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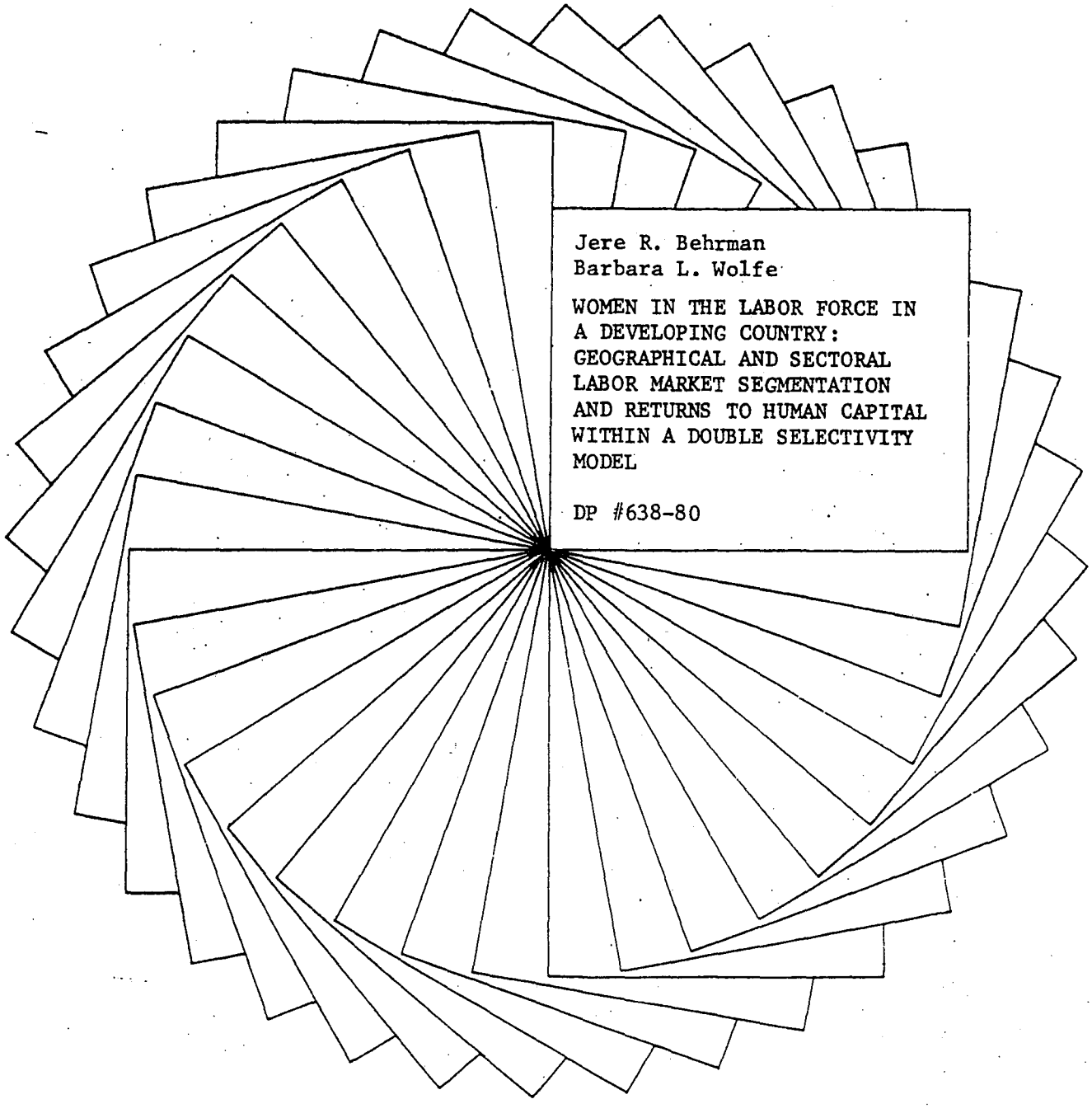

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WOMEN IN THE LABOR FORCE IN A DEVELOPING COUNTRY: GEOGRAPHICAL AND SECTORAL LABOR MARKET SEGMENTATION AND RETURNS TO HUMAN CAPITAL WITHIN A DOUBLE SELECTIVITY MODEL

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Women in the Labor Force in a Developing Country: Geographical and Sectoral Labor Market Segmentation and Returns to Human Capital Within a Double Selectivity Model

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ABSTRACT

This paper explores the differential returns to women's investment in human capital across geographical and sectoral labor markets in a developing country. Disaggregation is found to be important: both labor force participation and earnings relations differ significantly among regions and sectors. Returns to human capital investments include higher marginal productivities, earnings, and higher probabilities of being in certain sectors. For example, returns to schooling and experience are largest in the formal sector in the largest metropolitan area. Returns to an extended set of human capital variables such as nutrition, health, and migration also show regional-sectoral differences--e.g., the marginal returns to nutrition suggest higher returns for relatively malnourished, informal sector participants.

Selectivity terms are introduced, are found to be significant in the more urbanized area, but to have little effect on the substantive interpretations of the human capital variables.

We conclude that overall estimates may be misleading with regard to the returns to investment in human capital by women.

Women in the Labor Force in a Developing Country: Geographical and Sectoral Labor Market Segmentation and Returns to Human Capital Within a Double Selectivity Model

Three major themes have emerged in recent development literature: first, that segmentation or pluralism is a predominating feature of developing economies; second, that human capital investments, broadly defined, may be very important in attaining growth, distribution, and other goals; third, that women probably play a major role in the development process.[1] Despite considerable emphasis on their importance, many dimensions of these themes remain virtually unexplored.

In this paper we contribute to the understanding of the empirical realities of these three dimensions of the development process by estimating micro labor force participation and ln earnings functions for women from different geographical regions and different sectors of a developing country, using an extended definition of human capital within a double selectivity framework.[2]

Our data consist of a country-wide stratified random sample of women aged 15 to 45 (excluding nonworking students) which we collected in the developing Central American country of Nicaragua in 1977-1978.[3] We distinguish among three geographical regions by degree of urbanization: the central metropolis, with about half a million inhabitants (almost a quarter of the country's population); towns and cities, with from 500 to 76,000 inhabitants; and rural areas. We also distinguish among three sectors: formal (characterized by ongoing implicit or explicit

wage contracts, usually by defined work hours, often by explicit fringe benefits such as social security, and often by large-scale employers), informal (no contracts, no benefits like social security, small production units which often operate out of the home, on the streets, in open markets, or in other transitory quarters with many family workers), and domestic (in which women work in others' households at domestic tasks, often receiving room and almost always board as part of their payment). Our extended definition of human capital includes nutrition, health, and migratory status,[4] in addition to the standard schooling and work experience variables. In our ln earnings estimates we use a double-selectivity model to control for two sources of selectivity bias: first, and more commonly recognized, the selectivity of those participating in the labor force ("work inclination"); second, the selectivity of those within the labor force who report their earnings ("report inclination").

We sketch out our model in Section 1, and then turn to empirical estimates of labor force participation and ln earnings functions. We next discuss our overall estimates, the estimates for geographical disaggregation and for sectoral disaggregation, and estimates for both geographical and sectoral disaggregations. Our conclusions are given in Section 6.

1. MODEL FOR LABOR FORCE PARTICIPATION AND DOUBLE SELECTIVITY MODEL FOR ln EARNINGS

We begin with a standard human capital model in which ln earnings depend on formal education and linear and quadratic terms in experience.

As we mentioned above, our definition of human capital variables is extended to include nutrition, health, and migratory status. Employment conditions in many Latin American countries, including the one from which our sample is drawn, apparently satisfy at least one of the assumptions of most models of labor force supply better than do labor market conditions in the United States: hours worked can frequently be adjusted to equate the market wage and the shadow wage (see, e.g., Heckman, 1974).

But we can estimate a ln earnings function only for the women in our sample who report earnings. The subsample of such women is a nonrandom subsample of women selected first by rules pertaining to (1) labor force participation, or "work inclination," and (2) then by "report inclination." In our overall sample of 3773 women, 1533 participate in the labor force; of those participants, 1411 report earnings, indicating the possibility of a double selection framework. A number of studies consider the first selection rule. Generally, however, the possibility of additional selectivity in reporting earnings has not been considered; instead, those for whom earnings are not reported are assumed to be a random subsample. Because our earlier work (Behrman and Wolfe, 1980a; Behrman, Wolfe, and Tunali, 1980) suggests that reporting data may or may not cause selectivity, we posit a double selectivity framework which we formalize as follows.

For the ith individual in our random sample, we have:

(1) $Y_{1i}^{*} = \underline{\beta}_1' \underline{X}_i + U_{1i}$ "work inclination"

(2) $Y_{2i}^* = \underline{\beta}_2'\underline{X}_i + U_{2i}$ "report inclination"

(3) $Y_{3i} = \underline{\beta}_3'\underline{X}_i + U_{3i}$ ln earnings function

where $\underline{X}_i$ is a K x 1 vector of regressors, $\underline{\beta}_j$ is a K x 1 vector of unknown parameters, and

(4) $E(U_{ji}) = 0 \qquad j = 1,2,3;$

(5) $E(U_{ji}U_{j'i'}) = \begin{cases} \sigma_{jj'} & j,j' = 1,2,3; \quad i = i' \\ 0 & j,j' = 1,2,3; \quad i \neq i' \end{cases}$

Our main objective is to estimate the parameters of equation (3), with the unobservable continuous random variables Y_{1i}^* and Y_{2i}^* determining the subsample (or selecting individuals) for which complete observations satisfying equation (3) are available. We introduce the dichotomous variables Y_1 and Y_2 to indicate the outcomes of the selection processes in equations (1) and (2):

(6) $Y_{1i} = \begin{cases} 1 \text{ if } Y_{1i}^* > 0, & \text{individual participates in labor force.} \\ 0 \text{ if } Y_{1i}^* \leq 0, & \text{individual does not participate in labor force.} \end{cases}$

(7) $Y_{2i} = \begin{cases} 1 \text{ if } Y_{2i}^* > 0 \text{ and } Y_{1i} = 1, & \text{individual reports earnings (and participates in the labor force).} \\ 0 \text{ if } Y_{2i}^* \leq 0 \text{ and } Y_{1i} = 1, & \text{individual does not report earnings (even though participates in the labor force).} \\ \text{unobserved if } Y_{1i} = 0, & \text{individual does not participate in the labor force.} \end{cases}$

We observe Y_{3i} if and only if $Y_{2i} = 1$, that is, if and only if

(8) $Y_{1i}^* > 0$ and $Y_{2i}^* > 0$.

This sequential selection process partitions the original random sample into three mutually exclusive nonrandom subsamples, namely those with $Y_1 = 0$, those with $Y_2 = 0$, and those with $Y_2 = 1$. We denote the subsamples S_1 (not in labor force), S_2 (in labor force and does not report earnings), and S_3 (in labor force and reports earnings). Since S_3 consists of individuals for whom Y_3 is observed, the ln earnings regression equation of primary interest may be written as:

$$(9)\quad E(Y_{3i}|Y_{2i} = 1) = \underline{\beta}_3'\underline{X}_i + E(U_{3i}|Y_{2i} = 1)$$
$$= \underline{\beta}_3'\underline{X}_i + E(U_{3i}|Y_{1i}^* > 0,\ Y_{2i}^* > 0).$$

Therefore, if $E(U_{3i}|Y_{3i}^* > 0,\ Y_{2i}^* > 0) \neq 0$, ordinary least squares result in inconsistent parameter estimates, or "selection bias." Consistent estimation of the parameters in equation (9) requires knowledge of the form of the conditional expectation $E(U_{3i}|Y_{1i}^* > 0,\ Y_{2i}^* > 0)$, hence the conditional distribution of the error term. This calls for imposing additional structure on the model.

In earlier papers with Tunali (Tunali, Behrman, and Wolfe, 1980; Behrman, Wolfe, and Tunali, 1980) we have discussed the maximum likelihood formulation of this double selectivity problem, identification, estimation, and prediction, as well as the properties of a constrained model in which we assume that the two selection rules are independent. We demonstrate

that this constrained version is an extension of Heckman's (1976, 1979) selectivity estimator with sequential (independent) selection rules. In this case we can use S_1 to estimate the probability of reporting earnings conditional on labor force participation, and use the inverses of Mill's ratios from the two selection rules to control for selection in the estimation of the ln earnings function with subsample S_3:

$$(10)\quad Y_{3i} = \underline{\beta}_3'\underline{X}_i + \gamma_1^*\hat{\lambda}_1 + \gamma_2^*\hat{\lambda}_2 + W_3,$$

where $E(W_3 | Y_1^* > 0,\ Y_2^* > 0) = 0,$

$\hat{\lambda}_1 = \dfrac{f_1}{1-F_1}$ as estimated from probit for work inclination from S_1,

$\hat{\lambda}_2 = \dfrac{f_2}{1-F_2}$ as estimated from probit for reporting inclination from S_2.

We adopt this procedure for the present study, and refer the interested reader to Behrman, Wolfe, and Tunali (1980) and Tunali, Behrman and Wolfe (1980) for further details.

In Table 1 we present our probit estimates for the work inclination for the overall sample (S_1, S_2, and S_3) and for various geographical and sectoral subsamples. In each case we follow the standard model by positing that the decision whether or not to participate in the labor force depends upon a comparison of market wages and shadow wages in home production. Therefore we include among the determinants the extended human capital variables, a set of variables related to child care (whether there are

children under 5, whether home child care can be provided by other adults and children over 14), a set of variables related to marital status (single, previously cohabited) and income from other sources (with an added term if the other income is from own-farm activity, since the opportunities for home production differ significantly if the household operates a farm), and a set of variables related to norms about females working, both intergenerational (mother or other female raiser was not a housewife) and intragenerational (population, to indicate degree of urbanization, of community in which the woman resides; and proportion of the labor force that is female).

In Table 2 we present our probit estimates for reporting inclination, S_2 and S_3, subsamples for the whole country and for various geographical and sectoral subsamples. This reporting inclination depends upon whether or not a potential labor market participant has a job and, when she has a job, whether or not she reports her earnings in the interview.[5] We think that it is plausible that the woman's human capital stock affects the reporting inclination for both of these reasons--i.e., it may affect probability of employment and of reporting earnings. Thus, women with more human capital probably are more likely to have a job (conditional on labor force participation) and possibly are more likely to report earnings (conditional on having a job)--although the opposite in the latter case is not completely implausible.[6] We also think that it is plausible that the background variables mentioned above, plus age, number of siblings, and whether the woman had two adult raisers (generally parents) may affect the reporting inclination.

In Table 3 we present our ln earnings regression estimates for our S_3 subsample for the whole country and for various geographical and sectoral subsamples. These are estimates of equation (10) above, with the extended human capital variables in $\underline{X}_i$ and controls for selectivity due to work inclination and to reporting inclination.

The next four sections discuss in detail the labor force participation and ln earnings estimates in Tables 1 and 3. Less discussion is devoted to the reporting inclination probits in Table 2 because their purpose in this paper is primarily to control for possible selectivity. The general question of selectivity in missing data is, however, possibly an important one and is often ignored. We will therefore briefly summarize our results regarding the reporting inclination estimates before we turn to the estimates of primary interest for this study.

The probits in Table 2 are not very successful in capturing the reporting inclination. Chi square tests indicate that the estimated association could have occurred by chance with a probability as low as 10 percent only for the central metropolis and town and cities subsample on the regional level, and for the central metropolis-domestic and towns and cities-domestic subsamples on the regional-sectoral level. Not surprisingly, there are not many individual coefficient estimates that are significantly nonzero at standard levels. Among the human capital variables, the estimates suggest that more schooling increases the probability of reporting earnings in towns and cities on the regional level, but reduces it in rural areas on the regional level, in the

informal sector on the sectoral level, and in the rural informal sector on the geographical-sectoral level. These results suggest that the effect of schooling on reporting is nonlinear: At lower, but not higher, schooling levels there is an increased reluctance to provide information that outweighs the higher probability of having a job.

The only other human capital variable with significantly nonzero coefficients is the nutrition state, which has a positive effect in the central metropolis, particularly for the domestics in that region. Among the background variables, the presence of children under 5 has a significantly positive effect on reporting earnings for the overall sample, the central metropolis, and the informal sector. The number of siblings has a significantly positive effect in towns and cities (particularly in the informal sector), but a negative one in the central metropolis (also particularly in the formal sector). Given the marginal quality of the probits in Table 2, the benefit of attempting to understand the pattern of these estimates is probably not very high.

In the ln earnings regressions in Table 3, the coefficient estimates of the reporting inclination are significantly nonzero in the formal sector (in all regions combined, and in the central metropolis and towns and cities separately) and in the domestic sector. Given the weakness in the underlying probits, even this frequency of significance for the reporting selectivity terms is surprisingly high. While it hardly confirms that reporting selectivity is a problem, it suggests that it possibly should be more widely explored rather than ignored, as is usually the case.

2. OVERALL LABOR FORCE PARTICIPATION AND ln EARNINGS ESTIMATES

The first column in Table 1 gives a significant probit for the overall labor force participation of women. On this level of aggregation, more human capital in the form of schooling, work experience (increasingly so up to about 20 years), and nutrition state all significantly raise market wages relative to shadow wages and increase the probability of labor force participation. As is indicated in Table 4, on the average, women currently employed in the labor force have 5.0 years of schooling versus 3.7 years for those who are not, 9.6 versus 4.2 years of experience, and 66 versus 60 percent of international caloric intake standards. They also tend to be ill somewhat more often (4.6 versus 4.0 days) and to migrate somewhat less (47 versus 45 percent have never migrated), but neither of these human capital variables has a significant impact on overall labor force participation.

The estimates in Table 1 for the other variables in the overall labor force participation probit generally have the a priori anticipated patterns. The presence of children under 5 years of age significantly reduces the probability of participation, unless this effect is offset by home child-care options due to older children or adults in an extended family. Women who have always been single or previously have cohabited are less likely to receive income transfers and are significantly more likely to participate in the labor force. The significantly negative impact of nonwage income is due to the same phenomenon (but there is no special effect of agricultural income). Finally, the tastes for

work conditioned by the fact that the woman's mother worked has a significantly positive intergenerational impact on the probability of the woman working, even though the other variables pertaining to norms do not.

The first column in Table 3 gives the estimated overall ln earnings function with control for double selectivity. Under Mincerian assumptions, the estimated return to schooling is 12.0 percent per year, which makes investment in schooling for women reasonably attractive. We also report on two alternative specifications in regard to schooling which we explored (but are not shown).[7] First, often it is hypothesized that the quality of schooling differs between urban and rural areas. If, however, we include a dichotomous variable for urban-rural upbringing in addition to the linear schooling term, it does not have significant coefficient estimates at this or any other level of aggregation. Second, there may be increasing returns (over a range) to schooling. If a quadratic term in schooling is added, the linear coefficient estimate drops to .079 and the quadratic coefficient estimate is .003, with both significantly nonzero. This might seem to indicate increasing returns to schooling over a broad range of grades (e.g., 9.8 percent for 3 years of schooling, 11.7 percent for 6 years of schooling, 14.3 percent for 10 years of schooling). However, this appears to be an artifact of aggregation. On the geographical and sectoral levels, there is no evidence of increasing returns to schooling. At these levels of aggregation, the quadratic schooling terms generally do

not have significant coefficient estimates.[8] Therefore, in what follows we focus on the specification with only a linear schooling term.

Experience has a significant quadratic return, which reaches a maximum after 29 years.[9] In addition to the standard human capital variables of schooling and experience, nutrition and health (the inverse of days ill) both have significantly positive effects on earnings, apparently by increasing productivities in a Leibensteinian fashion (Leibenstein, 1957).[10] Migratory status is the only one of our human capital variables that does not have a significantly nonzero coefficient estimate. Finally, work inclination is significant at the standard 5 percent level, but report inclination is significant only at the 10 percent level.

These overall results suggest that the returns in terms of productivities and earnings to human capital investments in women are significant, that a broader definition of human capital to include nutrition and health in addition to schooling and work experience may be important, that these human capital variables work through the probability of labor force participation in addition to the level of earnings conditional on labor force participation, and that selectivity for labor force participation and perhaps for reporting earnings may be important.

3. GEOGRAPHICAL DISAGGREGATION BY DEGREE OF URBANIZATION

The development literature is full of assertions about the importance of geographical segmentations of markets, particularly across varying

degrees of urbanization. In this section we explore whether or not women's labor force participation, ln earnings functions, and therefore the effect of human capital vary significantly across three geographical areas defined by degree of urbanization: the central metropolis, towns and cities, and rural areas.

As is indicated in Table 5, in our sample there are 1586 women in the central metropolis (722 of whom have participated and reported earnings), 1241 (509) in towns and cities, and 946 (180) in rural areas. Tables 4 and 6 give the mean values of our human capital values for the three regions. Schooling (5.2 years for the central metropolis, 4.9 years for towns and cities, 1.6 for rural regions), and work experience (6.5, 6.6, 5.3 years respectively) tend to be higher in the central metropolis and towns and cities than in rural areas. Caloric intake is highest in towns and cities, next in the central metropolis, and lowest in the rural areas (60, 74, 51 percent of international standards). Days ill are higher in the central metropolis than in the other two areas (5.4, 3.3, 3.3). Migrants are most common in the rural areas[11] and least common in the towns (45, 53, 38).[12]

Table 6 gives the mean earnings in cordobas per half month (at the time of the survey 7 cordobas equaled one U.S. dollar): 275 for the central metropolis, 226 for towns and cities, and 145 for rural areas. Earnings certainly differ across regions, with much lower levels in the rural sectors than elsewhere. But whether these differences are due to the above-mentioned differences in the distributions of the

human capital variables or to differences in the returns to human capital variables is not immediately obvious. Therefore we turn to estimates of labor force participation and ln earnings estimates on the regional level.

Columns 2, 3, and 4 of Table 1 give regional labor force participation probits that differ significantly from the overall estimates in column 1. We consider first the human capital variables. In each of the regions the same three human capital variables significantly increase women's labor force participation: schooling, work experience, and nutrition. But, ceteris paribus, the effect of schooling and work experience is greater in towns and cities than in the central metropolis and rural areas, and the effect of experience is greater in the central metropolis than in rural areas.[13] In contrast, the effect of nutrition is greater in the central metropolis than elsewhere, although this may reflect a simultaneity problem between nutrition and domestic sector participation, to which we return below.

The impact of the other variables varies more substantially across the regions. The coefficient estimates for having children under 5 and for the availability of home child care are significantly nonzero (of opposite sign) only for the central metropolis. Apparently in other areas extended families are common and neighborhood environments are perceived generally to be sufficiently adequate, so that differences in numbers of small children and in home child care do not significantly alter labor force participation. The coefficient estimate for having previously cohabited is much larger for the rural area than for the

more urban areas, apparently because options for finding new male companions are much less. On the other hand, the coefficient estimates for being single are largest for the central metropolis, about half as large for towns and cities, and insignificant for rural areas. This pattern apparently reflects the stronger tendency for single women to be on their own in more urban areas, and thus to be participants in the paid labor force instead of receiving transfers from their families or participating in household (or farm) production. For a similar reason, other income has significantly negative effects on labor force participation in towns and cities and the central metropolis, but not in rural areas.

Finally, the impact of the variables constructed to represent norms for working women also differs across regions. The intergenerational role model of the mother's (or other female raiser) participating in the labor force has a significantly positive effect only in the central metropolis. The influence of intragenerational norms which differ across city sizes (the variable "population") has a significantly positive effect for the towns and cities, but not for the other areas.[14]

Columns 2, 3, and 4 of Table 3 give regression estimates of the ln earnings functions with control for double selectivity for the three regions. An F test indicates that these three differ significantly from the overall relation in column 1.[15] The formulation is much more consistent with variations in ln earnings for the central metropolis and towns and cities than for rural areas. Comparison of the point

estimates across these three relations points out some important details of these differences and some similarities. First of all, the returns to the standard schooling and work experience human capital variables are significantly positive and not statistically different between the central metropolis and the towns and cities, but are not significantly nonzero for rural areas. For schooling this may reflect a nonlinear or a threshold effect, but, as we note above, quadratic schooling terms do not have significant coefficient estimates. We expect that the return to schooling simply is not very great for women in rural areas. The real return may be in migrating to other labor markets, a possibility that we are exploring in another study (Behrman and Wolfe, 1980a), or in farming one's own farm. But if the latter is the case, it would seem that there would be a negative effect of schooling on labor force participation, not the positive one that we have found.[16]

Second, the returns to nutrition in the form of caloric intake are significantly positive in all three regions, but do not differ significantly among the regions. The returns to health (the inverse of days ill) also do not vary among regions, but are not significantly nonzero at the regional level of aggregation.

Third, we interpret the "never migrated" variable to relate to three phenomena: (1) the extent to which one is familiar with the local labor market and can gain rents from one's personal contacts, (2) the existence of limited motivation and/or ability to exploit better opportunities elsewhere, if they exist,[17] and (3) the environment in which one's work habits and attitudes have been formed.[18] In our

overall relation we find no significant effect of this variable. But with regional disaggregation we find a significantly positive one for the central metropolis and a significantly negative one for the rural areas. This could reflect a combination of the dominance of the first and third phenomena for the central metropolis (the second one may not be relevant in this case since there may not be dominant alternatives elsewhere) and of the second and third for the rural market (the first may not be very important because of the limited rural labor market). A pattern of that nature is lost in the overall aggregation, or in the towns and cities in which the opposing effects cancel each other out.

Fourth, the work inclination selectivity term has significantly nonzero coefficient estimates for the central metropolis and the towns and cities, but not for rural areas. Such a result is consistent with the suggestion above that there may not be much return to many kinds of ability, whether observed or not, in the rural labor market. Therefore there is no correlation between the disturbance term in the first selection rule of equation (1) and that in the ln earnings function of equation (3), both of which originate in unobserved abilities.

4. SECTORAL DISAGGREGATION

Another form of labor market segmentation which is widely emphasized is among the formal, informal, and domestic sectors. In our sample we have 569 women in the formal sector, 679 in the informal sector, and 163 in the domestic sector (Table 5).[19] Mean fortnightly earnings in

cordobas vary significantly among these three sectors: 358, 192, and 128 (Table 6). The means in Table 4 suggest, however, that the distributions of human capital also vary significantly across this disaggregation. The formal sector averages much more schooling (7.3 versus 3.3 and 3.5 years), somewhat better caloric intake (68 versus 64 and 66 percent of international standards), fewer days ill than at least the informal sector (3.8, 5.5, and 4.0), many more women who never have migrated than has the domestic sector (50, 50, 17 percent), and is second to the informal sector in regard to average years of work experience (8.8, 10.8, and 7.5 years). Therefore we again need to estimate labor participation and ln earnings relations to tell if the returns to various types of human capital vary across this disaggregation or if only the distributions vary.

Columns 5, 6, and 7 of Table 1 give sectoral labor force participation probits that differ significantly from the overall probit of column 1. A number of the differences are quite striking.

Consider first the human capital variables. The pattern of the coefficient estimates for schooling suggest that the least educated women select into the domestic sector, the next least into the informal sector, the somewhat more educated into no labor force participation (the excluded category), and the most educated into the formal sector. A very important return to schooling in developing countries which is not often emphasized is earnings studies, therefore, may be in regard to selection among sectors.

The estimated coefficients of work experience are basically the same for the participation in the formal and informal sectors, with a

peak after about 20 years in both cases. For the domestic sector the effect is much smaller (with the linear term not significant) and the peak is after only 10 years. There seems to be much more serial correlation in labor force experience for the formal and informal sectors, therefore, than for the domestic sector. The domestic sector apparently often is an entry point for inexperienced women.

The caloric intake variable has a large significant positive coefficient estimate for the domestic sector, a smaller one for the informal sector, and an insignificant positive coefficient estimate for the formal sector. The first of these probably reflects simultaneity. Domestics usually receive a substantial portion of their salary in the form of board, which often includes a more nutritious diet than they could buy on their own because of the food purchasing patterns of their relatively high income employers. Simultaneity is possibly a problem for the informal sector as well, although we feel much more comfortable in this case with the interpretation that more nutritious women are more likely to participate in this sector of the labor force as opposed to not participating.[20] The nutrition state for women who are likely candidates for the formal sector may be sufficiently better (and above some threshold) that it does not enter into the selection process in this case.

Days ill has a significantly negative coefficient estimate for the formal sector, but no significantly nonzero impact on selection into the other two sectors. This may indicate that bad health is much more of a deterrent for working regular hours with limited rest breaks in the formal sector than in the much more flexible informal and domestic sectors.

"Never migrated" has a significantly positive effect on selection into the informal sector and a negative one for selection into the domestic sector. The former probably indicates that informal sector options are greater for women who are not migrants because such options often involve family enterprises that are more likely to be available if one has not moved away from one's family. The latter may be due to the dominance of domestic work as an entry point for female immigrants into towns and cities and the central metropolis.

The effect of the other variables on the probability of selection into each of the three sectors varies in some interesting ways. Having children under 5 significantly selects women out of the domestic sector, in which on-the-job child care is rarely possible and hours away from home are often long (at times including most nights). Only for this sector, incidentally, does the presence of home child-care options significantly increase participation. The coefficient estimate of having small children also is negative for the formal sector (in which on-the-job child care is rarely possible), although not significantly so. In sharp contrast, the coefficient estimate of having children under 5 is significantly positive for the informal sector--presumably because the presence of small children increases the need for the woman's labor force participation and in the informal sector on-the-job child care is quite possible.

The magnitude of "other income" significantly selects out of all three sectors and into nonparticipation, but selects particularly strongly out of the domestic sector. Being single (i.e., never married) or having

previously cohabited increases the probability of formal or domestic sector participation (somewhat more the latter) as opposed to nonparticipation or work in the informal sector. These marital status coefficient estimates probably partly reflect the availability of other income, but also the differential opportunity costs, in terms of household production, of working in the various sectors, and differential tastes for work and careers among women with different marital status. The only significant coefficients for any of our more direct representations of factors affecting work norms, however, are two positive effects; the female raiser having worked affects selection into the informal sector, and population size affects selection into the domestic sector. The latter may reflect the concentration of domestic options in the more urban areas rather than the effect of urbanization on norms.

Columns 5, 6, and 7 of Table 3 present regression estimates of the ln earnings functions with control for double selectivity for the three sectors. An F test once again indicates that these three columns differ significantly from the overall relation in column 1 of the same table. The overall formulation is much more consistent with ln earnings variations in the formal than in the other two sectors.

The returns to the standard human capital variables in terms of earnings are much higher in the formal sector than in the other two sectors. Under Mincerian assumptions, the returns in the form of earnings to schooling are 15.2 percent per year in the formal sector, 8.4 percent in the informal sector, and not significantly different from zero in

the domestic sector. The returns to work experience are almost twice as high in the formal as in the domestic sector (with a peak after 17 years in the formal and after 15 years in the domestic), but insignificantly nonzero in the informal sector.

In the extended set of human capital variables, only the estimates of returns to nutritional status in the informal sector are significantly nonzero at the 5 percent level. For participants in this sector their nutritional state is low enough to show Liebensteinian (1957) increases in productivity and ln earnings that are associated with better nutrition. For the other two sectors, the nutritional states tend to be high enough that there is not a significantly positive return. For the domestic sector, in fact, the coefficient estimate is significantly negative at the 10 percent level, probably due to our undervaluation of food received in kind as part of the earnings in this sector. The only other coefficient estimate that is significantly nonzero at the 10 percent level in this group is the negative one for days ill in the informal sector. Although a poor health state does not significantly deter one from participating in this sector, there is some suggestion that it reduces earnings more in the informal sector, in which earnings are more closely tied to effort than in the other two sectors.

The coefficient estimates of the report inclination are significantly nonzero (but of opposite sign) for the formal and domestic sector. For the work inclination, only the one for the domestic sector is significantly nonzero. At least one form of double selectivity may be important, therefore, in two of the three sectors.

5. GEOGRAPHICAL AND SECTORAL DISAGGREGATION

The patterns of estimates which we have discussed in the previous two sections suggest that both geographical and sectoral segmentation of labor markets may be important. We now consider segmentation by both factors at once into eight subsamples.[21] Table 5 gives the resulting sample sizes for the ln earnings estimates, which range from 45 for domestics in cities and towns to 322 for the formal sector in the central metropolis Table 6 gives the mean half-monthly earnings in cordobas, which range from 103 to 405 in the same two sectors.

Table 4 indicates the means for the distributions of our human capital variables. Mean years of schooling range from 1.4 for the rural informal sector to 7.9 for the town and cities formal sector. Mean work experience ranges from 6.7 years for the town and cities domestic sector to 11.7 for the town and cities informal sector. Mean caloric intakes range from 53 percent of international standards for rural, informal sector workers to 79 percent for the towns and cities formal and domestic sectors. Mean days ill range from 1.9 for the towns and cities domestic sector to 7.1 for the central metropolitan informal worker sector. The mean percentage of those who never migrated ranges from 16 in the central metropolitan domestic sector to 63 for the town and cities formal sector. Thus the earnings outcomes and the distributions of human capital vary substantially across the eight regional and sectoral subsamples.

The last eight columns in Table 1 give the estimated probits for labor force participation in these eight subsamples. These differ significantly from the overall probit and from the regional and sectoral aggregates.

We follow the pattern of the previous two sections by discussing first the human capital variables and then turning to the others. The sectoral disaggregation within regions leads to a different understanding of the role of schooling than do the overall and regional aggregates in columns 1-4, which have positive estimates for the coefficient of schooling. In the central metropolis and in towns and cities, schooling selects among the sectors in much the same was as at the sectoral level of aggregation in rows 4-6: as schooling increases from very low levels, the probability shifts from being in the domestic sector, to being in the informal sector, to being a nonparticipant, to being in the formal sector. In the rural areas more schooling selects into the formal sector as opposed to informal sector or nonparticipation.

Work experience has a significant quadratic effect on participation in all of the subsamples except for town and cities domestics. The magnitudes of this effect are larger for the town and cities formal and informal sectors (particularly the latter) and for the same sectors in the central metropolitan and rural areas, and are smallest among the significant cases for central metropolitan domestics. Within the central metropolitan area, the peak impact of experience occurs with more years as one moves from the domestic to the informal to the formal sector, but the same pattern does not prevail elsewhere. All in all, serial correlation in labor force experience appears to be strong generally for the nondomestic sectors, particularly in the towns and cities.

Caloric intake has a significant association at the 5 percent level with labor force participation only in the two domestic sectors, a result which is quite obscured at the overall or regional level of aggregation in columns 1-4. This association, once again, probably reflects reverse causality. At the 10 percent lvel of significance, there also is a suggestion of a positive effect of caloric intake on participation in the other sectors in the central metropolis, and in the informal sector in rural areas, but that effect is not reflected in towns and cities, which have higher mean caloric intake. Once again this pattern may be due to a threshold effect of nutrition on participation.

The regional-sectoral estimates for days ill and never migrated also reflect the sectoral aggregation of columns 5-7 much more directly than the regional aggregation of columns 2-4. The only significantly nonzero coefficient estimate for days ill, even at the 10 percent level, is the one for towns and cities formal sector participation, which apparently underlies the significant negative effect of this variable on overall formal sector participation in column 5. For reasons that we have discussed in the previous section, "never migrated" has significantly positive effects on participation in the informal sectors in towns and cities and the central metropolis (but not in this sector in rural areas) and strong negative effects on participation in the domestic sector.

We turn now to the variables related to home child care and to other sources of family income. The presence of small children lessens labor force participation unless offset by home child care only in the central metropolitan formal and domestic sectors (and, at the 10 percent level of significance, in the town and cities domestic sector). Home child care does not effect participation in the central metropolitan

informal sector, probably because of the possibility of on-the-job child care in this case. The more aggregate estimates in columns 1-7 tend to obscure this disaggregate pattern.

The quantity of other income generally has a negative impact on participation (once the added term with the agricultural dummy is incorporated for the rural sector), but one that is significantly nonzero only for the central metropolitan formal and domestic participation and for the towns and cities informal and domestic participation. This effect is significantly reinforced by the absence of a companion, except in the informal sector in the central metropolis and in towns and cities.

For the variables pertaining to norms, the more aggregate relations again may obscure the underlying patterns. For example, underlying the significance of the female raiser having participated in the labor force, which can be seen in the overall estimate in column 1, in the central metropolitan estimate of column 2, and in the informal estimates of column 6, is a coefficient estimate for participation that is significant in the disaggregated estimates only in the informal sector both in the central metropolis and in towns and cities. This shows a weaker intergenerational norm effect than the more aggregate estimates suggest. Similarly, population has no significant effect on participation at this level of disaggregation, despite some suggestions of significance at more aggregate levels.

The last eight columns in Table 3 give estimates of the ln earnings functions with control for double selectivity for the eight regional-sectoral subsamples. F tests indicate that these differ significantly

from the more aggregate overall, regional, and sectoral estimates shown in columns 1-7 of the same table. They are most consistent with variations in ln earnings for formal sectors in the central metropolis and cities and towns and least consistent (and, in fact, not significantly so) for domestics in towns and cities.

The estimated returns to schooling in terms of earnings are significantly nonzero only for half of these eight subsamples: quite high levels of 19.9 percent per year for the formal sector in the central metropolis and of 12.9 percent for the formal sector in towns and cities, and more moderate rates of 7.8 and 6.6 percent for the informal sector in these same two areas. The returns to work experience in terms of earnings have significant effects only for the central metropolitan formal and domestic sector (and much larger for the former than for the latter), although the estimates for the formal sector in towns and cities are significantly nonzero at the 10 percent level. In regard to returns to the traditional human capital variables, therefore, the labor markets appear to be quite different across both regions and sectors.

The estimated returns in terms of earnings to our extended set of human capital variables also reflects considerable differences across labor markets. They are significant for nutritional status for the informal sectors in each region: in Table 4 that sector shows the lowest average caloric intakes among labor force participants in each region. This pattern may reflect a threshold effect, although the significance of additional nutrition for the metropolitan formal

sector is not easily interpreted in such a manner. There are no significant estimates of health effects, despite the significant coefficient estimate of days ill in the overall relation in column 1. "Never migrated" has a significantly positive coefficient estimate for the central metropolitan formal sector and negative ones for the formal sector in towns and cities and for the informal sector in rural areas. In the central metropolitan formal sector, therefore, rents apparently accrue to long-established contacts and modern work attitudes and habits, and there are no general incentives to migrate elsewhere in the country. In the other two cases, in contrast, selectivity in regard to migration probably has left the less talented behind.

The work inclination has significantly nonzero coefficient estimates only for the formal and domestic sectors in the central metropolis. The report inclination has significantly nonzero coefficient estimates only for the formal sectors in the central metropolis and in towns and cities. Possible selection biases thus appear to be more limited than the more aggregate estimates might suggest.

6. CONCLUSIONS

We have explored the existence of differential returns to human capital across geographical and sectoral labor markets among women in a developing economy. We have used a more satisfactory data set, and we have a more illuminating model of labor force participation and

earnings determination under double selectivity than those used heretofore. This section briefly summarizes our empirical results, which point to seven major conclusions.

1. Selectivity terms tend to be significant for more organized sectors in the more urban areas. In addition to selectivity due to labor force participation, selectivity in reporting earnings also may be a relevant factor. Selectivity is not, however, a major problem in that the substantive interpretations of the point estimates of interest are unaltered when the selectivity controls are excluded.

2. Disaggregation into regions and sectors is important for our sample. Labor force participation and ln earnings relations differ significantly among regions and among sectors. Therefore, labor market integration may increase overall income (although we have no estimate of the cost of such integration), but see point 7, below.

3. The returns to human capital investments include not only higher marginal productivities and earnings in certain regions and sectors, but higher probabilities of being in sectors (and possibly regions, although we do not explore migration determinants in this paper) with higher marginal returns to such investments. Schooling, for example, has a strong impact on selection into the formal sector as well as a high marginal return in that sector.

4. Overall estimates, and even regional and sectoral estimates, may be misleading in regard to the impact of human capital investments. For example, overall estimates suggest that the marginal returns to

schooling are quadratic in the ln earnings function, a pattern which is not supported in the disaggregate estimates. Regional estimates, for another example, miss the highly differential impact across sectors on participation and on ln earnings of schooling, experience, nutrition status, and migratory status. Disaggregation to the regional-sectoral level is preferable, but aggregation across regions probably is somewhat less misleading than is aggregation across sectors.

5. The marginal returns to the standard human capital variables of schooling and work experience are particularly large in the formal sectors of the central metropolis and, to a lesser extent, of towns and cities. Marginal returns to schooling are significant, but smaller, in the informal sectors in these regions; and marginal returns to experience are significant, but smaller, in the central metropolitan domestic sector. For other region-sector combinations, the marginal returns are insignificant.

6. The marginal returns to our extended set of human capital variables are also significant for some particular regional-sectoral combinations. For example, the marginal returns to nutrition in terms of earnings appear to have a threshold effect, with relatively high returns for the relatively malnourished informal sector participants.[22] There may also be a significant effect of migratory status in certain sector-region combinations. On the other hand we find evidence of a significant health effect on earnings only in our overall estimates, and not for the more disaggregated ones.[23]

Our results nevertheless suggest that a broader definition of human capital, encompassing more than the standard schooling and work experience variables, may be important in analyses and in efficiently designing policy, at least for poorer target groups.

7. There are, however important differences between marginal and average returns.[24] Despite the generally higher marginal returns to the standard human capital variables in the more "modern" regions and sectors (i.e., more urban, more formal), because of the pattern of constants the average earnings are not necessarily higher in the more modern sectors. For example, the estimates in columns 2-4 in Table 3 imply that, at the point of overall sample means, estimated earnings in the rural area are higher than in other towns and cities, although both are lower than are those for the central metropolis. Similarly, the estimates in columns 5-7 imply that, at the point of overall sample means, estimated earnings are highest in the informal sector and second in the formal sector. Therefore, only for those with relatively high stocks of these human capital variables do the more modern sectors tend to be preferable. And even in those cases there may be relatively high nonpecuniary returns elsewhere, such as the possibility of on-the-job child care in the informal sector. It would thus be incorrect to conclude that most women would be better off in the more modern regions and sectors, even though those with high schooling and experience are more likely to be.[25]

Table 1

Probits for Labor Force Participation or Work Inclination of Nicaraguan Women

		Levels of Aggregation													
		Regions			Sectors			Central Metropolis			Towns & Cities			Rural	
Variables	Overall 1	Central Metropolis 2	Towns & Cities 3	Rural 4	Formal 5	Informal 6	Domestic 7	Formal 8	Informal 9	Domestic 10	Formal 11	Informal 12	Domestic 13	Formal 14	Informal 15
Constant	-2.21	-1.82	-2.12	-.206	-2.88	-1.88	-2.90	-2.86	-1.56	-.853	-3.22	-1.45	-3.11	-2.64	-2.04
	(15.2)	(9.4)	(7.7)	(8.3)	(14.6)	(12.7)	(8.8)	(12.6)	(7.6)	(2.7)	(9.0)	(5.2)	(4.8)	(7.1)	(7.9)
Human Capital															
Schooling	.067	.054	.074	.052	.171	-.046	-.098	.191	-.079	.111	.173	-.045	-.107	.107	-.003
	(8.2)	(4.4)	(5.3)	(2.0)	(17.9)	(5.3)	(5.6)	(13.5)	(5.9)	(5.3)	(10.9)	(3.1)	(3.1)	(3.1)	(0.1)
Experience	.195	.196	.238	.131	.134	.135	.031	.137	.112	.059	.145	.182	.022	.115	.102
	(21.0)	(13.2)	(14.8)	(6.6)	(11.5)	(14.2)	(1.6)	(7.9)	(7.3)	(2.4)	(7.5)	(11.3)	(0.6)	(3.8)	(4.9)
Experience^2	-.005	-.005	-.006	-.003	-.004	-.003	-.002	-.004	.002	-.003	-.004	-.005	-.001	-.003	-.003
	(13.1)	(7.7)	(9.8)	(4.2)	(7.9)	(8.6)	(2.0)	(4.9)	(3.9)	(2.7)	(5.7)	(7.5)	(0.4)	(2.6)	(3.1)
Calories	.958	1.05	.546	-.624	.235	.645	1.88	.483	.436	.844	.360	.002	2.48	.268	.618
	(6.6)	(4.0)	(2.0)	(2.0)	(1.3)	(4.3)	(6.3)	(1.7)	(1.6)	(2.0)	(1.1)	(0.0)	(4.1)	(0.6)	(1.9)
Days Ill	-.002	-.002	-.005	-.003	-.005	.002	-.002	-.004	.001	.000	-.010	.005	-.023	-.004	.005
	(0.8)	(0.8)	(1.2)	(0.6)	(2.1)	(1.4)	(0.5)	(1.3)	(0.4)	(0.0)	(1.8)	(1.2)	(1.5)	(0.5)	(0.9)
Never Migrated	.031	.010	.082	-.079	.055	.192	-.749	.089	.242	-.727	.131	1.85	-.964	-.200	.004
	(0.6)	(0.1)	(1.0)	(0.8)	(0.9)	(3.8)	(6.9)	(1.1)	(3.0)	(5.4)	(1.3)	(2.1)	(4.6)	(1.2)	(0.0)
Child Care															
Children under 5	-.126	-.337	-.032	.054	-.118	.070	-.852	-.303	.113	-1.23	-.051	.127	-.430	-.028	.062
	(2.1)	(3.2)	(0.3)	(0.4)	(1.5)	(10.7)	(5.5)	(2.3)	(1.0)	(4.5)	(0.4)	(1.2)	(1.8)	(0.1)	(0.5)
Home Child Care	.137	.335	.012	.106	.092	.018	.671	.226	-.010	1.07	.012	-0.56	.014	.168	.066
	(2.2)	(3.4)	(0.1)	(0.8)	(1.2)	(0.3)	(4.1)	(1.8)	(0.1)	(3.9)	(0.1)	(0.5)	(0.0)	(0.9)	(0.5)
Marital Status															
Single	1.79	2.01	1.29	5.17	.691	-.093	1.16	.710	-.327	.902	.572	-.227	.157	.757	.186
	(11.2)	(8.3)	(5.5)	(0.5)	(5.8)	(0.7)	(7.0)	(4.5)	(1.7)	(4.3)	(2.8)	(1.1)	(4.5)	(1.4)	(3.6)
Previously Cohabited	.285	.221	.230	.407	.296	.038	.365	.237	-.028	.160	.325	-.124	.822	.331	.320
	(5.5)	(2.8)	(2.4)	(3.9)	(4.5)	(0.7)	(3.3)	(2.5)	(0.3)	(1.2)	(2.8)	(1.3)	(3.0)	(2.1)	(2.9)
Nonwage Income															
Other Income	.211	-.220	-.304	-.543	-.089	-.103	-1.27	-.116	-.075	-1.27	-.125	-.208	-1.80	.448	-.271
	(5.2)	(4.2)	(4.1)	(0.3)	(2.1)	(2.2)	(6.9)	(2.1)	(1.1)	(5.9)	(1.6)	(2.5)	(4.2)	(1.8)	(1.4)
Agric. Dummy × Other Income	.042			-.046	-.011	-.103	.934								
	(0.5)			(0.2)	(0.1)	(2.2)	(3.2)								
Norms for Working Women															
Female Raiser Not Housewife	.111	.095	.117	.087	-.042	-.192	-.012	-.076	.254	-.092	-.098	.210	.050	.127	.048
	(2.3)	(12.9)	(1.3)	(0.8)	(0.7)	(3.8)	(0.1)	(0.9)	(3.2)	(0.8)	(1.0)	(2.4)	(0.3)	(0.8)	(0.4)
Population	.004		.035	.000	.000	.000	-.012				.012	.023	.026	.011	-.002
	(1.8)		(2.4)	(0.0)	(0.1)	(0.2)	(2.5)				(0.7)	(1.5)	(0.8)	(0.6)	(0.2)
Proportion Labor Force Female	.247		.210	.346	.603	-.113	1.61				1.06	-.535	1.37	-.235	.503
	(0.5)		(0.3)	(0.5)	(0.9)	(0.2)	(1.4)				(1.2)	(0.7)	(0.9)	(0.2)	(0.7)
-2.0 Log Likelihood Ratio	1440	628	531	145	832	539	534	422	228	294	263	288	192	53	87
S_2 and S_3	1533	770	565	198	588	767	178	333	311	126	203	310	52	52	146
S_1, S_2, and S_3	3773	1586	1241	946	3773	3773	3773	1586	1586	1586	1241	1241	1241	946	946

Note: Numbers in parentheses are the absolute values of the ratios of the maximum likelihood point estimates to the asymptotic standard errors. Chi square tests indicate that all the relations are significantly nonzero at the 0.5 percent level. See Glossary for definition of variables and symbols.

Table 2

Probits for Earnings Report Inclination of Nicaraguan Women in Labor Force

		Levels of Aggregation														
		Regions			Sectors			Central Metropolis			Towns & Cities			Rural	
ariables	Overall 1	Central Metropolis 2	Towns & Cities 3	Rural 4	Formal 5	Informal 6	Domestic 7	Formal 8	Informal 9	Domestic 10	Formal 11	Informal 12	Domestic 13	Formal 14	Informal 15
onstant	.914	.917	.505	2.43	2.36	.969	-.514	3.22	.584	-3.12	5.44	.444	2.88	-4.28	3.36
	(2.1)	(1.6)	(0.7)	(2.0)	(1.9)	(1.8)	(0.3)	(2.3)	(0.7)	(1.6)	(0.1)	(0.4)	(0.0)	(0.0)	(2.4)
man Capital															
Schooling	.021	.008	.091	-.174	.040	-.058	.075	.033	-.061	.029	.210	.006	-2.18	.392	-.286
	(1.3)	(0.4)	(3.1)	(2.3)	(1.0)	(2.2)	(1.1)	(0.6)	(1.5)	(0.3)	(1.8)	(0.1)	(0.0)	(0.0)	(2.7)
Experience	.020	.049	.024	-.018	.003	.156	1.6	.018	.059	-.008	-.066	.070	-11.2	.147	-.037
	(1.0)	(1.5)	(0.7)	(0.2)	(0.1)	(1.8)	(1.6)	(0.2)	(1.4)	(0.1)	(0.4)	(1.8)	(0.1)	(0.0)	(0.4)
Experience^2	-.001	-.002	-.001	.000	-.001	-.002	.008	-.001	-.002	.003	.000	-.002	.352	-.017	.001
	(1.0)	(1.5)	(0.6)	(0.1)	(0.3)	(1.7)	(1.5)	(0.2)	(1.5)	(0.5)	(0.1)	(1.5)	(0.0)	(0.0)	(0.3)
Calories	.499	1.25	.077	1.05	.946	.550	.965	.671	1.11	6.45	1.33	.257	15.6	10.1	1.25
	(1.6)	(2.3)	(0.1)	(0.9)	(1.3)	(1.3)	(0.9)	(0.7)	(1.4)	(2.8)	(0.7)	(0.4)	(0.0)	(0.0)	(0.9)
Days Ill	.006	.008	.012	-.012	.002	.007	.054	-.005	.010	.127	.049	.013	1.26	-.200	-.013
	(1.1)	(1.0)	(1.0)	(0.9)	(0.1)	(1.1)	(1.1)	(0.3)	(0.9)	(1.2)	(0.7)	(1.0)	(0.0)	(0.0)	(0.9)
ild Care															
Children under 5	.403	.651	.354	.270	.588	.431	-.113	2.74	.704	2.70	.417	.480	-13.1	4.91	-.147
	(2.7)	(2.0)	(1.7)	(0.7)	(1.3)	(2.4)	(0.2)	(0.2)	(1.8)	(0.1)	(0.5)	(1.8)	(0.0)	(0.0)	(0.3)
Home Child Care	-.205	-.464	.010	-.209	-.343	-.203	.216	-2.44	-.521	-2.43	-.633	.125	19.9	1.64	-.103
	(1.3)	(1.4)	(0.0)	(0.5)	(0.7)	(1.1)	(0.3)	(0.1)	(1.4)	(0.1)	(0.7)	(0.4)	(0.0)	(0.0)	(0.2)
rital Status															
Single	.064	.096	.021	3.33	.567	.014	.462	-.952	.006	2.07	2.42	.084	-23.3	1.18	3.46
	(0.3)	(0.3)	(0.1)	(0.1)	(1.3)	(0.0)	(0.8)	(1.6)	(0.0)	(1.9)	(0.0)	(0.2)	(0.0)	(0.0)	(0.2)
Previously Cohabited	.097	.048	.035	-.474	.132	.062	.222	.328	-.120	.383	.150	.431	-32.7	-2.53	-.531
	(0.8)	(0.3)	(1.5)	(1.3)	(0.4)	(0.4)	(0.5)	(0.7)	(0.5)	(0.6)	(0.2)	(1.8)	(0.0)	(0.0)	(1.2)
nwage Income															
Other Income	.046	.118	-.110	.811	-.108	.217	-.499	.049	.215	1.25	-.589	.205	31.9	5.72	.365
	(0.5)	(0.9)	(0.7)	(0.9)	(0.9)	(1.4)	(0.7)	(0.3)	(1.0)	(1.1)	(1.7)	(0.8)	(0.0)	(0.0)	(0.4)
Agric. Dummy	-.037			-.565	.504	-.239								-.804	-.225
× Other Income	(0.2)			(0.6)	(0.1)	(0.7)								(0.0)	(0.2)
rms															
Population	.004		-.008	-.001	.002	.005	.015				-.124	-.031	5.51	.461	-.015
	(0.8)		(0.3)	(0.0)	(0.1)	(0.7)	(0.8)				(1.2)	(0.9)	(0.0)	(0.0)	(0.4)
Proportion of Labor	-.165		-.513	.508	-.149	-.568	.623				-2.67	-.945	-2.49	2.89	1.91
Force Female	(0.1)		(0.3)	(0.2)	(0.0)	(0.4)	(0.1)				(0.4)	(0.4)	(0.0)	(0.0)	(0.6)
ner Variables															
Age	.007	-.014	-.001	-.026	-.032	-.009	.019	-.061	.005	.015	-.004	-.011	2.10	.182	.049
	(0.8)	(1.0)	(0.1)	(1.0)	(0.0)	(0.8)	(0.6)	(1.7)	(0.3)	(0.0)	(0.0)	(0.6)	(0.0)	(0.0)	(1.6)
Number of Siblings	.002	-.060	.088	.011	.010	-.003	-.013	-.038	-.079	-.143	.181	.089	2.77	-.129	.023
	(0.1)	(2.5)	(2.7)	(0.3)	(0.2)	(0.0)	(0.3)	(0.7)	(2.2)	(1.9)	(1.2)	(2.2)	(0.0)	(0.0)	(0.4)
Both Raisers Pres.	.044	.159	-.299	-.543	-.470	.052	.263	.015	.109	.812	-4.55	-.078	-23.9	-4.56	-.561
n Childhood	(0.4)	(1.0)	(1.6)	(1.4)	(1.6)	(0.4)	(0.8)	(0.0)	(0.4)	(1.6)	(1.2)	(0.3)	(0.1)	(0.0)	(1.3)
0 Log Likelihood	22.2	21.8	25.5	16.1	19.4	20.4	14.3	15.2	17.5	19.8	18.9	21.3	41.1	9.9	16.8
atio	25	10	5	50	25	25	50	50	25	10	25	25	0.5	90	50
S_3	1411	725	522	185	572	697	163	323	284	118	198	279	45	51	134
S_2 and S_3	1533	770	565	198	588	767	178	333	311	126	203	310	52	52	146

e: Numbers in parentheses are the absolute values of the ratios of the maximum likelihood point estimates to the asymptotic standard errors. Numbers beneath 0 log likelihood ratio give the significance level of the overall relation according to a chi square test. See Glossary for definition of variables and sym- s.

Table 3

Various ln Earnings Functions for Nicaraguan Women Reporting Earnings (Regression Estimates)

	Levels of Aggregation														
		Regions			Sectors			Central Metropolis Regions and Sectors			Towns & Cities			Rural	
Variables	Overall 1	Central Metropolis 2	Towns & Cities 3	Rural 4	Formal 5	Informal 6	Domestic 7	Formal 8	Informal 9	Domestic 10	Formal 11	Informal 12	Domestic 13	Formal 14	Informal 15
Constant	4.23	3.57	3.41	4.29	3.87	4.69	4.98	2.46	3.98	4.58	4.65	3.92	5.13	5.76	4.27
	(21.6)	(13.5)	(11.3)	(9.2)	(11.1)	(6.2)	(23.3)	(5.0)	(4.8)	(14.5)	(7.5)	(4.3)	(11.0)	(3.8)	(6.5)
Human Capital															
Schooling	.120	.121	.134	.053	.152	.084	-.013	.199	.078	-.004	.129	.066	-.011	.050	.058
	(17.6)	(4.9)	(12.0)	(1.7)	(9.5)	(4.3)	(0.8)	(8.7)	(2.3)	(0.2)	(4.8)	(2.8)	(0.3)	(1.1)	(1.1)
Experience	.054	.088	.077	.001	.080	-.007	.048	.123	.044	.036	.051	.006	-.044	-.027	-.014
	(4.7)	(5.7)	(3.7)	(0.0)	(5.0)	(0.2)	(2.8)	(5.8)	(1.0)	(2.1)	(1.8)	(0.1)	(0.9)	(0.4)	(0.4)
Experience^2	-.001	-.002	-.002	.001	-.002	.001	-.002	-.003	-.001	-.001	-.002	.000	.002	-.001	.001
	(2.3)	(3.7)	(2.6)	(0.5)	(4.3)	(0.7)	(2.3)	(4.4)	(0.8)	(1.2)	(1.6)	(0.2)	(1.0)	(0.3)	(0.7)
Calories	.386	.904	.722	.888	.216	.939	-.455	.642	1.60	-.061	.228	1.38	-.509	-.414	1.13
	(3.0)	(4.2)	(3.2)	(2.1)	(1.4)	(3.7)	(1.8)	(3.0)	(3.9)	(0.1)	(0.7)	(4.1)	(1.0)	(0.6)	(2.1)
Days Ill	-.004	-.003	-.005	-.008	-.001	-.005	-.001	-.003	-.003	.000	-.005	-.005	.014	.011	-.010
	(2.3)	(1.5)	(1.4)	(1.2)	(0.4)	(1.9)	(0.2)	(1.2)	(1.0)	(0.1)	(1.0)	(1.0)	(0.8)	(0.8)	(2.1)
Never Migrated	.028	.212	-.014	-.300	-.042	-.031	-.142	.181	.176	-.228	-.223	.007	.182	-.166	-.343
	0.7	3.8	0.2	2.3	0.8	0.3	1.3	2.6	1.3	1.8	2.3	0.1	0.8	0.5	2.1
Double Selectivity															
Work Inclination	.189	.276	.338	.124	.203	-.140	.153	.739	-.170	.225	-.164	-.019	.013	-.358	.121
	(2.8)	(3.1)	(2.4)	(0.6)	(1.6)	(0.4)	(2.1)	(4.3)	(0.4)	(2.9)	(0.7)	(0.0)	(0.1)	(0.6)	(0.4)
Report Inclination	-.940	.369	.358	.327	2.39	-.875	-1.03	2.06	.089	-.454	1.14	-.022	-.24812	.000	-.256
	(1.8)	(0.7)	(0.8)	(0.5)	(4.7)	(1.5)	(2.6)	(3.8)	(0.1)	(1.7)	(2.3)	(0.0)	(0.6)	(0.0)	(0.4)
$\bar{R}^2$ SE	.29	.32	.31	.07	.41	.12	.11	.35	.15	.13	.50	.11	-.10	.04	.06
	.776	.729	.778	.824	.633	.873	.426	.610	.845	.403	.599	.874	.461	(.723)	(.863)
RSS S_3	844	378	302	116	225	511	28.0	116	195	17.7	67.2	198	7.7	22.0	89.4
	1411	722	509	180	282	679	163	322	282	118	196	268	45	51	129

Note: Numbers in parentheses are the absolute values of the t-statistics; a value equal to or greater than 2.0 indicates significance at the 5 percent level. F tests indicate that all of the overall relations are significantly nonzero at the 5 percent level, except domestics in towns and cities (significant only at 85 percent level) and the rural formal sector (significant at 30 percent level). See Glossary for definition of variables and symbols.

Table 4

Means of Distribution of Human Capital Variables among Labor Force Participation Subsamples (Nicaraguan Women)

Variable	Region	Participate and Report Earnings				Do not Participate and/or Do Not Report	Total
		Formal Sector	Informal Sector	Domestic Sector	All Sectors		
Schooling (years)	Central Metropolis	7.8	3.7	3.7	5.5	5.0	5.2
	Towns and Cities	7.9	3.9	3.2	5.4	4.6	4.9
	Rural	2.4	1.4	--	1.7	1.4	1.6
	All Regions	7.3	3.3	3.5	5.0	3.7	4.2
Work Experience (years)	Central Metropolis	8.9	10.8	7.8	9.5	4.0	6.5
	Towns and Cities	8.9	11.7	6.7	10.2	4.1	6.6
	Rural	9.2	8.7	--	8.8	4.4	5.3
	All Regions	8.9	10.8	7.5	9.6	4.2	6.2
Calories (percentage of international standards)	Central Metropolis	63	60	61	62	58	60
	Towns and Cities	79	73	79	76	73	74
	Rural	56	53	--	54	50	51
	All Regions	68	64	66	66	60	62
Days Ill (since last Christmas)	Central Metropolis	4.3	7.1	4.8	5.4	5.4	5.4
	Towns and Cities	3.1	4.6	1.9	3.8	3.0	3.3
	Rural	2.9	3.9	--	3.6	3.2	3.3
	All Regions	3.8	5.5	4.0	4.6	4.0	4.2
Never Migrated (percentage)	Central Metropolis	51	47	16	43	46	45
	Towns and Cities	63	58	20	56	50	53
	Rural	27	39	--	36	39	38
	All Regions	50	50	17	47	45	46

Table 5

Distribution of All Nicaraguan Women in Sample by Work Status, Regions, and Sectors

Region	Participate and Report Earnings				Do not Participate and/or Do Not Report	Total
	Formal Sector	Informal Sector	Domestic Sector	All Sectors		
Central Metropolis	332	282	118	722	864	1586
Towns and Cities	196	268	45	509	732	1241
Rural	51	129	0	180	766	946
All Regions	569	679	163	1411	2362	3773

Table 6

Mean Earnings Reported by Nicaraguan Women in Labor Force (in cordobas per half month)

Region	Formal Sector	Informal Sector	Domestic Sector	All Sectors
Central Metropolis	405	226	140	275
Towns and Cities	337	192	103	226
Rural	171	136	--	145
All Regions	358	192	128	236

Glossary

Schooling is measured by the highest grade completed.

Experience is actual labor force experience in years (not age minus years of school minus 6, nor related calculations).

Calories are percentage of international standard satisfied in previous week's diet.

Days ill is number of days missed from work or other similar activity since the previous Christmas.

Never migrated is a dummy variable, with a value of 1 if woman has always lived in the same area; 0 if not.

Children under 5 is a dummy variable, with a value of 1 if woman has children under 5 years of age; 0 if not.

Home child care is a dummy variable, with a value of 1 if there are other adults or older children in the household; 0 if not.

Single is a dummy variable, with a value of 1 if the woman has never been companioned; 0 if not.

Previously cohabited is a dummy variable, with a value of 1 if the woman formerly cohabited; 0 if not.

Other income includes earnings from other household members who are working, plus other nonearned income including transfers.

Agricultural dummy is an added term to capture income from own farm.

Female raiser not housewife is a dummy variable, with a value of 1 if the woman's female raiser worked outside the home; 0 if not.

Population is total population of the municipality in which the woman resides.

Proportion labor force female is percentage women aged 20 to 39 in labor force in geographical area in which woman resides.

Both raisers present in childhood is a dummy variable, with a value of 1 if both a female and a male raiser were present during woman's childhood; 0 if not.

For selectivity variables (Table 3), see discussion in Section 2.

S_1 is the subsample not in labor force.

S_2 is the subsample in labor force and not reporting earnings.

S_3 is the subsample in labor force and reporting earnings.

$\bar{R}^2$ is the coefficient of determination corrected for degrees of freedom.

SE is the standard error of the regression.

RSS is the residual sum of squares.

Notes

[1]There is a large literature on pluralism in developing countries, much of which follows (but some of which precedes) the seminal work by Lewis (1954). There is a growing literature on human capital in developing countries, some references to which are given in note 3 below and in other studies in this project (Behrman and Wolfe, 1979, 1980a-d; Behrman, Wolfe, and Blau, 1980; Behrman, Wolfe, et al., 1980; Behrman, Wolfe, and Tunali, 1980; Blau, 1977, 1980). Boserup (1970) is an early and quite well known general summary of the role of women in development; Burvinic (1976) provides a recent bibliography. See also our other studies in this project (those cited above, and Wolfe and Behrman, 1980a-d; Wolfe, Behrman, and Blau, 1980; Wolfe, Behrman, and Flesher, 1979).

[2]Earlier studies touch on some of these issues, but none of them have all of these characteristics. See for example, Behrman, Wolfe, and Tunali (1980), Chiswick (1977), Desai and Edison (1979), Psacharopoulos (1977), Rosenzweig (1978), and Ryan (1980).

[3]For more details concerning this data set, see Behrman, Wolfe, et al. (1980), Wolfe, Behrman, et al. (1979b), and Wolfe, Behrman, and Blau (1980).

[4]Our rationale for including migratory status is described in Section 3, below.

[5]Our data do not permit us to distinguish between these reasons for not reporting earnings in all cases. If they did, we could consider the procedure as a triple-selectivity model.

[6]We also are assuming that our observable variables capture all dimensions of the human capital variables that also enter into the work inclination selection rule. That is, our assumption of independence between the disturbance terms in equations (1) and (2) precludes the possibility of common unobserved human capital (or background or whatever) variables in U_{1i} and U_{2i}. In light of results which emphasize the importance of unobserved ability, motivation, and family background variables for more developed economies (Behrman, Hrubec, et al., 1980), this may be a strong assumption indeed. In other work in progress (Behrman and Wolfe, 1980f) we are exploring it for our sample.

[7]We thank Peter Linneman for suggesting that these alternatives might be of interest to explore.

[8]There is one exception. For the domestic sector, if both linear and quadratic schooling terms are included, they have respective coefficients of 0.75 and -0.010, respectively, but only the latter is significantly nonzero.

[9]In contrast to most studies, our experience variable is actual recalled work experience, not some artifact such as age minus years of schooling minus six (which would be particularly unsatisfactory for women given their low labor force participation rates). Studies for the United States indicate that for women who do not have continuous labor force experience, the actual experience is much more important than the potential experience (Mincer and Polachek, 1974).

[10]Of course there may be a simultaneity problem with these variables in that nutrition and health status may be dependent upon earnings. We have explored this question in Wolfe and Behrman (1980b) and Wolfe, Behrman, et al. (1979a) and have found a very limited impact of total household income (of which the woman's earnings is a small part on the average) on nutrition inputs and no significant impact on her health. Therefore, with the possible exception of domestics, to whom we return below, simultaneity does not seem to be an important problem.

[11]These refer to migrants by destination. The large proportion of migrants in rural areas may be surprising to many. We explore the determinants of migration in Behrman and Wolfe (1980c).

[12]We find many other differences in distributions of socioeconomic variables across these three regions in Behrman, Wolfe, et al. (1980).

[13]Since probit estimates are nonlinear, comparisons across point estimates are straightforward only if the overall probabilities are the same for the different probits. We are making such an assumption for purposes of our comparisons across probits. That is, we are assuming that the sums of the arguments are the same in each column and then, for example, we ask what would be the relative effects of adding one more year of schooling. Under such an assumption, this comparison reduces to a comparison of the estimated coefficients of schooling across relations.

However, this is <u>not</u> the same as comparing at the point of means. If the overall probability of labor force participation is lower at the point of means in one case than in another (e.g., for rural areas as

compared to the central metropolis), one more year of schooling in the former may increase the probability of participation more than in the latter, even if the coefficient estimate of schooling is lower for the former than for the latter.

[14]There also is an effect for the central metropolis area in that population would have a significantly positive coefficient if the subsample for it were combined with the subsample for the towns and cities. However, this effect is not apparent in the subsample for the central metropolis alone, since all women in that subsample live in a city with the same population.

[15]A basic assumption underlying this test is that the errors are homoscedastic. Judging by our estimates in Table 3, this assumption probably is satisfied in this case, but may be stronger for some applications that we make below. See Maddala (1977) and Toyoda (1974).

[16]Ryan (1980) also reports no significant return to schooling for women in rural India and suggests that this reflects that returns are relatively high in rural India in nonmarket activities, such as household and own-farm production, not in the daily labor market. However, he does not test to see if schooling has a negative coefficient estimate in the probit for rural labor force participation.

[17]Of course, this point relates to the selectivity problem in analyzing migrants (Behrman and Wolfe, 1980c).

[18]Schultz (1978) emphasizes the third and possibly the first of these.

[19]We have dropped from our sample 11 women in the domestic sector in rural areas because they are too small a subsample for statistical analysis.

[20]See note 10, above.

[21]We have too few rural domestics for analysis (see note 19 above).

[22]If, however, we include a quadratic term in nutrition, that variable does not have significant coefficient estimates in any of our relations.

[23]At Robert Pollak's suggestion, we also added quadratic terms in "days ill" to test for nonlinearity, but the resulting coefficient estimates are not significantly nonzero.

[24]We thank Claudia Goldin for suggesting this point.

[25]This observation relates to the stronger incentives for women with greater human capital stocks to migrate to more urban areas, as frequently reported (e.g., Schultz, 1978).

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