



Rural Nonfarm Incomes in Nicaragua

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Summary. — This paper examines nonfarm incomes of rural Nicaraguan households using a nationwide survey (LSMS) from 1998. The key findings are as follows. (a) Rural nonfarm income (RNFI) constitutes 41% of rural household incomes. (b) RNFI is much more important than farm wage-labor income. (c) RNFI tends to be relatively concentrated geographically and socioeconomically, toward the rural areas of the Managua zone and the Rest-of-Pacific zone, which are denser in infrastructure and population, and toward the upper income quartile of rural households. This concentration implies high entry barriers and capital requirements for rural nonfarm activity that the poor are simply not equipped to overcome. Equipping the rural poor through training and acquisition of diverse forms of capital to have a chance at the higher return nonfarm jobs would be a major step toward helping them to share the benefits of the rural nonfarm economy. (d) Self-employment (small enterprise) income in manufactures is very minor, probably due to the ease of obtaining manufactured goods from urban industries and imports. Wage employment constitutes the bulk of RNFI (despite it receiving little attention in development programs and debate). (e) Three-quarters of RNFI is in the service sector, and only one-quarter is from manufactures; that can be contrasted with the emphasis on small manufactures enterprises in rural development programs and research. (f) Education, road access, as well as access to electricity and water were found to be important to nonfarm incomes. © 2001 Elsevier Science Ltd. All rights reserved.

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1. INTRODUCTION

Nicaragua is the second poorest country (after Haiti) in Latin America and the Caribbean. The 1998 annual report of the Nicaraguan Central Bank states that 76% of the rural population are poor. Generation of rural nonfarm employment for the poor has emerged as an important rural development policy topic, given that the demand for farm labor by commercial farms is waning over time (Baumeister, 1999).

This paper explores two questions: (a) what are patterns in rural nonfarm incomes across zones and household strata? (b) What are the determinants of individual participation in household incomes from these activities?

Prior studies of rural nonfarm incomes and employment include—Nitlapán-UCA. (1995); Renzi and Agurto (1996); Davis, Carletto, and Sil (1997), and Ruben, Rodriquez, and Cortez

(1999). Most of these studies were based on surveys that were incomplete geographically or in terms of variables on which observations were collected or analyzed. Our study is based on a multitopic survey that treats in more detail the rural incomes in Nicaragua than most prior surveys. Our data source is the second Living Standards Measurement Survey (LSMS), undertaken in 1998 by the Nicaraguan National Institute of Statistics and Census with the technical and financial support of the World Bank, United Nations Development Program, the

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We proceed as follows. Section 2 discusses data and sample characteristics. Section 3 discusses patterns in household income sources. Section 4 examines the determinants of individual participation in the nonfarm sector and of sources of rural household incomes. Section 5 concludes with policy implications.

2. DATA AND SAMPLE CHARACTERISTICS

(a) *Data*

The nationally representative sample comprised 4,209 households—2,270 urban and 1,939 rural, with 1,861 rural households after exclusion of outliers. (Seventy-eight households' observations were dropped as outliers. These included 45 households with negative total income and 33 households with total income greater than the mean plus three standard deviations, or 32,382 cordobas.) The sampling universe included all households in Nicaragua at the time of the 1995 Housing and Population Census. "Rural" was defined by the LSMS as population concentrations of less than 1,000 inhabitants per village.

Income variables were defined as following. Farm income is net income, equal to the value of all output whether sold, given away, or home consumed, less the value of farm inputs (nonhousehold labor plus nonlabor inputs). Wage employment income from any sector is calculated as gross income. Self-employment income from commerce is calculated as net inventory movement hence gross sales less operational costs. Self-employment income in other nonfarm activities is calculated as net income.

(b) *Country, zones, and household characteristics*

The rural household income per capita is US\$315 as calculated from our nationwide rural sample. (Compare that to the official GNP per capita figure of US\$400.) Nicaragua is relatively thinly populated: in 1990, Nicaragua had 15 persons/square kilometer, *vs* 22 in all developing countries, and 52 in neighboring Guatemala. It is also relatively urbanized: the share of urban population in the total population was 54.4% in 1995, *vs* 38 in Guatemala and

40.7% in Honduras. But in only 33 of 145 municipalities is the rural population in the minority. Thus urbanization is relatively concentrated in the Managua department and the rest of the Pacific region (Baumeister, 1999).

Nicaraguan farm holdings are extremely concentrated. The survey data, which do not control for land quality, show that two-thirds of the farms are small (below five manzanas of owned plus rented land, with 1 manzana equalling 0.7 ha), and they operate less than one-twentieth of the farmland nationally. Large farms (50 manzanas and above) constitute only one-tenth of all farms, but control three-quarters of farmland. Thirty-eight percent of Nicaraguan rural households are landless, based on the survey data.

Table 1 shows rural household characteristics derived from the survey data. The sample is stratified into four zones, including one zone defined administratively, the Managua zone (a department in the Pacific region), and three zones defined agroclimatically (as the three "macroregions" in Baumeister, 1999)—the Rest-of-Pacific (the Pacific Macroregion less the Managua Department), the Interior zone, and the Atlantic zone. Note that we set the Managua Department apart from the rest of the Pacific macroregion because it contains the capital city and is substantially more densely populated and better served with infrastructure. The Rest-of-Pacific zone comprises two agroecological zones. The western subzone (León and Chinandega departments) is more hot and dry than the eastern zone, and has volcanic soils. The western subzone has historically had substantial agro-export activity, mainly of sugar, peanuts, bananas, and soy. The eastern subzone has a cooler climate and produces coffee, pineapple, and vegetables. The Rest-of-Pacific zone has fertile soils that permit intensive production of annual crops. This zone also has the best infrastructure and rural markets. The Atlantic zone covers more than 30% of Nicaragua, and is mostly humid tropical forests and mangrove swamps. There are several extensive ranching and subsistence agriculture areas. Infrastructure is poor, and markets for products and land are little developed. The Interior zone (which includes the Northern and Central subzones) has the most mountainous topography, and thus the greatest erosion problems. Its infrastructure is in third rank, after the Managua and Rest-of-Pacific zones. Its agriculture includes coffee, vegetables, tobacco, and livestock.

Table 1. *Characteristics of rural households by Zone, 1998*

	All	Managua Zone ^a	Rest-of- Pacific ^b	Interior ^c	Atlantic ^d
Number of households (%)	1861	3.2	33.1	44.1	19.6
<i>Land holdings</i>					
Avg. farm size (manzanas)	14.1	6.8	6.1	9.2	39.8
Landlessness rate (% of households)	37.9	58.3	52.2	35.1	16.7
% of households with 0>5 mzs	33.4	26.7	31.2	39.0	26.0
<i>Labor and demographic</i>					
Gender of household head (% men)	82.2	78.3	80.5	81.3	86.8
Household head Miskito (%)	2.8	0.0	0.0	0.0	14.5
Household head Creole (%)	0.4	0.0	0.0	0.0	2.2
Age of household head	44.9	47.3	46.5	44.5	42.7
Number of adults (>12 years)	3.7	3.7	3.8	3.7	3.6
Adults who can read and write (%)	61.2	77.5	71.8	56.9	51.3
Ave. years of education of adults ^e	2.9	4.9	3.8	2.5	2.1
Degree of most educated member					
Preschool (% of households)	8.9	1.7	11.9	8.7	4.1
Primary (% of households)	33.2	46.7	44.9	28.7	21.9
Secondary (% of households)	4.9	16.7	9.3	2.6	2.2
University (% of households)	2.7	11.7	4.7	1.8	0.8
Incidence of migration to ^f					
Domestic (%)	8.1	8.3	9.3	8.9	4.4
Foreign (%)	2.1	1.7	4.4	1.2	0.3
<i>Infrastructure access</i> (% households)					
Access to household					
Paved road	7.2	6.7	9.8	8.0	0.3
Dirt road	52.8	90.0	70.6	43.0	41.4
Trail	28.8	0.0	14.1	36.7	38.1
Electricity hook-up	29.5	83.3	51.6	21.9	5.8
Water hook-up	19.6	56.7	36.7	12.4	4.1
<i>Social and organizational capital^g</i>					
Community related social capital	30.5	51.7	28.7	33.0	28.2
Business related social capital	2.1	8.3	2.2	1.8	2.5

T tests on the equality of means for Table 1

	Managua vs Pacific	Managua vs Interior	Managua vs Atlantic	Pacific vs Interior	Pacific vs Atlantic	Interior vs Atlantic
<i>Land holdings</i>						
Average farm size (manzanas)	ns ^h	ns	*	***	***	
Owned	ns	ns	***	*	***	***
Rented	ns	ns	ns	ns	***	***
<i>Labor and demographic</i>						
Gender of household head (% men)	ns	ns	*	ns	**	**
Age of household head	ns	ns	**	**	***	*
Number of adults (>12 years)	ns	ns	ns	ns	**	ns
Average years of education of adults	***	***	***	***	***	***
Adults who can read and write (%)	ns	***	***	***	***	**
Degree of most educated member						
Preschool (% of households)	**	*	ns	***	***	***
Primary (% of households)	ns	***	***	***	***	**
Secondary (% of households)	**	***	***	***	***	ns
University (% of households)	***	***	***	***	***	ns
Incidence of migration to						
Domestic (%)	ns	ns	ns	ns	***	***
Foreign (%)	ns	ns	ns	***	***	ns

Continued next page

Table 1—*continued*

	Managua <i>vs</i> Pacific	Managua <i>vs</i> Interior	Managua <i>vs</i> Atlantic	Pacific <i>vs</i> Interior	Pacific <i>vs</i> Atlantic	Interior <i>vs</i> Atlantic
<i>Infrastructure access</i>						
(% households)						
Access to household						
Paved road	ns	ns	***	ns	***	***
Dirt road	***	***	***	***	***	ns
Trail	***	***	***	***	***	ns
Electricity hook-up	***	***	***	***	***	***
Water hook-up	***	***	***	***	***	***
<i>Social and organizational capital</i> (% of households)						
Community related social capital	***	***	***	***	ns	*
Business related social capital	***	***	**	ns	ns	ns

^a The Managua zone includes the department of Managua.

^b The “Rest-of-Pacific” includes the departments Chinandega, León, Masaya, Granada, Carazo, and Rivas.

^c The “Interior” includes the departments Nueva Segovia, Jinotega, Madriz, Esteli, Matagalpa, Boaco, and Chontales.

^d The Atlantic zone includes the departments Río San Juan, RAAN and RAAS.

^e Imputed years of education for each member were obtained in the following manner: if highest degree was: Preschool and knows how to read and write: 3 years; Preschool and does not read or write: 1 year; Primary: 6 years; Secondary: 11 years; Basic Technical school: 6 years; Middle Technical school: 9 years; Superior Technical school: 12 years; University: 16 years. To these imputed years the approved years in their current studies, if any, were added. Household average years of education of adults were obtained by averaging over household members who are 12 years or older.

^f Incidence of migration represents a household member reporting having changed residential location for work reasons over the past 12 months.

^g Social and organizational capital indicates whether a household member participated in a community organization or group, such as religious organizations, parent associations, neighborhood committees or municipal development committee, or if a household member participates in a professional association or a loan and savings cooperative.

^h ns—not statistically significantly different from each other.

* Area statistically different from each other at 10% level.

** Area statistically different from each other at 5% level.

*** Area statistically different from each other at 1% level.

As one moves from the rural areas of Managua and the Rest-of-Pacific zones toward the Interior and then Atlantic zones, hence from near to the country’s capital and ports to furthest from them, poverty increases. According to a survey by the Ministry of Social Action in 1997 (MAG-FOR, 1999), 64% of the population is poor in the Atlantic Zone and 72% are poor in the Interior. As shown in Table 1: (i) average farm size increases, from 6 mz in the Rest-of-Pacific, to 9.2 in the Interior, and 39.8 mz in the Atlantic zone; (ii) infrastructure (road, electricity, and potable water) and population density decline; (iii) the population share of the landless declines (from half to about a third); (iv) literacy and education decrease; (v) business- and community-related social capital (such as associations) declines; (vi) migration rates decrease although overall they are lower than might be expected. Note that only 8% of households have migrants to other parts of Nicaragua and only 2% have

migrants outside Nicaragua for the survey year. One-quarter of those undertaking migratory employment do so as farm workers, and three-quarters as nonfarm workers. There is a relative geographic concentration of foreign migration among households in the Managua and Rest-of-Pacific zones. Moreover, the poor tend to migrate to farm jobs as these require the least qualifications but offer the lowest pay.

3. PATTERNS IN NONFARM EARNINGS

(a) *Nationwide patterns*

Table 2 shows national patterns of income sources of rural households by land and income strata. Total sample figures are averages over the strata, weighting by strata populations. The average share of nonfarm income in total earned income (excluding transfers and pensions) is 41%. Despite the importance for

Table 2. *Income/capita sources of rural Nicaraguan households by land and income strata*

	No. of households (%)	Own-farm income	Agriculture wage income	Nonfarm wage income	Nonfarm self-employment	Rental income	Pensions	Other income	Total income	Total income 1998 Cordobas
All	1861	35 (2.2) ^a	17 (2.4)	30 (2.5)	11 (4.1)	0 (19.2)	0 (15.3)	7 (4.0)	100	3450 (1.2)
<i>Land strata</i>										
0 mzs	37.9	3 (3.5)	23 (2.0)	52 (1.8)	13 (3.5)	0 (15.9)	0 (10.9)	8 (3.3)	100	3758 (1.1)
<2 mzs	12.7	39 (2.4)	24 (1.8)	21 (2.4)	8 (4.0)	0 (14.9)	0 (12.6)	6 (5.7)	100	2897 (1.3)
2 < 5 mzs	20.7	51 (2.0)	18 (3.2)	17 (3.0)	7 (5.0)	0 -	0 (19.2)	6 (3.5)	100	2882 (1.3)
5 < 20 mzs	14.6	64 (1.5)	9 (2.6)	11 (3.2)	9 (6.0)	0 (12.8)	0 (17.0)	6 (3.1)	100	3364 (1.3)
20 < 50 mzs	6.4	57 (1.3)	5 (2.5)	15 (3.1)	15 (3.1)	0 (11.0)	0 -	9 (4.1)	100	4033 (1.2)
>50 mzs	7.6	78 (1.2)	5 (3.6)	3 (3.1)	7 (3.4)	0 -	0 (11.7)	7 (6.1)	100	4091 (1.1)
<i>Income strata</i>										
Lowest	25	53 (1.2)	24 (2.0)	15 (4.1)	-1 (-53.2)	0 (19.0)	0 (18.0)	9 (3.3)	100	439 (0.6)
2nd	25	41 (1.0)	29 (1.4)	19 (2.1)	4 (6.3)	0 (28.0)	1 (10.6)	7 (2.9)	100	1488 (0.2)
3rd	25	35 (1.2)	24 (1.5)	26 (1.5)	6 (2.9)	1 (10.5)	0 (15.5)	8 (2.3)	100	3099 (0.2)
Highest	25	33 (1.6)	13 (2.3)	34 (1.5)	14 (2.3)	0 (18.7)	0 (11.2)	7 (3.1)	100	8771 (0.6)

^a CVs in parentheses.

the average household of nonfarm income, a given household tends to specialize in one of the two sectors. We found that 49% of rural households earn only farm income, 6% earn only nonfarm income, and 41% earn both. If we "tighten" the criterion for participation to "at least 20% of income," we find that only 18% of rural households participate in both sectors in the same year. Nonspecialization rises with household income, hence diversification is a superior good for rural Nicaraguan households.

The first stratification in Table 2 is by income quartiles, constructed by ranking households within a zone by total income per capita and then dividing the sample into quartiles containing equal numbers of households. The share of nonfarm in total income rises sharply from the poorest to the richest quartile. This makes sense given the relative sectoral payoffs and that the richest have the capital to overcome entry barriers and investment requirements. Overall, nonfarm income is 2.5 times more important than farm wage income, which runs contrary to conventional wisdom. The average income share from farm wage employment income is only 17%. But the share of households with some farm wage income is 40%, while the average income share from farm wage income is 17%. The discrepancy is partly accounted for by the gap between farm and nonfarm wages. For instance, the data from the Atlantic zone show that farm wage labor pays only 45 cordobas per day, versus 64 for manufacturing, 53 for construction, 55 for commerce, and 45 for other services; these patterns hold in the other zones. Moreover, many households tend to undertake farm work but mix it over the year with nonfarm work, and not earn much from either. The regressions for the participation of individuals in nonfarm activities add more information: the youngest and least educated household members tend to be the ones who undertake farm wage labor. The discrepancy is, however, less striking among the poorest quartile households, as 34% earn farm wage income and the share of income from this source in that quartile is 24%. This coincides with our earlier point that farm wage employment is the easiest off-farm activity for the poor to enter given its low entry requirements in terms of skills, education, and capital.

The second stratification of Table 2 is by farmland owned and rented. There are six strata, from landless to large farmers. Note that the share of income from nonfarm sources (a

measure of diversification) is in sharp negative correlation with landholding. The landless earn 65%, the small and medium farmers earn about 30%, and the large farmers earn only 10% of their incomes from nonfarm sources. It is interesting to note that the landless rely twice as much as do small farmers on nonfarm income but the two groups rely nearly equally on farm wage income. Note also that, in contrast to the landless, farm wage income is nearly as important as nonfarm income for the small farmers, although the landless earn three times the nonfarm income of the small farmers (800 compared to 2,400 cordobas). The average landless household is 30% richer than the average small farmer household and 10% richer than medium farmer households (with 5–20 ha), and only find their income equals in the medium-large farmer households. The latter point actually disguises the sharp bifurcation in nonfarm earning power over the landless households.

Table 3 shows income sources of the landless. The landless sample is split in two, with a cutoff at their average education level of 3.5 years. The least-educated landless had very different income composition and levels compared to the most-educated: (i) their average income was half as high; (ii) they relied only half as much on nonfarm income (48% versus 82% for the most-educated); (iii) they relied twice as much on farm wage income; (vi) surprisingly, however, the ratio of income from manufactures income to services income is the same between the two groups. In the service sector, however, the least-educated concentrate on construction and commerce, while the most-educated tend toward "other services" jobs like teaching that are better paid and require more education.

Not shown in Table 3 is that the landless are better equipped (compared to small farmers) for participation in the better-paid nonfarm jobs. The landless: have more education; 5% of the landless *vs* 2% of small farmers have a member with university education, 7% *vs* 4% with secondary school, 38% *vs* 30 with primary school and 66% *vs* 58 are literate (*vs* 61% for the rural sample). They are more apt to live near a main road (13 *vs* 4%). They are also more likely to live in the Managua or Rest-of-Pacific zones (e.g., 51% of the landless live in the Rest-of-Pacific zone, as compared to 35% of small farmers), as these zones are densely populated and urbanized and thus afford more service-sector skilled jobs (such as teachers or

Table 3. *Landless income shares by household average years of education of adults and occupation^a*

	Average years of education		<i>t</i> -test ^b
	<3.5 years education	≥ 3.5 years	
Number of household	349	356	
Agriculture—total	39 (2)	18 (2)	*
Own	4 (4)	2 (3)	ns
Wage	35 (2)	16 (2)	*
Extractive—total	3 (10)	3 (8)	ns
Own	1 (17)	* (13)	ns
Wage	3 (10)	2 (8)	ns
Manufacture—total	8 (5)	12 (4)	
Own	2 (8)	2 (9)	ns
Wage	6 (6)	9 (4)	***
Services: Construction—total	4 (7)	5 (8)	ns
Own	vs (11)	1 (9)	ns
Wage	3 (8)	4 (9)	ns
Services: Commerce—total	20 (4)	25 (2)	***
Own	6 (7)	8 (4)	*
Wage	13 (5)	18 (3)	***
Other services—total	16 (4)	30 (2)	***
Own	1 (9)	4 (5)	**
Wage	15 (5)	26 (2)	***
Rental income	* (15)	* (14)	ns
Pensions	1 (9)	* (12)	ns
Other income	10 (3)	7 (3)	ns
Total	100	100	
Total income per capita in 1998	2841	4558	***
Cordobas	(1)	(1)	

^a Coefficients of variation in parenthesis. vs means the number is so small it rounds to zero. Other income includes: (a) interest, (b) insurance payments, (c) dividends, lottery, (d) inheritances, (e) scholarships; (f) transfers from other households and family members; note that (f) is 1/3 of this category.

^b ns—not statistically significantly different from each other.

* Are statistically different from each other at 10% level.

** Are statistically different from each other at 5% level.

*** Are statistically different from each other at 1% level.

factory workers who commute from rural to urban areas each day). Finally, they are more apt to have electricity (46% of the landless vs 23% of the small farmers).

In almost all landholding strata, most nonfarm income is earned from wage employment. The share of wage income in total nonfarm income starts at 80% among the

landless, and drops to 71–72% among small farmers, to 50–55% among medium farmers, to 25% only among the largest farmers. The converse is that the self-employment share of nonfarm income rises with farm size, and with overall household income. This result coincides with results elsewhere in the literature, as large landowners have cash surpluses, collateral, and bank connections to start enterprises (see Reardon, 1997, for African evidence).

(b) *Urban vs rural patterns*

Table 4 shows income sources by zone and nationally, for urban and rural areas, and by subsector. First, some Latin American studies have found the share of farm sector income is important for urban households. There is evidence that this has been spurred by the increasing ease of commuting from town to farm, allowing farmworkers to live in towns where living conditions are better. For example, evidence from Chile includes that for the fruit areas as discussed in Berdegué (2001) and Rivera and Cruz (1984). An implication is that limiting one's analysis to rural households might result in the underestimation of the importance of agricultural income and overestimation of the importance of rural nonfarm income in a given regional economy.

In Table 4, we search—but in vain—for a similar phenomenon in Nicaragua. The shares of agricultural income in total urban household incomes are low: only 5% for the country, and 1, 3, 12, and 6%, for the Managua, Rest-of-Pacific, Interior, and Atlantic zones, respectively. The income shares between own-farming and farm wage employment are roughly equal except for the Atlantic, where income is mainly from own-farming. Own-farming is far more variable across households across urban than across rural households, as one would expect, shown by the much higher coefficients of variation. This suggests that relatively few urban households participate in the farm sector and that there is lower specialization in the farm sector among those who do. This is corroborated by our calculations (not shown in Table 4) that the shares of urban households who have agricultural land are 11%, 2%, 8%, 17%, and 22% for nationally, Managua, Rest-of-Pacific, Interior, and Atlantic zones, respectively. That is, only in the poorest and most rural zones (the Interior and Atlantic, see Moncada, 1999) is the share high.

Second, Klein (1992) hypothesized, based on rural and urban census data from the 1970s, that the composition of urban nonfarm employment (in terms of manufactures versus services) is similar or convergent to the composition of rural nonfarm employment in Latin America. We cannot test whether they are convergent but we do find that they are not similar in Nicaragua. Table 4 shows that the weight of commerce and other services in nonfarm income is much higher in urban than in rural incomes. This would not seem surprising given the services function of urban areas in agricultural zones (Rondinelli, 1983).

(c) *Zone and subsector patterns*

Table 4 shows several findings that diverge from conventional wisdom. First, contrary to the conventional wisdom in rural development nonfarm project circles where debate and projects are focused on self-employment in rural manufacturing enterprises, the great majority (80%) of nonfarm income is wage employment in the services sector. That service sector income is nearly equally divided between commerce and other services, and a tiny share comes from construction income. The rest is manufactures income. The latter is about half self-employment and half wage employment in Nicaragua rural areas. Contrast that to the fact that urban households' manufactures income is 85% wage employment. The divergence is probably due to larger manufacture firms being located in towns and cities. By contrast, services income of rural households is 77% wage income (similar to that of urban households).

Second, compared to the other zones, rural households in the Managua and Rest-of-Pacific zones rely about twice as much on nonfarm income (an average of 58% over the two zones versus an average of 25% for the Interior and the Atlantic), and earn nearly three times as much. The latter suggests that higher skilled rural nonfarm jobs are more prevalent in Managua and Rest-of-Pacific rural areas. Both results make sense when one recalls that the Managua and Rest-of-Pacific zones differ from the other two zones in being more densely populated, with higher urbanization rates in the departments they comprise (including the leonine presence of Managua itself), and better served by rural infrastructure of all types, and have a greater rate of rural landlessness. Recall that these findings are based on a broad, statistically representative sample of rural

Table 4. *Urban and rural zone income shares by sector and occupation^a*

	Managua		Rest-of-Pacific		Interior		Atlantic		Country	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Number of household	453	60	845	615	598	821	303	365	2199	1861
Agriculture—total	1	24	3	32	12	67	6	65	5	52
	(5.7)	(2.0)	(3.8)	(1.8)	(6.9)	(1.6)	(3.6)	(1.3)	(8.0)	(1.6)
Own	0	16	1	15	7	46	5	54	3	35
	(5.9)	(2.5)	(6.1)	(2.5)	(11.3)	(2.2)	(4.3)	(1.5)	(12.8)	(2.2)
Wage	*	9	2	17	5	22	1	11	2	17
	(9.5)	(3.1)	(4.5)	(2.6)	(6.0)	(2.2)	(3.7)	(2.4)	(7.2)	(2.4)
Extractive—total	*	1	1	1	2	1	4	2	1	1
	(13.3)	(6.0)	(10.3)	(9.3)	(24.4)	(20.3)	(8.4)	(11.1)	(17.1)	(13.4)
Own	*	0	1	*	2	*	*	1	1	*
	(21.3)	—	(13.7)	(14.4)	(24.4)	(28.7)	(58.4)	(13.0)	(34.9)	(24.0)
Wage	*	1	*	1	*	1	4	1	1	1
	(15.3)	(6.0)	(13.5)	(10.2)	(24.5)	(20.3)	(5.0)	(11.4)	(11.3)	(13.6)
Manufacture—total	10	6	8	9	7	6	4	5	8	7
	(3.3)	(3.3)	(5.0)	(4.0)	(4.0)	(5.6)	(6.4)	(5.0)	(4.4)	(4.7)
Own	1	1	2	2	2	3	1	4	1	3
	(12.3)	(4.8)	(7.6)	(9.9)	(6.1)	(7.3)	(7.7)	(5.2)	(7.6)	(7.4)
Wage	10	5	7	7	4	4	3	1	6	4
	(3.4)	(3.9)	(6.0)	(4.3)	(5.2)	(8.3)	(8.6)	(13.2)	(5.2)	(6.2)
Services: construction—total	3	3	2	2	4	3	3	1	3	2
	(4.6)	(3.3)	(6.1)	(5.6)	(4.1)	(11.9)	(4.5)	(17.0)	(4.8)	(10.1)
Own	1	*	1	1	1	*	*	*	1	*
	(7.0)	(7.7)	(12.2)	(7.8)	(7.4)	(17.7)	(12.5)	(28.0)	(9.3)	(11.7)

Table 4—continued

	Managua		Rest-of-Pacific		Interior		Atlantic		Country	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Wage	2 (5.4)	2 (3.7)	1 (7.1)	2 (7.6)	2 (5.0)	3 (13.2)	3 (4.8)	1 (18.1)	2 (5.7)	2 (12.3)
Services: commerce—total	30 (3.1)	16 (2.5)	34 (3.5)	22 (3.1)	40 (5.9)	8 (5.2)	37 (3.7)	13 (4.8)	35 (4.4)	15 (4.0)
Own	10 (5.3)	6 (3.8)	13 (5.9)	6 (4.7)	21 (8.7)	3 (7.7)	14 (4.5)	6 (5.9)	14 (7.4)	5 (5.8)
Wage	19 (2.5)	10 (2.5)	21 (3.1)	15 (3.5)	19 (3.9)	5 (5.3)	23 (3.8)	6 (4.9)	21 (3.3)	9 (4.4)
Other services—total	44 (2.5)	42 (1.8)	40 (3.8)	22 (2.7)	31 (2.7)	9 (4.5)	26 (3.0)	6 (4.1)	37 (3.2)	15 (3.5)
Own	4 (6.9)	5 (5.4)	7 (6.8)	4 (7.9)	5 (8.8)	1 (12.7)	* (86.3)	* (12.8)	5 (8.6)	2 (10.8)
Wage	40 (2.6)	37 (1.6)	33 (4.2)	18 (2.7)	27 (2.6)	9 (4.4)	26 (2.7)	6 (4.2)	32 (3.4)	13 (3.4)
Rental income	2 (13.6)	0 —	1 (17.8)	* (18.5)	* (16.1)	* (16.0)	3 (13.1)	* (16.9)	1 (17.5)	* (18.3)
Pensions	2 (11.1)	0 (—)	1 (5.6)	1 (10.3)	* (7.1)	* (19.3)	* (9.3)	* (—)	1 (13.5)	* (15.3)
Other income	8 (3.2)	7 (4.0)	10 (2.8)	10 (2.7)	5 (3.7)	4 (5.4)	18 (4.0)	8 (5.2)	9 (3.8)	7 (4.0)
Total	100	100	100	100	100	100	100	100	100	100
Total income per capita in 1998 Cordobas	10706 (1.5)	5347 (1.0)	8594 (2.1)	3853 (1.1)	8637 (2.6)	3006 (1.3)	8474 (1.7)	3459 (1.2)	9024 (2.0)	3450 (1.2)

^a Coefficients of variation in parentheses. * means the number is so small it rounds to zero. Other income includes: (a) interest, (b) insurance payments, (c) dividends, lottery, (d) inheritances, (e) scholarships; (f) transfers from other households and family members; note that (f) is 1/3 of this category.

households, and do not contradict the presence of several important areas of commercial agriculture in the zones, reflected in the higher share of farm wage-labor income in total farm sector income in the Managua and Rest-of-Pacific zones as compared to the other two zones.

Third, the share of manufactures income in nonfarm income is lower in the Managua (9%, calculated from the table) and the Rest-of-Pacific (18%) than in the other two zones (20%). In the former two zones, the better roads and presence of nearby towns and cities facilitate rural residents' traveling to towns to buy manufactured goods and services. That can explain why rural commerce income is (modestly) relatively less important than in the two "hinterland" zones (24% of nonfarm income in Managua comes from commerce, 43% in the Rest-of-Pacific, *vs* 32 and 50% in the other two zones). But, this disguises that rural commerce in *level* terms is twice as great per household in the Managua rural area compared to the Atlantic rural area. This reflects a difference in two fundamentally different levels of overall zone economic activity, whether urban or rural. The corollary is that "other services" and construction are much more important than commerce in the Managua rural area. All this goes along with an image of a greater concentration of urban economy spinoffs and skill-demanding services such as teaching and vehicle repair.

Fourth, the wage share in manufactures income in the rural areas of the Managua and the Rest-of-Pacific zones is much higher than in the other zones. This suggests commuting of rural residents to firms in rural towns or cities. (Our data however do not show the location of the firm for which the household works, so we cannot test this hypothesis.) By contrast, the wage employment share in services income (about three-quarters) is similar over all the zones with the exception of the Atlantic, where it is only half. All this provides an image of more self-employment in both manufacturing and commerce as one moves into less dense zones.

4. DETERMINANTS OF NONFARM PARTICIPATION AND INCOMES

(a) *Determinants of individual participation in nonfarm activities*

The standard model of household employment in the nonfarm sector arises from the

labor supply literature: participation and level of labor supply is a function of the incentives the household faces, in particular the relative returns and risks of farm and nonfarm activities; the household's capacity to undertake the activities, manifested in access to public assets such as roads and private assets such as education.

The regression specification for this general model is shown in Table 5 for Probit regressions explaining individual primary-activity participation in off-farm activities. There are separate equations for farm wage employment, nonfarm wage employment, and nonfarm self-employment. Each is a function of proxies for incentives and capacity variables, represented in (i) individual characteristics, in particular gender, age, and education, (ii) household characteristics, in particular, landholdings, and access to electricity, drinkingwater, and roads, and (iii) zone (taking as reference point the Rest-of-Pacific zone).

Several statistically significant (at 10% or better) points emerge. First, nonhousehold-head men gravitate toward wage employment off-farm. Women and household heads gravitate toward self-employment. Older persons tend toward nonfarm wage employment. These results accord with the relation of lifecycle capital accumulation and the relative capital entry requirements of the activities.

Second, literacy and education are determinants of whether an individual chooses wage employment in the farm *vs* the nonfarm sector. Striking are the positive effects of literacy, and primary, secondary, and university degrees on engagement in nonfarm wage employment—and the negative effects of beyond-preschool degrees (primary and secondary schooling) on engagement in farm wage employment. This concords with the relative entry requirements of the activities. Education is an exit path from low-paying farm wage labor. Interestingly, education does not have a significant effect on self-employment in the nonfarm sector, possibly because the products of these firms are for traditional consumption tastes and use traditional technologies.

Third, land scarcity is only a driving force in participation in nonfarm employment, with the effect least strong for self-employment. The latter makes sense given that more land means more capital for investment in nonfarm business.

Fourth, access to improved roads is important to participation in farm and nonfarm wage

Table 5. *Determinants of individual's participation in off-farm activities (Probit)^a*

	Mean value	Agricultural wage employment ^b		Nonfarm wage employment		Nonfarm self-employment	
		Marginal effect	$P > Z $	Marginal effect	$P > Z $	Marginal effect	$P > Z $
<i>Individual characteristics</i>							
Gender (man = 1)	0.516	0.146	0.00	0.005	0.40	-0.019	0.00
Miskito	0.029	-0.070	0.00	-0.018	0.23	-0.011	0.25
Creole	0.003	-0.013	0.83	-0.001	0.98	0.217	0.00
Head of household	0.269	-0.011	0.31	-0.014	0.11	0.029	0.00
Spouse of household head	0.206	-0.052	0.00	-0.037	0.00	0.023	0.00
Age	32.161	0.007	0.00	0.010	0.00	0.004	0.00
Age squared	1274.8	-0.000	0.00	-0.000	0.00	-0.000	0.00
Can read and write	0.617	0.002	0.79	0.030	0.00	0.010	0.00
Pre-school degree	0.052	0.011	0.51	-0.005	0.64	-0.002	0.82
Primary degree	0.170	-0.009	0.312	0.018	0.01	0.006	0.22
Secondary degree	0.025	-0.030	0.14	0.113	0.00	-0.010	0.13
University degree	0.003			0.413	0.00	-0.012	0.56
<i>Household assets and characteristics</i>							
Land assets per adult (mz)	3.790	-0.001	0.14	-0.001	0.05	-0.000	0.12
Average years of education of adults	2.902	-0.010	0.00	0.005	0.00	0.000	0.79
Age of household head	47.619	-0.001	0.01	-0.001	0.002	-0.000	0.94
Electricity	0.304	0.003	0.73	0.024	0.00	0.006	0.11
Km. from water source	0.174	-0.006	0.46	0.007	0.01	-0.006	0.11
Km. from health center	5.429	-0.001	0.04	-0.002	0.00	-0.001	0.00
<i>Access to household</i>							
Paved road	0.077	0.066	0.00	0.051	0.00	0.012	0.22
Dirt road	0.529	0.030	0.04	0.017	0.15	0.011	0.11
Trail	0.289	0.029	0.08	0.015	0.23	0.005	0.45
<i>Zone characteristics</i>							
<i>Zones</i>							
Managua (reference reg.)	0.032						
Rest-of-Pacific	0.340	0.052	0.02	-0.010	0.45	0.017	0.05
Interior	0.439	0.052	0.02	-0.029	0.04	0.004	0.62
Atlantic	0.189	0.030	0.25	-0.031	0.03	0.002	0.86
No. of observations		6847		6865		6865	
Prob $> \chi^2$ ^c		0.000		0.000		0.000	
Pseudo- R^2 ^d		0.168		0.201		0.166	
Observed P		0.117		0.085		0.045	
Predicted P (at \bar{x}) ^e		0.071		0.045		0.021	
Link test $P > Z $ ^f		0.866		0.320		0.283	

^a Robust standard errors adjusted for clustering by household. The change in the probability for an infinitesimal change in each independent, continuous variable and the discrete change in the probability for dummy variables.

^b For agricultural wage employment a university degree predicted failure perfectly and therefore 18 observations were not used.

^c The likelihood-ratio χ^2 model test is defined as $2(L_1 - L_0)$, where L_1 is the log-likelihood of the full model and L_0 is the log-likelihood of the "constant-only" model.

^d The pseudo- R^2 is defined as $1 - L_1/L_0$.

^e Where P is the participation rate in the off-farm activity.

^f The link test is that, conditional on the specification, the independent variables are specified incorrectly (STATA Reference Manual H-O, p. 186).

employment, but is only a very modest determinant of nonfarm self-employment. Thus, the evidence here and above produces an image of rural self-employment dominated by small enterprises run in their majority by women serving local rural markets.

Finally, relative to the Managua zone (the reference point), the other zones offer more opportunity for farm and nonfarm self-employment (controlling for other individual and household characteristics of the earner), and less opportunity for nonfarm wage employ-

ment. These findings are consistent with the patterns found across zones.

(b) *Determinants of household nonfarm income*

Table 6 shows regressions explaining household income sources in level terms as functions of household access to land, human, and public assets. The total income and the farm income models were estimated using OLS (ordinary least squares) which yield consistent parameter estimates. We used Huber-corrected standard errors to account for heteroscedasticity. For the off-farm income models (with separate equations for farm wage income, nonfarm wage income, and nonfarm self-employment income), we used CLAD (censored least absolute deviation model) to account for censoring and heteroscedasticity (Deaton, 1997).

Several salient points emerge from the OLS results. An increase in landholdings per person increases overall income and farm income, but with negative curvature, implying that land productivity decreases as farm size increases. Male-headed and Creole (nonindigenous) households earn more overall income and farm income. More educated households earn more overall income but not more farm income, implying they are diversifying income into nonfarm occupations. This is a finding increasingly emerging in the recent literature (see, for example, Yunez & Taylor, 2001; de Janvry & Sadolet, 2001). Infrastructure has a strong positive impact on overall income, although not on farm income. This should not be interpreted as road access actually lowering farm income. Rather, farming appears to be located further from and nonfarm businesses nearer to the main roads, and near rur-urban concentrations. One expects this based on the theories of von Thunen concerning the changes in land use as one moves away from urban centers and land prices decline.

The salient CLAD results are as follows. First, an increase in land per capita is associated with a decrease in wage employment income in both sectors. This suggests that wage employment is a compensation for land constraints. But land per capita has a weak positive effect on nonfarm self-employment income. This finding appears elsewhere in the literature (see, for example, Berdegú, 2001 for the Chile case). This implies that on the one hand, land (perhaps as collateral) increases household capacity to undertake nonfarm business by serving to overcome capital barriers

for starting nonfarm businesses. But on the other hand, land produces income that is a substitute for nonfarm income.

Second, being "Creole" heightens the chance of having nonfarm income. By contrast, being indigenous (Miskito) is correlated with residence in the hinterland zones, which we have shown have less population density and less nonfarm employment. Moreover, age has a strong positive effect on nonfarm income, but not on other off-farm jobs, implying that there is more skill and experience required.

Third, more years of education among adults in the family sharply increases nonfarm income both from self- and wage employment. The higher the schooling degree, the lower the income from farm wage employment. Interestingly, the degree does not influence earnings in nonfarm self-employment, reinforcing the image of the latter as a local, traditional, small-scale activity in rural Nicaragua. By far, the biggest payoff of education is obtained in nonfarm wage employment.

Fourth, access to roads (especially paved and dirt roads) strongly increases nonfarm wage income, implying the need to commute. Having access to electricity and drinkingwater hook-ups strongly influences earnings from nonfarm self-employment, and along with at least a passable dirt road, appear to be prerequisites for successful rural business.

Finally, after controlling for household assets, there are significant differences in household earnings in nonfarm activities, especially between rural Managua and the Rest-of-Pacific on the one hand, and the Interior and Atlantic zones on the other, confirming what our prior zone patterns results point to.

5. CONCLUSIONS AND IMPLICATIONS

First, as nonfarm employment and income are often a very neglected element of rural development strategic debates (Lanjouw & Lanjouw, 1997), it is crucial for one key fact to enter the policy debate: nonfarm income is very important to Nicaraguan rural households, constituting 41% of their income. Moreover, nonfarm income is much more important than farm wage-labor income (although this finding is somewhat attenuated but not reversed in the case of the poorest).

Second, unfortunately for the rural poor in Nicaragua, rural nonfarm income tends to be

Table 6. *Determinants of rural household income, 1998*^a

Variable	OLS		CLAD		
	Total income	Farm income	Farm wage income	Nonfarm wage income	Nonfarm self-employment
<i>Land assets</i>					
Log of land per adult, mz	0.488*** (0.109)	0.852*** (0.144)	-1.743*** (0.447)	-2.622*** (0.428)	-0.201 (0.634)
Log of land per adult square	-0.054** (0.027)	-0.113*** (0.037)	0.169 (0.149)	0.424*** (0.121)	0.294* (0.163)
<i>Household head characteristics</i>					
Gender (man = 1)	-0.055 (0.092)	0.434*** (0.139)	0.409 (0.256)	-0.440 (0.385)	-0.465 (0.515)
Miskito	-0.395 (0.267)	0.455** (0.215)	-7.593*** (2.067)	0.567 (1.127)	-3.122 (2.234)
Creole	1.508*** (0.366)	0.736* (0.406)	-5.876** (2.653)	6.483*** (1.524)	5.771*** (1.660)
Log age	-2.398 (1.676)	0.630 (2.076)	1.454 (4.434)	19.698*** (6.769)	-1.116 (12.068)
Log age squared	0.287 (0.224)	-0.099 (0.280)	-0.294 (0.603)	-2.722*** (0.905)	0.418 (1.615)
<i>Household characteristics</i>					
Average years of education of adults	0.389*** (0.089)	0.131 (0.097)	0.047 (0.174)	1.509*** (0.377)	1.483*** (0.582)
Degree of most educated					
Pre-school	-0.167 (0.143)	0.069 (0.134)	-0.393 (0.292)	-0.516 (0.438)	0.840 (0.693)
Primary	0.004 (0.107)	-0.059 (0.128)	-0.562** (0.236)	0.101 (0.394)	0.307 (0.652)
Secondary	0.144 (0.164)	-0.054 (0.277)	-2.759 (2.057)	0.492 (0.556)	-0.492 (0.925)
University	0.521*** (0.190)	0.248 (0.340)	-1.832 (1.904)	0.972 (0.692)	-0.768 (1.267)
Percentage of adults	0.869*** (0.126)	0.877*** (0.145)	1.380*** (0.292)	0.688* (0.409)	-1.042* (0.640)
<i>Public assets</i>					
Access to household					
Paved road	0.769*** (0.166)	-0.033 (0.226)	0.593 (0.426)	2.464*** (0.605)	1.433 (1.031)
Dirt road	0.456*** (0.146)	0.139 (0.134)	0.532 (0.387)	1.965*** (0.464)	1.572** (0.799)
Trail road	0.237 (0.158)	0.140 (0.141)	0.506 (0.406)	1.309** (0.574)	0.507 (0.899)
Electricity hook-up	0.318*** (0.090)	-0.137 (0.147)	0.162 (0.187)	1.208*** (0.245)	1.021** (0.486)
Water hook-up	0.298*** (0.079)	0.105 (0.127)	-0.159 (0.208)	0.257 (0.258)	1.156** (0.498)
Zone effect (base = Rest-of-Pacific)					
Managua	-0.263 (0.194)	0.148 (0.412)	-1.176 (1.353)	-0.313 (0.412)	-0.824 (1.089)
Interior	-0.217*** (0.083)	0.515*** (0.111)	0.285 (0.183)	-0.997*** (0.319)	-1.202*** (0.473)
Atlantic	0.076 (0.119)	0.288*** (0.148)	0.924** (0.372)	-1.446** (0.589)	-0.986 (0.753)
Constant term	11.640*** (3.107)	4.500 (3.799)	5.910 (8.043)	-31.262** (12.770)	0.587 (22.252)
R ²	0.16	0.16	0.07	0.19	0.08
No. of observations	1861	1106	1861	1861	1825

Continued next page

Table 1—continued

^aAll measures of income are in logs. The total income and farm income estimates are ordinary least squares (OLS), and the standard errors are Huber/White/sandwich to account for heteroscedasticity. The agricultural wage, nonfarm wage and non farm self employment income estimates are censored least absolute deviation (CLAD) estimates. The standard errors are bootstrap estimates resulting from resampling 1,000 times. Standard errors are in parentheses.

* *P*-value is less than 0.1.

** *P*-value is less than 0.05.

*** *P*-value is less than 0.01.

relatively concentrated geographically and socioeconomically, toward the Rest-of-Pacific and the Managua rural areas, which are denser in infrastructure, population, and rural towns, and toward the upper-income quartile of rural households. This concentration implies high entry barriers and capital requirements for rural nonfarm activity that the poor are simply not equipped to overcome. They are forced to be much more dependent than the rich on agriculture, and when they are able to diversify into nonfarm activities, they are caught in low-return “dead-end” jobs. Equipping them through training and acquisition of diverse forms of capital to have a chance at engaging in the higher return nonfarm jobs would be a major step toward helping them to share the benefits of the large rural nonfarm economy of Nicaragua.

Third, when the rural nonfarm economy does arise in rural development debates, it often enters as a discussion of rural industrialization—how to help the rural poor start small manufacturing enterprises. We have seen, however, that self-employment in manufacture

by rural households is very minor in Nicaragua, probably due to the ease of obtaining manufactured goods from urban industries and imports. Moreover, three out of every four cordobas earned by rural households in the rural nonfarm sector are earned in the service sector, and one of two service sector cordobas are earned in commerce, mainly as employees. Little is known about how stable or capable of being expanded or improved these service sector jobs are. In fact, in the developing country debate about rural nonfarm employment, little has been said about service sector jobs. This is an important issue to address in Nicaragua, and it is not clear *a priori* whether the opportunities found will exceed the threats discovered. It is probable that infrastructure and skills improvement will figure as main ways to facilitate increases in participation in and productivity of such service sector employment.

Fourth, education, road access, and access to electricity and water were found to be important to nonfarm incomes and thus investments therein will promote equitable nonfarm sector development in rural Nicaragua.

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