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Testing for the Existence of Bargaining in Rural Households: a Study of Decisions on Labor Market Participation in the Cordillera Region of the Philippines

by

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DISCUSSION PAPER

TESTING FOR THE EXISTENCE OF BARGAINING IN RURAL HOUSEHOLDS. A STUDY OF DECISIONS ON LABOR MARKET PARTICIPATION IN THE CORDILLERA REGION OF THE PHILIPPINES

By

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ABSTRACT

In this paper we derive testable implications of a unitary farm household model and a non-unitary, i.e. bargaining, model. In the unitary household model the impact of spouse specific resources and non-labor income on household decisions should not be different from that of the resources and non-labor income common to the household. In a bargaining model we expect to find a specific impact of spouse specific resources and non-labor income. Our empirical tests are based on a small survey of households in the Cordillera region of Northern Luzon (Philippines). In this region each spouse retains specific rights on her/his inherited land, although within marriage this land is treated as part of the household farm. Inherited land is a truly exogenous variable, which we use as the indicator of bargaining power. We perform probit regressions in which the spouses' inherited land is a determinant of the probability that a husband or wife participates in the labor market. The statistical results provide some evidence of a specific impact of spouse specific land on labor market participation decisions and therefore cast doubt on the unitary farm household model. They are compatible with a bargaining model of household behavior.

1. INTRODUCTION

Decisions on demand for goods and services, labor supply, investment in human resources, etc. are taken within the household. The effects of policies on food supply, poverty alleviation, health and education are filtered through the household decision process. Understanding this process is therefore of crucial importance for the formulation of such policies.

We distinguish between the unitary and collective models of household behavior. The *unitary* model of the household treats the household as a single decision maker. It assumes that the household's preferences are adequately described by a single utility function. Many studies have questioned the validity of this approach and provided evidence for its rejection. The alternative *collective* model is based on the individual preferences of household members. It focuses on how the possibly conflicting preferences of individuals are combined to reach collective decisions. In collective household models it is natural to consider the household decisions as the outcome of a *bargaining* process between household members. Not only is this alternative approach more consistent with the assumptions of economic analysis on individual behavior, it may also be a more adequate reflection of reality.

This paper presents the results of empirical tests of the unitary model's implications for household decisions on labor market participation. The tests are base on data[1] one of the authors collected in the Cordillera region of Northern Luzon (Philippines). In this region there has been an increasing integration of formerly subsistence villages into the regional and national economic systems. Mining, logging, temperate vegetable production and tourism have all contributed to the increased commercialization of Cordillera farm households' production activities. Markets for farm outputs and inputs and for manufactured goods have arisen. These developments have provided opportunities for couples to reallocate their available time between leisure and on- and off-family farm labor. (We will use the terms 'household farm' and 'family farm' as synonyms.)

The farm households' supply of off-family farm labor (or participation in the labor market) has been the subject of several studies (see Rosenzweig, 1980, Huffman, 1980, Huffman and Lange, 1989, Kimhi, 1994, Jacoby, 1993, Skoufias, 1994). All these studies are based on the unitary

[1] In early 1994, one of the authors administered a questionnaire on intrahousehold relations to respondents from 126-landholding households in three villages in the Cordillera. In this region, the farm household's primary access to land is by and large through inheritance and usufruct rights

farm household model. Several studies on labor supply of urban households have tested the hypothesis of income pooling. To our knowledge none as yet has attempted to test the implications of a collective household model for the labor market participation decisions of farm household members[2].

Applying tests of income pooling to rural households is problematic because many rural households have little or no non-labor income receipts. Faced with this difficulty we followed a suggestion made by Schultz (1990) to concentrate on ownership of an underlying income generating asset. A successful implementation of a test of the pooling hypothesis requires that such an asset must be exogenous to the household's decisions. The situation in the sample area provides a truly exogenous asset, i.e. spouse specific inherited land.

In using inherited land as a measure of a spouse's bargaining power, we comply with the requirements suggested in the literature for a proper indicator of a threat point in a bargaining model. First, it should be exogenous to household decisions. Second, it should be a resource on which an individual spouse retains rights, i.e. brought into marriage by a spouse, but returned to this spouse when the marriage breaks up. Finally the asset should not be directly related to this spouse's human capital[3].

In section 2, we discuss the labor allocation decision of a farm couple using respectively a unitary and a static Nash bargaining model of a farm household. We show why individual inherited land and non-labor income have separate effects on labor supply in a bargaining model. In section 3, we present the data of our household survey and a description of the variables used in the regressions of section 4, where we estimate a labor market participation function. Our purpose is to test whether a spouse's inherited land has an impact on each spouse's decision to participate in the labor market, i.e. to do off family farm work. If a spouse's inherited land is found to have an impact on a spouse's labor market participation, distinct from the household's total land, this finding can be interpreted as a rejection of the unitary household model. Section 5 concludes.

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2 A study which applies the insights of a bargaining model to rural households but focuses on consumption is Doss (1996b).

3 As Quisumbing (1992) points out, in rural economies where a significant proportion of wealth is inherited, and financial markets are imperfect, non-labor income may take the form of non-realized capital gains from inherited land.

2. OFF-FARM LABOR SUPPLY IN A UNITARY AND A COLLECTIVE FARM HOUSEHOLD MODEL

We consider a farm-household consisting of a husband and wife who can choose to work on the family farm and/or off- farm. We analyze this household's labor allocation decision using two household models : the traditional unitary household model and a collective model, in which decision making is characterized by Nash bargaining[4]. The constraints in the two models are identical, but preferences differ.

2.1. The objective functions

The unitary household model is based on the assumption that there exist household preferences which are accepted by husband and wife. These are represented by a unique household utility function:

$$(1) \qquad U[C, L_h, L_w]$$

where C stands for household consumption and L_h and L_w for the husband's and the wife's leisure time. The function is assumed to have the usual characteristics[5].

In the collective model each spouse has her own preferences represented by spouse specific utility functions :

$$(2) \qquad U^i[C, L_i] \qquad (i=h,w)$$

each with the usual characteristics. Since our analysis will focus on labor allocation, we assume that C is a shared good within the household, a 'public' good available for husband and wife. Leisure is spouse specific and a spouse's increased leisure does not directly affect the partner's utility.

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4 See also the static Nash bargaining model with household production developed by Ott (1992: 46-67).

5 Decreasing marginal utility with respect to each of the arguments and marginal utility tending to infinity as consumption and each spouse's leisure time tend to zero. As a result C and L_i (i = h,w) will be positive.

Decisions are reached in the framework of a Nash bargaining process in which each spouse has a specific threat point D^i. The bargaining process can be modeled by an objective function, the Nash product, which can be used as the household's objective function :

$$(3) \qquad (U^h - D^h)(U^w - D^w)$$

A spouse's threat point is the result of maximizing her individual utility function subject to her individual budget and time constraints (see section 2.3). Cooperation in the framework of the household should produce benefits. Each spouse's utility as a household member should not be less than her utility as an individual, so that in the bargaining model individual utility cannot fall below the threat point. When a spouse's utility level obtained from cooperation in household activities would fall below this fallback position, she would withdraw her cooperation. The utility gains generated by household activities resulting from the spouses' cooperative behavior are shared according to the spouses' bargaining strength[6].

2.2. The constraints

The household faces three (pairs of) constraints on resources. These are the time constraints, the production function of the family farm and the household budget constraint. First there are individual time constraints for husband and wife

$$(4) \qquad T_i = F_i + M_i + L_i \qquad i = h, w$$

where T_i is a spouse's time endowment, F_i is time spent on work on the family farm, M_i is time spent on off-farm (market) work, and L_i is leisure time.

The second constraint is the farm production function. Farm output (Q) is produced from inputs of heterogeneous family labor consisting of that of the husband (F_h) and the wife (F_w), other variable inputs (X, which may be a vector) and a fixed amount of land (K). Variable inputs include purchased inputs like

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[6] For simplicity, we assume that spouses have equal bargaining skills. This assumption is not relevant to our analysis. It can be dropped without altering our conclusions.

seeds and fertilizer, and hired labor. Family labor and hired labor are not perfect substitutes in production. K is the household's farmland that can consist of inherited land brought into the marriage by each spouse, non-inherited land jointly acquired by the couple or land on which a spouse may have usufruct rights.

(5) $$Q = G[F_h, F_w, X; K]$$

The marginal contribution of each factor to output is assumed to be positive.

Income from the farm (π) is called profit. It is equal to $P_qQ - P_xX$, where P_q is the price of farm output and P_x represents (a vector of) the prices of farm inputs.

The third constraint is the joint household budget constraint

(6) $$\pi + v_hM_h + v_wM_w + I_h + I_w = P_cC$$

The left-hand side is the sum of farm income (π), the spouses' off-farm earnings (v_iM_i) and non-labor income (I_i). This income must cover consumption expenditures, P_cC, where P_c is the price level of the purchased good. By distinguishing each spouse's earnings from market work, v_hM_h and v_wM_w, we are able to account for differences in wage rates.

The production constraint (5) can be combined with the income constraint (6) to obtain

(6a) $$(P_qG[F_h, F_w, X, K] - P_xX) + v_hM_h + v_wM_w + I_h + I_w = P_cC$$

The model also includes non-negativity constraints on each spouse's family farm work and market work. Remark that in contrast to household consumption and leisure time, work on the family farm and market work may be equal to zero.

2.3. The threat point

Before deriving the market labor supply decisions resulting from the two models, we first discuss the threat points, D^i ($i = h,w$), in the bargaining model. We have

previously defined D^i is the level of utility that a spouse would enjoy if she/he were to live by herself as a single-person household rather than with the partner. This implies that we assume that the best alternative to being married is to be single. Under this assumption, D^i is equal to the utility resulting from the maximization problem of a single-person household :

$$(7) \qquad D^i = \max U^i[C_i, L_i]$$

subject to a spouse's individual time and budget constraints as well as the non-negativity constraints on individual on- and off-household farm labor.

$$(8) \qquad F_i + M_i + L_i = T_i$$

$$(9) \qquad (P_q G[F_i, X, K_i] - P_x X) + v_i M_i + I_i = P_c C_i$$

and non-negativity constraints on F_i and M_i.

The solution of this problem depends on the parameters of the model, i.e., prices, the wage rate, landholding and non-labor income. Therefore we can write

$$(10) \qquad D^i = D_i(P_q, P_x, P_c, v_i, K_i, I_i)$$

The value of D^i represents a spouse's threat potential. Precisely for this reason it is also referred to as the *conflict* point.[7]. An analytical expression for the threat point in the case of a loglinear utility function and a Cobb-Douglas farm production function is derived in appendix.

2.4. Off-family farm labor supply

The decisions on consumption, farm production and time allocation that result from the two household models, are obtained as the solution of two maximization problems. In the unitary household model expression (1) is maximized subject to

[7] Exogenous changes in threat points result from changes in the environment, e.g. changes in prices, wages or transfers (see McElroy, 1990). Threat points can also change due to endogenous factors. The latter refer to changes that result from household decisions themselves such as savings or periods of 'unemployment' voluntarily chosen in order to raise children (see Ott, 1992). We do not consider the latter.

the constraints (4) - (6) and the non-negativity constraints for on- and off-farm labor. In the collective model expression (3) is maximized, using (10) as the threat point, subject to the same constraints.

In this text we are particularly interested in the spouses' decisions on participation in the labor market. We therefore define the off-family farm or market labor supply in both models. In the unitary household model, each spouse's off-family farm labor supply can be written as

$$(11) \qquad M_i = f(P_c, P_q, P_x, v_i, v_j, K, I_i + I_j) \qquad (i = h,w, i \neq j)$$

Market labor supply thus depends on total available land and on the sum of the spouses' non-labor income.

In the collective or bargaining model the market labor supply can be written as

$$(12) \qquad M_i = f(P_c, P_q, P_x, v_i, v_j, K, I_i + I_j, D^i, D^j) \qquad (i = h,w, i \neq j)$$

which, using (10) can be reformulated as

$$(13) \qquad M_i = f(P_c, P_q, v_i, v_j, K, K_i, K_j, I_i + I_j, , I_i, I_j) \quad (i = h,w, i \neq j)$$

Thus in the bargaining model inherited land enters the labor supply in two ways, once as a component of the land available to the household and second as a resource to which a spouse has individual rights, in the sense that in case of a marriage break-up it would go to this spouse. Similarly a spouse's non-labor income enters as a component of a couple's non-labor income, but also as a separate determinant.

The absence of D^h and D^w from or their presence in the labor supply function provides an opportunity to discriminate between the two models of household behavior we specified in subsection 1. According to the unitary model of household behavior spouse-specific land and non-labor income enter in the market labor supply function only as components of the household's available land and non-labor income. In a bargaining model they also enter separately, as determinants of each spouse's threat point.

In our empirical research we concentrate on landed property; we do not explicitly consider non-labor income. To discriminate between the two models we need information on resources that a spouse brings into the marriage but can take along when the marriage dissolves. Local custom in the Cordillera region of Northern Luzon provides an ideal example of such a resource. In this region the individual spouse continues to own the land she or he inherited. In the case of marriage dissolution she/he takes it along (Prill-Brett, 1987; Wiber, 1986). Therefore, inherited land is an obvious candidate as an indicator of a spouse's threat point. The validity of the unitary household model can thus be tested by analyzing whether an individual spouse's inherited land is a determinant of off-household farm labor supply. If this turns out to be the case, the collective model would appear to offer a more adequate description of household behavior than the unitary model.

3. THE DATA FOR THE EMPIRICAL ANALYSIS

The data for our empirical analysis were collected in the framework of a household survey. A sample of 126 landholding households was drawn from three villages, in the highlands of Northern Luzon in the Philippines. The villages were Paoay (Benguet province), Cudog (Ifugao province) and Sagada (Mountain province). Farming is a major source of livelihood in these rural areas. Commercial vegetable production is a primary occupation in Paoay and an alternative farming activity in Sagada and Cudog. In the latter villages rice is the primary crop. It is often grown mainly for home consumption, but households sell part of their rice harvest.

After dropping observations with missing values, a sample of 225 married individuals with 112 couples and one husband (for whose wife the information was missing) was used for estimating our regression equations. Of the 112 couples 48 couples lived in Paoay, 24 in Cudog, and 40 in Sagada.

3.1. Off-farm work

In this paper we try to explain a spouse's participation in the labor market. Participation is a dummy variable equal to one if a person does off-family farm work and 0 otherwise. Participation rather than labor supply was used because we had no adequate data on the latter.

With households adopting commercial vegetable farming, hiring labor for farm work has increased markedly. Because of this and other opportunities for work generated by rural commercialization, wage earnings have become an important alternative source of income. The number of persons with work outside the family farm in the sample is shown in Table 1. In our sample there are relatively more husbands (64%) than wives (45%) who work outside the family farm.

Table 1: Persons in the sample working outside the family farm

	Spouses		Husbands		Wives	
	n	%	n	%	n	%
Total	123	55	72	64	51	45
Paoay	40	42	23	48	17	35
Cudog	29	60	18	75	11	46
Sagada	54	68	31	78	23	58

The percentage of persons doing off-family farm work varies among the villages. The percentage is lowest in Paoay and highest in Sagada both for husbands and wives. This can be explained by the larger farm sizes in Paoay and the presence of more opportunities for off-farm work such as tourism related activities in Sagada.

The distribution of households in the sample by the on and off-family farm work status is presented in table 2.

Table 2: Distribution of households based on spouses' on or off-family farm work status

			husband participating in market work		
			no	yes	Total
wife participating in market work	no	n	30	31	61
			27%	28%	55%
	yes	n	11	40	51
		%	10%	36%	46%
Total		n	41	71	112
		%	37%	64%	100,0%

In 27% of households in the sample both spouses work only on their farm; in 36% of households both spouses work both on and off the family farm. While there are 28% of households where the husband does off-farm work while the wife does not, there are only 10% of households where the wife does off-family farm work and the husband doesn't.

3.2. Inherited land

An important form of access to cultivated land among farm households is through inheritance. In the mountain provinces of Northern Luzon inheritance rules for land do not discriminate between males and females. Both daughters and sons can inherit land. In case of a 'divorce' (in the sense of the customary way of dissolving a marriage) often due to childlessness, a spouse retains property rights on her or his inherited land. Property passes from parent to child, but it does not cross clan lines. If a spouse dies childless, her or his inherited land returns to her/his clan. Although there is a clear customary recognition of each spouse's control over her/his inherited land within marriage, plots are cultivated jointly as a family farm. There are no plots specifically for wives or for husbands (see Prill-Brett, 1987; Wiber, 1986).

As shown in section 2.3 in a bargaining model the amount of inherited land is one of the variables determining a spouse's threat point, i.e. her or his fallback position. Using inherited land as a determinant of a spouse's threat point and hence including it in the off-family farm labor participation function has the great advantage that it is a truly exogenous variable. It does not result from household decisions on savings and asset accumulation, nor is it affected by labor allocation decisions.

Table 3 shows the number of households where husbands and/or wives own inherited land. In almost half of the couples in the sample both husband and wife own inherited land, while there are only 15 couples where neither husband nor wife does so.

Table 3: Households with inherited land

		Husband has inherited land		
		no	yes	total
Wife has	no	15	28	43
inherited land	yes	18	52	70
	total	33	80	113

In all three villages the mean of inherited land conditional upon owning such land is higher for husbands than for wives. The differences between the unconditional means of husbands' and wives' inherited land are larger than the conditional means shown in table 4, because there are more women than men without inherited land. For non-irrigated land the difference between husbands' and wives' inherited land is more pronounced than for irrigated land. Therefore we will include separately each spouse's inherited irrigated and non-irrigated land holdings in our regressions.

Table 4: Mean and Standard Deviation (in parenthesis) of Variables Used in Probit Equations

	Spouses	Husbands	Wives
	n = 225	n = 113	n = 112
Participants in work outside the family farm	n = 123	n = 72	n = 51
Land variables			
Couple's inherited land (in hectares)			
Irrigated	0.25 (0.52)		
non-irrigated	0.34 (0.74)		
Personal inherited land, conditional upon holding such land (in hectares)	0.13 (0.35)	0.15 (0.39)	0.10 (0.27)
irrigated	0.17 (0.54)	0.21 (0.65)	0.12 (0.38)
non-irrigated			
Land asymmetry (in favor of the husband)			
irrigated		0.07 (0.60)	
non-irrigated		0.05 (0.69)	
Personal characteristics			
age	43.2 (11.9)	44.6 (12.1)	41.7 (11.6)
finished high school		n = 36	n = 25
finished college		n = 10	n = 18
Household composition			
number of children aged less than 6 years	0.94 (1.11)		
number of children aged 6 to 11 years old	1.04 (1.13)		
number of children aged 12 to 18 years old	1.09 (1.24)		
Village effect (Reference village = Cudog)			
Dummy variable for village Paoay	n = 96	n = 48	n = 48
Dummy variable for village Sagada	n = 80	n = 40	n = 40

In the regressions we will represent the individual spouses' inherited land by a land asymmetry variable. The reason for doing so is that what matters is not simply the bargaining strength of each spouse *per se* but rather one spouse's strength relative to the other's. This is also suggested by the analysis of the special case of a loglinear utility function and a Cobb-Douglas farm production function (Crisologo-Mendoza, 1997). We introduced asymmetry variables separately for irrigated and for non-irrigated inherited land.

In the univariate probit regressions of section 4 based on pooled data of married individuals, the asymmetry variable for inherited land is defined as $(K_i - K_j)/(K_i + K_j)$ where K_i is own and K_j is the spouse's inherited land. In the separate univariate probit regressions for husbands and wives and in the bivariate probit regressions, the variable measuring the asymmetry in inherited land is defined as the husband's minus the wife's inherited land divided by the sum of the husband's and the wife's inherited land, i.e. $(K_h - K_w)/(K_h + K_w)$. The asymmetry variable is thus measured 'in favor' of the husband. In this case the coefficient of the variable may therefore be expected to have opposite signs for husbands and for wives. For the 15 couples where both husband and wife did not have inherited land, the asymmetry variable was set equal to zero.

Remark that a spouse's inherited land also enters the regression as a component of the household's total available land. We define this as the sum of the husband's and the wife's inherited land. Non-inherited land is not included as it is not independent of the decision to work on or off the family farm (see also Huffman and Lange, 1989). Means of access to non-inherited land include fixed rental, sharecropping or purchase.

3. Other explanatory variables

In expressions (11) and (13) apart from land (and non-labor income on which we have no data) off-family farm labor supply is also determined by the prices of consumption goods and farm inputs and by market wages. As prices are identical for all persons in a village we do not include them in our labor market participation regressions. Village dummies may capture price differences across villages.

We do include as explanatory variables personal characteristics like sex, age and education. Personal characteristics like sex, age and schooling determine an individual's productivity and can therefore be considered as determinants of the spouses' actual or potential wage. We also include three indicators of household composition, i.e. the number of children in three age groups. These may determine a spouse's willingness to participate in off-family farm work. marginal value of his/her time when none of it is allocated to off-farm work. Data on age, schooling and household composition are given in table 4.

In addition to land, personal characteristics and household composition variables, we also include as explanatory variables in our regressions village dummies. This is done to catch village effects.

The dummy variables stand for differences in the local labor markets as well as for differences in the farming systems, land and crop types[8]. Cudog was used as reference village.

4. ESTIMATION RESULTS

In this section, we present tests on whether a spouse's inherited land affects the decision to participate in work outside the family farm in the Cordillera region of the Philippines. The primary intent is to establish whether the relative bargaining power of husband and wife matter when a household takes decisions on labor market participation.

We proceed in the following manner. First, we estimate a univariate probit model explaining the probability of participation in work outside the family farm for a married individual. We assume that data on the individuals in our sample are independent observations and we use a dummy variable for gender. Second we estimate a univariate probit model separately for husbands and wives. Finally we use a bivariate probit model to estimate the decisions on labor market participation of husband and wife. This model takes into account the interdependency of these decisions, i.e. the fact that these decisions are made jointly by husband and wife. Also, it is likely that the error terms in the off-farm participation functions of husbands and wives are correlated because of unobserved characteristics (see Kimhi, 1994).

In each regression we test whether a spouse's inherited land has an impact on labor market participation decisions that is distinct from the total land available to the household. The hypothesis that only the total land available to a couple and not the individual components on which one of the spouses has specific rights, matter for household decisions, is a characteristic of the unitary model. Unlike the unitary model, the collective model asserts that spouse-specific resources have an impact on household decisions distinct from that of pooled household resources. As stated in section 3.2, in our models spouse-specific control of resources is represented by variables measuring asymmetry in ownership of inherited land, irrigated and non-irrigated. These variables are meant to capture the bargaining power of a spouse relative to that of her or his partner.

4.1. Univariate probit model for married individuals

[8] Other studies include farm characteristics such as type of crop grown or value of farm assets, or acres of farmland operated as explanatory variables (see Huffman, 1980, Kimhi, 1994). This we do not do. Differences in the type of crop are captured by the dummy variables for the villages.

We first present results based on data for all individuals in the sample, considered as independent observations. The variables included in the regression and the estimation results are presented in Table 5.

The probit model correctly predicts 70 per cent of the total number of cases, 60 per cent of those who do not participate in the labor market and 79 percent of those who do.

The coefficient of the sum of the couple's inherited irrigated land has a negative sign and is significantly different from zero. This can be interpreted as follows : having more irrigated land raises the productivity of time allocated to farm work which reduces the probability of off-farm work. The same cannot be said of non-irrigated land: the coefficient of the sum of non-irrigated land is positive, but it is not significantly different from zero.

The coefficients of the asymmetry variables for inherited irrigated and non-irrigated land are not significantly different from zero. The estimation of the univariate probit model does not offer support for the assertion that spouse-specific resources matter for decisions on labor market participation. This implies that there is no indication of bargaining between spouses when such decisions are taken. Thus the hypothesis that the unitary household behavior model is valid, is not rejected.

Table 5: Probit estimates of off-farm work status of married individuals

Dependent variable: probability that a spouse works off-family farm	coefficient (standard error in parenthesis)
intercept	2.46 (2.30)
(log of) sum of inherited irrigated land	-0.05** (0.02)
(log of) sum of inherited non-irrigated land	0.01 (0.02)
asymmetry in inherited irrigated land in one's favor	-0.16 (0.15)
asymmetry in inherited non-irrigated land in one's favor	0.11 (0.13)
(log of) own age	0.98 (0.89)
(log of) spouse's age	-1.54* (0.91)
dummy for completed high school education	0.08 (0.30)
dummy for spouse's completed high school education	-0.64** (0.31)
dummy for completed college education	0.80** (0.41)
dummy for spouse's completed college education	-1.45*** (0.42)
dummy for gender (wife = 1)	-0.48** (0.22)
number of children aged less than 6 years	-0.07 (0.13)
number of children aged 6 to 11 years	0.24*** (0.09)
number of children aged 12 to 18 years	0.10 (0.08)
dummy for Paoay village	-0.35 (0.25)
dummy for Sagada village	0.54** (0.27)
χ^2 (df = 16)	52.81

*, **, *** denote coefficient significantly different from 0 at respectively 0.90, 0.95, and 0.99 probability levels.

Frequencies of actual and predicted outcomes

Actual	Predicted	0	1	Total
0		61	41	102
1		26	97	123
Total		87	138	225

We briefly comment on the other estimation results. The coefficient of own age is positive, but statistically not different from zero. The coefficient of the spouse's age is negative and statistically different from zero at the 10 percent level. This suggests that the older one's partner is, the less likely it is that a person will do off-family farm work. Three of the four education variables are significantly different from zero. Their signs suggest that a higher level of education raises the probability that a person participates in the labor market, whereas a higher level of a spouse's education reduces this probability. The gender dummy variable is negative and significantly different from zero at the five per cent level., suggesting that wives are less likely than husbands to do off-family farm work. The coefficient for the number of young children is negative but not significantly different from zero. The coefficients for the two groups of older children are positive; for the number of children aged 6 to 11 years it is significantly different from zero at the one per cent level. These results are an indication that the presence of older children may substitute for adult work on the farm or in the home. Finally the probability of participating in the labor market is significantly higher for people living in Sagada than for those living in Cudog. Compared to Cudog, Sagada provides more opportunities for off-farm work as a result of the growth in tourism-related activities.

4.2. Separate univariate probit estimates for husbands and wives

In the univariate probit regression of the previous section, the dummy variable for gender had a coefficient significantly different from zero. This result suggests that the participation in the labor market is determined in a different way for husbands and wives. Therefore it seems appropriate to estimate a labor market participation function separately for husbands and wives. This we do in this section. One implication of this procedure of course is to reduce the degrees of freedom by fifty per cent. Table 6 presents the coefficient estimates for the univariate probit model for husbands and wives separately.

Table 6: Probit estimates of the off-farm work status of husbands and wives

	Dependent variable: probability that a HUSBAND works off-family farm	Dependent variable: probability that a WIFE works off -family farm
	coefficient (standard error in parenthesis)	coefficient (standard error in parenthesis)
intercept	-1.29 (3.56)	4.0 (3.24)
(log of) sum of inherited irrigated land	-0.06 (0.04)	-0.04 (0.03)
(log of) sum of inherited non-irrigated land	0.04 (0.03)	-0.02 (0.03)
asymmetry in inherited irrigated land in favor of the husband	-0.51** (0.27)	0.16 (0.23)
asymmetry in inherited non-irrigated land in favor of the husband	-0.15 (0.21)	-0.06 (0.20)
(log of) husband's age	1.82 (1.48)	-1.89 (1.40)
(log of) wife's age	-1.51 (1.40)	0.89 (1.3)
dummy for husband's completed high school education	0.07 (0.43)	-0.92** (0.42)
dummy for wife's completed high school education	-0.29 (0.54)	0.14 (0.49)
dummy for husband's completed college education	1.42* (0.86)	-1.13* (0.68)
dummy for wife's completed college education	-1.91*** (0.69)	0.64 (0.57)
no. of children less than 6 years	0.17 (0.21)	-0.18 (0.18)
number of children aged 6 to 11 years	0.34** (0.16)	0.21 (0.13)
number of children aged 12 to 18 years	0.29** (0.14)	-0.007 (0.12)
dummy for Paoay village	-0.63 (0.40)	-0.18 (0.35)
dummy for Sagada village	0.65 (0.45)	0.50 (0.36)
χ^2 (df = 15)	35.39	20.69

*, **, *** denote coefficient significantly different from 0 at respectively 0.90, 0.95 and 0.99 levels of probability.

Frequencies of actual and predicted outcomes

		Husbands			Wives		
Actual	Predicted	0	1	Total	0	1	Total
0		22	19	41	47	14	61
1		9	62	71	20	31	51
Total		31	81	112	67	45	112

The chi-square statistic for the husbands' probit regression is significant at the one per cent level while for the wives' probit regression it is not significant at the ten per cent level. The model correctly predicts 75 per cent of the cases for the husbands and 70 per cent for the wives.

In both regressions the coefficient of the sum of inherited irrigated and non-irrigated land is not significantly different from zero at the ten per cent level. In the regression for husbands the coefficient of the asymmetry variable for irrigated land is negative and significantly different from zero, meaning that the more inherited land a husband holds compared to his wife, the less likely he is to do off-family farm work In the regression for wives this coefficient is positive, but not significantly different from zero. The coefficients of asymmetry of inherited non-irrigated land holding are also not significantly different from zero, this time in both regressions. These results thus offer mixed evidence as to the hypothesis implicit in the unitary model that individual inherited land holding does not matter in decisions on labor market participation.

As for the other variables, the coefficients of own education are positive while those of the spouse's education are all negative. Moreover four of the eight coefficients are significantly different from zero. This is evidence that a person's own education has a positive impact on her/his labor market participation whereas her/his spouse's education reduces her/his probability of being involved in off-family farm work. In the equation for husbands the coefficients of the number of children in the two older age groups are positive and significantly different from zero at the five per cent level. For wives these coefficients are not significantly different from zero. The presence of older children seems to enhance the probability of off-family farm work by the husband. But the data provide no evidence of an impact of the number of children on labor

participation by wives. Finally the village dummies have the same sign as in table 5, but are not significantly different from zero at conventional levels.

4.3. Bivariate probit model for farm couples

In this section we use a bivariate probit model to check for the eventual impact of individual spouse's inherited land on labor market participation. We use a bivariate model to take into account that labor market participation decisions of husband and wife in a household are unlikely to be independent. Therefore the corresponding disturbances ε_h and ε_w are likely to be correlated. Assuming that ε_h and ε_w have a standard joint normal distribution, the appropriate statistical model is the bivariate probit model (see Huffman and Lange, 1989; Guyomard and Benjamin, 1992; Kimhi, 1994). The estimation results for this model are presented in table 7.

As table 7 shows, the correlation between ε_h and ε_w is confirmed by our results. The model "predicts" correctly decisions on labor market participation by 80% of the couples in the sample. But very few coefficients in this regression are significantly different from zero at conventional levels of probability. In fact this is the case only for two education variables and for one household composition variables. More particularly none of the individual land variables turns out to be statistically different from zero at the 90% confidence level.

Table 7: Bivariate probit estimates of off-farm work status

	HUSBAND	WIFE
Dependent variables: probability that husband/wife works off-family farm	coefficient (standard error in parenthesis)	coefficient (standard error in parenthesis)
Intercept	-1.19	3.64
	(4.60)	(3.56)
(log of) sum of inherited irrigated land	-0.05	-0.05
	(0.04)	(0.04)
(log of) sum of inherited non-irrigated land	0.04	-0.02
	(0.05	(0.04)
asymmetry in inherited irrigated land in favor of the husband	-0.53	0.19
	(0.34)	(0.24)
asymmetry in inherited non-irrigated land in favor of the husband	-0.16	-0.04
	(0.24)	(0.23)
(log of) age of husband	1.77	-2.02
	(1.85)	(1.59)
(log of) age of wife	-1.48	1.12
	(1.83)	(1.43)
dummy for husband's completed high school education	0.17	-0.94*
	(0.49)	(0.50)
dummy for wife's completed high school education	-0.29	0.21
	(0.67)	(0.58)
dummy for husband's completed college education	1.32	-1.18
	(1.17)	(0.87)
dummy for wife's completed college education	-1.83**	0.72
	(0.88)	(0.67)
number of children aged less than 6 years	0.15	-0.17
	(0.25)	(0.19)
number of children aged 6 to 11 years	0.32	0.21
	(0.21)	(0.15)
number of children aged 12 to 18 years	0.26*	-0.006
	(0.15)	(0.13)
dummy for Paoay village	-0.69	-0.18
	(0.45)	(0.37)
dummy for Sagada village	0.51	0.50
	(0.57)	(0.41)

correlation coefficient for ε_h and ε_w	0.56** (0.25)	

*, **, *** denote coefficient significantly different from 0 at respectively 0.90, 0.95, and 0.99 levels of probability.

Actual and predicted (in parenthesis) outcomes

Wives	Husbands		
	0	1	Total
0	30 (31)	31 (27)	61 (58)
1	11 (4)	40 (50)	51 (54)
Total	41 (35)	71 (77)	112 (112)

Let us now focus on the coefficients of the asymmetry variables. The coefficients of the asymmetry variables (defined as asymmetry in the husband's favor) for inherited irrigated land have signs similar to those in tables 5 and 6; the signs suggest that the probability of a person's participation in the labor market decreases as she/he holds more inherited irrigated land relative to her/his spouse. But for neither husbands nor wives these coefficients are significantly different from zero at conventional levels. The coefficients of the asymmetry variables for inherited non-irrigated land are both negative, but they have relatively high standard errors implying that they are not at all significantly different from zero.

Can we conclude that the unitary model of the household cannot be rejected by our analysis? Indeed, none of the coefficients of the asymmetry variables for inherited land is singly significantly different from zero. However since the spouses' labor market participation decisions are not independent, we need to test whether the asymmetry variables for husband and spouse are jointly not significantly different from zero. To do this we test whether the regression results incorporating the restriction that the asymmetry in inherited land holding are zero are not statistically different from those of a regression in which the value of the asymmetry variables coefficients is unrestricted.

If the hypothesis that asymmetry in inherited land holding has no effect on a spouse's labor market participation, then the maximum value of the log-likehood function incorporating the restriction, $\ln L_R$, should not be significantly lower than $\ln L_{UR}$, the maximum value of the log-likelihood function when this restriction is not imposed. The log-likelihood ratio test is whether $2(\ln L_{UR}$ -

$\ln L_R$) is significantly different from zero (see Kennedy, 1979). This statistic follows a chi-square distribution.

For inherited irrigated land, we obtain a value of the statistic of 5.89, compared to a critical value of 4.61 (n=2) at the 10% level of significance. We conclude that the two coefficients are jointly different from zero. For inherited non-irrigated land a similar test does not permit us to reject the hypothesis that the coefficients of the asymmetry variables are equal to zero. The analysis thus provides some evidence which conflicts with the assumptions of the unitary household model.

5. CONCLUSION

In this article we have devised a test for analyzing whether within rural households in the Cordillera region of northern Luzon (Philippines) decisions on spouses' participation in labor markets are made by husband and wife acting as one decision maker (the unitary household model) or rather result from a bargaining process (the bargaining model). The test is based on the importance of inherited land in household decisions and on the fact that each spouse retains his rights on such land in case of a marriage break-up. Such land also does not cross clan lines. Inherited land is a truly exogenous variable that can be used as an indicator of a spouse's bargaining power.

The unitary model implies that the sum of spouse-specific inherited land is what matters in household decisions. We therefore we tested the unitary model's implicit restriction that individual inherited land has no separate impact on labor market participation decisions.

The results of all our regressions, except the regression for labor market participation of wives only, provide some evidence of the impact of inherited irrigated land on labor market participation decisions and in favor of rejecting the unitary model's claim. However not all evidence points in this direction. The main exception is non-irrigated inherited land for which no distinct effect on labor market participation was found. However this was also the case for the sum of non-irrigated land. As a result it seems that non-irrigated land, whatever its status, is not a determinant of labor market participation decisions. But control of spouse-specific resources in the form of inherited irrigated land may matter for household allocation decisions. To the extent that this is true, our data offer evidence rejecting the unitary household model.

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Appendix. Derivation of the Threat Point.

We consider a one person household with loglinear preferences over consumption and leisure and a Cobb-Douglas production function for the family farm. Farm production depends on family labor and on land and is characterised by constant returns to scale. For simplicity other inputs are omitted. Household labor can be employed on the family farm or offered in the market. In the latter case employment opportunities are available at a fixed wage. Non-labor inputs are omitted; their inclusion makes the problem not analytically treatable.

Under these assumptions, the decision problem of a single person household may be written as follows

$\max \beta_c \ln C + \beta_l \ln L$

subject to $P_q F^{\alpha} K^{1-\alpha} + vM = P_c C$ (1)

$L + F + M \leq T$ (2)

$M = 0$ (3)

All variables refer to the single decision maker. Land K is exogenously determined. T stands for the total time. The decision variables are

C = consumption;
L = leisure;
F = on farm labor;
M = market labor.

The decision maker has no impact on prices, i.e. the prices of farm output P_q, and of consumer goods, P_c, and the wage rate, v.

The constraints refer to the budget, the time constraint and the non-negativity of off-family-farm labor. The associated dual variables are written as λ, γ, and ϕ. Remark that consumption C, leisure L and farm labor F will be non-negative due to the form of the objective function and of the farm production function.

The first order conditions for a maximum are

$$\beta_c/C - \lambda P_c = 0 \qquad (4)$$

$$\beta_l/L - \gamma = 0 \qquad (5)$$

$$\lambda\alpha P_q F^{\alpha-1} K^{1-\alpha} - \gamma = 0 \qquad (6)$$

$$\lambda v - \gamma + \phi = 0 \qquad (7)$$

and the constraints (1) to (3). Remark that due to the specification of the objective function and the production function for the family farm, constraints (1) and (2) will hold with equality in the optimum. The complementary slackness condition associated with constraint (3) is $\phi M = 0$.

If in the optimum M = 0, we can drop (3) and (7). We first analyse this case and then consider a solution with M>0.

Case 1 : M = 0

In this case constraint (2) implies that $L = T - F$. By using this expression for L, combining expressions (5) and (6) and substituting for λ from (4) we obtain

$$\beta_l/(T-F) = \beta_c P_q \alpha F^{\alpha-1} K^{1-\alpha}/(P_c C)$$

Substituting for $P_C C$ from the budget constraint (1) we obtain

$$\beta_l/(T-F) = \alpha\beta_c/F$$

This gives us the following expressions for farm labor F :

$$F = [\alpha\beta_c/(\alpha\beta_c+\beta_l)]T \qquad (8)$$

As leisure $L = T - L$, we can write leisure as :

$$L = [\beta_l/(\alpha\beta_c+\beta_l)]T \qquad (9)$$

Finally we derive consumption C from the budget constraint (1) and family farm labor F as defined in (8) :

$$C = (P_q/P_c)[\alpha\beta_c/(\alpha\beta_c+\beta_l)]^{\alpha}T^{\alpha}K^{1-\alpha} \qquad (10)$$

Substituting expressions (9) and (10) in the objective function, we obtain the following expression for the utility maximising value of the objective function, i.e. the threat point :

$$D = \beta_c \ln(P_q/P_c) + (\alpha\beta_c+\beta_l)\ln T + (1-\alpha)\beta_c \ln K + z \qquad (11)$$

where z is a function of the parameters of the model :

$$z = \alpha\beta_c \ln[\alpha\beta_c/(\alpha\beta_c+\beta_l)] + \beta_l \ln[\beta_l/(\alpha\beta_c+\beta_l)]$$

Expression (11) shows that D is an increasing function of land K.

Case 2 : M>0

If M>0, by complementary slackness, ϕ=0. Therefore, from (6) and (7) we can derive

$$\alpha P_q F^{\alpha-1} K^{1-\alpha} = v$$

which results immediately in an expression for F :

$$F = (\alpha P_q/v)^{1/(1-\alpha)}K \qquad (12)$$

Next we derive M. First we derive two analytical expressions for γ. Substituting in expression (7) for λ from (4), using the budget constraint (1), and substituting for F from (12), we obtain :

$$\gamma = \beta_c v/[P_q(\alpha P_q/v)^{\alpha/(1-\alpha)}K + vM] \qquad (13)$$

From (5), using time constraint (2) and substituting for F from (12), we derive a second expression for γ :

$$\gamma = \beta_l/L = \beta_l/[T - (\alpha P_q/v)^{1/(1-\alpha)}K - M] \qquad (14)$$

From the right hand sides of equations (13) and (14) we derive, after some manipulations, an analytical expression for M :

$$M = \beta_c/(\beta_c+\beta_l)T - (1/\alpha)Z(\alpha P_q/v)^{1/(1-\alpha)}K \qquad (15)$$

where $Z = (\alpha\beta_c + \beta_l)/(\beta_c + \beta_l)$.

By substituting (12) and (15) in time constraint (2) we derive the following expression for leisure :

$$L = [\beta_l/(\beta_c+\beta_l)][T + ((1-\alpha)/\alpha))(\alpha P_q/v)^{1/(1-\alpha)}K] \quad (16)$$

Finally we derive an analytical expression for consumption C by substituting (12) and (15) in the budget constraint :

$$P_cC = P_q(\alpha P_q/v)^{\alpha/(1-\alpha)}K + v[\beta_c/(\beta_c+\beta_l)]T - (v/\alpha)Z(\alpha P_q/v)^{1/(1-\alpha)}K$$

Dividing by P_C which we get an expression for consumption :

$$C = (v/P_c)\,[\beta_c/(\beta_c+\beta_l)][T + ((1-\alpha)/\alpha)(\alpha P_q/v)^{1/(1-\alpha)}K] \qquad (17)$$

Substituting expressions (16) and (17) in the objective function, we obtain the following expression for the utility maximizing value of the objective function, i.e. the threat point :

$$D = \beta_c\ln(v/P_c) + (\beta_c+\beta_l)\ln[T + ((1-\alpha)/\alpha)(\alpha P_q/v)^{1/(1-\alpha)}K] + z' \quad (18)$$

where $z' = \beta_c\ln[\beta_c/(\beta_c+\beta_l)]. + \beta_l\ln[\beta_l/(\beta_c+\beta_l)]$.

From (18) it is immediately clear that the threat point is an increasing function of land K.