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The Determinants of Nonfarm Income Diversification in Rural Peru

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Summary. – This paper shows in Peruvian rural areas, there has been substantial growth over the past decade in household employment outside of own-farming. At present 51% of the net income of rural households comes from these off-farm activities, and thus they certainly cannot be considered as "marginal." The reasons households diversify their incomes are several. Important is access to public assets such as roads and private assets such as education and credit. Increasing access to these assets will help rural households to increase their self-employment as well as wage-employment in the nonfarm sector.

Keywords -- Income Diversification, Latin America, Peru, Rural Sector.

1. INTRODUCTION

In rural Peru almost 35% of labor is allocated to and 51% of income comes from economic activities outside of own-farming. This fact suggests that these off-farm activities, once referred to as "complementary activities," can no longer be thus called. These activities include activities in the nonfarm sector, including manufacturing and services, both in self-employment (e.g., operating a small handicraft enterprise) and in wage-employment, and in the agricultural sector in wage employment.

Despite the growing importance of these activities, very little is known about them and on the role that they play in the income generation strategies of rural households in Peru. This paper thus has two objectives. The first is to analyze the determinants of rural households' decisions to undertake off-farm activities. We postulate that the chosen portfolio of activities will depend on the households access to public and private assets, physical, financial, human, and organizational. The second is to explore the implications of these income diversification strategies for the pattern of income distribution in rural Peru. We find that promotion of nonfarm activity is not necessarily consonant with improvement in the income distribution, and for it to do so, specific policy interventions are needed.

The paper proceeds as follows. Section 2 provides a brief overview of general issues and background from the literature. Section 3 uses data from the Living Standard Measurement Studies (LSMS) surveys for Peru between 1985 and 1997 to show the growing importance of self-employment nonfarm activities and the decline in wage-employment in the nonfarm and farm sectors. Moreover, 1997 LSMS data are used to describe rural household income sources, differentiating farm and nonfarm sector and self-employment and wage-employment. Finally, the section assesses the impact of income diversification on income distribution. Section 4 then concludes with policy

recommendations and some hypotheses about the effects of structural adjustment policies on the course of rural income diversification.

2. ISSUES AND REVIEW OF LITERATURE

The common view of the rural sector among Peruvian policymakers is that of a sector driven almost entirely by agriculture. Rural income is equated with farm income and, even more, with agricultural income. Thus, policymakers view policies to combat rural poverty as policies to enhance farm productivity. Most official reports produced by the Peruvian government or by multilateral institutions such as the World Bank, as well as others who have shaped the Peruvian agricultural policy agenda during the past 15 years, have focused almost exclusively on agricultural development as the way to reduce rural poverty and achieve sustainable economic growth in rural areas. Illustrations of this way of viewing rural poverty alleviation include include World Bank (1998), Ministerio de Agricultura (1986, 1993) and Vásquez (2000). This view has been perpetuated by a political system that separates rural policymaking into several sectoral ministries (Agriculture, Industry, Mining, and Fisheries, among the most important).

Despite this narrow view, there is growing evidence in developing regions that the rural sector is much more than just farming. Reardon et. al. (1998) summarize the evidence regarding the nature, importance, determinants, and effects on farm households of rural nonfarm activity in developing regions. They show the growing importance of rural nonfarm activity that accounts for roughly 25% of employment and as much as 40% of the incomes generated in rural Latin America. Data from other regions of the world show also sizable income shares for the nonfarm rural sector (32% in Asia and 42% in Africa).

Reardon et. al. (1998) also show that although the pattern of income diversification between farm and nonfarm activities varies sharply across regions, it is clearly linked to the assets or endowments of rural households. Where markets often do not operate in a competitive or efficient way, personal and institutional constraints can play an important role in determining participation in nonfarm activities. Household wealth, private and public asset endowments, and regional characteristics such as agroclimate can play a critical role as they may enhance or hinder the profitability of the household endowment base.

The literature has also established that the composition of rural incomes changes varies with wealth – whether analyzed at the individual, household, or regional level. for regions and countries. This relationship is conditioned by cash or credit constraints as well as access to infrastructure. That explains for example why equally poor areas such as West Africa and South Asia differ in the composition of their rural nonfarm incomes.

Many studies have shown that rural households in developing countries earn more from own-farming than any other income source. This is the case of most studies reported in Reardon et. al. (1998), Elbers and Lanjouw (this volume), Reardon, Cruz, and Berdegué (1998) and Reardon (1997). Only in a few countries, were landless peasants constitute a sizable population, is the importance of nonfarm incomes greater than own-farm income.

Moreover, in theory, the functional income distribution of off-farm income differs over households and regions. However, there is a dearth of data to explore this empirically, as Reardon et. al. (1998) note that few studies distinguish nonfarm wage-income and self-employment income within nonfarm income. However, the evidence they muster shows that nonfarm wage employment is much more important than farm wage employment income, particularly in Africa (and less sharply in Asia and Latin America), although the

poorer households tend to be the main ones to undertake farm wage employment, and the farm wage tends to be below the nonfarm wage. There is also some evidence that there may be a segmented rural labor market and that there are some cases (related to highly skilled activities) for which the agriculture wage may be higher than the average nonfarm wage.

Most analyses on income diversification in rural Peru are a by-product of the literature on rural poverty. Studies on poverty such as that of Moncada (1996) or World Bank (1999) have shown that a little more than half of the Peruvian population - roughly 14 million - can be considered as poor. Regional disparities are large and increasing. Most reduction in poverty occurring in the past decade occurred in only two zones that are both urban: in the capital, Lima, and in the urban Sierra (mountain zone). Rural Peru maintains a high poverty rate: two of every three rural inhabitants are poor. Gonzales de Olarte (1996) and Escobal et.al. (1998), among others, have shown that this poverty profile can be explained by the distinct regional allocation of human, physical, financial and organizational assets as well as the endowment of public goods. It is likely that certain combinations of public and private assets may enhance the opportunities of the rural poor to diversify incomes and at the same time avail themselves of higher-skilled and better-paid rural jobs.

Several studies have shown the importance of off-farm, or more precisely, nonfarm activities in rural Peru. Figueroa's (1989) study of eight rural communities in the central and southern Sierra, concluded that nonfarm activities (as noted above, those activities outside of own-farming and farm wage employment) account for as much as 37% of total income. Gonzales de Olarte (1996) showed for several communities of the northern Sierra that more than 40% of net income comes from nonfarm sources.

However, the Peruvian literature lacks a detailed analysis of the determinants of these nonfarm income patterns, and the roles that key public and private assets play in determining them. Some research, however, has focused on the effect of specific assets, such as human capital, productive capital or financial capital on incomes and employment diversification in rural Peru. Valdivia and Robles (1997) and Valdivia (1998) point out the importance of family size and composition as well as farm size on wage employment and earnings in rural Peru. Valdivia (1997) and Trivelli (1997) examine how credit constraints shape the income strategies of rural dwellers. Using a standard household model, hey show that credit availability can be an alternative to employment diversification to smooth negative idiosyncratic shocks. Jacoby (1992), Valdivia and Robles (1997), and Laszlo (200) have developed formal models to analyze producer-consumer household labor supply behavior. While Valdivia and Robles (1997) have based their estimations in a standard agricultural household model where the separability of consumption and production decisions hold, Jacoby (1992) developed a more structural approach to estimate the opportunity cost of time, or shadow wages, of Peruvian rural household workers. Laszlo (2000) examined labor supply behavior in nonfarm self-employment in rural Peru and showed that the labor market neither uniquely nor primarily determines household earnings. Following an approach inspired by Frisch demand analysis, the author concludes that more education is associated with a higher probability of engaging in these activities but does little to contribute to greater nonfarm self-employment profitability.

The determinants of participation in and returns to rural nonfarm activities include the household's asset endowment (quantity and quality) and its access to public goods and services, as shown in various studies such as Reardon et. al. 1998), de Janvry and Sadoulet (1996), and Elbers and Lanjouw (this volume). For particular activities such as skilled jobs,

particular assets are important, such as education. Some households are "pushed" to diversify their activities off-farm if just to cope with external shocks to their own farming (such as from drought or a steep decline in farmgate prices). Or, households may be "pulled" into nonfarm activity because it often pays more than farming and generates cash.

A standard rural household model of the determinants of income diversification (for either push or pull reasons) has the following features, after de Janvry and Sadoulet (1996). The household problem is to maximize its utility subject to several constraints; among them: 1) a cash constraint, 2) production technologies for own-farming and nonfarm self-employment activities; 3) exogenous effective prices for tradables; 4) an equilibrium condition for self-sufficiency of farm production; and 5) an equilibrium condition for family labor. First-order conditions of this type of model give a system of factor supply and demand functions, which in turn permit the determination of the labor allocation between farm and nonfarm sectors and self-employment and wage-employment.

Reduced form equations for the model have the following form:

$$S_{ij} = f(\mathbf{p}; \mathbf{z_{ag}}, \mathbf{z_{nag}}, \mathbf{z_k}, \mathbf{z_h}, \mathbf{z_{pu}}, \mathbf{z_g})$$

where $\mathbf{S_{ij}}$ represents the net income shares coming from farm and nonfarm sector activities as well as self-employment and wage-employment; **p** is the vector of exogenous input and output prices; and the z vectors are the different fixed assets that are available to the household. Z_{ag} represents the fixed farm assets (such as land or cattle); z_{nag} represents fixed nonfarm assets such as experience in crafts or trade; z_k represents other key financial assets that facilitate access to credit; z_h is the vector of human capital including family size and composition (by age and gender), as well as education; z_{pu} is the vector of key public assets

such electricity, roads, sewage, or drinking water; finally, z_g includes other key assets related to characteristics of the area (agroclimate, land quality, etc.).

Lopez (1986) showed that if time allocations between on-farm and off-farm have different utility connotations or if there is commuting time associated with off-farm work, the shadow price of on-farm work is endogenously determined within the household. If this is so, production and consumption decisions are non-separable and we can therefore expect to find household characteristics affecting labor allocation decisions. This is the reason why income diversification equations have the specific form depicted above.

Diversification of income sources may be related to "pull" or "push" factors discussed above. It may be limited by cash or credit constraints or by geographic characteristics. In any case, diversification strategies will tend to be different for the poorest as compared to the richest rural households. Reardon (1997) shows that the nonfarm income share is much larger for rich than for poor rural African households. Reardon et. al. (2000) show that this is the case in several Latin American countries as Argentina and Mexico and Elbers and Lanjouw (this volume) show this for Ecuador. For Asian countries, however, Reardon et.al. (2000) show that the evidence is somewhat mixed, with some areas in India and Pakistan having a smaller share of nonfarm income for the wealthiest households.

Given the importance of nonfarm income in rural areas of most developing countries, the question of whether and under what conditions nonfarm employment increases or decreases overall rural inequality is also an important issue. As Reardon et.al. (2000) point out, the assertion that nonfarm employment reduces income inequality is based on three empirical assumptions: "…(1) that the income created by such activities is large enough to influence the rural income distribution (which is, as noted above, a

reasonable assumption in most developing areas); (2) that nonfarm income is unequally distributed (an income source that is perfectly equally distributed, by definition, cannot alter the distribution of total income); and (3) that this unequally distributed income source favours the poor". They present evidence that none of the off-farm employment sources necessarily reduces rural inequality. Since individual asset holdings as well as public goods and services influence nonfarm employment, the distribution of these assets plays an important role in rural income distribution as well as the incidence of such employment. Hence, for example, the distribution of education can influence income distribution through its effect on households' access to well paying nonfarm employment.

3. PATTERNS OF INCOME GENERATING OPTIONS FOR RURAL PERU

(a) The data

The data on labor allocation come from three national surveys conducted between 1985 and 1997. These surveys are household surveys similar to the Living Standard Measurement Surveys (LSMS) conducted by the World Bank in various developing countries. These surveys provide a sampling framework that assures that they are statistically representative of urban and rural Peru at the regional level (i.e., for the Coastal, Highlands, and Amazon regions). This paper uses only the rural sample, comprising 2,284 households in the 1985-1986 survey, 1,338 households in the 1994 survey, and 1,191 in the 1997 survey. The three surveys maintained the same format. Thus, consumption and labor time allocation data can be compared over the surveys. Note that the 1996 LSMS survey was not included in our analysis due to the small rural sample size. The data on net

income come from the 1997 LSMS survey which was the only one of the surveys that included all sources of income.[1] The income module of the survey uses an income recall for the 12 months prior to the survey. Income data include both primary and secondary sources.

We divide income into eight categories depending on whether the income is generated by: (1) self-employment or wage-employment activities; b) farm or nonfarm sector activities; and c) skilled or unskilled labor activities. Self-employment is defined as activity that does not generate wage or salary earnings. Self-employment typically includes petty commerce, handicraft manufacture, and machinery repair and rental. Skilled labor employment includes the "professionals" such as teaching, formal commerce, and employment as military officers. Unskilled labor includes for example unskilled operators of simple machines, unskilled soldiery.

The data patterns and regressions weight the household observations by the probability of the household falling in the sample frame because the observations come from a stratified random sample. The rural area was first divided in segments (coast, highland and jungle) and each segment was further divided into clusters (a bundle of geographically continuous households).

(b) Time allocation and Income Diversification between farm and nonfarm sector activities in rural areas

Rural household labor time allocation over activities changed over the past decade, with an apparent relation to the economic cycle. Table 1 shows that between 1985-1986 and 1994 there was a large increase in nonfarm self-employment, with a notable shift from

own-farming. The macroeconomic stabilization program in place since 1990 initially hurt the farm sector. Real farmgate prices for most crops declined substantially during the 1990s, reducing the profitability of farm sector labor. Households increased the share of total labor time allocated to nonfarm self-employment 15% to 25%, and the share of labor to nonfarm wage-employment went from 10% to almost 13%. The importance of nonfarm self-employment was maintained after the adjustment crisis, apparently because the relative return to nonfarm activity had improved with the adjustment, and because of substantial investment in rural infrastructure (roads and electrification) in the mid 1990s.

Household labor allocation patterns do not vary much over regions. We had expected that wage employment would have a greater share in total family labor allocation in the Coastal region because of a denser road network and better access to markets and towns. However, Table 2 shows, using 1997 LSMS data, that there is little difference over regions in terms of rural household labor allocation between self-employment and wage-employment and between farm and nonfarm sector activities. For example, the share of self-employment labor in total labor in the Highlands is only 1% above the national average and that of the Coast only 6% below.

Moreover, this lack of sharp differences in allocation stands against the substantial inter-regional variation in per-capita household incomes, as shown in Table 3, which coincides with wage variation over regions (with higher wages in the Coastal region). These results do not support the hypothesis of Klein (1992) of convergence in wage rates over locations in Latin American countries, and rather suggests market segmentation. Table 3 also shows that between the Coast and Highland regions, labor productivity differs sharply in the farm sector but does not differ much in the nonfarm sector. Differences in the agroclimates and sizes of farms in the two regions explains the farm productivity

diffference. Wages also differ over labor categories due, as we explore further below, to geographic characteristics and to household and individual assets such as education and experience. The data show a premium of at least 30% for skilled labor in the farm sector and 50% in the nonfarm sector.

Table 4 shows incomes by source. The data suggest that rural households earn much more from nonfarm self-employment than from farm wage or nonfarm wage employment. This is consistent with findings elsewhere in Latin America, such as in Ecuador as reported by Lanjouw (1999) and Elbers and Lanjouw (this volume). Own-farm income is still the most important source, however, and that is so for most rural Peruvian households because most of them own a plot and land is relatively evenly distributed. We expect that off-farm income would be higher in areas that are richer and have better infrastructure, such as the Coast region. Surprisingly, the data show that the share of wage employment income and nonfarm self-employment income is actually higher in the poorer regions, the Highlands and the Amazon regions. This suggests that diversification "push" factors are important in poorer regions, as Reardon et al. (1998) find for African countries. However, those with skilled labor have higher incomes than the unskilled in the Coast – but not in the Highlands and Amazon regions. That suggests relative underdevelopment of the labor markets in these two regions.

(c) Income Diversification Variation over Income Strata

Income diversification varies in extent and nature with household wealth. Poorer households tend to concentrate on the lower-pay, easy-entry agricultural labor market, and less on unskilled labor-intensive non-agricultural wage-employment and nonfarm self-

employment. This is due to their scant education and credit and cash constraints. By contrast, higher income rural households with more education and fewer cash constraints tend to pursue non-agricultural self-employment activities such as handicrafts, commerce, tools and machinery repair, and agroprocessing. Table 5 shows that even though much of the agricultural wage labor is supplied by the poorest rural households, this is not true of the nonfarm wage labor market, due to the skills required for the latter.

Despite these household-wealth differentiated patterns, the impact of nonfarm employment on the income distribution is ambiguous. Table 6 shows Gini and pseudo-Gini coefficients for total rural income and for the main rural income sources. Gini coefficients have been calculated using all households for which a particular income source was available. In contrast, pseudo-Gini coefficients where calculated for the full sample.

The pseudo-Ginis show that all income sources are more unequally distributed than total rural income. Following Shorrocks (1983), we decomposed the Gini of total rural income into its factor components (S_k). Our decomposition rule considers the relative importance of each income source, the pattern of inequality of each income source (measured by the pseudo Gini coefficient), and the correlation between different income sources.

$$S_k = \frac{cov(Y_k, Y)}{var(Y_k)} \overline{G}(Y_k) \qquad \sum_k S_k = 1$$

Where $\overline{G}(Y_k)$, the "pseudo-Gini" value for income component k can be computed as follows:

$$\overline{G}(\mathbf{Y_k}) = \frac{2}{n^2 \mu} \sum_i (i - \frac{n+1}{2})\mathbf{Y}_{ik}$$

ìbeing the mean value of Y.

Using this income decomposition method we can show that incomes coming from wage-employment are important enough to account for up to 45% of income inequality. Wage employment income is relatively unequally distributed (showing pseudo-Ginis of 0.92 and 0.77 for farm and nonfarm wage employment incomes, respectively), but does not appear to favor the poor because they are participating mainly in the low-wage farm labor.

This may suggest that the nonfarm wage labor market actually increases income inequality. However, Reardon et. al. (2000) note that if an individual source of income is more unequally distributed than overall income, that does not necessarily impy that this source is contributing to overall income inequality. Thus we must note that this decomposition exercise does not necessarily imply any causal link. For example, it is possible that if those who are currently employed in the non-agriculture wage-employment sector were engaged in some alternate employment activity, such as agricultural wage-employment, then agricultural wage rates might be lower and overall income inequality could actually rise. So then rather than raising inequality, the non-agriculture wage-employment sector could actually be keeping inequality from rising even further. However, the segmented nature of rural markets may well prevent this effect. This evidence is consistent with that reported by Reardon et. al. (1998) and Klein (1992). If that is so, based on the inter-strata differences discussed above, we can maintain our claim that rural wage-employment income sources are contributing very little or nothing to reduction in income inequality.

4. MODELING INCOME DIVERSIFICATION STRATEGIES

Following the conceptual model presented in Section 2, we divide rural income sources into the following six categories: (1) self-employment unskilled agricultural activities; (2) self-employment skilled agricultural activities; (3) wage-employment unskilled non-agricultural activities; (4) wage-employment skilled non-agricultural activities; (5) self-employment non-agricultural activities (skilled and unskilled); (6) wage-employment agricultural activities (skilled and unskilled). However, we joined skilled and unskilled self-employment non-agricultural activities as well as skilled and unskilled wage-employment agricultural activities because we did not find clear differences in their patterns.

The equations estimated where those representing the share of total rural income in each of the above four income sources. The estimation method is Tobit double-censored estimation. The equations were estimated as a system, dropping the last equation, as income shares must sum to one.

The determinants include: (1) location variables (regional dummy variables, regional land productivity, and local market size); (2) human capital variables (family size and composition, age, gender, and years of schooling); (3) public assets (access to electricity and roads, approximated by the distance to market); (4) agriculture-specific assets (land and cattle); (5) non-agriculture-specific assets (wage labor experience); (6) financial assets (access to credit). Finally, regional dummies were placed in the estimation in order to control for regional price variations.

Table 7 shows results. The table shows the number of left- and right-censored observations in each equation as well as a likelihood-ratio test as a goodness-of-fit indicators. Note that all equations fit the data reasonably well. Furthermore, an important number of observations (over two-thirds) are either left- or right-censored, justifying the estimation method.

Table 7 shows that location, and ownership of private and public assets are key determinants of household income diversification in rural Peru. For example, in poor agricultural zones (based on the proxy of average land productivity in the district). In effect, the higher the land productivity of the district, hence the stronger the agricultural sector, the greater are nonfarm income shares in overall incomes.

As expected, the ownership of fixed agricultural assets increases the share of own-farm income in total household income, and reduces the need for undertaking wage-employment in the farm and nonfarm sectors. Credit access is also a key determinant of self-employment (whether in farm or the nonfarm sectors). However, it should be noted that nonfarm income sources relax the cash constraint as substitutes for credit or credit constraint.

Another key asset affecting income diversification sources is human capital. The effect of education is very clear: the higher the education level, the lower the incentive to obtain income from own-farming, and the greater the incentive to commit time to nonfarm self-employment activities as well as nonfarm (but not farm) wage-employment.

It is interesting to note that we have not found any gender bias in the income diversification strategies of rural dwellers in Peru. This is consistent with the evidence shown by Valdivia and Robles (1997), that even though there exist gender roles in farming, there is no evidence of gender discrimination in Peruvian rural labor markets.

Finally, the role of some key public assets such as rural electrification and roads is clearly shown in our results. Access to these public assets raises the profitability of both farm and nonfarm activities, but especially of nonfarm businesses.

5. CONCLUSIONS

In a world of complete certainty, where markets for all goods exist and are perfect, labor allocation decisions tend to be driven by relative wages. However, in rural Peru, labor markets are not perfect. Shadow wages can differ from market wages, and are determined by the marginal productivity of labor, the price of consumption goods, time endowment, non-labor income and private and public asset endowments. Labor allocation decisions between self-employment and wage employment activities would then result from, inter alia, binding constraints in the rural labor market or in the credit market or an insufficient provision of public goods.

This paper has shown that indeed access to public goods and services together with an adequate endowment of private assets (especially education and credit) can improve access to self-employment non-agricultural as well as wage- employment income sources in rural Peru.

We have also shown the importance for the rural sector of the activities that go beyond agricultural tasks within the farm, and that this importance has increased substantially during at least the past decade. At present, 51% of the net income of Peruvian rural households originates from activities other than own-farming. This suggests that the off-farm activities should certainly no longer be considered as "marginal," as they have so often in past rural debates. Although richer households tend to rely more on nonfarm

sources than do the poor, the latter also participate in a substantial way in the nonfarm sector; poverty might be even more rampant were it not for these income sources.

The reasons to diversify income in rural Peru are various. A large group of farmers complement their faring with farm wage employment and nonfarm activities due insufficient land or cattle or farm capital. Yet another group has sufficient education, skills, credit, and access to roads and electricity to allow them to undertake nonfarm wage employment (such as making handicrafts, repairing and renting equipment, and commerce). Many of these nonfarm activities are indirectly linked to the farm sector, which is why one finds such high levels of participation in the nonfarm sector in the more dynamic agricultural areas.

A better understanding of why rural households diversify income sources can help us to assess the likely impact of recent structural reforms on rural income diversification. During the past decade, the Peruvian rural sector has been exposed to a major liberalization program. These reforms swept away much of what had been highly interventionist policies. In addition to macroeconomic reforms, the government implemented major structural reforms in the areas of trade policy, privatization, and the financial sector. In agriculture, the reforms included substantial liberalization of agricultural trade, the elimination of price controls over agricultural products, the liberalization of the land market allowing land ownership by domestic firms and foreigners, the elimination of most agricultural input subsidies, and a severe downsizing of most public agricultural institutions including the Ministry of Agriculture, marketing agencies, the Agrarian Bank, and the agricultural research service. Together with these policy reforms, there was a major investment effort undertaken in the rural areas, including rural roads, electrification, and drinkable water and sewage systems.

Access to some of these public services (like electricity and roads) and access to credit is important in explaining why some rural dwellers can access better income sources. For example, more developed public infrastructure can help increase the size of rural towns and small cities, especially in the Highlands region. Better infrastructure and denser population drive down transaction costs and boost investment in both the agricultural sector and the non-agricultural sectors.

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REFERENCES

Deaton, A. (1997). *The Analysis of Household Surveys: a microeconomic approach to development policy*, Baltimore: The World Bank and Johns Hopkins University Press.

de Janvry, A. and Sadoulet, E. (1996). Household Modeling for the Design of Poverty Alleviation Strategies. Working Paper 787, University of California, Berkeley, Department of Agricultural and Resource Economics.

Elbers and Lanjouw, P. (this volume). Intersectoral transfer, growth, and inequality in rural Ecuador. *World Development*.

Escobal, J., Saavedra, J., and Torero, M. (1998). Los activos de los pobres en el Perú. Unprocessed, Research Report R-361. Inter-American Development Bank Research Network, Washington D.C.

Figueroa, A. (1989). *La Economía Campesina de la Sierra del Perú*, Fourth Edition, Lima: Fondo Editorial Pontificia Universidad Católica del Perú.

Gonzáles Olarte, E. (1996). El Ajuste Estructural y los Campesinos. Colección Mínima, 33. Lima: Instituto de Estudios Peruanos.

Grosh, M. and Glewwe, P. (1995). A Guide to Living Standards Measurement Study Surveys and Their Data Sets. LSMS Working Paper 120, Washington, D.C.: World Bank.

Jacoby, H. (1993). Shadow Wages and Peasant Family Labour Supply: An Econometric Application to the Peruvian Sierra. *Review of Economic Studies* 60(4), October, 903-21.

Klein, E. (1992). El empleo rural no agricola en America Latina. Report No. 364. PREALC, Santiago, Chile.

Lanjouw, P. (1999). Rural Non-Agricultural Employment and Poverty in Ecuador. *Economic Development and Cultural Change*, 48(1) October, 91-122.

Laszlo, S. (2000). Labour Supply and the Household Enterprise: The Case of Nonfarm Self-Employment In Rural Peru. Unprocessed, Department of Economics, University of Toronto

Le, A. (1994). Empirical Studies of Self-Employment. *Journal of Economic Surveys* 13(4), April, 381-436.

Lopez, R. (1986). Structural Models of the Farm Household that Allow for Interdependent Utility and Profit Maximizing Decisions. In Singh, Squire, L., and Strauss, J. *Agricultural Household Models, Extensions, Applications and Policy,* Baltimore: World Bank and The Johns Hopkins University Press, 306 - 325.

Ministerio de Agricultura. (1986). Perú ... hacia un país agrario. Report to the Peruvian Congress. Lima, Ministerio de Agricultura..

Ministerio de Agricultura. (1993). Los desafíos del agro en la década del noventa. Lima: Ministerio de Agricultura.

Moncada, G. (1996). El perfil de la pobreza en el Perú: Método de Estimación y resultados. In Moncada, G. and Webb R. *¿Cómo estamos? Análisis de la Encuesta de Niveles de Vida.* Lima: Instituto Cuánto and UNICEF.

Reardon, T. (1997). Using Evidence of Household Income Diversification to Inform Study of the Rural Nonfarm Labor Market in Africa. *World Development*, 25 (5), 735-748.

Reardon, T. and Barrett, C.B. (2000). Agroindustrialization, Globalization, and International Development: an overview of issues, patterns, and determinants. *Agricultural Economics*.

Reardon, T., Cruz, M.E., Berdegué, J. (1998). Los pobres en el desarrollo del empleo rural no agrícola en América Latina: paradojas y desafíos. Invited Plenary Paper at the Tercer Simposio Latinoamericano de Investigatión y Extensión en Sistemas Agropecuarios, Lima, 19-21 August.

Reardon, T., Rello, F., Schejtman, A., Stamoulis, K. (1999). The Effects of Agroindustrialization on Rural Employment in Latin America: analytical framework, hypotheses, and evidence. Paper pesented at the AAEA Preconference

"Agroindustrialization, Globalization, and International Development," 6-7 August, Nashville, Tennessee.

Reardon, T., Stamoulis, K., Cruz, M.E., Balisacan, A., Berdegué, J.A., Banks, B. (1998). Rural Nonfarm Income in Developing Countries. Special Chapter in FAO, *The State of Food and Agriculture 1998*, Rome: Food and Agriculture Organization.

Reardon, T., Taylor, J.E., Stamoulis, K., Lanjouw, P., Balisacan, A. (2000). Effects of Nonfarm Employment on Rural Income Inequality in Developing Countries: An Investment Perspective. *Journal of Agricultural Economics*, 51 (2), May, 266-288.

Singh, I., Squire, L. and Strauss, J. (1986). A Survey of Agricultural Household Models: Recent Findings and Policy Implications. *World Bank Economic Review*, 1(1), September, 149-79.

Shorrocks, A.F. (1983). The Impact of Income Components on the Distribution of Family Incomes. *Quarterly Journal of Economics*, May, 311-326.

Suarez, R. (1988). Informal Sector, Labour Markets, and Returns to Education in Peru. LSMS Working Paper 32. Washington D.C.: World Bank.

Trivelli, C. (1997). Crédito en los hogares rurales del Perú. Serie Investigaciones Breves, 4, Lima: CIE.

Urrutia, J. (1995). Relaciones laborales, empleo agrícola y sociedad rural. Working Paper, Lima, CEPES.

Valdivia, M. (1997). Mercados de Trabajo y manejo de riesgo en economías rurales: evaluación de los hogares de Pomacanchi, Cuzco. Unprocessed, Lima, GRADE.

Valdivia, M. (1998). El trabajo asalariado en las economías rurales del Perú. *Boletín de opinión* No. 33. January. Lima, Consorcio de Investigación Económica, 110-118.

Valdivia, M. and Robles, M. (1997). Decisiones Laborales en las Economías Rurales del Perú. *Notas para el Debate,* 14, GRADE. Lima, Peru, 79 -131.

Vásquez, A. (2000). *Desarrollo Agrario: Antecedentes y Propuesta de Política para el Siglo XXI*, Lima: Universidad Nacional Agraria La Molina.

World Bank. (1998). Peru: An Agricultural Development Strategy. Green Cover Document. March, Washington.

World Bank. (1991). Basic Information. Peru: Living Standards Measurement Survey. Poverty and Human Resources Division. 1991, Washington D.C.

World Bank (1999). Poverty and Social Developments in Peru, 1994-1997. World Bank Country Study. Latin American and the Caribbean Region, Washington D.C.

TABLE 1

Labor Allocation Of Peruvian Rural Households

(Percentage)

	1985-1986	1994	1997
SELF-EMPLOYMENT	90.4	87.4	90.5
- Agricultural Activities	75.8	62.3	64.7
- Non-agricultural Activities	14.6	25.1	25.8
WAGE-EMPLOYMENT	9.6	12.6	9.5
- Agricultural Activities	4.3	6.2	4.8
- Non-agricultural Activities	5.3	6.5	4.7

Source: LSMS surveys of 1985-86, 1994 and 1997.

TABLE 2
Regional Differences In Labor Allocation
Peru – 1997
(Percentage)

	COAST	HIGHLANDS	AMAZON	RURAL PERU
SELF-EMPLOYMENT	84.7	91.5	89.0	90.5
- Agricultural Activities	61.3	66.7	58.0	64.7
- Non-agricultural Activities	23.4	24.8	31.0	25.8
WAGE-EMPLOYMENT	15.3	8.5	11.0	9.5
- Agricultural Activities	9.7	4.0	5.5	4.8
- Non-agricultural Activities	5.6	4.5	5.5	4.7
TOTAL	100.0	100.0	100.0	100.0

Source: Own estimates based on Peruvian LSMS of 1997

TABLE 3
Average Returns By Income Source
RURAL PERU - 1997
(US$ per workday)

	COAST	HIGHLANDS	AMAZON	RURAL PERU
SELF-EMPLOYMENT				
- Agricultural Activities	1.5	0.3	0.6	0.4
- Non-agricultural Activities	0.8	0.7	0.5	0.7
WAGE-EMPLOYMENT				
- Agricultural Activities	1.6	0.7	0.7	0.8
- Non-agricultural Activities	1.6	2.0	1.1	1.8
TOTAL	1.4	0.5	0.6	0.6

Source: Own estimates based on Peruvian LSMS of 1997

TABLE 4
Net Income By Source
RURAL PERU - 1997
(US$ per capita)

	COAST	HIGHLANDS	AMAZON	RURAL PERU
SELF-EMPLOYMENT				
- Agricultural Activities	455.5	130.3	169.7	167.0
	(67.6%)	(41.6%)	(56.5%)	(49.0%)
- Non-agricultural Activities	97.8	109.2	79.0	101.1
	(14.5%)	(34.8%)	(26.3%)	(29.7%)
WAGE-EMPLOYMENT				
- Agricultural Activities	76.6	16.7	20.6	22.7
	(11.4%)	(5.3%)	(6.9%)	(6.7%)
- Non-agricultural Activities	44.3	57.2	31.0	49.9
	(6.6%)	(18.3%)	(10.3%)	(14.6%)
TOTAL	674.2	313.3	300.3	340.6
	(100.0%)	(100.0%)	(100.0%)	(100.0%)

Source: Own estimates based on Peruvian LSMS of 1997

TABLE 5
Net Income Distribution By Quintile
RURAL PERU 1997
(Row Percentages)

	Self-Employment Income:		Wage-Employment Income:		
Quintile	Agricultural (1)	Non Agricultural (2)	Agricultural (3)	Non Agricultural (4)	(2)+(3)+(4)
I	70.5	20.0	4.5	4.9	29.5
II	62.8	19.7	12.8	4.7	37.2
III	58.1	22.2	12.6	7.2	41.9
IV	46.9	29.1	10.0	14.0	53.1
V	45.5	32.8	4.1	17.6	54.5
Rural Peru	49.0	29.7	6.7	14.6	51.0

Note: Quintiles are ordered in increasing per capita income terms
Source: LSMS survey of 1997

TABLE 6
Income Inequality Decomposition By Income Source
(Gini Index)

Sources	GINI	PSEUDO GINI	CONTRIBUTION (%)	GINI DECOMPOSITION
Self-Employment Agricultural activities	0.5417	0.9264	7.03	0.0135
Self-Employment Non-Agricultural activities	0.6707	0.7122	47.82	0.2977
Wage-Employment Agricultural activities	0.5299	0.9249	11.53	0.0172
Wage-Employment Non-Agricultural activities	0.6150	0.7733	33.62	0.2486
TOTAL	0.5770	0.5770	100.00	0.5770

Note: Gini coefficient is calculated considering only those who participate in an activity while pseudo-Gini considers all households
Source: Own estimates based on Peruvian LSMS of 1997

TABLE 7

Determinant Of Income Diversification: Rural Peru 1997

(Dependent variables: Income shares)

	Income source:					
Variables	Self-employment unskilled agri-cultural activities	Self-employment Skilled agri-Cultural activities	Wage-employment unskilled nonagri-cultural activities	Wage-employment skilled nonagri-cultural activities	Self-employment nonagricultural activities	Wage-employment agricultural activities
Family size	0.031*	-0.004	0.043	-0.267***	-0.022	0.036
	(1.7)	(-0.2)	(1.6)	(-3.8)	(-0.9)	(0.9)
Age of household head	0.002	0.003	-0.002	0.005	-0.001	0.002
	(0.9)	(1.2)	(-0.6)	(0.7)	(-0.3)	(0.3)
Gender of household head	0.010	0.261	-0.192	0.813	-0.045	0.251
	(0.1)	(1.4)	(-0.9)	(1.1)	(-0.2)	(0.8)
Years of education (average)	-0.950***	-0.532	1.575***	4.373***	2.274***	-0.272
	(-3.0)	(-1.4)	(3.4)	(4.3)	(5.2)	(-0.4)
Labor Experience (years)	0.012	0.110***	0.041	0.209***	-0.007	-0.141
	(1.1)	(2.9)	(0.3)	(3.2)	(0.8)	(1.1)
Access to electricity	-0.205**	0.122	0.007	0.897	0.124 **	-0.073
	(-2.0)	(0.9)	(0.0)	(1.4)	(2.3)	(-0.3)
Access to credit	0.199**	0.278***	0.475	0.494	0.532***	0.274
	(2.3)	(2.6)	(1.2)	(1.3)	(4.9)	(1.6)
Livestock (in sheep equivalents)	0.972***	-0.257	-1.082***	0.016	-0.866***	-1.055**
	(6.0)	(-1.3)	(-3.4)	(0.0)	(-3.1)	(-2.5)
Land size (has.)	0.356**	1.341**	-0.175	0.115	-0.006	-1.183
	(2.1)	(2.5)	(-0.2)	(0.1)	(-0.0)	(-1.1)
Distance to the Market (Km)	-0.002	0.000	-0.003	-0.006*	-0.030***	0.000
	(-1.1)	(0.2)	(-0.9)	(-1.8)	(-2.8)	(0.1)
Local Market Size (population)	0.007**	0.005	0.000	0.014*	0.005	-0.006
	(2.6)	(1.5)	(0.0)	(1.7)	(1.3)	(-1.0)
Local Land Productivity (Soles per ha.)	-0.011**	0.014***	0.018***	0.008	0.018***	-0.002
	(-2.6)	(2.9)	(3.5)	(0.7)	(3.5)	(-0.3)
Coast Dummy	0.641**	-0.844**	-1.498***	-4.207***	-1.689***	-0.730
	(2.4)	(-2.5)	(-3.5)	(-3.2)	(-4.0)	(-1.2)
Highland Dummy	0.902***	-1.148***	-1.057**	-4.931***	-1.611***	-0.959
	(2.8)	(-2.9)	(-2.1)	(-3.3)	(-3.3)	(-1.3)
Amazon Dummy	0.666***	-0.723**	-1.387***	-3.827***	-1.565***	-1.424***
	(2.8)	(-2.5)	(-3.7)	(-3.2)	(-4.2)	(-2.6)
Left-Censored observations	295	462	668	744	642	667
Right-Censored observations	334	70	4	1	5	22
Uncensored observations	149	246	106	33	131	89
Log likelihhod value	-772.55	-670.02	-303.90	-124.17	-359.68	-359.14
Prob. (L.R. Statistic) > chi2(35)	0.000 ***	0.000 ***	0.031 **	0.047 **	0.021 **	0.024 **

Note: This is a tobit double censored estimation. T-values in parenthesis.

The symbols ***, **, * indicate that the null hypothesis can be rejected at 1%, 5% y 10% respectively.

ENDNOTES

[1] Although the LSMS questionnaire is long, survey quality is assured through two visits to the households and directing different parts of the questionnaire to the appropriate household member. The surveys generated detailed data on primary and secondary wage-employment and self-employment activities. Although is is sometimes difficult to use data from nationwide multitopic surveys to measure income and expenditures (due to problems related to imputation, recall, and seasonality of activities, among other challenges), the evolution of expenditures between 1985 and 1997 as measured by the Peru LSMS surveys tracks well the data from the National Accounts. Moreover, Deaton (1997) notes that LSMS survey income and expenditure data are of generally good quality.