OUT-MIGRATION AND TRANSITIONS IN LABOR ALLOCATION AND LABOR REGIMES IN RURAL MEXICO[♣]

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Abstract :

Changes in the allocation of labor and labor regimes in households of agrarian societies are potentially critically influenced by local labor out-migration. Development of an understanding of the specific changes experienced by rural Mexican households is the objective of this paper. Using economic data from 522 rural households in 18 communities of central-south Mexico, we analyze the impact of labor out-migration on household labor allocation and regime membership. An analysis of families with migrant relatives and/or migration experience versus those without is followed by two econometric analyses of changes in labor-market participation, job-holding and labor regimen membership. First, parametric logit models estimate changes in on-farm and off-farm labor allocations for males and females. Second, an asset-endowment-sensitive ordered probit model with variable regime thresholds estimates transitions in labor regimes. Results suggest that increases in off-farm single job-holding labor allocation are, in part, due to out-migration. Further, they also imply that labor regime transitions -- from net-demanders to self-sufficient and from that to net-sellers -- are likely caused by out-migration.

Introduction

Changes in the allocation of household labor in agrarian societies are potentially critically influenced by household labor out-migration. Development of an understanding of the specific changes in both labor time allocation and the form of market participation experienced by rural Mexican households is the objective of this paper.

How individuals and families assign their time among different sources of income constitutes an important economic issue. Two sources of frequent discussion are multiple job-holding and membership in labor regimes. This is particularly the case in self-employed farm households of developing countries. Their economic competitiveness seems to be largely determined by interactions among different sources of employment held by the individuals within a family (Evenson, 1978). Likewise, labor participation and regime membership seem to very

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sensitive to household endowments. Some important questions help to define the dimensions of multiple job-holding and membership in labor regimes in agriculture: How frequent is multiple job-holding among self-employed rural households? What factors best explain particular multiple job-holding and labor regime membership structures (Gronau, 1997 and Sadoulet *et al.,* 1998)? Are there important differences in multiple job-holding among members of a household or across economic groups? If so, can the differences be attributed to specialization issues that may be translated into market selectivity (de Janvry and Garcia-Barrios, 1988, and deJanvry, *et al.,* 1991)? In the case of agricultural settings in developing countries, can multiple job-holding and membership in labor regimes be understood as parts of a larger transition process, i.e., migration, urbanization, and so on (see, for example, Schultz 1951)?[1]

This paper focuses on these questions to analyze labor time allocation and membership in labor regimes in Mexican communities. Specifically, this paper studies multiple job-holding, gender labor division and membership in labor regimes in households. Important findings have supported several determinants of these phenomena (see, for example, Rosenzweig, 1980 and 1988; Sadoulet *et al.,* 1998; Kimhi, 1994; Benjamin, *et al.*, 1996; Corsi and Findeis, 2000, see also, Foster and Rosenzweig, 1999). These studies extend beyond the traditional neoclassical rationality by also considering demographic, geographical and cultural characteristics such as household age and sex composition, labor availability and quality regarding education, age and gender issues, as well as structural determinants such as asset availability and other similar factors. Therefore, the driving factors affecting both time allocation and labor regime membership of individuals and households in rural areas should mainly be related to both groups of elements (Evenson, 1978; Sadoulet *et al.*, 1998). In the case of time allocation, the argument under this hypothesis will focus on the specific joint determinants of male and female labor requirements of households for agricultural and "home economic" activities and eventually their off-farm work participation decisions (Tokle and Huffman, 1991; Kimhi, 1994). In the case of membership in labor regimes, it is hypothesized that household endowments in terms of quantity and quality of resources (i.e., household labor) and transaction costs attributable to market participation hierarchically determine a household's membership in a particular labor regime.

[1] This question integrates this paper's objectives and scope with those of previous questions.

For this purpose, Section 2 of this paper assesses the impacts of migration on household time allocation and labor regime membership. In Section 3 the general separable household model is introduced to explain the foundations of the joint determinants of household labor time allocation (Evenson, 1978; Rosenzweig, 1980; Skoufias, 1994). Section 4 includes estimation of the determinants of alternative work choices made by both males and females, using survey data from Mexican peasant communities, and explores how this may explain differentiated transitions of migration and gender specialization. Thus, comparative analyses discriminating families with migrants from those without migrants will constitute the core of the paper. A more complex approach, namely that households endowed with heterogeneous labor quality face different labor regimes and labor market imperfections (Sadoulet *et al.*, 1998; de Janvry, *et al.*, 1991), will be addressed in Section 5 to understand endowment and imperfection effects of labor regime membership and how migration influences household membership. Discussion of the results and some final remarks follow in Section 6.

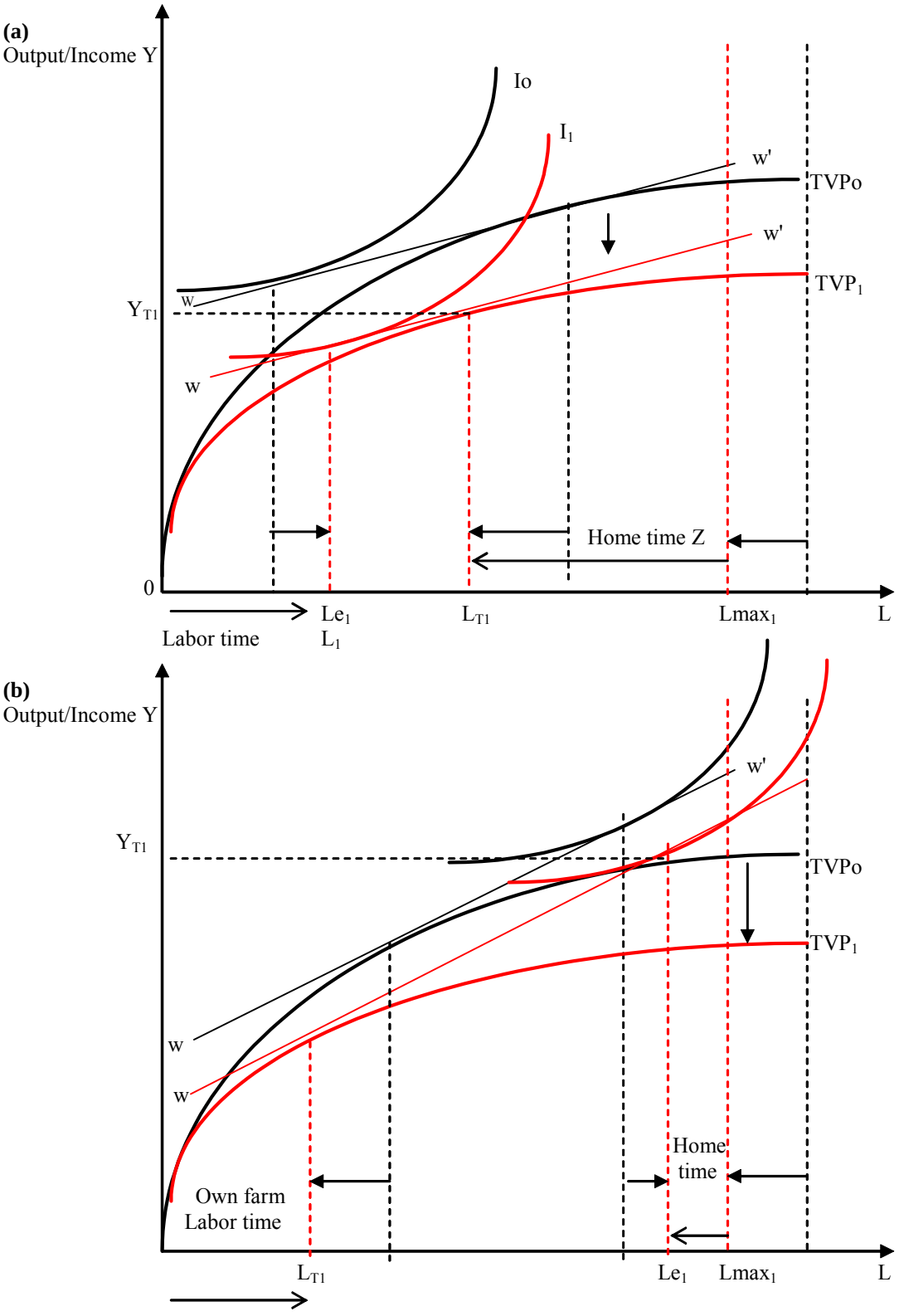
2. Out-Migration and Labor Participation

Like analyses focused on the impact of out-migration on farm production, we analyze the effect of migration on labor participation considering the production effects as the mechanism through which out-migration influences the labor allocation of households. The analysis is based on farm household theory and the new home economics.

2.1 Migration and household time allocation with a labor market

As stated by Ellis (1993) and Singh *et al.* (1986), the farm household model analyzes the impacts of competitive labor markets focusing on simultaneous consumption and production decisions. Figures 1a and 1b (based on Ellis 1986 and further developed for this paper) show the initial case where labor is either hired in (Figure 1a) or hired out (Figure 1b). The initial equilibrium conditions are indicated using 'o' as subscripts. **C**ompetitive wages (*ww'*) in local labor markets determine the equilibrium conditions in both cases. *Lmax* is the total amount of labor available for the household that, depending on the relationship between preferences and technology (represented by household production capacity, TVP, and by the indifference

Figure 1. Farm Household (a) Hiring-in Labor. and (b) Hiring-out Labor, With Migration Impact



conditions, I) is allocated, for example to farm production (from O to L_e), and leisure ($L_t - L_e$) and home time ($L_{max} - L_t$). The allocation depends on the relationship between preferences and technology (represented by household production capacity, TVP, and the indifference utility condition, I.

However, assuming a negative production impact of out-migration as was shown Ortega-Sanchez (2001), these initial equilibrium conditions are altered by out-migration. Figures 1a and 1b show how in each case the household labor allocation is changed as well as the demand for labor. For example, in Figure 1a there is an increase in the amount of household labor allocated to farm production, 0 to Le_1, and home time $Lmax$-L_{T1} and a marked decrease of hired-in labor. In other words, there is a contraction of hired-in labor demand resulting from the production impact of household labor out-migration. On the other hand, Figure 1b shows an important decrease of both labor time allocated to household own farm, L_{T1} and "home activity,"[2] but increases in off-farm labor time as seen from the magnitude of Le_1-$L_{T1} > Le_o$-L_{To}. Such an increase is explained by the increase in the opportunity cost of household labor given the market wages. We can observe *ceteris paribus* a reduction in household welfare as a result. Note also that the total amount of time (time endowment) decreases in both, $Lmax_1 < Lmax_o$, indicating the reduction in total labor availability due to out-migration. Quite interestingly, the demographic part usually excluded at the time of introducing labor markets is again present when we consider production changes caused by labor out-migration, although the separation conditions remain.

2.2. **Migration and time allocation in the new home economics**

Bearing in mind the differences between the new home economics and the previous model regarding the components of the utility function, namely commodities, we examine the impacts of out-migration. Note that in this approach "…the household is seen as a production unit that converts purchased goods and services, as well as domestic resources, into a set of final use values yielding utility in consumption. Moreover, the consumption level of these *Z*-goods is

[2] As Ellis (1993) states "Home activity" may include "… food processing and preparation, house building and repair, water and fuel carrying, child-care, and so on …" (p. 148).

determined not only by the relative market prices of the ingredients, but also by the relative cost of its production to the household in terms of the time required for its preparation" (Ellis, 1993: p.144, see also Singh *et al.,* 1986; Gronau, 1997).

Figure 2 (based on Ellis, 1993, and further developed for this paper) is similar in most respects to the earlier ones, and presents the initial conditions of equilibrium (production at point A and consumption at point B) where the household produces one commodity using both market goods and time. Note also that households consume the produced commodity and leisure. The total household time endowment is divided into the three components: home economic production time (T_Z), wage work time (T_W), and leisure (T_h).

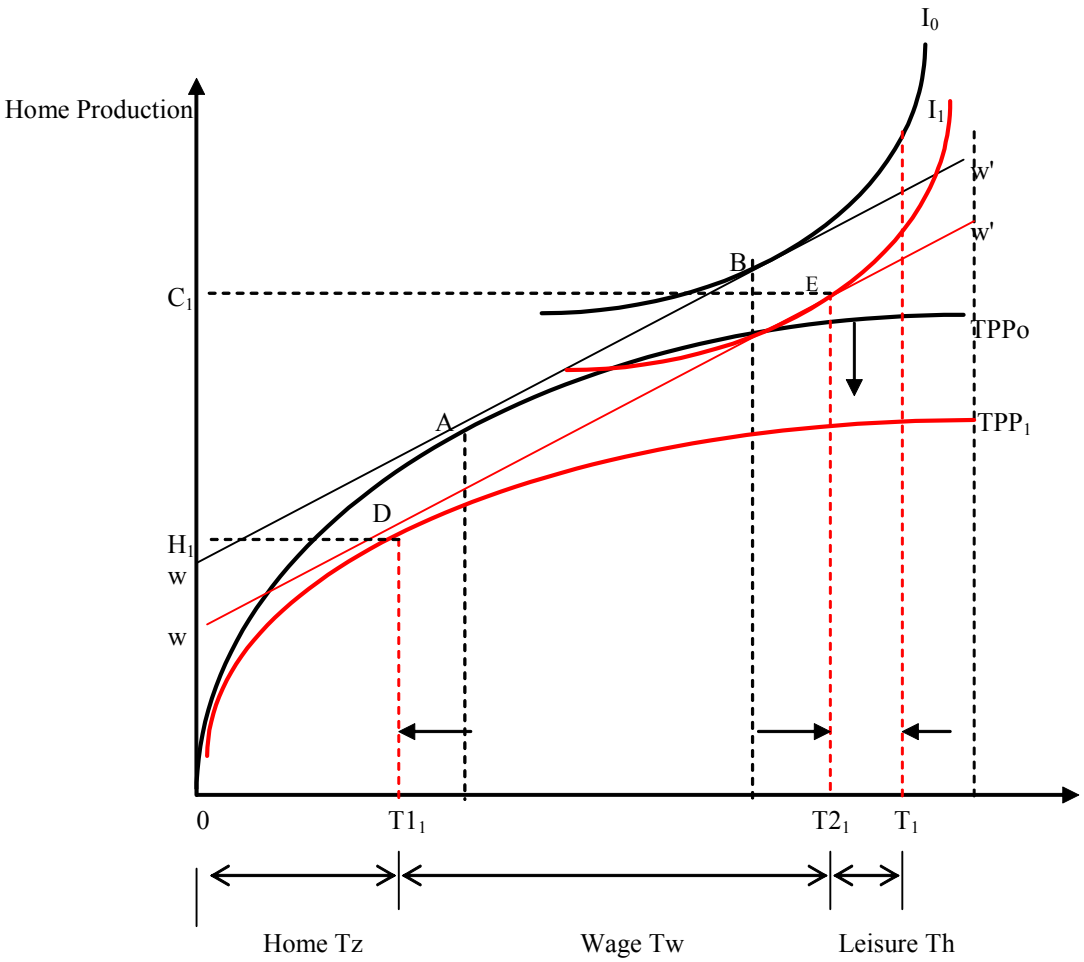
Similar to the previous case, the home economics model will be used to explore the impact of out-migration when a production change happens. Figure 2 presents such an impact. As can be seen, the amount of labor for home production of the commodity decreases to $T1_1$ ($<T1o$). Likewise, the amount of time for leisure T_1-$T2_1$ ($<T_o$-$T2_o$) decreases. On the other hand, there is a significant increase in the time of wage labor participation, $T2_1$ -$T1_1$ ($> T2_o$-$T1_o$). This is due to the increase in the opportunity cost, since the productivity of home production decreases. Similarly, there is a negative impact, *ceteris paribus,* on household welfare as can be observed by the shift of the indifference curve from I_o to I_1 ($U_o > U_1$). Note also the reduction in the total amount of family labor (in time) available to the household.

2.3. **Migration and time allocation in the general farm household model**

The general farm household model constitutes the benchmark model in the analysis of labor allocation. A description of the model is provided in Singh *et al.* (1986) and will also be explained in the next section of this paper. The main difference with respect to the previous models is that here we are dealing with a farm as well as a household. This means that the production function refers to farm output that can be traded, not just to "home" production for direct use. Moreover, the farm household has the option of hiring in labor at the market wage as well as hiring it out. There are now three items in the utility function; time for the production of Z-goods and for leisure combined, *Tz*, home consumption of output, *C*, and purchased goods, *M*.

The existence of three pairs of consumption trade-offs and three resources in the production function mean that this model cannot be shown in a single graph. Nevertheless, part

Figure 2. The Home Production Model With Migration Impact



of its logic is demonstrated in Figure 3. This figure illustrates 1) the choice between more time to spend on home production activities, *Tz*, and higher consumption of farm output, C, the equilibrium condition for consumption being at point A; 2) the production function for a single farm output with labor as a single variable input, the equilibrium condition for production at point B*;* 3) the case when labor is hired in rather than hired out by the farm household.

To analyze the impact of out-migration through production changes within the general farm household model framework, we will focus on Figure 3. The household's total quantity of time, given by *T* along the horizontal axis, is reduced because of migration. However, the main changes are described by the changes in the new consumption and production equilibria (points D and E, respectively). Household production on farm and at home is reduced because of the migration. Consequently, hired labor, $T2_1$-$T1_1$ (< *T2o*-*T1o*), is reduced as well as leisure; family labor increases from *T1o* to $T1_1$. Labor time is now divided between the farm work of family members, T_F, hours of hired labor, T*w,* and the home time of household members, *Tz*. All other things equal, the opportunity cost increases despite the relative market wage, represented by the lines ww', remaining constant. In fact, the total implicit cost of all units of time available to the household, no matter whether family or hired, increases due to the changes in prospective production.

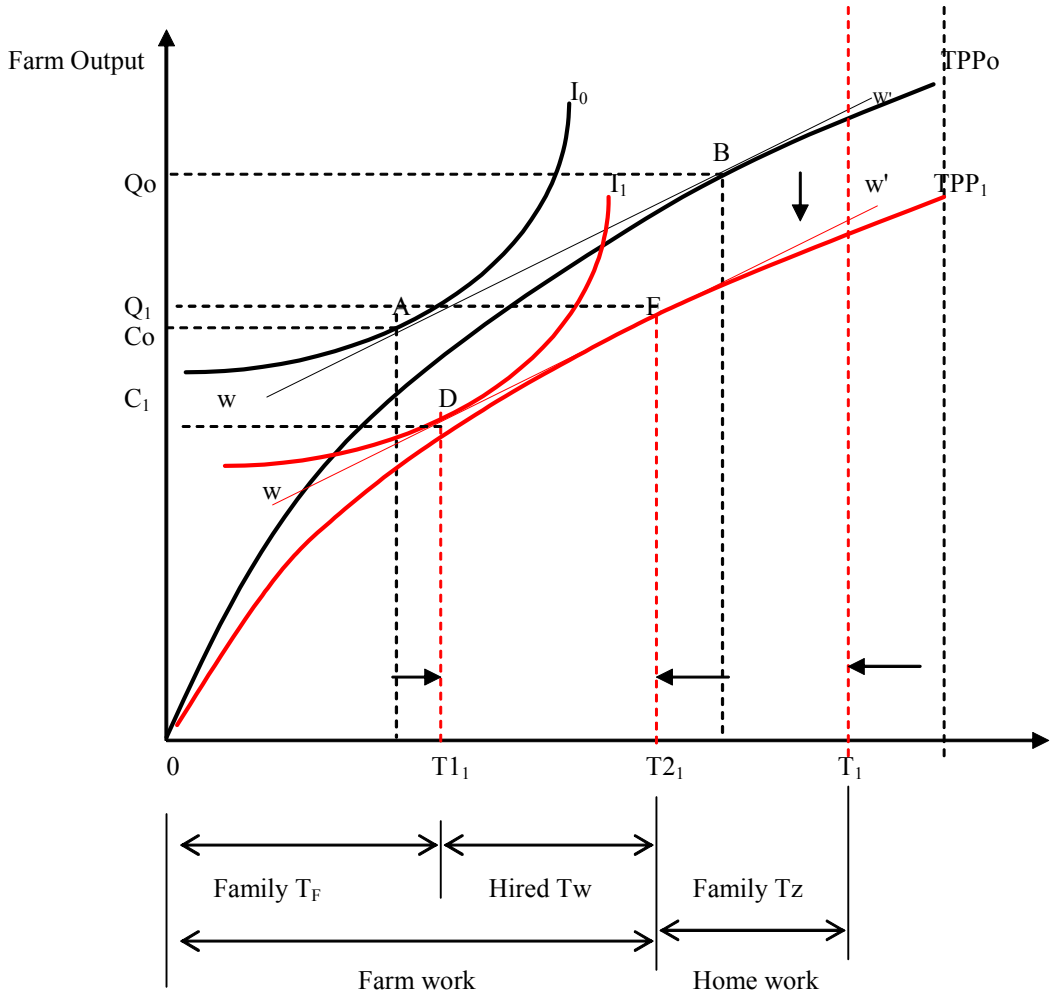
In general, the migration impact on labor allocation and regime membership might be seen as part of a complex process where farm production is first affected and consequently labor decisions are changed. Two forms of analyzing such changes in the Mexican context are presented in the next sections.

3. A Standard General Household Model

Modern household economic theory analyses the time allocation of farm households as part of a complicated and joint decision-making process involving consumption and production. Assuming a two-member male/female household in a complete market environment, the household maximization problem can be presented as:[3]

[3] For a complete treatment, see Singh *et al.*, 1986; or Horney and McElroy, 1988.

Figure 3. The Farm Household Model With Migration Impact



$$Max \;\; U\left(Z\left(C, t_m, t_f\right), L_m, L_f; Q_h(x)\right) \tag{1}$$

subject to:

$$P \cdot C + W_m \cdot t_m + W_f \cdot t_f \leq V + W_m \cdot T_m + W_f \cdot T_f + P_a \cdot F\left(t_{ma}, t_{fa}, H_{ai} + H_{ar}; Q_p(x)\right) \tag{2}$$

$$L_m + L_f + T_m + T_f + t_m + t_f + t_{ma} + t_{fa} \leq T \tag{3}$$

$$H_{ai} + H_{ar} + H_n = H \tag{4}$$

where $U(\cdot)$ is presumed to be the household utility function depending on: a composite commodity Z (which depends on a market good, C, and the non-market time of labor from both the female and male, t_m and t_f) and household leisure, L_m and L_f. The last term in the utility function, $Q_h(x)$, describes the specific characteristics of households in terms of socio-demographic, geographical and environmental characteristics.

Equation (2) describes the household budget constraint. The last term on the right-hand side expresses the value of agricultural production for a given price P_a and technology $F(\cdot)$. The production function is assumed to be well-behaved and depends on the amount of land cultivated (irrigated or rain-fed), $H_{ai} + H_{ar}$, on both male/female labor, and on $Q_p(x)$ that are the particular production characteristics of the farm. The products $W_m \cdot T_m$ and $W_f \cdot T_f$ describe the differentiated household wage income derived from labor supply in off-farm labor markets and the V is the non-human wealth returns. The component V may include transfers of any kind, non-labor income, interest derived from assets like rented land and credit, among other forms of passive income. On the left-hand side of equation (2) are expenses for consumption goods, C, at a price P and -- under the assumption of complete markets -- the "purchases" of leisure at the same market wages. Equation (3) is the allocation rule of the household's total labor time, the major concern in this paper. Finally, equation (4) describes the household's land endowment (H) and allocation (H_n = not cultivated).

The three constraints may be collapsed into a single expenditure constraint, F', that is an augmented form of the "full income" concept:

$$W_f L_f + W_m L_m + P_m Z_m = \Pi^R(t_{ma}, t_{fa}, H_{ai} + H_{ar}; Q_p(x)) + W_m T_m + W_f T_f \tag{5}$$

where $W_f L_f + W_m L_m$ is the opportunity cost of the time spent in the production of commodities, $P_a Z_m$ is the market value of home consumption of output, $W_m T_m + W_f T_f$ is the value of labor income, and $\Pi^R(')$ is the conditional profit function that depends on household labor, land endowments (in a more general fashion, it may also depend on hired labor, see Sadoulet *et al.,* 1998*)* and farm production characteristics $Q_p(x)$.

4. Migration and Labor Participation Among Adults in Mexico Households

The data used for this paper are from the "Determinants of Household's Income Survey," a bi-institutional research project conducted by the Centro de Investigaciones Multidisciplinarias from the Universidad Nacional Autonoma de México (CRIM-UNAM) and the University of California at Berkeley. In these data a number of *ejidos* in Mexico were studied between 1993-1996 in the first stage of study and another group of *ejidos* were examined in the second stage between 1997-1999. Each *ejido* was visited only once and two surveys were simultaneously conducted. The *ejidos* belong to the central and south regions of Mexico. They were selected to give a broad diversity in technological predominance as well as in the types of local institutions. The unit of study was the family farm and the survey questions focused on the process of agricultural production, labor allocation and the demographic characteristics of households. The surveys comprised a fieldwork period of four to seven weeks per community and data were collected from the last two agricultural cycles. The data focus on the year previous to the survey.

To analyze the farm household's time allocation decisions and labor regime membership we use the CRIM-UNAM survey of 504 households from Mexican rural communities. The relevant variables useful for analyzing labor decisions are listed in Appendix Table A.1. However, the information available is limited in content and constrains our analysis to consider only the case of one joint agricultural season.

A wide definition of migration is used. Mainly, we consider migration not only in those cases where definitive migration happened but also in cases where migration is partial or seasonal. Not much of a distinction is made between internal and international migration effects, although international migration may imply longer periods and less agricultural seasonality than internal migration might. Migration is defined at the household level and later at the plot/farm level. A household with migration status is defined as one with migrated relatives and/or when

the household head has migration experience (past migration). The objective is to categorize and differentiate households with relative family-labor scarcity from those who are not facing this scarcity. The definition of migration also considers those cases where household members work an important number of days off-farm, and considers whether this work was performed out of or during the agricultural cycle.

Table 1 describes the main characteristics of communities and households in the CRIM-UNAM sample. The data include households with very small farms who engage in both subsistence agriculture production and the sale of labor, a large number of households who are self-sufficient in labor, and households with farms that are large and/or better endowed in productive assets (economic information on assets endowments and income by household economic and migration status is provided in the Appendix Tables A2 and A3). Table 1 includes the average number of members in a household per community and agricultural environment. The weighted mean of household size is 6.92 persons with the highest being in *ejido* Luviano (10.2) in Estado de Mexico and El Aleman (9.91) in Durango and the smallest in San Andres Yutumi (5.13). Table 1 also shows the percentages of households with migrated relatives and the percentages of households receiving remittances. Both San Andres Yutuni and Paso del Muerto have high percentages of households with migrants (around 45%), while Ixtal (21%) and Cheran Atzicurin and Macuil (23%) have the lowest. Table 1 also presents the ratio between household size and land owned. This ratio is used to illustrate the per capita relative access to land across communities. The smaller the number the more land per capita in the community. On average, there are almost four persons for each hectare of land. However, variation is high (8.98). Communities like Capulcapan (9.59) and Macuil (9.15) in Oaxaca have the highest ratios while Francisco Villa (0.74) and Guivicia (0.65) have the smallest.

Household typology

To better understand the characteristics of communities and households in the CRIM-UNAM sample, a household typology that describes in more details the household characteristics of the sample is developed. Since households are far from being equal even within small and apparently homogeneous communities, they are differentiated in a typology to be able to assess adjustments to out-migration in different types of households.

Table 1. Households and Migration by Community/*Ejidos* and Agricultural Environment. CRIM_UNAM Data.

Community or *Ejido*	State	Period of Survey	Agricultural Environment	Households			% With Migrants	% Received Remittance	Household Size / Land Owned (no./ ha.)	Confidence Level (95.0%)*
				Number	Mean Size	No Migrant				
Luviano	Edo. Mex.	93-96	Modern	20	10.2	Municipal	43.0	17.5	1.59	3.42
San Juan -San Agustin	Edo. Mex.	93-96	Modern	23	6.48	3.55	32.7	1.7	1.95	0.72
Francisco Villa	Chiapas	93-96	Modern	42	5.23	3.26	25.5	18.0	0.74	2.45
Paso del Muerto	Michoacan	93-96	Semi-Modern	20	9.6	2.27	45.3	40.9	4.78	0.25
Quinceo	Michoacan	93-96	Semi-Modern	18	8.11	4.09	31.7	7.4	2.06	1.4
Hierbabuena	Oaxaca	93-96	Semi-Modern	25	6.6	2.14	34.5	32.8	2.28	0.57
San Juan Michis	Durango	93-96	Semi-Modern	20	8.65	1.88	28.4	24.7	4.12	0.33
El Aleman	Durango	93-96	Semi-Modern	12	9.91	1.96	41.6	36.8	3.12	0.86
San Juan Coyula	Oaxaca	93-96	Semi-Modern	25	7.08	2.05	29.1	22.8	5.40	0.2
Capulcapan	Oaxaca	98-99	Semi-Modern	40	6.52	3.17	37.5	15.9	9.59	0.18
Alvaro Obregon	Chihuaha	93-96	Semi-Modern	20	7.7	3.61	41.6	47.5	1.13	1.76
Macuil	Oaxaca	98-99	Semi-Modern	41	7.14	3.29	23.2	18.7	9.15	0.21
San Andres Yutuni	Oaxaca	98-99	Semi-Modern	40	5.13	2.32	45.1	26.3	6.84	0.15
Guivicia	-	93-96	Semi-Modern	24	6.01	7.78	43.6	24.4	0.65	2.87
Cheran Atzicurin	Michoacan	93-96	Traditional	19	8.89	2.52	23.2	23.1	6.68	0.24
Tangancicuaro	Michoacan	93-96	Traditional	22	6.95	1.59	34.4	33.0	1.37	0.39
Ixtal	Oaxaca	98-99	Traditional	53	5.56	5.93	21.1	20.8	2.13	2.84
Teococulco St Marcos	Oaxaca	98-99	Traditional	40	6.7	2.77	31.8	38.3	8.17	0.2
Total				504	6.92		34.1	25.0	3.99	

Source: Based on 1993-96 and 1998-99 surveys, CRIM-UNAM data.

A household typology was used to identify three major economic groups. These groups have as a key distinctive characteristic their relative access to resources, in particular. The access or endowments of key resources determine the production organization and it is hypothesized that out-migration responds to household circumstances and thus their effect may vary with them. Differentiated access or ownership of land, livestock, agricultural machinery and family labor determines household participation in labor, credit, land and insurance markets. Large households with very little or no land may likely be inclined to supply labor off-farm, demand credit, rent in land and machinery, and borrow capital, while households endowed with relatively more land and agricultural machinery will tend to hire labor in the local market, rent out land and even supply credit resources. In the middle is a group of households with some endowments and access and with fluctuated or selected market participation. This group might not participate in the market in some cases because the household availability of some resources might make them self-sufficient, as will be the case of household labor. These three economic groups are constructed in our sample and households classified according to these parameters.

4.1. Migration descriptive analysis

Four categories are distinguished for male labor allocation: hired for agricultural activities in the agricultural sector during the agricultural season, hired for non-agricultural activities, self-employed for agricultural work also in both seasons, and self-employed in home economic production. The same four work categories are used for females.

Reported days allocated to all agricultural activities are summed for several reasons. First, a more general model implies the use of the present value of the household utility function considering at least three periods: say, two agricultural seasons and one non-agricultural. Second, there is a limited number of observations in relevant variables for supporting the estimation of a more general model. Finally, the assumptions on which the model is based suggest this aggregation. Table 2 shows the labor participation (dichotomous) of males and females in each activity or category of participation. In the case of males, many work on their own parcels (80.8%), while 43.6% participate as hired labor in local agricultural markets, 29.3% of them work in home economic production, and the lowest percentage (17.9%) participate in non-agricultural labor markets as wage labor.

Table 2. Descriptive Statistics of Labor Participation, CRIM-UNAM Data.

Variable	N	Mean	Std dev.	Observations
Male:				
Agricultural wage work	509	0.4362	0.5163	222
Non-agricultural wage work	501	0.1796	0.6190	90
Own farm work	501	0.8083	0.4649	405
Home economic production	514	0.2937	0.3808	151
Female:				
Agricultural wage work	533	0.2645	0.2785	141
Non-agricultural wage work	520	0.1076	0.1470	56
Own farm work	509	0.5363	0.4950	273
Home economic production	516	0.489*	0.5157	201*

*Includes 54 women whose labor participation was reported as "doing nothing."

In the case of females, labor participation presents a clear concentration in self-employment on their own farms (53.1%) and in home economic production (48%), while participation in agricultural (26.4%) and non-agricultural (10.7%) wage labor markets is relatively low. This may suggest a form of gender specialization within the household (see Unni, 1994): males reported working more days on farm and outside the home, while females present low participation rates in formal labor markets, although over half work on their own farms. Further, the partial correlation coefficients of labor allocation for males and females presented in Table 3 show some broad results worth mentioning: (1) in each case, there exist significant correlation coefficients for each type of activity between days worked by adult males and days worked by adult females; (2) for both males and females, the correlation coefficients for participating in agricultural and non-agricultural wage labor markets move in opposite directions to those corresponding to home economic production and work on own farm; moreover, days of own-farm work is negatively correlated with days worked in home economic production; and (3) it is interesting to see that the number of days worked by both female and male in the same work category moves in the same direction; e.g., both work more either at home, on farm, or off-farm.

4.2. Labor participation and multiple job-holding in rural Mexico

For the different combinations of multiple labor participations of households, there are sixteen possible cases (2^4). Tables 3 and 4 show male and female labor participation, respectively. From Table 4, the most important category of labor allocation is on own farm and as hired farm labor (144 observations). That is followed in importance by on-farm and home economic production allocations (137 observations) and by only on-farm allocation (112 observations). Two extreme cases, each one with only one observation, were detected: one male declared no work at all and one male reported to be participating in all work categories except agricultural wage work.

In Table 5, there is a clearer pattern for adult females. The greatest frequency was observed among those defined by no participation in labor markets. Females' labor appears more concentrated in on-farm and home economic production activities than male labor. The prominent cases for female labor allocation are: exclusive on-farm work (138 observed); exclusive home economic production (94 observed); and allocation both to work on their own farms and to home economic production (68 observed). Unlike males, some females report no zero participation in work (54 of 509, a little over 10%).

This section suggests two conclusions: first, in Tables 3 and 4 there is evidence of multiple job-holding for both males and females, second, it may also suggest a gender specialization in the Mexican data set. Adult females participated more on or near the household farm while males tended to be involved more in market activities off the farm. The overlap of both seems to be in on-farm activities that may include some gender specialization or labor division. Technical division of farm tasks might exist, namely that labor participation either on (or off) the farm presents a different structure of time allocation.

4.3. A model of labor participation

To better understand the underlying rationality supporting the complex labor allocation within a household and examine the influence of out-migration, an estimation model of multiple job-holding for Mexican households is suggested. On the whole, the previous descriptive results, especially those condensed in Table 3, suggest simultaneous treatment of labor participation of both females and males rather than independent estimation.

Table 3. Correlation Analysis of Days Worked (Pearson Correlation Coefficients)

	Male days worked				Females days worked			
	Agricultural wage work	**Nonagricultural wage work**	**Own farm work**	**Home economic production**	**Agricultural wage work**	**Nonagricultural wage work**	**Own farm work**	**Home economic production**
Males								
Agricultural wage work	1.00000 (0.0)[a]	-0.21534 0.0001	-0.39355 0.0001	-0.29454 0.0001	0.37035 0.0001	-0.03044 0.4818	-0.06016 0.1643	-0.20175 0.0001
Nonagricultural wage work	-0.21534 0.0001	1.00000 0.0	-0.37865 0.0001	-0.23464 0.0001	-0.00521 0.9041	0.21300 0.0001	-0.15481 0.0003	0.13104 0.0024
Own farm work	-0.39355 0.0001	0.37865 0.0001	1.00000 0.0	-0.18667 0.0001	-0.18286 0.0001	-0.09623 0.0259	0.12996 0.0026	0.10097 0.0194
Home economic production	-0.29454 0.0001	-0.23464 0.0001	-0.18667 0.0001	1.00000 0.0	-0.10972 0.0110	-0.05565 0.1983	-0.07967 0.0653	0.21304 0.0001
Females								
Agricultural wage work	0.37035 0.0001	-0.00521 0.9041	-0.18286 0.0001	-0.10972 0.0110	1.00000 0.0	0.04648 0.2827	-0.21885 0.0001	-0.05585 0.1967
Nonagricultural wage work	-0.03044 0.4818	0.21300 0.0001	-0.09623 0.0259	-0.05565 0.1983	0.04648 0.2827	1.00000 0.0	-0.09329 0.0308	-0.07818 0.0705
Own farm work	-0.06016 0.1643	-0.15481 0.0003	0.12996 0.0026	-0.07967 0.0653	-0.21885 0.0001	-0.09329 0.0308	1.00000 0.0	-0.62924 0.0001
Home economic production	-0.20175 0.0001	0.13104 0.0024	0.10097 0.0194	0.21304 0.0001	-0.05585 0.1967	-0.07818 0.0705	-0.62924 0.0001	1.00000 0.0

Source: Based on 1993-96 and 1998-99 surveys, CRIM-UNAM data.

[a]Prob > |R| under Ho: $Rh_o=0$

Dependent variable

According to the heuristic model presented in Section 3 and because of data limitations some basic combinations of the observed cases were introduced to define the dependent variable. Four categories are defined following the frequency of the observations and the size of the major subgroups shown in Tables 4 and 5. The first category integrates individuals (females and males) who combine on-farm and agricultural wage work, the second category combines observations of individuals principally working on-farm and in home economic production, the third category refers exclusively to on-farm work, and finally the fourth category includes the remaining observations. Note that some leisure time may be gathered together with home economic production, a data limitation. Likewise, the number of observed cases for labor participation in nonagricultural work is not enough to support a single regression and so were integrated into one single case termed "otherwise." This category includes also the other cases not considered relevant in the estimation.

Regarding these considerations and considering the size of the major subgroups, three alternative options (or categories) were considered for both males and females for the dependent variable. Table 6 shows the dependent variable specification for individual males and females.

Independent variables

Although standard household models like the one discussed in Section 3 suggest including all independent variables, only a subset of them will be taken into account. This is mainly due to important data constraints that limit the explanatory power of the models. Three limitations are worth mentioning: First, the model may be misspecified because relevant omitted variables are not available in the data set. For example, important information related to wages and prices of agricultural products are partially included. Therefore, to assess the value of home economic production requires some corrections in the form of shadow wages and prices, and instrumental variables might be introduced. Second, there is not a feasible characterization of home economic production technology, such as the sequence or simultaneity of home economic production labor and on-farm activities. Third, although the analysis is limited to labor time allocation within the agricultural cycles, labor used during the non-agricultural season is not presented and could be part of the time included in the agricultural cycles.

Table 4. Adult Male Multiple Labor Participation, CRIM-UNAM Data.

(Own farm work, Agricultural wage work)	**(Home economic production, Nonagricultural wage work)**			
	(0,0)	**(0,1)**	**(1,0)**	**(1,1)**
(0,0)	1	20	4	0
(0,1)	7	58	3	3
(1,0)	112	4	137	1
(1,1)	144	4	3	0

n = 501

Table 5. Adult Female Multiple Labor Participation, CRIM-UNAM Data.

(Own farm work, Agricultural wage work)	(Home economic production, Nonagricultural wage work)			
	(0,0)	(0,1)	(1,0)	(1,1)
(0,0)	54	10	94	0
(0,1)	5	37	34	2
(1,0)	138	3	68	1
(1,1)	58	3	2	0

n = 509

Table 6. Multiple Labor Time Allocation for Males and Females.

Category	Type of labor or time allocation (Definition)	Number of observations	
		Males	Females
1	Own-farm and off-farm agriculture	154	97
2	Own-farm and home economic production	143	217
3	Only own-farm	112	138
0	Otherwise (off-farm including non-agriculture)	92	57
N		501	509

Table 7 shows the explanatory variables for the estimated regression. All variables are common to the male and female specifications. The first group of three variables refer to the sources of non-earned income represented by ***W*** (irrigated land, total amount of land cultivated and the value of assets, including land); the second group are specific human capital endowments, ***HC*** (age and education); and finally, the third group refers to household type, family composition and agricultural environment, ***Z*** (household economic type; mother or mother-in-law in the household; a child younger than 5 years old living in the household; household in Oaxaca or Chiapas, Durango or Michoacan or Chihuahua or Estado de Mexico; household head migration experience and migration status).

Table 7. Model Specification (Independent Variables) for Adult Males and Females, CRIM UNAM Data.

Group	Variable Definition	Male Specification	Female Specification
W_1	Dummy variable=1 if household has irrigated land (=0 otherwise)	√	√
W_2	Natural logarithm of assets (variable calculated)	√	√
W_3	Hectares of total land cultivated	√	√
HC_1	Age in years	√	√
HC_2	Age-squared	√	√
HC_3	Years of formal schooling	√	√
Z_{1A}	Dummy variable=1 if household economic status is low (=0 otherwise)	√	√
Z_{1B}	Dummy variable=1 if household economic status is mid (=0 otherwise)	√	√
Z_{1C}	Dummy variable=1 if household economic status is high (=0 otherwise)	√	√
Z_2	Dummy variable representing presence of either mother or mother-in-law (mother-in-law =1, otherwise 0)	√	√
Z_3	Dummy variable representing presence of a young child (child's age<5 =1, otherwise 0)	-	√
Z_4	Dummy=1 if household is in Oaxaca or Chiapas (=0 otherwise)	√	√
Z_5	Dummy=1 if household is in Durango or Michoacan (=0 otherwise)	√	√
Z_6	Dummy=1 if household is in Chihuahua or Estado de Mexico (=0 otherwise)	√	√
Z_7	Dummy=1 if household has migrant relatives (=0 otherwise)	√	√
Z_8	Dummy=1 if household's head has past migration experience (=0 otherwise)	√	√

Household assets, land cultivated and irrigated land availability are believed to positively affect the participation in work on own farm (including home economic production) because the household's labor becomes more productive with additional assets, including land cultivated and irrigated land. It might be more appropriate to consider net cultivated area as a better explanatory variable for time allocation decision-making, although this was not a statistically significant variable and thus was not retained in our case. For both males and females, age and education introduce personal characteristics that may influence work decisions. Age captures a stage in the life-cycle productivity. Time allocation in off-farm labor markets may be enhanced at the beginning with age, but after reaching a peak, a decrease with age is likely.

Education is assumed to increase the productivity of labor both on and off the farm; therefore, its net effects on time allocation may respond to some underlying factors in the production technology or the household's preferences. For our case, formal education may have a stronger effect on off-farm productivity and thus education can be expected to affect farm participation negatively and to affect off-farm participation positively (Kimhi, 1994). Further, off-farm agricultural work participation may be less sensitive to education than off-farm nonagricultural work. In other words, education may increase the time allocated to nonagricultural labor markets more than to off-farm agricultural ones. In addition, the impact of schooling may be differentiated across gender, as Benjamin *et al.* (1996) observed. However, some studies have shown that the effect of human capital (schooling) on the probability of off-farm work is ambiguous; a distinction between different and specific agricultural human capital, as could be the interaction of schooling and household labor size, turns out to be important in some studies in reducing off-farm participation probability (Benjamin, *et al.*, 1996).

Third, family characteristics like the presence of children under 5 years old and the presence of the mother or mother-in-law, allow the identification of certain differentiated gender effects. If farm work is considered to be more complementary to home economic production than any type of off-farm work, then on-farm participation would be expected to be less sensitive to the number of children than off-farm participation (Kimhi, 1994; Benjamin *et al.*, 1996). Finally, the specific variables introduced as the "household typology" may help to recognize which economic group is more sensitive to labor allocation within the surveyed Mexican communities.

Among the location characteristics, three state variables and one migration status variable are included among the independent variables to capture some particular characteristics of household location. The variable Z_4 is included to identify Oaxaca and Chiapas, two states located in the south of Mexico and having very similar conditions. Likewise, Z_5 is for Durango and Michoacan, describing their central location, although these states are different in other aspects. Finally, Z_6 intends to capture a specific condition in these two states, namely their proximity to the border of the United States for Chihuahua or to Mexico City for Estado de Mexico. These variables may capture some specific labor market conditions like unemployment, informal sector, size and proximity of labor markets.

Finally, Z_7 and Z_8 describe the migration condition of household members. Again, it is hypothesized that household migration status as defined in Section 3 and the household head's past migration experience may increase off-farm labor participation and multiple job-holding. In other words, men and particularly women, all other things equal, may tend to exhibit multiple job-holding in those households with migrant relatives or when the household head has some out-migration experience.

4.4. The multinomial logit model

We estimate a standard multinomial logit model as defined by Maddala (1983, pp. 34-41), Judge *et al.* (1985) or Greene and Terza (1996). For male and female specifications, the four categories of labor participation defined above are considered. Thus, the explanatory variables described in Table 7 are used to calculate the probability that an individual $i = \{1,...,n\}$ with characteristics $\boldsymbol{z_i} = \{W_i, HC_i, Z_i\}$ chooses to participate in $j = \{0,1,2,3\}$. Let $\boldsymbol{z_{ij}}$ be the vector of the values of these characteristics for participating under category j perceived by individual i. The probability that individual i chooses to participate under category j is

$$P\left(y_i = j\right) = \frac{\exp\left(z_{ij}^T \beta\right)}{\left[1 + \sum_{l=1}^{J-1} \exp\left(z_{ij}^T \beta\right)\right]} \qquad (j = 1, \ldots, J-1) \tag{6}$$

where $y_i = j$ is the qualitative variable for individual i when j is chosen and $\boldsymbol{\beta} = (\beta_1, ..., \beta_8)$ is the vector of coefficients. A possible J unordered outcomes can occur. To identify the parameters of the model, $\beta_1 = 0$ is imposed which gives the following expression:

$$P\left(y_i = J\right) = \frac{1}{\left[1 + \sum_{l=1}^{J-1} \exp\left(z_{ij}^T \beta\right)\right]} \tag{7}$$

For the estimation exercise, the log-likelihood function will be:

$$L(\beta) = \sum_{i=1}^{n} \left\{ \sum_{j=1}^{J-1} w_{ij} \log\left[\frac{\exp\left(z_{ij}^T \beta\right)}{1 + \sum_{l=1}^{J=1} \exp\left(z_{ij}^T \beta\right)} \right] - w_{iJ} \log\left[1 + \sum_{l=1}^{J=1} \exp\left(z_{ij}^T \beta\right)\right] \right\}$$

or equivalently:

$$L(\beta) = \sum_{i=1}^{n} \left\{ \sum_{j=1}^{J-1} w_{ij} z_{ij}^T \beta - \log\left[1 + \sum_{l=1}^{J=1} \exp\left(z_{ij}^T \beta\right)\right] \right\} \tag{8}$$

Therefore, taking the first and second derivatives of equation (8), we formally can determine the estimates of the $\boldsymbol{\beta}$ vector that maximizes the likelihood function:

$$\frac{\partial L(\beta)}{\partial \beta} = \sum_{i=1}^{n} \sum_{j=1}^{J-1} \left[w_{ij} - \frac{\exp\left(z_{ij}^T \beta\right)}{\left[1 + \sum_{l=1}^{J=1} \exp\left(z_{ij}^T \beta\right)\right]} \right] \tag{9}$$

$$\frac{\partial^2 L(\beta)}{\partial \beta \partial \beta^T} = -\sum_{i=1}^{n} \left\langle \left[1 + \sum_{l=1}^{J=1} \exp\left(z_{ij}^T \beta\right)\right]^{-2} \left\{ \left[1 + \sum_{l=1}^{J=1} \exp\left(z_{ij}^T \beta\right)\right] \sum_{j=1}^{J=1} \exp\left(z_{ij}^T \beta\right) + \left[\sum_{j=1}^{J=1} \exp\left(z_{ij}^T \beta\right) \cdot \sum_{l=1}^{J=1} \exp\left(z_{ij}^T \beta\right)\right] \right\} z_{ij} z_{il}^T \right\rangle \tag{10}$$

In the empirical estimation we used the econometric reduced form version of equation (7) for both male and female specifications. Specifically, it uses the Newton-Raphson iteration method to obtain the estimates. The results of both male and female specifications are presented in Tables 7 and 8, respectively, while Tables 9 and 10 describe the performance of both specifications.

4.5. Analysis of the results and discussion

The analysis for each case is obtained from the three categories of time allocation described as follows: (1) *own-farm* and *hired-out agriculture* labor participation, (2) *own-farm* and *home production* participation, and (3) *on own farm only*. These three categories are contrasted with *off-farm non-agriculture* or "*other."*

Case of males

Table 8 shows the estimated logit regression for adult males. The estimated model has a good fit. The significance level is high, with a probability less than 1% for the likelihood ratio (chi-squared distribution). Males' labor allocation presents a few consistencies with our hypotheses. The model of labor participation for males correctly predicts a little over 50% of the observed cases (see Table 9), although rejecting the model is limited because it has a higher level of statistical significance (see Table 8). Regarding the individual coefficients for the exogenous variables, it is observed that their levels, signs and statistical significance vary among the different categories of labor, as expected. To analyze these results, the probabilities of labor participation of each individual concerning each activity should be calculated. As the non-linear equation (6) shows, the multinomial model estimates these probabilities simultaneously using all of the estimated coefficients. In Table 8 these probabilities are presented for "average" males of each group defined by categories of participation (1), (2), and (3).

The multinomial model predicts well the participation of average males in *on-farm* and *hired-out agriculture* and on *own farm only* but fails in the case *on-farm* and *home production*. It is interesting to note that the mean values of all variables correlated with both non-earned incomes and human capital investment have important differences among groups. This suggests some systematic impact of these variables on the labor participation decisions of adult males. For instance, increments in either the amount of land cultivated or human capital investments increase the likelihood of working only on own-farm. This behavior is well predicted by our heuristic model since it is highly probable that these individuals do not face constraints of any kind (borrowing or seasonal) and therefore their productivity for all activities will be enhanced. Consequently, their optimal decision of labor allocation will basically prefer their own farms.

The following points can be made from Table 8. The first category exhibits the proper signs for the first three variables (all statistically significant): First, wealth is negatively correlated (significantly at 5%) with on own-farm and hired-out in agriculture labor participation, and positively (significantly at 1%) with own-farm and home economic production (the coefficient of wealth is not significant for the category *on own farm only*). Land cultivated is positively (significantly) correlated with the three categories and thus decreases the probability of only off-farm labor participation. Overall, wealth (with a positive sign for the second category

Table 8. Multinomial Logit Estimates, Mean and Probability Values of Multiple Job Holding for Adult Males, CRIM-UNAM Data.

Independent Variables		Own-farm and hired-out for agriculture			Own-farm and home production			Own-farm only		
		Beta	exp(beta)	Mean	Beta	exp(beta)	Mean	Beta	exp(beta)	Mean
Intercept		1.509 *	4.5208		-5.086 *	0.0062		-2.438 *	0.0873	
Agriculture										
Irrigated land	W_1	1.329 ***	3.7773	1	1.076 ***	2.9329	1	1.390 *	4.0140	0
Wealth (assets)	W_2	-0.112 **	0.8941	7.88	0.436 *	1.5459	9.09	-0.058	0.9439	8.09
Land cultivated	W_3	0.000 ***	1.0001	1116.64	0.000 **	1.0002	1219.33	0.001 *	1.0005	1189.33
Human Capital of Males										
Age	HC_1	-0.004	0.9963	36.04	0.008	1.0081	40.54	0.027 **	1.0278	40.54
Age-squared	HC_2	5.4E-05 **	1.0001	1203.97	0.000 ***	1.0002	1580.48	0.000 *	1.0002	1580.48
Education	HC_3	-0.112 **	0.8940	5.95	-0.110 *	0.8961	6.46	-0.065 *	0.9368	6.46
Household Typology										
Low economic status (reference)										
Middle economic status	Z_{1B}	0.475	1.6075	1	0.450	1.5684	0	0.518	1.6790	0
High economic status	Z_{2C}	-0.421 ***	0.6564	0	-0.081	0.9223	1	2.E-04 ***	1.0002	1
Family Status										
Mother and/or mother-in-law	Z_2	-0.898 *	0.4073	1	0.032 *	1.0328	1	-0.502	0.6055	1
Children < 5	Z_3	0.000	1.0003	0	0.000	1.0002	0	0.003	1.0035	0
Closeness to Markets										
Oaxaca & Chiapas (reference)										
Durango & Michoacan	Z_5	0.000 **	1.0000	0	0.004	1.0045	0	0.249 **	1.2833	0
Chihuahua & E.Mexico	Z_6	-0.003 **	0.9970	0	-0.010 **	0.9899	1	-0.102	0.9035	1
Migration										
Household head migration experience	Z_8	-0.003 **	0.9965	1	-0.008 **	0.9924	0	-0.010 **	0.9898	1
Migration status	Z_7	-0.004 *	0.9956	1	-0.008 *	0.9922	1	-0.009 *	0.9912	1
Predicted probabilities										
	P1	0.4565			0.2410			0.1504		
	P2	0.1790			0.2926			0.1349		
	P3	0.1755			0.1739			0.0947		
	P0	0.1890			0.2925			0.6200		
Log-Likelihood		-557.36								
Restricted Log-L.		-601.06								
Chi-Squared		87.4037 *								
Significance Level		0.00032								
N		501								

Source: Adapted data from CRIM-UNAM 1993-96 and 1997-2000.

*** denotes p<0.1, ** denotes p<0.05, * denotes p<0.01.

Table 9. Predicted vs. Actual Observations for Males

	Predicted				
Actual	0	1	2	3	Total
0	121	16	9	8	154
1	70	59	8	6	143
2	40	14	42	16	112
3	31	15	10	36	92
Total	262	104	69	66	501
Predicted outcome has maximum probability.					0.515

and a negative sign for the first category) and land cultivated may indicate that more wealth and more cultivated land area result in more productive male labor on-farm and, therefore, the lower the off-farm participation probability. Second, education has a negative sign implying a positive relationship between education and off-farm participation. This result confirms the idea that education has a stronger effect on off-farm productivity than on own-farm productivity. This result is also strongly consistent with our hypothesis because asset availability is usually associated with more non-labor income and usually involves more labor demand. Both reasons decrease off-farm participation.

With respect to males' human capital, age affects positively (significantly) the third category and is insignificant for the other two. Unlike age, the three coefficients of the age-squared variable (life-cycle productivity) are positive and significant, although the coefficients are small. In the case of the household typology variables, the coefficients of high economic status are significant for the first and third categories but with inverse signs.

Interestingly, the presence of a mother or mother-in-law in the household decreases the probability of the first category but increases the probability of the second category. On the other hand, the presence of children younger than 5 years old is not significant for any of the categories.

Regional characteristics introduced through the state variables add a differentiated effect to the probabilities. In the case of Durango and Michoacan, an important positive impact in the third category (only own farm) is expected and was found, but the same impact is relatively small for the first category. As expected, residence in Chihuahua and Estado de Mexico have a negative impact on the first two categories in favor of higher off-farm labor participation.

Quite interesting is the significance of the intercept. Since we have three sets of dummy variables -- one for the economic groups, the second for the state location and the third for the migration variables -- we can assign an interactive component to the intercept composed by the first economic group and the states of Oaxaca and Chiapas (net of the autonomous elements usually assigned to the intercepts), since these were used as references in the estimation. The intercept is positive for category one but negative for the remaining two. Although significant at 10%, the possibility of belonging to the high economic group seems to be negatively associated with the participation in "own" and "off farm" agricultural labor markets for the first and second categories. As expected, only own farm participation is correlated with high economic status.

With respect to the migration variables, in all cases these variables show the hypothesized signs. Previous household head migration experience (at the 5% level) increases the probability of off-farm job-holding by decreasing the remaining probabilities. Likewise, migration status, in terms of out-migrated relatives, is associated negatively with the three categories. Men in households with out-migrated relatives may tend to have off-farm jobs (both in agriculture and non-agriculture). An important correlation seems to exist between transitions to off-farm employment and migration status.

Case of females

Regarding the estimation for adult females, their results are presented in Tables 10 and 11. Globally, the adult female model explains 50% of the observed decisions but the probabilities predicted for the "average" female fail somewhat more than those for the male model (see Table 11). The failures to predict the observed categories are in groups (2) and (3). The means of their exogenous variables are almost the same throughout all the groups. Accordingly, the females' multinomial model will predict almost the same ranking of probabilities for all "average" females. Therefore, the model is weakly supported by the data, and despite the inclusion of socioeconomic variables (not reported in the table) the variation is systematic across the female labor groups.

The weak support of the result of females' labor allocation brings some points to light concerning our main hypothesis. Specifically, Table 11 shows that irrigated land and wealth increase the probability of being in the second and third groups to the detriment of off-farm

Table 10. Predicted vs. Actual Observations for Females

	Predicted				
Actual	0	1	2	3	Total
0	37	54	6	0	97
1	25	184	15	3	217
2	20	83	21	14	138
3	1	34	9	13	57
Total	73	355	51	30	509
Predicted outcome has maximum probability.					0.501

participation. Note that wealth has a positive sign (except for category one), as opposed to the case for males. There is no direct explanation of this result, although it may be that female labor productivity increases much more in work on the farm or in home production than in the off-farm non-agricultural sector. Also note that the coefficients are larger for "on own farm only," indicating a correlation between these two variables and less off-farm labor participation. However, land cultivated has a positive sign for the first category, implying a combination of own-farm and wage work in agriculture.

Regarding females' human capital, education increases females' productivity in own-farm and off-farm work against home activities. Since the education variable is not significant in the second and third categories, it can be inferred that off-farm participation is favored by more female education. Hence, it would increase the probability of females' off-farm participation. Note that both the age and age-squared variable coefficient are both significant for the "on own farm only" category.

Contrary to the case for males, children no older than five years affect females' labor allocation along with the presence of a mother and/or mother-in-law (also important for males). These family characteristics suggest some sort of gender specialization concerning types of household duties, as mentioned above. In Table 11, the three categories exhibit a negative sign for mother/mother-in-law, although only the second (own farm and home production) is significant. The coefficients of the children under 5 years old variable have positive signs.

For the second labor category, the wealth and irrigated land variables have the expected signs and both are statistically significant. It may seem that asset availability improves the probability of females' specialization in dual job-holding and reduces the probability of considering only home economics (or off-farm allocation). On the other hand, the positive

Table 11. Multinomial Logit Estimates, Mean and Probability Values of Multiple Job Holding for Adults Females, CRIM-UNAM Data.

Independent Variables		Own-farm and hired-out for agriculture			Own-farm and home production			Own-farm only		
		Beta	exp(beta)	Mean	Beta	exp(beta)	Mean	Beta	exp(beta)	Mean
Intercept		-1.638	0.1944		-3.987 *	0.0186		-12.384 *	0.0000	
Agriculture										
Irrigated land	W_1	0.897	2.4522	1	0.500 ***	1.6487	0	0.959 *	2.6099	1
Wealth	W_2	-0.231	0.7941	7.40	0.059 *	1.0610	7.25	0.784 *	2.1910	7.25
Land cultivated	W_3	0.005 *	1.0051	1180.57	0.001	1.0006	1180.57	0.002	1.0020	1180.57
Human capital of females										
Age	HC_1	0.003 *	1.0027	30.90	0.003 ***	1.0029	30.90	0.034 *	1.0345	30.90
Age-squared	HC_2	2E-05	1.0000	890.95	0.007	1.0068	910.95	0.005 *	1.0054	910.95
Education	HC_3	-0.099 *	0.9062	3.88	0.087	1.0909	3.91	0.069	1.0713	3.77
Household typology										
Low economic status (reference)										
Middle economic status	Z_{1B}	0.418 ***	1.5192	1	-0.050	0.9514	1	-0.019	0.9808	1
High economic status	Z_{2C}	0.000155	1.0002	1	-0.069	0.9333	1	7.E-01 **	1.9747	1
Family status										
Mother or mother in law	Z_2	-0.602	0.5479	0	-0.766 ***	0.4650	0	-0.535	0.5858	0
Children < 5	Z_3	0.746	2.1077	1.0933	0.868 **	2.3810	1.0933	0.987 *	2.6831	1.09333
Closeness to markets										
Oaxaca & Chiapas (reference)										
Durango & Michoacan	Z_5	0.249 ***	1.2833	0	0.005 **	1.0055	1	0.249	1.2833	1
Chihuahua & E.Mexico	Z_6	-0.102 ***	0.9035	1	-0.029 ***	0.9714	0	-0.204	0.8159	0
Migration										
Head migration experience	Z_8	-0.050	0.9510	1	-0.483 ***	0.6169	1	-0.103	0.9023	1
Migration status	Z_7	-0.088	0.9158	1	-0.008 **	0.9922	1	-0.098	0.9067	1
Predicted probabilities										
	P1	0.3954			0.3633			0.4288		
	P2	0.3573			0.3923			0.3033		
	P3	0.2197			0.2019			0.2477		
	P0	0.0277			0.0425			0.0202		
Log-Likelihood		-523.85								
Restricted Log-L.		-597.48								
Chi-Squared		147.28 *								
Significance Level		0.0000								
N		509								

Source: Adapted data from CRIM-UNAM 1993-96 and 1997-2000

*** denotes p<0.1, ** denotes p<0.05, * denotes p<0.01

coefficient of children variable contradicts the previous "specialization" hypothesis, but reinforces "multiple job-holding." Another intuitive result is the positive sign of the coefficient of age, which is expected to reduce women's options for multiple jobs on and off the farm and to constrain them into on-farm and home economic production activities.

Finally, the results of the third category for the females' case seem to reinforce those of the second one: irrigated land and wealth assets and young children all have a positive signs (all statistically significant) implying that the probability of specialization is much higher (on own farm). This result may be somewhat counter-intuitive considering the idea of home specialization assumed for women. However, the negative effect is stronger for the case of off-farm participation which may be explained by a strong complementarity between home production and own-farm activities in using female labor. Also, assets may affect more negatively off-farm participation by making female work more productive on-farm than off-farm. As expected, the children variable coefficient had a positive sign (significant).

Regarding the migration variables, they also present the expected (negative) sign but they are significant only for the second labor category (own farm and home production). This may be an indication that supports our transition hypothesis in the sense that household head migration experience and household migration status may facilitate off-farm labor participation of women both in agricultural jobs as well as in non-agricultural employment.

5. Labor Regimes and Out-Migration

One basic assumption in the previous estimations (Sections 3 and 4) is that labor markets are homogeneous and competitive, differentiated only by the different work alternatives available for women and men conditional on their relative productivity and (or) specialization. Moreover, such gender stratification of labor markets allows the possibility of gender specialization and therefore a differentiated response to labor participation and job-holding.

The model in Section 2 introduces different wages to reflect an implicit gender specialization in terms of time allocation. However, all households were assumed and modeled as (net) suppliers of homogeneous (except for gender) off-farm labor which limits the scope of the empirical analysis. In this section we extend the standard household model, so that households have the possibility of hiring-in labor (demand) as well as hiring-out. For example, instead of a single market, there may be many stratified labor markets. That would be possible

by making "explicit" the implicit differential marginal productivity (or skills) of household labor of the model in Section 2. This modification allows us to differentiate the impact of out-migration on labor participation and allocation across economic groups.

The main distinctive characteristic that will be emphasized across economic groups is their labor market participation: whether households are net sellers, self-sufficient or net buyers of labor. Such differentiation is relevant because of labor market imperfections.

5.1. Labor regime membership and out-migration

Household labor, either because it embodies household-farm-specific human capital or because it provides non-marketable supervision resources to the efficient household farm operation, *ceteris paribus*, makes farm households use first their labor on-farm (or in home production activity) up to a point where its opportunity cost is less than or equal to the household's labor productivity. Off-farm participation may be conditional, not only on household endowments or farm technology but also on transaction costs that households face in labor markets. In the previous estimations, it was implicitly assumed that those costs were zero. This idea was compatible with the labor net-sellers assumption and with a non-hierarchical labor participation and job-holding.

In this section, three hierarchical labor regimes are considered for market participation of household labor (conditional on endowments and idiosyncratic transactional costs[4]). The central argument is that migration factors like the household head migration experience and the migration status of households along with the asset endowments and transaction costs may determine (or change) the household's labor regime membership. Specifically, it is hypothesized that households' labor regime membership is sensitive to out-migration for two reasons: (1) it may alter its idiosyncratic transaction costs, and (2) due to production distortions, it may change the opportunity costs of non-migrant household labor. Moreover, such sensitivity may be asymmetric for households depending on their initial labor regime. It may be hypothesized that the range of wages within which farmers self-select from the labor market (the self-sufficient regime) may increase due to the low elasticity of farm production with respect to household out-migrant labor. But, the negative effect of out-migration on farm production may increase the

[4] Idiosyncratic transaction costs are understood as those specific transaction costs attributable to household conditions in terms of avoiding market imperfections.

opportunity cost of “stayers” in migrating households and improve off-farm participation. Therefore, the net effect on self-sufficient households may be ambiguous, for it will depend on both the relative effect on the opportunity cost as well as on the transaction costs. On the other hand, it might be hypothesized that the labor demand of "net buyers," *ceteris paribus*, may collapse even more while the opportunity cost for "net sellers" may increase due to farm production distortions, thus increasing their labor supply for a given market wage.

To operationalize this set of hypotheses and empirically estimate them, part of the estimation procedure of Sadoulet *et al.* (1998) is adapted. Unlike Sadoulet *et al.* (1998), who develop a household model with differential labor skills and transaction costs in accessing labor markets (supply and/or demand), the analysis here will be focused more on migration impacts irrespective of labor skills. The objectives are three: (1) rigorously construct a predictive typology of farm households by labor regimes, (2) test for or predict the separability selection by labor regime, and (3) identify the determinants of differentiated performance across household types.

The results of Sadoulet *et al.* (1998) show that the typology has strong predictive power and that separability holds among sellers and buyers of labor but not among self-sufficient households. Moreover, "[r]ecursiveness implies that labor intensity and labor productivity do not vary with the asset position of households, while they are affected by asset position when recursiveness does not hold, providing the test of the model" (Sadoulet *et al.,* 1998: p. 87). To analyze endowment effects, our previous definition of economic groups would be considered a guiding source, since it is an endowment-sensitive typology.

The model

The theoretical framework applied in this case is similar to the previous one in Section 4 with three exceptions: land and type of land will be considered a fixed factor in the production function, labor hired-in is another choice variable of the household, and the commodity in the utility function is substituted by income. The model is adapted here, using the previous notation:

$$Max \;\; U\left(L_1, L_1, M; Q_h(x)\right) \tag{11}$$

subject to:

$$w_h h + w_1 \cdot t_{1a} + w_2 \cdot t_{2a} \le V + w_1 \cdot t_1 + w_2 \cdot t_2 + p_a \cdot F\left(t_{1a} + t_{2a} + h, H; Q_p(x)\right) \tag{12}$$

$$L_i + t_i + t_{ia} \le T^i \quad \text{for all } i = 1,2. \tag{13}$$

where h is the amount of hired-in labor. By making some substitutions, the model can be rewritten in the following way:

$$\underset{h, L_f^i, L_o^i}{Max}\; U\left(T^1 - t_1 - t_{1a}, T^2 - t_2 - t_{2a}, M, Q_h(x)\right) \tag{14}$$

subject to:

$$\pi^R\left(p_a, h, t_{1a}, t_{2a}, H, Q_p(x), C\right) + w_1 t_1 + w_2 t_2 + V \ge M \tag{15}$$

$$0 \le L_f^i + L_o^i + L_l^i \le T^i \qquad \forall i = 1,2 \tag{16}$$

$$t_{ia} \ge 0, \quad t_i \ge 0, \quad L_i \ge 0 \quad \forall i = 1,2 \tag{17}$$

$$M \ge 0$$

In this case, the utility function U depends on on-farm work t_{ia} (i=1,2), and off-farm work t_i (i=1,2); it also depends on income M, and other household characteristics denoted $Q_h(x)$. The function $\pi^R\left(p_a, h, t_{1a}, t_{2a}, H, Q_p(x)\right)$ is the restricted conditional profit function that depends on

variable output prices p_a, hired-in labor h, on-farm labor levels t_{ia}, (i=1,2), fixed input levels H, and other farm characteristics Q_p(x). Household characteristics are also assumed to influence the agricultural production process; w_i is the wage rate for off-farm work t_i and it is assumed to be independent of current hours of work. For any individual i, T^i represents the total number of hours available for all activities, i.e., on-farm work, off-farm work and leisure L_i. Finally, non-negativity constraints are stated.

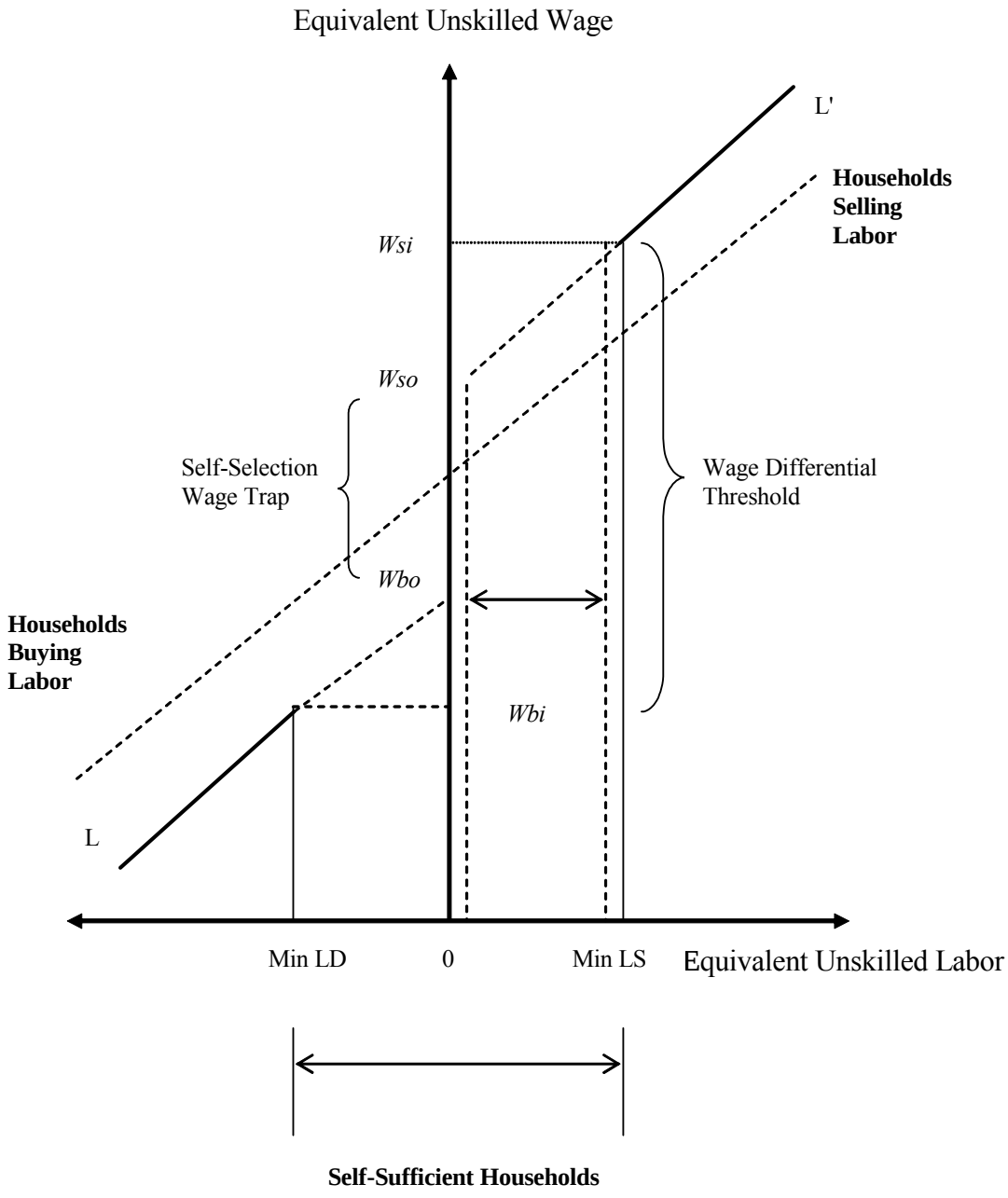
As in Sadoulet *et al*. (1998) (see also Skoufias, 1994), the standard assumptions on production and utility functions together with the non-negativity conditions ensure that the problem admits only one solution, given the Kuhn-Tucker conditions. The solution of the problem reveals that the household's optimal strategy depends on its initial endowments of land, household labor and on exogenous transfers (e.g., remittances stemming from migration). The interesting case is the solution for the labor self-sufficient households. A shadow wage is proposed, namely:

$$w^* = w^*\left(\underset{+}{H}, \underset{-}{T^1}, \underset{\pm}{T^2}, \underset{+}{V}\right) \tag{18}$$

which is an increasing function of farm assets and transfers and ambiguously related to the household labor types. Figure 4 shows the endowment effects for the labor self-sufficient case. The asset equivalent (or wage equivalent for "unskilled" labor) is measured on the y-axis and the equivalent unskilled labor is on the x-axis. The line LL' is the net labor demand equivalent function under non-competitive labor markets[5]. The region in the middle is the self-selection, namely that households self-select from labor markets in such a range due not only to own-farm requirements (or home production) but also to transaction costs involved in the participation. The bold lines represent the labor demand or supply of labor. Note that they are shifted from the ideal LL' net demand curve because of the transaction costs. *MinLD* represents the minimum amount of labor demanded and *MinLS* the minimum amount of labor supplied. These labor thresholds are derived from the two sources: the "wage trap" (W_{so} - W_{bo}) indicating the opportunity cost of labor for farm or home production and the transaction cost that is added to the "wage trap" from the wage differential threshold (W_{si} - W_{bi}). The W_{si} is the minimum wage of

[5] A competitive net labor demand function might be represented by the continuous dotted line where, other things equal, a labor supplier (moving from right to left) might automatically turn into a labor demander.

Figure 4. Labor Market Membership and Labor Endowments



labor supply composed by a transactional premium (W_{si} -W_{so}) and the W_{bi} is the minimum wage of labor demand composed by a transactional premium (W_{bo} -W_{bi}).

The hypothesized effect of migration could be illustrated in Figure 4 by shifting of the *L'L* curve to the right and down, producing an inward shift of the demand side and outward shift of the supply side. That might be concurrent with our central hypothesis, since it would be an indication of a labor demand contraction and an increase in labor supply that, conditional on a negative production impact, would be unemployed. However, as stated before, the effect on the threshold might be ambiguous and would depend on idiosyncratic and endowment characteristics.

5.2. A model of labor regime membership

To learn about the underlying rationality that explains the different participation in labor markets and the impacts of migration, a labor regime membership model for Mexican households will be estimated.

Dependent variable

According to the heuristic model presented in the previous subsection and because of the data limitations mentioned above, some changes were made to the dependent variable. Almost all households in the CRIM-UNAM data include some labor supply and labor demand data and there are more complications when considering reciprocal labor. To define the dependent variable, some basic considerations were introduced. Each household A was assigned a specific labor membership according to its labor requirements per unit of land (as described in Ortega-Sanchez, 2001) and its dominant off-farm (or on-farm) labor participation described in previous sections. Specifically, conditional on land cultivated, a net seller membership was assigned to households with total amount of labor supplied (man-days) that were significantly greater than the mean requirements of family labor declared for agricultural tasks. The inverse rule was used for buyers. The self-sufficient cases were assigned to those households that were not previously assigned to the net seller or net buyer groups and that were grouped in an intermediate case.

This methodology introduces some measurement problems and, as a result, an alternative form was considered that used household labor availability for agriculture within the agricultural

cycle contrasted with labor requirements. However, the generated memberships were contradictory to actual observations in the data and the economic group typology, not mentioning the potential endogenous bias that might require further correction. With such consideration in mind, our dependent variable is defined in Table 12.

Table 12. Dominant Membership in Labor Regimes for the Ordered Probit Model.

Category	Characteristic of labor participation (Definition)	Number of households observed
0	Dominant or net sellers of labor	169
1	Dominant self-sufficient households	201
2	Dominant or net buyers of labor	132
Total number of observations		502

Independent variables

Two additional variables were introduced to the set of independent variables used in the estimation of multiple job-holding choices: children over 10 years and total labor availability in the household. However, like the previous case, the probit model may be misspecified because relevant omitted variables are not available in the data set or gathered with limitations. Important information related to wages and prices of agricultural products are partially included, and the prices of home products are not included. Ordered Polychotomous Dependent Variable (OPDV) models have the advantage of overturning this constraint by redefining the variable, although with recuperability constraints, as will be explain below.

5.3. The ordered multinomial probit model

Based on OPDV, the ordered probit model of this section can be defined (see, for example, Greene and Terza, 1996). The procedure that will follow is different from the one presented in Sadoulet *et al.* (1998), mainly because it reduces some data requirements and economizes in the estimation of a linear wage index function and separated threshold functions. The specification is as follows:

$$\varpi_i^* = w_i^*(\cdot) - w_{bi}(\cdot\,, TC_{bi}) + \varepsilon_i \qquad (19)$$

where ϖ_i^* is a latent variable unobserved by the researcher. This variable is the difference between a shadow wage $w^*(\cdot)$ that may depend on the household's asset endowments as defined

before, and the threshold (lower) wage of buying labor that may depend on the idiosyncratic transactional costs as defined in Sadoulet *et al.* (1998). The error component ε_i is assumed to have a normal distribution. Note that for a particular observation, our unobserved latent variable could be positive or negative depending not only on the size of the first two components (the shadow wage and the transaction-costs dependent wage) but also on the value of the error component. Up to this point our procedure is analogous to that of Sadoulet *et al.* (1998) except for the definition of the wage thresholds. Now following a different procedure, let's define the threshold differential (upper and lower bound) as $\mu = w_{si}(\cdot, TC_{si}) - w_{bi}(\cdot, TC_{bi})$, namely the wage differential between hiring and selling, and both depending on idiosyncratic transaction costs and household asset endowments. As previously mentioned, the vertical axis in Figure 7 helps to illustrate the threshold by the differences in selling and buying wages. Therefore, we can construct our dependent variable as follows:

$$w_i = \begin{cases} 0 & \text{if } \varpi^* \le 0 \\ 1 & \text{if } 0 < \varpi^* \le \mu \quad \text{for all } i=1,\ldots N \\ 2 & \text{if } \mu \le \varpi^* \end{cases} \tag{20}$$

Using this definition, we can assign probabilities to these three events as follows:

$$\begin{aligned} &\Pr(i \in buyer) = \Pr\left(\varpi^* \le 0\right) \\ &\Pr(i \in self\text{ - }sufficient) = \Pr\left(0 < \varpi^* \le \mu\right) \\ &\Pr(i \in seller) = \Pr\left(\mu \le \varpi^*\right) \end{aligned} \tag{21}$$

The procedure of estimation includes the threshold, μ, namely our model will be a variable threshold probit. Note that in this case the threshold differential μ is working as the real threshold for the estimation and it helps to reduce the estimation procedure. However, the two true-wage thresholds will not be recoverable afterwards.

It is typically assumed that the dependent variable is jointly distributed with a random vector of regressors. Moreover, it is assumed that both the dependent variable and the vector of regressors are independent and identically distributed (i.i.d.) across the sample, and that the multinomial probability density function (pdf) of the dependent variable conditional on the regressors is defined as:

$$\Pr(w_i = 1 / \boldsymbol{x}_i) = \Phi(x_{i,j}\theta) - \Phi(x_{i,j-1}\theta) \quad \text{for } j=1,2,3 \text{ and } i=1,\ldots N \tag{21}$$

where $\Phi(\cdot)$ is the normal cumulative distribution function with unitary range interval, $\boldsymbol{\theta}$ is the vector of parameters and $\boldsymbol{x}_i=[x_{1i}, x_{2i}, x_{3i}]$ is the vector of regressors. Additionally, it is assumed that the distribution of $\boldsymbol{x}_i$ does not involve $\boldsymbol{\theta}$. Also, note that in our case the vector of parameters $\boldsymbol{\theta}$ will be defined as $\theta^T = \left[\beta_z^T \quad \beta_x^T \quad \sigma\right]^T$ where $\boldsymbol{\beta}_z^T$ is the vector of parameters to be estimated for the variable threshold, $\boldsymbol{\beta}_x^T$ is the vector of parameters to be estimated for the probit model, and $\boldsymbol{\sigma}$ is the standard deviation. Although in our model $\boldsymbol{x}$ and $\boldsymbol{z}$ are equal, this may not always necessarily be the case. One important point here is that $\boldsymbol{\beta}_x$ and $\boldsymbol{\sigma}$ are not structural parameters since we adopted the reduced form at the moment of defining the threshold. Therefore, along with the no recuperability of individual wage thresholds, our structural estimates will not be identified, only the reduced coefficients.

The most commonly applied estimation technique in this context is the maximum likelihood method which yields "best asymptotically normal" (BAN) estimators of the elements of $\boldsymbol{\theta}$ (Greene and Terza, 1996), and therefore the conditional log-likelihood function would be:

$$L(\theta / \boldsymbol{x}) = \sum_{i=1}^{N}\sum_{j=1}^{3} w_{ij} \ln\left(\Pr\left(w_{ij} = 1 / \boldsymbol{x}_i\right)\right) \tag{22}$$

After maximization of this log-likelihood function we can calculate the marginal effect of a one unit change in one of the exogenous variables on the probability that a household with characteristics x_0 falls into the j-th category in the following way

$$\frac{\partial \Pr\left(w_j = 1 / \boldsymbol{x}_0\right)}{\partial \boldsymbol{x}_k} = \left[\phi\left(\mu_j - \boldsymbol{x}_0\hat{\beta}\right) - \phi\left(\mu_{j-1} - \boldsymbol{x}_0\hat{\beta}\right)\right]\hat{\beta}_k \tag{23}$$

where β_k denotes the k-th element of β_x. Since our case is reduced to only three categories and the first threshold is equal to zero, then the marginal effects can be stated as follows (see Greene, 1999):

$$\begin{aligned}
\frac{\partial \Pr(w=0)}{\partial \boldsymbol{x}} &= -\phi\left(\boldsymbol{x}\hat{\beta}\right)\hat{\beta} \\
\frac{\partial \Pr\left(w=1\right)}{\partial \boldsymbol{x}} &= \left[\phi\left(-\boldsymbol{x}\hat{\beta}\right) - \phi\left(\mu - \boldsymbol{x}\hat{\beta}\right)\right]\hat{\beta} \\
\frac{\partial \Pr\left(w=2\right)}{\partial \boldsymbol{x}} &= \phi\left(\mu - \boldsymbol{x}\hat{\beta}\right)\hat{\beta}
\end{aligned} \tag{24}$$

where $\phi(\cdot)$ is the probability density function valued at different points.

5.4. Discussion of results

Table 13 presents the results of the ordered probit estimation. It also presents (in the right side) the estimation of the threshold, $\hat{\mu}$. The threshold coefficients can be interpreted as those of a simple linear regression. In this context, threshold coefficients that are statistically significant include the household's resource endowments (with a negative impact on the threshold size), and the household head's education and household labor availability (both having a positive impact on the threshold size). Also, belonging to the third economic group seems to determine positively the size of the threshold. One element that is relevant is the significance of both migration variables, i.e., the household head's migration experience and migration status.

Contrary to what might be hypothesized, the household head's migration experience and household migration status positively influence the wage threshold size. This could indicate that the range of the opportunity cost of household labor increases with the migration variables but may not be a direct indication of an increase in labor productivity Two factors may help to explain this: (1) behind self-sufficiency is a self-selection of farm activities that might be hidden if we consider a production impact, and (2) remittances, if any, might be playing a role in such self-selection. Specifically, conditional on a negative production impact of out-migration, the increase in the size of the threshold might indicate lower market participation incentives reducing labor demand because of production declines and not increasing labor supply because of remittances and market imperfections, although it is not clear if the effect is either symmetric or produces a horizontal shift of the self-sufficiency window to one of the sides.

The ordered probit estimation is presented in the left-hand side of Table 13. The hierarchical probit anchors "sellers" at the top followed by "self-sufficient" and "buyers" regimes, in that order. Therefore, a positive (negative) sign of a coefficient indicates the direction of the impact in the probability of being a "seller" to the detriment (benefit) of the other two categories. In addition, marginal values could be calculated using the expression mentioned above for individual variables. As expected, both wealth and land cultivated decrease the probability of being a net labor seller. Age-squared (a proxy for experience and life-cycle productivity) also has a similar effect, although it might be correlated with the agricultural assets. On the other

Table 13 Ordered Mulinomial Probit of Labor Regime Membership.

Dependent Variable: Probability of being net seller, self-sufficient or net buye

Independent Variables		Ordered Probit		Sample Mean			Threshold =1.297†	
		Beta	t-ratio	Sellers	Self	Buyers	Beta	t-ratio
Intercept		2.4001 *	4.94				1.0025 *	3.68
Agriculture								
Irrigated land	W_1	0.8780	1.18				0.0004	1.37
Wealth (ln)	W_2	-0.0026 *	2.25	7.8026	8.0921	9.0712	-0.7317 *	3.47
Land cultivated	W_3	-3.9E-06 **	2.05	1164.5	1332.0	1410.0	0.0009 *	2.37
Human capital of household head								
Age	HC_1	0.0012	0.55	37.4958	41.9356	38.5396	0.0532	1.27
Age-squared	HC_2	-0.0051 *	2.14	1291.3	1229.2	1430.2	0.0009	1.18
Education	HC_3	0.0649 *	3.23	5.9510	6.6615	6.1539	0.4098 *	2.31
Household Typology								
Low economic status (reference)								
Middle economic status	Z_1	0.0008 ***	1.87	0	1	0	-0.9876	0.05
High economic status	Z_2	0.2521	1.03	0	0	1	0.4425 *	2.63
Family Labor Endowments								
Labor (males+females)	Z_3	0.7945 *	4.53	3.4548	3.2750	3.1989	0.7717 *	3.12
Children >10	Z_4	0.0672 ***	1.75	1.8468	1.6690	1.6775	-0.8200	0.08
Closeness to Markets								
Oaxaca & Chiapas (reference)								
Durango & Michoacan	Z_5	0.0025	0.18	0	0	0	-0.3504	0.12
Chihuahua & E.Mexico	Z_6	0.9832 **	2.01	0	0	1	-0.7323	1.40
Migration								
Head migration experience	Z_8	0.0298 *	2.30	1	1	1	0.8876 *	2.27
Migration status	Z_7	0.9485 *	3.22	1	1	1	0.4100 *	4.57
Log-Likelihood (constant threshold)			-489.00					
Log-Likelihood (variable threshold)			-517.00					
Chi-Squared			56.00					
Significance Level (P-value variable threshold)			0.00					

Predicted Probability Values		Sellers	Self	Buyers
	Pr. 0	0.4729	0.3896	0.1023
	Pr. 1	0.4176	0.4558	0.4091
	Pr. 2	0.1095	0.1547	0.4886

	Predicted Observations [a]			
Actual	0	1	2	TOTAL
0	89	50	30	169
1	50	114	37	201
2	25	38	69	132
TOTAL	164	202	136	502
% Correct	52.66	56.72	52.27	54.18

Source: Estimated using data from CRIM-UNAM 1993-96 and 1997-2000

*** denotes p<0.1, ** denotes p<0.05, * denotes p<0.01

† Estimated Threshold Value = 1.297

a Predicted outcome has maximum probability

hand, also as expected, greater labor availability and number of children over age 10 increase the probability of being a net seller of labor.

Since variables representing household typology and closeness to labor markets are dummy variables, the interpretation of the coefficients is not straightforward. Nevertheless, the significant coefficients of households in the middle economic category (at 10%) increases the chances of the probability ranking and particularly of being net labor sellers, as was previously hypothesized. In the case of market proximity, only those households that belong to Chihuahua or Estado de Mexico show a significant (at 5%) estimated coefficient. Note that household of low economic status and those located in Oaxaca or Chiapas (through the intercept at 1%) might be significant. However, it is important to be cautious about the significance of the intercept, since it is capturing the autonomous variability of the ranking as well as working as a multivariable interaction term. Alternative orderings of the regional and economic status dummies (not presented here) shows significant levels only in the case of economic group one (at 10%).

Regarding migration, the ordinal probability distribution is reinforced by the two migration variables since both variables are significant (at the 1% level). This is an indication, independent of the direction of the coefficients, that out-migration significantly determines labor regime membership. Note also that both variables are dummies. In this case, both variables are positive which reinforces the particular ordinal variable in the sense that the probability of being a "net seller" of labor is positively influenced. These latter results might explain a hypothetical regime transition caused by migration. When out-migration happens and when there is some migration experience, the household may tend to participate more in labor markets as labor suppliers.

Corroborating these results, Table 13 also presents the predicted observations and probabilities for the labor regime membership. The predicted versus actual results are in the lower part of Table 13. Overall, the ordered probit model predicts about 54% of the actual observations, with the highest (57%) for the labor self-sufficiency regime. Using the sub-sample means of variables and the estimated threshold value (1.297), the diverse probabilities are also calculated in the lower part of Table 13. As shown in this table, greater probabilities correspond to the appropriate sub-sample mean values used in the calculation. Specifically, a the time of calculating the probability distribution of regime membership of a hypothetical household, a

relatively higher probability value of being a "net seller" is expected (about 0.47 for seller, 0.42 for self-sufficient and 0.11 for net buyers) when the mean values of the seller's group are used. Similarly, when it is used either the "self-sufficient" or "net buyer" groups the probabilities support the ordering distribution. Note also that the ranking of the probabilities in each case respects the order among regimes, namely that a buyer might have higher probabilities of becoming first self-sufficient than a net seller. Overall, these results are an indication that there are significant differences in the independent variables that explain the partition of the probability among the labor regimes, and that migration, conditional on household characteristics and asset endowments, plays an important role in splitting the probability of the labor regimes membership.

6. Final Remarks

This paper assesses the changes in the allocation of household labor within the agricultural cycle as a reflection of the out-migration influence on production in rural Mexico. In this context, the examination of multiple job-holding and membership in alternative labor regimes was developed. To analyze factors affecting multiple job-holding a multinomial logit model was used to estimate time allocation among different options and job-holding combinations while an ordered multinomial probit model was used to estimate the labor regime membership of households. For the multiple job-holding case, Tables 7 and 8 report the estimations of three categories describing these results (three for males and three for females). In addition, Tables 9 and 10 present the maximum likelihood probabilities of predicted results for both groups that support the estimations of Table 8. In the case of labor regime membership, Table 13 presents the maximum likelihood ordered probit estimation and the predicted capacity of the estimated model.

The central results of Sections 4 and 5 intend to explain why the hypothesis of multiple job-holding is fairly dominated in the case of females by evidence that emphasizes more concentration in one or two work roles with a focus on home production and/or own-farm work. On the other hand, estimates for males show stronger results supporting multiple job-holding. An important aspect of this result refers to the household's time constraints for male and female members. In each case, labor time constitutes a scarce resource and its use is adjusted under the household's efficiency criteria or welfare.

The results of the separated estimates of multiple job-holding for household males and females indicate that out-migration is an important factor explaining labor allocation within the agricultural cycle. Specifically, a higher probability of off-farm employment (including non-agricultural self-employment) or multiple job-holding, can be associated with both males and females when the household head's past migration experience is observed. The increases in the probability of off-farm job-holding for males decrease the probabilities of own-farm work. Similarly, migration status as defined in Section 3 is associated with higher probabilities of men having off-farm jobs (both in agriculture and non-agriculture). This result shows an important correlation between the probability of transition to off-farm employment and migration status for males. Overall, the results support our transition hypothesis.

The central results of Section 5 serve to show that labor regime membership is sensitive not only to endowments but also to migration variables. Although the results are limited, they help to identify both components. The results show that labor regime membership is influenced by variables reflecting agricultural and human capital endowments. The estimated probabilities indicate that when households' endowments are higher in terms of agricultural assets (wealth and land cultivated) and as the household's head life-cycle productivity (age-squared) is higher, the probability of being a net seller of labor decreases significantly but it increases with household labor force size, children older than 10 years and for those households in the middle economics status group. Estimated probabilities tend to support these results especially when considering hypothetical transitions between regimes and therefore of labor participation. An important aspect of this result refers to the causes underlying these transitions, with migration and endowment variables seeming to explain a great part of this variation. As a final comment, the study suggests that the basic assumptions to describe labor regimes may be adequate for describing relevant labor alternatives: net sellers of labor, net buyers, and self-sufficiency. Migration variables, by reinforcing the ordinal variable definition in the sense that the probability of being a "net seller" of labor is positively influenced by out-migration, influence the transition through regimes.

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APPENDIX
CHARACTERISTICS OF LABOR VARIABLES

Table A.1. List of Labor Variables.

Description	**Measure**
Variables Describing Number of Observations	
Work off-farm in agriculture / male	Number of observations
Work off-farm in non-agriculture / male	"
Self-employed in agriculture / male	"
Self-employed in home economic production / male	"
Work off-farm in agriculture / female	"
Work off-farm in non-agriculture / female	"
Self-employed in agriculture / female	"
Self-employed in home economics / female	"
Variables Describing Participation	
Work off-farm in agriculture / male	Number of days
Work off-farm in non-agriculture / male	"
Self-employed in agriculture / male	"
Self-employed in home economic production / male	"
Work off-farm in agriculture / female	"
Work off-farm in non-agriculture / female	"
Self-employed in agriculture / female	"
Self-employed in home economic production / female	"
Independent Variables	
Dummy=1 if household has irrigated land (=0 otherwise)	Dummy
Natural logarithm of assets	Value in $ Mexican Pesos
Total land cultivated	Number of acres
Age at time of interview	Years
Years of formal education	Years
Dummy=1 if household status is low (=0 otherwise)	Dummy
Dummy=1 if household status is middle (=0 otherwise)	Dummy
Dummy=1 if household status is high (=0 otherwise)	Dummy
Dummy=1 if presence of mother or mother-in-law (=0 otherwise)	Dummy
Dummy=1 if household's head has migration experience (=0 otherwise)	Dummy
Dummy=1 if any child's age<5 (=0 otherwise)	Dummy
Dummy=1 if farm household is in Oaxaca or Chiapas (=0 otherwise)	Dummy
Dummy=1 if farm household is in Durango or Michoacan (=0 otherwise)	Dummy
Dummy=1 if farm household is in Chihuahua or Estado de Mexico (=0 otherwise)	Dummy
Dummy=1 if household has migrant relatives (=0 otherwise)	Dummy
Dummy=1 if household head has past migration experience (=0 otherwise)	Dummy

Table A.2. Household Characteristics and Endowments by Economic Group and Migration Status, CRIM-UNAM Data.

	ECONOMIC STATUS						All Households
	Low		Medium		High		
	FWNM	FWM	FWNM	FWM	FWNM	FWM	
Household Characteristics							
Household size (persons)	6.12	5.84	6.08	6.04	5.69	4.89	5.92
Age of household head (years)	38.21	40.02	41.50	39.80	39.50	41.80	39.84
Education of household head (years)	5.78	6.10	6.20	6.84	6.48	6.45	6.21
Labor Endowments							
Household adults (number)	4.26	3.01	3.67	2.57	4.65	3.87	3.64
Children over 10 years old (number)	1.99	2.04	1.85	1.75	1.66	1.68	1.88
Land Endowments							
Per capita land owned (ha.)	1.89	1.95	2.45	2.56	4.65	4.52	2.62
Per capita agricultural land (ha.)	1.77	1.85	2.26	2.34	4.21	3.98	2.41
Percentage irrigated (%)	18.38	19.01	23.10	25.40	33.08	32.45	23.18
Other Endowments							
Machinery ownership (%)	12.50	16.00	28.43	29.58	43.08	40.00	24.40
Livestock ownership (number of cattle)	21.32	22.00	25.49	25.35	47.69	46.67	27.78
Herd size (number)	2.58	3.24	5.80	6.70	14.40	21.45	6.59
Number of observations	136	100	102	71	65	30	504

Source: Calculations based on 1993-96 and 1998-99 surveys, CRIM-UNAM data.
FWNM= Non-migrant status families (without migrant relatives and migration experience).
FWM = Migrant status families. (with migrant relatives and household head migration experience)

Table A.3. Household Income By Economic Group and Migration Status.

	Economic Status						All Households
	Low		Medium		High		
	FWNM	FWM	FWNM	FWM	FWNM	FWM	
	%		%				%
Percent of Households	26.98	19.84	20.24	14.09	12.90	5.95	100.00
Income sources							
Share from agriculture:	55.02	54.89	56.20	55.68	58.77	59.33	56.07
Crops	51.02	46.54	47.01	47.07	49.47	47.73	48.37
Livestock (cattle)	4.00	8.35	9.19	8.61	9.30	11.60	7.70
Share from off-farm labor (wage)	31.24	29.10	25.67	29.45	18.23	12.89	26.67
Share from non-farm business	9.74	4.20	8.94	2.89	13.70	13.45	8.25
Share from remittances	-	11.81	-	11.98	-	14.33	12.25
Share of households receiving							
Remittances	-	30.15	-	27.01	-	10.27	26.07
Potential other sources of income							
Share of household with:							
Backyard livestock	22.79	24.00	25.49	23.94	16.92	16.67	22.62
Backyard agriculture	25.00	24.00	24.51	23.94	16.92	16.67	23.02
Total income (pesos)							
Per household	5230	5946	17687	12589	19876	20586	11732.72
Number of observations	136	100	102	71	65	30	504

Source: Calculations based on 1993-96 and 1998-99 surveys, CRIM-UNAM data.
FWNM= Non-migrant status families (without migrant relatives and migration experience).
FWM = Migrant status families. (with migrant relatives and household head migration experience)