



Pergamon

Food Policy 25 (2000) 389–409

FOOD
POLICY

www.elsevier.com/locate/foodpol

Rural poverty in Latin America Determinants and exit paths

Alain de Janvry^{*}, Elisabeth Sadoulet

University of California at Berkeley and the World Bank, USA

Abstract

While rural poverty in Latin America has declined over the last three decades, success has been uneven across countries and rural poverty remains huge. Reduction in the number of rural relative to urban poor has been mainly the outcome of migration, not of successful rural development. We show that rural incomes are explained by the asset position of households and the characteristics of the context where assets are used. Given heterogeneity in asset positions and contexts, many strategies to escape poverty consequently exist. We identify four paths out of poverty: exit, agricultural, pluriactive, and assistance. Successful rural development to promote the agricultural and pluriactive paths requires a wholesale new approach based on regional development, decentralization and participation. Agricultural technology has a role to play in these two strategies. In Latin America, however, the bulk of the benefits from technological change has been captured through indirect effects via the price of food, employment creation and contributions to aggregate growth. © 2000 Elsevier Science Ltd. All rights reserved.

Keywords: Rural poverty; Agricultural technology; Rural development; Poverty reduction

Introduction

Despite rapid urbanization and the convergence in poverty rates between rural and urban areas, rural poverty remains an important welfare problem in most Latin American countries, a huge wastage of human resources, a frequent source of political destabilization and a cause of environmental pressures. The policy record in dealing with rural poverty has been highly uneven and generally disappointing, with the

^{*} Corresponding author. Tel.: +1-510-642-3348; fax: +1-510-643-8911.

E-mail address: alain@are.berkeley.edu (A. de Janvry).

sources of gains in reducing the relative number of rural to urban poor mainly caused by population shifts as opposed to successful rural poverty reduction. We venture the opinion that an important reason why the policy record has been lacking is because the causes and dynamics of poverty have been much misunderstood. Setting the record straight regarding what creates rural poverty and how specific individuals and communities have escaped poverty is thus an important part of a solution. With significant progress in democratic rights, the decentralization of governance, the thickening of civil society organizations and the potential offered by new technological and institutional innovations, the time is ripe for improved information about the causes of poverty and the paths out of poverty to be used in more effective anti-poverty strategies. We present such information. We particularly explore the role that technological change in agriculture can play as an instrument for poverty reduction and the conditions under which it can be made to be more effective for this purpose.

Retrospective on rural poverty: the development record

In the aggregate, Latin American rural poverty trends have been favourable, at least compared to urban poverty (Fig. 1). Over the last 27 years, the incidence of poverty in the rural sector has fallen, and the number of rural poor has also declined, whereas the incidence of urban poverty failed to decline and the absolute number of urban poor rose sharply. This, however, hides considerable heterogeneity and is dominated by successful rural poverty reduction in Brazil. For the rest of Latin America as an aggregate, the incidence of rural poverty has been constant or rising, and the number of rural poor increasing. Heterogeneity is thus an important issue; global statements must be examined with caution.

We start by characterising the nature of rural poverty in Latin America and how it evolved between 1970 and 1997 (Table 1). The following secondary headings are statements that can be made on the situation.

Rural poverty is extensive

Using a poverty line defined as twice the expenditure to achieve a minimum nutritional requirement, the incidence of rural poverty was 51% across Latin America in 1997 [own calculations based on CEPAL (1999) data]. It was above 50% in six of the 12 countries with data, Mexico (53%), Colombia (54%), Peru (61%), El Salvador (62%), Guatemala (75%) and Honduras (80%). Despite relatively high income levels among developing countries, Latin American countries have high incidences of rural poverty because of the highly unequal distribution of income that characterizes them, both between sectors and within the rural sector.

The incidence of rural poverty (P_0^r) is considerably higher than the incidence of urban poverty (P_0^u)

In 1997, the ratio of headcount ratios for the rural and urban sectors was 1.7 for Latin America and is larger than 1.0 in all countries. For Chile, Colombia, Costa

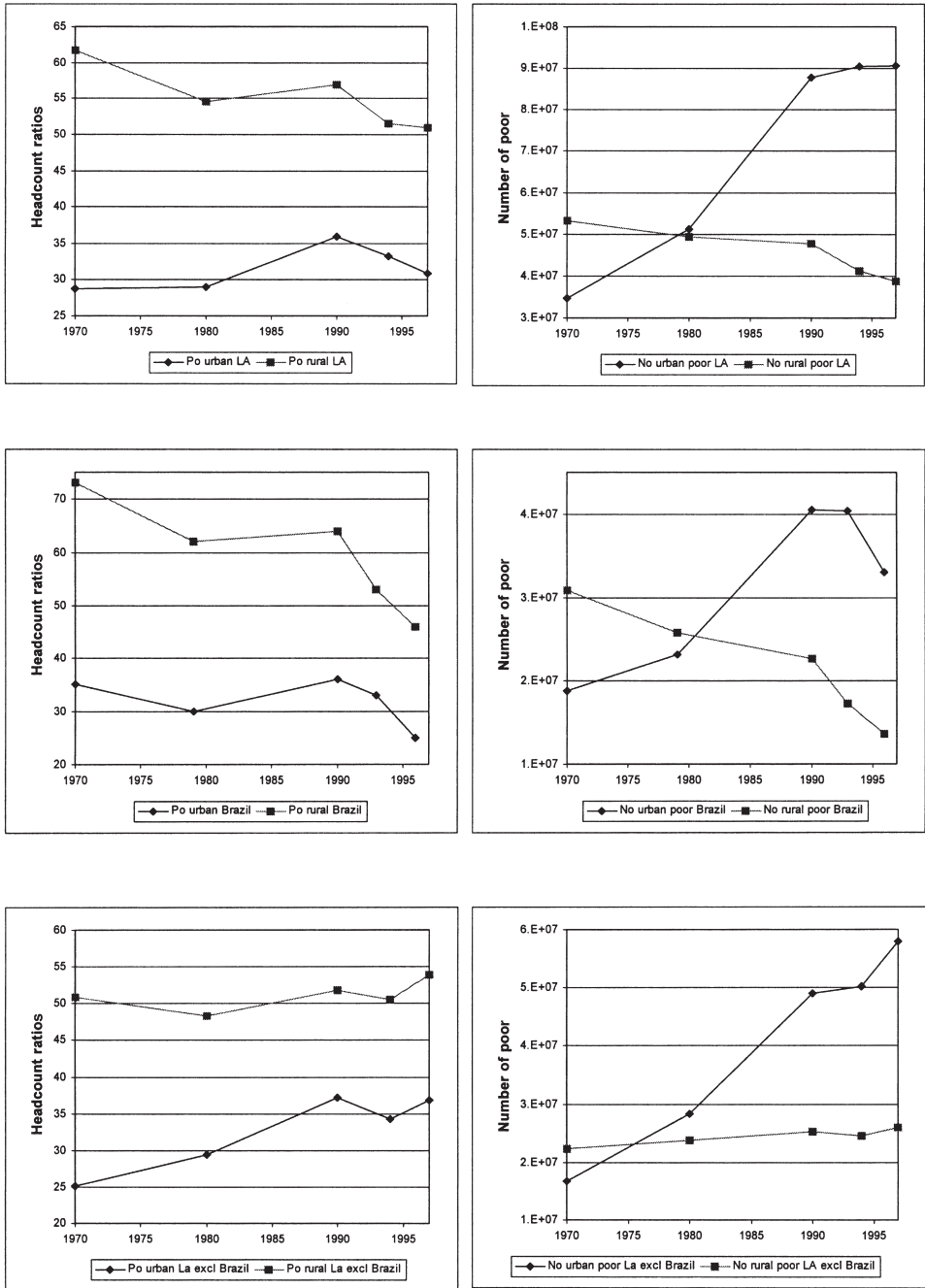


Fig. 1. Rural and urban poverty, Latin America 1970-97. Data are the population weighted aggregates for Brazil, Chile, Colombia, Costa Rica, Honduras, Mexico, Peru, and Venezuela. These eight countries, with consistent data over the period, account for 80% of the population of Latin America.

Table 1
Poverty and extreme poverty in Latin America^a, 1970–97

Year	Poverty headcount ratio (P_0)(%)			Rural population (% of total)	Rural percentage of total poverty	Rural P_0 /urban P_0	No. rural poor/no. urban poor	Rural poor (no.)
	Rural	Urban	Total					
<i>Poverty</i>								
1970	61.7	28.8	42.5	41.7	60.5	2.1	1.5	53,267,397
1980	54.6	29.0	37.6	33.9	49.1	1.9	1.0	49,410,781
1990	56.9	35.9	41.3	25.6	35.3	1.6	0.5	47,806,315
1994	51.5	33.2	37.4	22.8	31.4	1.5	0.5	41,309,017
1997	51.0	30.9	35.0	20.6	30.0	1.7	0.4	38,783,735
<i>Extreme poverty</i>								
1970	32.2	10.9	19.8	41.7	67.9	3.0	2.1	27,797,448
1980	28.7	9.3	15.9	33.9	61.2	3.1	1.6	25,963,428
1990	32.5	12.2	17.4	25.6	47.9	2.7	0.9	27,319,867
1994	28.3	11.0	14.9	22.8	43.3	2.6	0.8	22,735,212
1997	26.8	9.7	13.2	20.6	41.9	2.8	0.7	20,410,464

^a Source: Calculated on the basis of data in CEPAL (1999). The eight countries used for the Latin America aggregate are: Brazil, Chile, Colombia, Costa Rica, Honduras, Mexico, Peru and Venezuela.

Rica, Guatemala, Mexico and Panama, this ratio is 1.4; it reaches 1.6 in El Salvador, 1.8 in Brazil, 2.3 in Uruguay and 2.4 in Peru. Hence a huge gap occurs in the incidence of poverty between the rural and urban populations, with that incidence being much higher in rural areas.

The rural sector's share in the total number of poor remains high despite urbanization

For Latin America, rural poverty represents 30% of total poverty. In the aggregate, poverty is principally urban. However, rural poverty accounts for most of the poor in Central American countries (Panama 52%, Honduras 55%, Costa Rica 58%, El Salvador 62% and Guatemala 68%).

Rural poverty is considerably deeper than urban poverty

Extreme poverty disproportionately affects rural households. Defining extreme poverty as the income necessary to cover the cost of the minimum nutritional requirement, extreme poverty characterized 27% of the rural population in Latin America in 1997, affecting 41% of the rural population in Peru, 53% in Guatemala and 59% in Honduras. The ratio of extreme poverty headcount ratios for the rural and urban sectors was 2.8 for all of Latin America, reaching 2.0 in Chile, 2.3 in El Salvador, 2.5 in Mexico, 2.9 in Brazil and 5.9 in Peru.

The incidence of rural poverty and the number of rural poor have declined, but not in the 'rest of Latin America' excluding Brazil

The incidence of rural poverty declined rapidly in the 1970s (62–55%), increased in the 1980s (55–57%), and has declined sharply since (57–51%). The number of rural poor has also declined. This is a remarkable success. However, much of this is because of the rapid decline in rural poverty in Brazil. For the 'rest of Latin America' (Table 1), the incidence of rural poverty has not declined (51% in 1970 rising to 54% in 1997) and the absolute number of rural poor increased by 16%.

The rural headcount ratio is convergent with the urban ratio

Although the headcount ratio remains higher in the rural than in the urban sector, the two ratios have been converging in basically every country. For Latin America, the ratio P_r^h/P_u^h fell from 2.1 in 1970 to 1.7 in 1997. For most countries, this ratio was above 2 in 1970, falling to 1.4 in the late 1990s. This suggests that labour markets have become increasingly integrated, through both permanent and seasonal migration, and that off-farm sources of income are increasingly the same in the two sectors.

The share of rural poverty in total poverty has declined

This decline has been quite dramatic. We analyse its determinants later. For Latin America as a whole, rural poverty accounted for 61% of total poverty in 1970 but only 30% in 1997.

Rural poverty is responsive to aggregate income growth and to income shocks

Overall, rural poverty fell during the 1970s, rose during the 1980s when most countries were affected by the debt crisis, and fell again in the 1990s with economic recovery. In specific countries that were affected by economic crises in the 1990s, rural poverty rose again. This was the case in Mexico during the peso crisis (1994–96) and in Venezuela (1990–94). Rural poverty is thus anti-cyclical with aggregate economic growth. However, overall, rural poverty is less sensitive to aggregate income growth and to downturns than is urban poverty.

Rural inequality rises with recession but may not have declined with recovery

Although evidence is weak (through lack of data), rural inequality seems to have increased during the 1980s while countries were adjusting to the debt crisis. In the 1990s, the recovery of growth does not seem to have led to declining rural inequalities. This is consistent with data on inequality at the aggregate level (Londoño and Székely, 1997; de Janvry and Sadoulet, 1998). Thus, although late growth has been effective in reducing poverty, this does not appear to be the case for inequality. Hence, if high inequality is a policy concern, particularly because it lowers the poverty reduction effect of aggregate income growth (Ravallion, 1997), it needs to be addressed through direct instruments rather than indirectly through growth.

Rural poverty is multidimensional

Income is an important dimension of welfare. Indicators of income poverty, income security, and income inequality measure the welfare contribution of income. Control over income is an important determinant of consumption expenditures. But, poverty is multidimensional, including other elements of basic needs (health, education), the satisfaction of being employed, empowerment, the strength of community relations, legal and human rights, and political freedoms (World Bank, 2000). Overall, the satisfaction of basic needs in rural areas is only a fraction of that in the urban sector. In El Salvador, infant mortality is 17% higher in rural than in urban areas whereas it is 31% higher in Guatemala. Hence, for rural households, poverty in basic needs usually compounds income poverty. However, it also indicates that poverty can be attacked both by income gains and by gains on many other fronts. In Chile, for instance, although gaps persist in the incidence of income poverty between rural and urban sectors, health achievements (infant mortality under 5 years of age) have reached parity (Valdés and Wiens, 1996).

The rural poor are heterogeneous in assets positions

Poor rural households are highly heterogeneous in their control over productive assets. These assets are multidimensional and include:

1. Land and other natural assets: water, animals, trees, soil fertility.
2. Human assets: number of working adults in a household, education, experience.
3. Institutional assets: access to credit, insurance, extension and information, and inclusion in government programmes.
4. Social assets: social capital, membership in corporate communities.
5. Regional context: location in areas with differential income earning opportunities.

As we shall later see, household endowments in these assets have a strong explanatory power on household income. High substitution effects among assets in generating income indicate that to the heterogeneity of asset positions correspond many strategies out of poverty consisting in altering asset endowments. Households in poverty are those with low endowments in all assets.

Market failures differentially affect the rural poor

Because of high transaction costs on product and factor markets, rural households are differentially integrated into markets: some are net sellers, some net buyers, some self-sufficient (i.e. not integrated into markets) and others both sell and buy during the same agricultural season. This distinction is important because the same price effect will have markedly different consequences on a household's real income according to the nature of its market integration. For instance, a fall in the market price of maize in Mexico caused by the North American Free Trade Agreement (NAFTA) will hurt net sellers, leave autarkic households unaffected, benefit net buyers and some net sellers become self-sufficient while some autarkic households become net buyers.

Data in Table 2 for Mexico (de Janvry et al., 1997) and Nicaragua (Davis et al., 1997) show that, contrary to conventional wisdom, most landed rural households are not net sellers of the major food crops they produce. In the Mexican ejido, 59% of

Table 2
Landed household participation in staple food markets

Percentage of farm households	Maize—Mexican <i>ejido</i>	Maize—Nicaragua	Beans—Nicaragua
Net buyers	27	23	28
Self-sufficient	32	30	30
Net sellers	28	39	37
Sellers and buyers	13	9	5

Sources: Mexico (de Janvry et al., 1997); Nicaragua (Davis et al., 1997)

corn producers never sell any. In Nicaragua, this is true for 53% of the farm households in corn and 58% in beans. A price policy that turns the terms of trade in favour of these crops will consequently not benefit most of the landed households.

Institutional gaps and public goods deficits differentially affect the rural poor

Access to credit and technical assistance is minimal overall among the rural poor. In the Mexican *ejido*, households below median income are 25% less likely to have access to credit and 62% less likely to have access to technical assistance. For the *ejido* as a whole, the main technical assistance programme (Alianza para el Campo) only reaches 13% of households and only 18% have access to formal credit (World Bank, 1998). In Nicaragua, 9% of all farm households have access to technical assistance and 9% to formal credit. These institutional gaps lower the income generating capacity of the meagre asset endowments that the poor possess.

Income strategies are heterogeneous

Heterogeneous access to assets, heterogeneous exposure to market failures and to institutional gaps and heterogeneous access to public goods induce income earning strategies that are highly diverse across households. Table 3 illustrates this with information for the Mexican *ejido* sector and landed households in Nicaragua. The data are striking in that, among these landed households, 73% in Mexico and 34% in Nicaragua derive more than half their income from off-farm activities. Off-farm sources of income serve as substitutes for farm incomes derived from access to land. Thus, in Mexico, the share of total household income derived off-farm falls from 86% on small farms to 40% on larger farms. In Nicaragua, where access to off-farm incomes is less, this share falls from 68 to 16%. Interestingly, control over the assets needed to derive income from off-farm activities rises with access to land. As a result, those with larger farms are able to derive larger incomes from off-farm activities, even though off-farm incomes rise with farm size less than do farm incomes. In Mexico, off-farm incomes yield 4242 pesos on small farms and 8726 pesos on large farms. In Nicaragua, small-scale farmers earn 702 cordobas off-farm and large-scale farmers, 1498 cordobas. Among off-farm sources of income, agricultural wage income is the most equalising, while other incomes (e.g. non-agricultural wage income, self-employment in micro-enterprises, migration and rents) are highly related to land assets. Land-poor households are thus confined to easy-entry, low paying, farm labour market activities, while wealthier households can enter high paying activities. Thus, because of extensive credit market failures, land endowments are important in explaining relative abilities to diversify in non-farm activities.

Change in the relative number of rural and urban poor: aggregate analysis

Success in rural development initiatives should help reduce the number of rural poor relative to that of urban poor. Over the 1970–97 period, this ratio has indeed

Table 3
Sources of income by farm size, Mexico and Nicaragua

Farm size in hectares	<2	2–5	5–10	10–18	>18
<i>Sources of income in the Mexican ejido by farm size, 1997</i>					
Number of households (%)	16.9	31.3	23.5	17.4	10.9
Total income in pesos of 1994	5270	7797	14,834	16,570	20,351
Total farm income	719	2336	6854	9355	12,316
Total off-farm income	4552	5462	7980	7215	8036
Wages	2014	2827	4180	2938	2131
Self-employment, remittances and other	2538	2635	3800	4277	5905
Total income in % shares	100	100	100	100	100
Total farm income	13.6	30.0	46.2	56.5	60.5
Total off-farm income	86.4	70.0	53.8	43.5	39.5
Wages	38.2	36.3	28.2	17.7	10.5
Self-employment, remittances and other	48.2	33.8	25.6	25.8	29.0
<i>Sources of income in Nicaragua by farm size, 1996</i>					
Farm size in manzanas ^a	<2	2–5	5–20	20–50	>50
Number of households (%)	20.7	23.8	29.5	15.4	10.6
Total income in cordobas of 1996 (per capita)	1027	1561	2090	3626	9557
Total farm income	325	896	1615	2939	8059
Total off-farm income	702	665	475	687	1498
Wages	512	338	262	206	356
Self-employment, remittances and other	190	327	213	481	1142
Total income in % shares	100	100	100	100	100
Total farm income	31.6	57.4	77.3	81.1	84.3
Total off-farm income	68.4	42.6	22.7	18.9	15.7
Wages	49.9	21.7	12.5	5.7	3.7
Self-employment, remittances and other	18.5	20.9	10.2	13.3	11.9

Sources: Mexico (1997 ejido survey); Nicaragua (Davis et al., 1997)

^a mz=manzanas (equivalent to 80 m²).

declined markedly, from about 1.5 to 0.4 (Table 1). Whence comes this success? It may have come from a decline in the headcount ratio in the rural sector, an increase in the headcount ratio in the urban sector and a shift in population from the rural to the urban sector.

Let the ratio of the number of rural (R) to urban (U) poor be written as:

$$\frac{R}{U} = \frac{P_0^r r}{P_0^u 1-r}$$

where P_0^r is the headcount ratio in the rural sector and P_0^u that in the urban sector, and r is the share of rural in total population. The change (denoted by d) in this ratio between two periods can be decomposed into four effects as follows:

A change in the:

rural headcount ratio

$$r(1-r)P_0^u dP_0^r$$

urban headcount ratio

$$-r(1-r)P_0^r dP_0^u$$

share of population in the rural sector

$$P_0^u P_0^r dr$$

interaction terms

$$P_0^u(1-r)dP_0^r dr + P_0^r r dP_0^u dr.$$

Table 4 presents results of this decomposition. In the 1970s, the incidence of rural poverty was declining relative to the incidence of urban poverty and the population was rapidly leaving the rural sector. R/U was consequently falling for two reasons: a faster decline in the incidence of rural than urban poverty and rapid outmigration. However, the population effect was dominant, explaining 76% of the fall in R/U while the decline in P_0^r only accounted for 28% of the decline.

During the 1980s recession, the incidence of urban poverty was rising much faster than that of rural poverty but rural–urban migration was continuing. The fall in R/U was consequently explained at 39% by rising P_0^u and at 61% by outmigration. Population movements were thus still the dominant force in reducing R/U .

Finally, in late recovery (1994–97), R/U was falling although urban poverty declined more rapidly than rural poverty because of continuing migration. The falling incidence of rural poverty explained only 16% of the fall in R/U whereas population movement contributed 235% of the decline in R/U .

These results show that in all three growth episodes population movements were the dominant force in explaining the decline in R/U . By contrast, we observe the relatively weak performance of growth and of rural development interventions in reducing total poverty through falling headcount ratios in the rural sector. Note that

Table 4
Roles of P_0 and population in the change in rural poverty relative to urban poverty

Period	Average annual rates of growth ^a				Shares in $d(R/U)^b$, percentage role of			
	GDP _{pc}	P_0	P_0^u	r	R/U	P_0^u	P_0^r	r
1970–80	3.8	-1.2	0.1	-2.0	-4.5	28	1	76
1980–90	-0.2	0.4	2.4	-2.8	-5.6	-7	39	61
1990–94	1.4	-2.5	-0.9	-2.9	-4.3	61	-48	95
1994–97	1.5	-0.3	-0.8	-3.3	-2.2	16	-118	206

Source: Calculated on the basis of data in Table 1

^a GDP_{pc}=Gross Disposable Product per capita; P_0^u =incidence of rural poverty; P_0^r =incidence of urban poverty; R/U =no. rural poor/no. urban poor.

^b $d(R/U)$ =change in the ratio (rural/urban poor).

this analysis underestimates the role of migration in explaining R/U because migration is likely to help reduce P_0^r and to increase P_0^u . Hence, the result presented here on the role of migration in affecting the number of rural poor relative to urban poor errs on the conservative side.

Role of asset endowments in explaining rural poverty

We now turn to household-level data to analyse the determinants of incomes and poverty among rural households. We use a 1997 data set for the Mexican *ejido*, an especially poor population of smallholders benefited by the Mexican land reform (World Bank, 1998). Results show that access to land is an important determinant of total income, particularly irrigated land, which yields almost five times more income per hectare than rainfed land (Table 5). One hectare of irrigated land increases household income by 17% among the lowest half of farm sizes. Human assets (number of adults and average level of adult education in the household) also create large income effects. Migration assets to the United States (measured as the number of household members from the immediate and the extended family with recent migration experience minus one) are also an important source of income. For migration to be successful, the size of the migration network to which a household has access is thus key (Winters et al., 1999). Ethnicity has a high income cost (at 80% level of significance) as it lowers income by 19% in the lowest half of farm sizes. Indeed, much rural poverty in Mexico is tied to indigenous populations. Finally, regional effects remain even after controlling for the differential asset position of households, with households in the Centre differentially poorer than are those in the North.

Disaggregating income by source and analysing the determinants of each source shows the relative importance of particular assets for each income source.

Access to agrarian institutions

Although, among *ejido* households, access to credit (18%) and technical assistance (7%) are dismally low after the state's withdrawal from delivering these services, they make high contributions to agricultural income. Hence, what matters for poverty reduction is the complementarity between access to land and institutional development to help achieve more productive use of the land.

Education

Adult education has positive pay-offs in agriculture, animal, non-agricultural wage income and self-employment income. However, a hierarchy exists in the way these sources of income value an additional year of adult education in an *ejido* household:

Animal income: NP\$207

Self-employment income: NP\$640

Table 5
Determinants of household income, total and by source^a

	Income regression Total	Agricultural	Animal	Income Tobit Agric. wage	Non-agric. wage Self-employment	Remittance
<i>Land assets (exogenous in ejido)</i>						
Area owned						
Irrigated	1144*** ^b	858**	62	-69	194	108
Rainfed	254***	59	115***	-188***	61*	143***
Pasture	23	-1	25***	-9	-13	-51*
Common property area per household	6	-1	4*	-19**	2	-30**
<i>Human assets</i>						
Household head gender (man=1)	-2752	-2064	1190***	-2638	62	1292
Household head age	94***	3	21**	-109***	13	310***
Adult education (av. yr)	1610***	641***	207***	-881***	640***	-1032***
Adults (no.)	665***	-280*	-160*	1147***	474***	517
<i>Per capita migration assets</i>						
Mexico	-8	-35	48*	36	37	183*
US	840***	154	168***	-320***	58	1773***
<i>Institutional assets</i>						
Used tech. assistance (dummy)	2277	2466*	6	-2333*	-35	1899
Used formal credit (dummy)	1137	2576**	-277	-1334	-10	-146
<i>Social assets</i>						
Indigenous (dummy)	-1315*	-815	-127	386	906	-4538***
<i>Regional effects (base=North)</i>						
North Pacific	-4438**	-705	199	-1404	-397	-5869***
Centre	-3933***	-387	47	-4219***	1511*	-1129
Gulf	-2172	-773	386	-1086	2924***	-2594
South	-1846	1537	1016*	-6570***	417	-1195
Constant term	-2519	1279	-2493***	4455	-21,730***	-32890***
Pseudo-R squared	0.20	0.11	0.10			

Source: Data from 1997 *ejido* survey

^a Number of observations=956.

^b ***Significant at the 95% confidence level; **at the 90% level, and *at the 80% level.

Agriculture income: NP\$641

Non-agricultural wage income: NP\$1988

Hence, rural education is most valued in non-agricultural labour markets, indicating that the type of education with the highest pay-off in rural areas should prepare adults to access non-agricultural employment. Education has a negative role on agricultural wage income because educated household members seek employment in more remunerative markets. Similarly, education impacts negatively on remittance income suggesting that migrants send less remittances to households with higher educational endowments and hence with higher capacity to generate income autonomously.

Migration to the United States

Membership of migration networks is key for success in receiving remittance income. Networks serve the function of providing information about how to migrate and find employment in the United States, and provide assistance to cover the costs involved.

Regional effects

Even after controlling for the asset position of households, regional effects are important for agricultural and non-agricultural wage income, with households in the South less favoured on both markets. Hence, a regional dimension to poverty exists that reflects unequal opportunities across regions to use asset endowments to generate income.

What role for agricultural technology in poverty reduction?

What can be done to attack rural poverty other than through migration? The analysis of income determinants has shown the importance of asset endowments, including institutional and social assets. Also important in determining income levels is the productivity of assets. Because technology affects that, we should ask how agricultural technology is expected to influence income levels among the poor, both rural and urban.

Technology and poverty: direct and indirect effects

Technological change in agriculture can act on poverty through two channels. First, it can help reduce poverty directly by raising the welfare of poor farmers who adopt the technological innovation. Second, technological change can help reduce poverty indirectly through the effects that adoption by both poor and non-poor farmers has on:

1. The price of food for consumers.
2. Employment and wage effects in agriculture.
3. Employment and wage effects in other sectors of economic activity through production, consumption and savings linkages with agriculture (Adelman, 1975), lower costs of agricultural raw materials, lower nominal wages for employers (as a consequence of lower food prices) and foreign exchange contributions of agriculture to overall economic growth.

Through the price of food, indirect effects can benefit a broad spectrum of the national poor including landless farm workers, net food-buying smallholders, non-agricultural rural poor and the urban poor for whom food represents a large share of total expenditures. Indirect effects via employment creation are important for landless farm workers, net labour selling smallholders and the rural non-agricultural and the urban poor. Hence, the indirect effects of technological change can be highly important for poverty reduction not only among urban households but also in the rural sector among the landless and many of the landed poor.

When do trade-offs occur between the direct and indirect effects of technological change? Within a given agro-ecological environment, if land is unequally distributed, market failures occur, and institutional gaps and conditions of access to public goods vary systematically with farm size, then optimum farming systems will differ across farms. Small-scale farmers will typically prefer farming systems that are less capital intensive and less risky whereas large-scale farmers will prefer farming systems that are less intensive in labour and they can afford to assume risks. In this case, unless lands were equally distributed, heterogeneity of farming systems prevails and trade-offs typically occur between indirect and direct effects. The more unequally land is distributed and the more market failures, institutional gaps, and access to public goods are farm-size specific (and in Latin America in general) the sharper the trade-off.

Quantifying the relative magnitudes of direct and indirect poverty reduction effects of technological change is difficult as they are interrelated and depend on the structure of the economy, the characteristics of poverty and the nature of technological change. Because general equilibrium effects are involved, we can use a computable general equilibrium approach. We constructed a model that typifies the structure of Latin American cereal importing countries (Sadoulet and de Janvry, 1992).

We can use this model to simulate the impact of an increase in total factor productivity caused by technological change in all crops. Results show that, in Latin America where urban poverty dominates aggregate poverty, the urban poor capture 70% of the aggregate increase in real income. Overall, indirect effects account for 86% of the total effect on the real income of the poor. With high levels of urbanization and a large share of the rural poor households highly dependent on off-farm income sources and on buying food, the indirect effects of technological change largely dominate.

These results have several caveats. First, at a lower level of aggregation, one would find situations in particular regions of Latin America where direct effects dominate. Hence the optimum balance between direct and indirect effects needs to

be determined for each particular regional context. Second, the dilemma for research budget allocation between generating direct and indirect effects disappears with certain types of research. Biotechnology, for instance, helps dissociate research on traits from research on varieties, by contrast to traditional breeding where they are confounded. Research on genes that convey different forms of biotic and abiotic resistance may be neutral to varieties and farming systems and hence achieve both direct and indirect effects.

What to expect from agricultural technology for the rural poor?

In reviewing the status and determinants of rural poverty, we made the following observations:

1. Rural-to-urban migration has been a major contributor to the decline in rural poverty. Hence, an 'exit path' to rural poverty exists and has been highly important in Latin America. The existence of this path out of poverty is not surprising. The surprise is how important it has been quantitatively in explaining declining rural poverty relative to urban poverty whenever declines occurred, and yet how little policy has done to optimize the economic and social impact of these transitions.
2. An 'agricultural path' out of poverty exists for households with sufficient access to land, and with market, institutional, public goods and policy conditions that allow them to achieve high productivity in resource use, have low transactions costs in relating to markets and face favourable prices on markets. Surprisingly, this path has been weakly prevalent and apparently weaker in the 1990s than the 1970s. This is the path that traditional approaches to rural development have pursued. Weak success in the 1990s should raise concerns about the effectiveness of rural development interventions and stress the need for a major overhaul of such interventions.
3. For most poor rural households in Latin America, the income strategy they pursue is one that combines cultivation of a small plot of land with access to off-farm sources of income. The double element of surprise here is how pervasive this income strategy is today and how some microholders have been relatively successful in using it to overcome poverty despite low farm assets. Therefore there exists a 'pluriactive path' out of poverty that has been highly important for households that did not abandon rural areas. Yet, until recently, most scholars systematically ignored it and policymakers continue to do so.
4. Finally, an 'assistance path' out of poverty also exists. The key policy issue here is one of targeting and transfer of the right type of assistance to help households in this path escape poverty. This regroups several situations:
 - (a) Chronic poor in poverty traps caused by insufficient control over a minimum bundle of assets to allow them to escape low level equilibria and move on to higher income levels. This is the 'assistance path out of poverty traps', where assistance consists of a one-time transfer of productive assets.
 - (b) Chronic poor unable to help themselves, even with asset transfers (includes many of the young, aged, disabled, etc). In this case, transfer is of a flow

of income or food to reach the poverty line. This is the ‘assistance path into sustained welfare’.

- (c) Transitory poverty caused by shocks such as illness, bad weather or macroeconomic crises. Provision of safety nets is important, both to prevent distress and to avoid irreversibilities whereby the poor respond to crises by taking children out of school, where nutritional deficits lead to stunting of child growth and where farmers decapitalize by selling productive assets. This is the ‘assistance path through safety nets’.

What can be said about the role of agricultural technology for each of these paths out of poverty?

Exit path

If the exit path is to be promoted as a way of reducing rural poverty, the key is to help migrants relocate among the non-poor, otherwise only a geographical relocation of poverty is achieved. Agricultural technology has a clear indirect role here in inducing overall economic growth and thus employment and wages for migrants. But the key for success is education of a type that prepares rural children for non-farm jobs.

Agricultural path

This is the path that land reform and rural development programmes have most pursued. Where it is being pursued through land reform to create ‘viable’ family farms, a condition for success has been complementarity between land and institutional reforms in support of the competitiveness of beneficiaries (Warriner, 1969). Where this path has been pursued via rural development programmes for the existing smallholders, key aspects of interventions have focused on:

1. Reducing market failures for smallholders (Carter and Barham, 1996).
2. Constructing agrarian institutions for the delivery of credit, the supply of technical assistance, availability of ex-ante safety nets for the provision of risk-coping instruments and the reduction of transaction costs.
3. Technology for smallholders: direct effects can be achieved through the supply of improved crops, farming systems and traits specific to this clientele. Technology should address not only production issues (through precision farming, production ecology and biotechnology) but also information technology to identify market opportunities and reduce transactions costs.
4. Provision of public goods accessible to smallholders and complementary to their particular types of investments.
5. A macroeconomic and sectoral policy framework that does not discriminate against agriculture and smallholders.

Because of the heterogeneity of poverty, and thus also the heterogeneity of poten-

tial solutions to poverty, local information is key. For this reason, rural development initiatives have been reorganized since experiences with integrated rural development in the 1960s to mobilize local information and engage the poor in identifying solutions (World Bank, 1997). New approaches to rural development have stressed:

1. Decentralization and improved capacity of local governments,
2. Promotion of grassroots organizations often assisted by non-government organizations,
3. Participation of organized beneficiaries,
4. Devolution to user groups of control over common property resources and local public goods and
5. Collective action for the management of common property resources, the delivery of local public goods and bargaining over policy making.

In technology, considerable broadening of the range of innovations potentially available for smallholders through new advances in precision farming, production ecology and biotechnology also calls for using a participatory approach to customize technology to a heterogeneous demand (Ashby and Sperling, 1995).

Pluriactive path

This household strategy differs markedly from that of a household on the ‘agricultural path’. Households on this path have a double set of activities. As part-time farmers, they can benefit from the direct effects of technological change; as part-time workers and micro-entrepreneurs, they can benefit from the indirect effects of technological change.

For households as part-time farmers, farming is more often in the hands of women and elders than of adult men, and often with discontinuous presence of adult labour and decision-makers. Hence, technology should be labour-saving as opposed to labour-intensive—a common mistake in the design of technology for smallholders who are perceived as having a labour surplus because they engage in off-farm activities. Technologies also should not be excessively sensitive to discontinuities in the presence of adult workers on the farm because they have to pursue the vagaries of job opportunities and there is high premium to immediate availability. Much of the production is food for home consumption. Because of transaction costs in accessing food markets, shadow prices (for self-sufficient households) and purchase prices (for net buying households) are higher than prices for net sellers. Thus this farming can be economical even when market prices are too low for net sellers to be competitive (Fafchamps et al., 1995). This agriculture can absorb modern technology with purchased inputs despite lack of a marketable surplus: cash expenses are met with revenues from wages and other off-farm activities. Yet its specific technological demands have been grossly neglected by formal research.

An important contribution of technology is to increase labour productivity in food production to free labour for more productive pursuits off the farm. Another important contribution is to increase the productivity of z-goods production. In sub-

sistence farming, household members, particularly women, devote a high share of working time to gathering wood, fetching water, preparing food and tending children. These tasks are fixed costs of the household, absorbing a high share of disposable working time. If they can be made more efficient (e.g. planting fast-growing trees as hedgerows) considerable income gains may result. Yet the technology of z-goods production has been badly neglected in the setting of research priorities.

Households as part-time workers and micro-entrepreneurs depend on employment creation in agriculture, particularly if they have few other assets. Agricultural technology has important roles to play through indirect effects. One role is by employment creation in the fields of large-scale farmers. Pro-poor technology should thus be labour-intensive (as opposed to technology for part-time farmers, which should be labour-saving, an apparent paradox). Labour-saving chemical herbicides, Roundup-ready seeds and mechanization are not favourable to part-time workers (Nuffield Foundation, 1999). Another role is through linkage effects with agriculture in non-agricultural activities. A dynamic agriculture helps create local demand for non-tradables through the expenditure of farm incomes. Chile has been successful in reducing rural poverty not through an 'agricultural path' but through employment creation in labour-intensive field activities (fruits and vegetables) and in agro-processing (Lopez and Valdés, 1997). Off-farm employment in non-agricultural activities is enhanced by infrastructure investment, decentralization of economic activity, development of secondary towns, neighbourhood effects and co-ordination in the location of economic activity.

That the pluriactive path can be an effective way out of poverty is demonstrated by contrasting the income strategies of non-poor and poor smallholders (households with less than 5 ha of land) in the Mexican *ejido*. In support of the proposition, we observe that 35% of these smallholders are above the poverty line. Non-poor smallholders rely more on non-agriculture wage income, self-employment and remittances from the United States than do poor smallholders. Non-poor smallholders have greater endowments in human assets (number of adults, educational levels and migration assets) and are less ethnic. They are also geographically concentrated in specific regions. Land reforms that create access to a small plot of land can thus be successful in bringing households out of poverty provided these households have high human and social asset endowments and are located in regions that offer them non-farm income opportunities. Creating 'viable' family farms through land reforms is thus not necessary. Part-time farms may be cheaper to set up if these other conditions hold.

Conclusions

Although rural poverty in Latin America has declined and aggregate poverty is increasingly urban, the number of rural poor remains high with considerable variability being evidenced across countries. More importantly, the decline in the relative number of rural to urban poor has been fundamentally the result of rural-to-urban migration that displaces poverty to the urban sector. Thus, because rural poverty

creates hardships both in the rural sector and (through migration) in the urban sector, the need to identify instruments to raise rural incomes is doubly urgent.

Household asset endowments, and the institutional, social and geographical context where those assets are used, are key determinants of rural incomes. The productivity of assets is also important in income determination and this is where agricultural technology has a role to play.

Technology can affect poverty directly and indirectly. The relative importance of these two effects depends on the structure of the economy, the characteristics of poverty and the nature of technology. In a typical Latin American set-up we found that indirect effects, materialising through employment creation, higher aggregate income growth and lower food prices, are more important than direct effects in reducing aggregate poverty. The rural poor capture one third of the benefits and the urban poor capture the remaining two thirds.

A multiplicity of pathways out of poverty exists. The dominant form of exit has been migration with its relocation of poverty to urban areas. For this path, agricultural technology has a role to play in enhancing indirect effects through food prices, employment creation and higher aggregate growth. The agricultural path out of poverty has been traditionally pursued in integrated rural development programmes. Its success depends importantly on the development of new farming systems for small-scale farmers. For this purpose, a participatory approach to research is required because accurate, local information is hard for scientists to acquire when technology needs to be customized to the heterogeneity of asset positions and contexts.

The most important path out of poverty for the Latin American rural poor should, however, rely on pluriactivity. This has not been recognized in traditional rural development programmes, nor has it been sufficiently taken into account in the design of technology. For these households, technology has an important role to play both through indirect effects in their roles as workers and net buyers of food and through direct effects in their roles as wholesale producers of some of their own food needs. Assisting this path out of poverty requires a redesign of rural development, focusing on a territorial and multisectoral approach that provides institutional support to the multiplicity of income sources that characterize the vast majority of the Latin American rural poor.

Rural development initiatives must thus seek complementarity in interventions between building the asset position of the poor and improving the productivity of those assets, particularly through technological change. The delivery of technological change for rural poverty reduction needs to be tailored to the specific features of poverty in particular regional settings. A regional approach to using technology for poverty reduction is essential. And by involving the participation of local households in the design process, this approach can be relied upon to adjust research priorities to the heterogeneous demands of the rural poor.

References

- Adelman, I., 1975. Growth, income distribution, and equity-oriented development strategies. *World Development* 3, 67–76.

- Anon., *Social Panorama in Latin America*, 1998. CEPAL, Santiago, Chile.
- Ashby, J., Sperling, L., 1995. Institutionalizing participatory, client-driven research and technology development in agriculture. *Development and Change* 26 (4), 753–770.
- Carter, M., Barham, B., 1996. Level playing fields and laissez-faire: postliberal development strategy in inegalitarian agrarian economies. *World Development* 24 (7), 1133–1149.
- Davis, B., Carletto, C., Sil, J., 1997. Los hogares agropecuarios en Nicaragua: un análisis de tipología. Department of Agricultural and Resource Economics, University of California at Berkeley.
- de Janvry, A., Sadoulet, E., 1998. Growth, poverty, and inequality in Latin America: a causal analysis, 1970–94. Department of Agricultural and Resource Economics, University of California at Berkeley.
- de Janvry, A., Gordillo, G., Sadoulet, E., 1997. Mexico's second agrarian reform: household and community responses. Center for U.S.–Mexican Studies, University of California at San Diego.
- Fafchamps, M., de Janvry, A., Sadoulet, E., 1995. Transactions costs, market failures, competitiveness, and the state. In: Peters, G. et al. (Eds.), *Agricultural Competitiveness: Market Forces and Policy Choice*. Dartmouth Publishing Co, Vermont, pp. 343–354.
- Londoño, J.L., Székely, M., 1997. Persistent poverty and excess inequality: Latin America, 1970–1995. Inter-American Development Bank, Working Paper No. 357, Washington.
- Lopez, R., Valdés, A., 1997. Rural poverty in Latin America: analytics, new empirical evidence, and policy. Technical Department, Latin America and the Caribbean Region, The World Bank, Washington.
- Nuffield Foundation, 1999. Nuffield Council on Bioethics. <http://www.nuffieldfoundation.org/bioethics/publication>
- Ravallion, M., 1997. Can high-inequality developing countries escape absolute poverty? *Economic Letters* 56, 51–57.
- Sadoulet, E., de Janvry, A., 1992. Agricultural trade liberalization and low income countries: a general equilibrium-multimarket approach. *American Journal of Agricultural Economics* 74 (2), 268–280.
- Valdés, A., Wiens, T., 1996. Rural poverty in Latin America and the Caribbean. In: *Annual Conference on Development in Latin America and the Caribbean*. World Bank, Washington.
- Warriner, D., 1969. *Land Reform in Principle and Practice*. Clarendon Press, UK.
- Winters, P., de Janvry, A., Sadoulet, E., 1999. Family and community networks in Mexico–U.S. migration. Department of Agricultural and Resource Economics, University of California at Berkeley.
- World Bank, 1997. *Rural Development: From Vision to Action*. ESSD Studies and Monographs Series No. 12y. World Bank, Washington.
- World Bank, 1998. *Economic Adjustment and Institutional Reforms: Mexico's Ejido Sector Responds*. Mexico Country Management Unit, Latin America and the Caribbean Region, Washington.
- World Bank, 2000. *World Development Report, 2000/1*. Draft copy, Washington.