQUARE	.07420	RESIDUAL	171.
STD DEVIATION	10.82711	COEFF OF VARIABILITY	83.9 PCT

	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFICANCE
REGRESSION	2239.67774	447.93555	3.82112	.003
RESIDUAL	20045.68950	117.22625		

REGRESSION ON FATHER'S FARM IMPUTED WAGE

DEPENDENT VARIABLE.. FFARMVAL

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T
FAGE	.21782072E-01	.48597397E-01	.44821480
LANDSUP	.15158022E-01	.30437451E-01	.49800562
IRRG	.33447243	.12064061	2.7724697
IRRO	-.93213274	.68338859	-1.3639864
FAMCAP68	-.47276208E-04	.16541129E-04	-2.8581005
EDF	.80923419E-01	.88785124E-01	.91145245
LAND	.29563739	.26134628	1.1312094
SUPHIRE1	-.14054444E 01	1.0539783	-.13334663E-01
CONSTANT	8.2997288	1.7524019	4.7362016

MULTIPLE R	.20758	ANALYSIS OF VARIANCE	DF
R SQUARE	.04309	REGRESSION	8.
ADJUSTED R SQUARE	.02573	RESIDUAL	441.
STD DEVIATION	10.10658	COEFF OF VARIABILITY	91.6 PCT

	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFICANCE
REGRESSION	2028.33296	253.54162	2.48222	.012
RESIDUAL	2028.33296	253.54162		

TABLE 7

REGRESSIONS ON LABOR SUPPLY AND FERTILITY

REGRESSION ON MOTHERS MARKET TIME

DEPENDENT VARIABLE.. HRSWK76

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T
DISTPOB	.52682812	.65211849	.80787178
PROPCH15	2.0180587	21.138534	.95468244E-01
MHLTH68	1.7971707	4.6980752	.38253341
SUPHIRE1	-6.2433043	1.9021213	-3.2822850
FY68	.27978430E 02	.23486417E-02	1.1912600
EDM	-2.8291830	.70362643	-4.0208595
PROPCH3	-40.610655	34.340117	-1.1826010
MMARKWAG	.14245393E-01	.33245302E-02	4.2849341
LAMBDAM1	-16.779232	4.2513355	-3.9468143
MAGE	2.2378579	.46058635	4.8587152
CONSTANT	-8.3758905	29.554198	-.28340780

MULTIPLE R	.72197	ANALYSIS OF VARIANCE	DF
R SQUARE	.52124	REGRESSION	10.
ADJUSTED R SQUARE	.40724	RESIDUAL	42.
STD DEVIATION	15.86529	COEFF OF VARIABILITY	64.7 PCT

	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFICANCE
REGRESSION	11509.50198	1150.95020	4.57257	.000
RESIDUAL	10571.70557	251.70728		

REGRESSION ON MOTHERS FARM TIME

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T
MAGE	3.3507374	4.0766435	.82193536
LANDSQ	-6.8549619	4.4032421	-1.5567988
SUPHIRE1	54.747803	79.096041	.69216868
MHLTH68	-4.8593573	35.699686	-.13611765
MFARMWAG	3.1792570	12.148178	-.26170649
EDM	-1.6555700	4.3724016	-.37864087
LAMBDAM2	442.54909	128.88275	3.4337340
PROPCH3	-567.86570	517.57251	-1.0971713
FY68	.63637995E-01	.17605227E-01	3.6147216
PROPCH15	66.255137	172.50336	.38408027
LANDSUP	-29.966532	33.563627	-.89282758
LAND	60.022610	47.599976	1.2609798
CONSTANT	-136.27285	267.98354	-.50851201

MULTIPLE R	.28232	ANALYSIS OF VARIANCE	DF
R SQUARE	.07970	REGRESSION	12.
ADJUSTED R SQUARE	.04464	RESIDUAL	315.
STD DEVIATION	398.93302	COEFF OF VARIABILITY	136.2 PCT

	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFICANCE
REGRESSION	4341605.30285	361800.44190	2.27336	.009
RESIDUAL	50131478.58740	159147.55107		

REGRESSION ON FATHERS MARKET TIME

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T
FAGE	-1.6629027	1.8179458	-.91471525
MY68	.34680307E-01	.26656093E-01	1.3010274
HMTCH68	-.90641291	.36961655	-2.4523061
SUPHIRE1	-40.490356	24.820702	-1.6313139
PROPCH3	-16.678345	152.38446	-.10944912
FMARKWAG	-1.5575174	4.4906410	-.34683631
PROPCH15	-8.9737917	62.885337	-.14270086
EDF	3.5941407	2.5803123	1.3929092
CONSTANT	186.66606	88.879325	2.1002192

MULTIPLE R	.31109	ANALYSIS OF VARIANCE	DF
R SQUARE	.09678	REGRESSION	8.
ADJUSTED R SQUARE	.05377	RESIDUAL	168.
STD DEVIATION	113.91663	COEFF OF VARIABILITY	76.2 PCT

	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFICANCE
REGRESSION	233590.54506	29198.81813	2.25004	.026
RESIDUAL	2180135.63573	12976.99783		

REGRESSION ON FATHER'S FARM TIME

DEPENDENT VARIABLE.. FFARMTIM

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T
FAGE	-15.011682	26.691984	-.56240413
LANDSUP	-.93893409	8.7938314	-.10677190
HMTCH68	16.371407	7.1223855	2.2985848
MY68	.12948460	.34759843	.37251205
EDF	-14.381099	31.635366	-.45458930
FFARMWAG	-30.743932	90.422156	-.34000442
PROPCH3	3772.4157	3865.2742	.97597622
PROPCH15	-962.12875	1220.1176	-.78855410
SUPHIRE1	56.108608	372.97919	.15043362
CONSTANT	1828.8226	1712.7226	1.0677868

MULTIPLE R	.14794	ANALYSIS OF VARIANCE	DF
R SQUARE	.02189	REGRESSION	9.
ADJUSTED R SQUARE	.00188	RESIDUAL	440.
STD DEVIATION	3598.65622	COEFF OF VARIABILITY	503.1 PCT

	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFICANCE
REGRESSION	127498454.67725	14166494.96414	1.09391	.366
RESIDUAL	5698143704.22049	12950326.60050		

REGRESSION ON CHILDREN EVER BORN

DEPENDENT VARIABLE.. CEB

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT
MACE	.32167083E-01	.16546236E-01	1.9440726	-.33512322E-03,
FAMPDIST	.24354955E-01	.47780007E-01	.50973109	-.69500570E-01,
MEXPER	-.16508242	.79557621E-01	-2.0750044	-.32135954,
MHLTH68	-.36099437	.24460465	-1.4758279	-.84147772,
SUPHIRE1	-.48509192	.19692096	-2.4633839	-.87190893,
EDM	-.10851106	.36533844E-01	-2.9701516	-.18027545,
MFARMWAG	.16400161E-01	.45118147E-01	.36349368	-.72226601E-01,
DISTPOB	.23332341E-01	.58543073E-01	.39854999	-.91665357E-01,
MMARKWAG	.32606522E-03	.13722168E-03	2.3761933	.56517073E-04,
CONSTANT	7.5250669	.93590144	8.0404481	5.6866511,

MULTIPLE R	.19532	ANALYSIS OF VARIANCE	DF	SUM OF
R SQUARE	.03815	REGRESSION	9.	
ADJUSTED R SQUARE	.02227	RESIDUAL	545.	
STD DEVIATION	3.65126	COEFF OF VARIABILITY	52.1 PCT	

	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFICANCE
REGRESSION	288.19643	32.02183	2.40193	.011
RESIDUAL	7265.77474	13.33170		

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