Rural Finance, Poverty Alleviation, and Sustainable Land Use

The Role of Credit for the Adoption of Agroforestry Systems in Occidental Honduras

Ruerd Ruben
Luud Clercx

Abstract: This paper analyzes the relationship between financial services provided by different agents, the adoption of agroforestry systems, and the implications for food security and sustainable soil management. Attention is focused on the role of rural finance in reducing risk and stabilizing household income and yields. We conclude that credit provision performs critical functions for reinforcing the resilience of rural livelihoods in less-favored areas. Rural development programs in the Occidental region of Honduras have been rather reluctant to provide rural financial services. Unfavorable agroclimatic conditions and the scarcity of infrastructure lead to extreme poverty. The local economy is fairly dynamic due to the availability of nonfarm income sources and crossborder trade. Within the framework of the FAO Lempira-Sur program, provision of rural credit and savings services created the conditions for adopting the Quezungual
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agroforestry system. This innovation contributes to higher and more stable cereal yields and reduced labor demands in agriculture. Access to rural finance thus reinforces food security and enables income diversification as a precondition for subsequent in-depth investments.

Rural development projects and programs in developing countries increasingly rely on a wide variety of financial services for enhancing farm household welfare and for promoting more sustainable land-use practices. In degraded or fragile areas, the delivery of rural credit is frequently considered a suitable device to increase farmers’ willingness to invest. Given the fungibility of money, it is not often well understood which mechanisms for providing access to rural financial services could contribute to improved land-use practices. The relationship might be either direct (funds are directly used for land use intensification through fixed investments or purchased external inputs) or indirect (funds are used for activity diversification or income stabilization). We will argue that the latter procedure, where credit is helpful for reinforcing the fragile income and food security conditions of rural households in early stages of their development, is an important precondition for stimulating subsequent in-depth investments by farmers in sustainable natural resource management.

In this paper we discuss the different roles and functions attributed to rural financial services for farm household adjustments in land-use practices, labor allocation, and factor rewards. We therefore consider two major changes in production systems in the Occidental region of Lempira, Honduras: (1) the adjustment of cultivation practices (abandonment of burning, application of agrochemical inputs) and (2) the investments made for the establishment of improved agroforestry.

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systems. Special attention is given to the required complemen-
tarities between both activities, the sequence of their imple-
mentation, and the mediating conditions that influence
adoption by different types of farmers.

The relationship between access and use of rural financial
services and the adoption of sustainable land use practices is
subject to a wide debate. Some authors state that credit streams
could undermine the investments in ecologically-sound pro-
duction systems because the additional resources are likely to
be used for the purchase of yield-increasing inputs (de Zeeuw,
Baumeister, Kolmans, and Rens, 1995, for Central America;
is made to pervasive market imperfections, poverty, and the
high rate of time preference as reasons for low investment in
erosion-control measures. When credit is only available for
short-term loans, long-term and lumpy investment (e.g., in soil
and water conservation structures or perennial crops) are
likely to be neglected. In addition, agricultural technologies
that could provide rapid returns are scarcely available.

Others have stressed, however, that access to rural finan-
cial services can provide important incentives to invest in
improved land-use practices, both directly through the avail-
ability of liquidity and indirectly through reduced uncertainty
(Panayotou, 1993; Reardon & Vosti, 1992, 1995). The latter
effect is considered particularly important, since credit can be
used for activity diversification and thus reduces income vari-
ance. Moreover, the input efficiency of purchased fertilizers
usually depends on the implementation of improved soil
conservation methods. These investments may be hindered,
however, by differences in wealth, insecure land tenure rights,
and high access costs to local factor and commodity markets.

Changes in land-use and resource-management practices
should thus be perceived as a complex adjustment process that
is influenced by a wide range of behavioral, technical, and
socioeconomic factors. For the purpose of policymaking, it is
highly important to be able to identify the exact role of each
factor in the transition toward more sustainable resource use, in order to be able to schedule the most adequate sequence of interventions. Since tradeoffs are likely to occur between welfare and sustainability objectives, major attention ought to be devoted to those instruments that favor potential synergies between both aspects of farm household behavior (Lee & Barratt, 2000). Other factors, like participation in local networks, investments in education, engagement in market exchange, and diversification of income sources might provide an explanatory framework for understanding the observed heterogeneity in adoption behavior and supply response.

The remainder of this paper is structured in the following way. First we review the production and exchange conditions of rural households in Occidental Honduras, highlighting current land-use practices and the evolution of different rural financial services in the region. Then we present an analytical framework for disentangling the complex linkages between rural financial services and changing land-use practices. We provide empirical evidence regarding the role of rural finance in the adoption of improved land-use practices, followed by a discussion of different direct and indirect mechanisms that influence credit demand and land-use changes. We conclude with some major policy implications for the operational design of rural financial services that may be contributing to the enhancement of investment in sustainable land use systems and practices.

Farmers and Finance in Occidental Honduras

The department of Lempira is located in the Occidental region of Honduras, close to the border with El Salvador (see Figure 1). The southern part of Lempira covers an area of 2,600 square km with a total population of about 95,000 inhabitants. The area is characterized by marginal soil conditions and hillside agriculture, devoted to basic grains (maize, beans), extensive livestock, and some coffee production. Physical and social infrastructure facilities are barely developed, as reflected by the
lowest human development index within the country (FAO, 1999; Kortekaas, 2000).¹

Land resources are strongly concentrated on small farms (80% with less than 5 hectare) that possess less than 30% of arable land. Landless farmers acquire land through lease or sharecropping arrangements. Major production systems are based on subsistence crops (maize associated with millet; beans) with extremely low yields (1000 kg/ha for maize; 400 kg/ha for beans), combined with some livestock at low stocking rates (6 animal units/ha). Small-scale animal husbandry (chickens, pigs), roots and tuber crops, horticulture, and fruit trees are important for diversification purposes. Off-farm and nonfarm employment opportunities also gain importance when farmers' involvement in local and external market exchange increases (Zelaya & Reardon, 2001; Ruben & van den Berg, 2001).

Local markets are usually thin and demonstrate low integration. Basic grains production is partly oriented toward personal consumption and local delivery. However, small farmers are net-consumers during a major part of the year and thus
need cash resources in order to guarantee their food security. Crossborder trade with El Salvador is rapidly increasing due to higher purchasing power available in the neighboring country.

The local labor market is equally limited (80% of the economically active population are own-account workers), but informal labor exchange (mano vuelta) is a known practice and seasonal migration takes place towards the northern coffee areas. More permanent migration toward the coastal region (with banana and palm oil plantations, and the 'maquila' tax-free zone textile export industry in San Pedro Sula), or abroad (USA), is registered among 10% of the households, making remittances an important additional income source. Female-headed households thus represent an important segment of the rural population. Labor scarcity is currently acknowledged as a primary limitation for intensification of land use.

The land market is rather informal and based on leasehold and sharecropping arrangements. Land prices usually do not reflect the efforts made for soil quality improvement or soil conservation measures. Use of chemical inputs (fertilizers and herbicides) is widely spread throughout the region, both for reducing labor demands and for maintaining yields. Improved land-use systems based on natural regeneration of interstitial trees (locally called Quezunagua) proved to be highly acceptable to local farmers due to their potential for more permanent land use, limited labor requirements, and savings in material inputs. These systems have a long tradition in the region and have proved to be successful in reducing fallow periods, controlling weed incidence, and enhancing soil organic matter content, thus enabling a higher sowing density.

Financial markets in the southern hillside region of Honduras are mostly organized around ongoing rural development projects. Formal credit services are almost absent, but a wide network of local microfinance systems (including communal banks, credit and savings cooperatives, rural cashiers, etc.) became active during the last five years, providing different types of financial services to rural households.
Rural Finance and Sustainable Land Use

(Falck, Rodriguez, Triguero, Washington, and Barth, 2000). These services are mostly supported by nongovernmental organizations (NGOs) and tend to be concentrated in the poorest areas. The average group size of these microfinance associations is about 45 persons, with 35% being female members. They offer both savings and credit services in rather small amounts (average Lps. 2700 or US$ 180) for agriculture, trade, and small industry, as well as loans for consumptive purposes (health, schooling, housing, etc).

The institutional framework involves a wide number of local organizations that provide community services (health care, education, drinking water), supporting the (participatory) community development process and offering assistance for the creation of income-generating activities. The latter activities are usually assisted by the provision of financial services (savings and credit). The financial landscape includes some 300 informal alternative financial institutions that receive backstopping from four NGOs and three major regional development programs.

Microfinance, Production Systems, and Livelihood Strategies

In the following, we focus attention on the role of financial services provided by the FAO Lempira-Sur project and other agents for the transformation of agricultural production systems in the region. Since the adoption of new and improved land use practices is usually a nonlinear process, access to finance fulfills different functions during specific stages of adjustment. Starting from a traditional slash-and-burn system, financial services tend to be used initially for the purchase of yield-maintaining and labor-saving inputs. Increasing land scarcity obliges farmers to intensify land use and to shorten fallow periods, making burning a less attractive option. At this stage, finance tends to be used for yield-increasing crop and land management activities and input substitution (e.g., reducing labor demands in basic grains production) that offer
subsequent options for income diversification, either within the farm boundaries (e.g., coffee or livestock) or through engagement in off-farm activities. Finally, investment in agroforestry activities might take place as a strategy to improve input efficiency, e.g., to improve net returns to external inputs and (family) labor.

For a better understanding of the role of financial services as an instrument for enhancing pathways out of poverty, it is important to discuss the different functions of rural credit for the simultaneous adjustment of production systems and related livelihood strategies. In the case of Lempira, three different stages can be distinguished (see Figure 2).³

The three stages of the development of local production systems are associated with some specific structural and performance parameters (see Table 1). Small farm households with limited land resources and less secure holdings are mainly investing in input-intensive production of traditional crops. Abandonment of traditional burning practices is strongly promoted in order to reduce weed incidence, thus reducing labor demands for crop maintenance and other farm activities. Once the returns to land and labor have been secured and stabilized, crop and activity diversification can take place and some initial soil conservation activities can be introduced. In-depth investments in agroforestry systems are most likely to occur on

Figure 2. Lempira: Transition pathways of agrarian production systems (% of survey farms)

(0) Slash and Burn Agriculture (60%)

(1) Burning with Fertilizers (15%)

(2) Diversification and Input Substitution (47%)

(3) Intensification with Agroforestry (38%)

(0) Slash and Burn Agriculture (60%)

(1) Burning with Fertilizers (15%)

(2) Diversification and Input Substitution (47%)

(3) Intensification with Agroforestry (38%)
<table>
<thead>
<tr>
<th>Indicator</th>
<th>Phase 1: Stabilization (N=25)</th>
<th>Phase 2: Diversification (N=82)</th>
<th>Phase 3: Agroforestry Intensification (N=66)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land area (in manzanas)</td>
<td>6.6</td>
<td>9.0</td>
<td>12.5</td>
</tr>
<tr>
<td>Tenancy (% own land)</td>
<td>48.3</td>
<td>58.0</td>
<td>80.3</td>
</tr>
<tr>
<td>Land use of own land (manzanas)</td>
<td>10.2</td>
<td>13.8</td>
<td>14.7</td>
</tr>
<tr>
<td>Education level (years of schooling)</td>
<td>3.4</td>
<td>3.5</td>
<td>4.8</td>
</tr>
<tr>
<td>Organization level (number)</td>
<td>2</td>
<td>2</td>
<td>2.5</td>
</tr>
<tr>
<td>Possession of livestock (% of farms)</td>
<td>38</td>
<td>42</td>
<td>58</td>
</tr>
<tr>
<td>Areas of coffee (% of farms)</td>
<td>24</td>
<td>39</td>
<td>47</td>
</tr>
<tr>
<td>Crop diversification (% of farms)</td>
<td>11</td>
<td>40</td>
<td>49</td>
</tr>
<tr>
<td>Conservation practices (number)</td>
<td>1.4</td>
<td>1.8</td>
<td>3.4</td>
</tr>
<tr>
<td>Maize yields (q/q/manzana)</td>
<td>29</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>Labor intensity (days/manzana)</td>
<td>80</td>
<td>65</td>
<td>38</td>
</tr>
<tr>
<td>Fertilizer use (q/q/manzana)</td>
<td>5.7</td>
<td>4.2</td>
<td>4.2</td>
</tr>
<tr>
<td>Herbicide use (lps/manzana)</td>
<td>327</td>
<td>274</td>
<td>257</td>
</tr>
</tbody>
</table>

Note. 1 manzana = 0.7 ha; 1 q = 48 kg; 1 US$ = 14.9 lempira. Italic figures indicate significant differences (T-test at <0.10). Differences in land area refer to the average area in ownership; land use of own land refers only to the segment of farmers with land ownership. From CDR-ULA Lempira Field Survey (2000).
medium-size farms with more secure tenancy, since the process of natural regeneration requires a minimum amount of land for improved fallow and crop rotation purposes. The intensification process permits a further reduction of the reliance on external input and permits savings on labor use, while maintaining returns to land.

The transition to agroforestry is strongly related to the factor availability at the farm household level. Small farms give priority to the improvement of returns to land, while somewhat larger farms have to face scarcity of labor as their major constraint. Consequently, land use and production systems that enable substantial savings in labor use are preferred. This tendency is reinforced when engagement in off-farm and non-farm activities raises the opportunity costs of labor. This pattern of technological change thus follows the well-known induced innovation path (Hayami & Ruttan, 1985).

Credit, Food Security, and Sustainable Land Use

Access to and use of rural credit services are usually considered important incentives for adjusting resource allocation at the farm household level. Three different functions attributed to rural finance should be distinguished: (1) improving the access to external resources, (2) enhancing the productivity of private resources (land and labor), and (3) enabling risk-taking behavior. The latter function is particularly important, since credit supply can only lead to resource reallocation when farmer experience an increasing certainty regarding expected revenue streams. Therefore, investments should be made into programs that guarantee positive synergistic effects among inputs (complementarities), as well as increasing returns to critical production factors (especially labor).

During the 1960s broad attention was given to rural development strategies based on the supply of inputs through credit systems. Supervized credit arrangements were put in place to guarantee small farmers access to improved inputs (seed, fertilizer). In practice, however, this supply-driven approach to
rural finance did not adequately respond to local demand conditions. Most poor farmers considered the use of credit for subsistence cropping too risky. Consequently, farmers tended to use (part of) the credit for other—mainly consumptive—purposes.

Recognizing the fungibility of rural finance, credit programs in subsequent periods started to consider access to financial services to be an important condition for reducing general investment and expenditure constraints. Adoption of improved technologies could thus be facilitated with financial resources, provided that positive cost-benefit ratios of the available technologies are guaranteed (compared to other resource allocation options). However, field studies regarding the determinants of adoption indicate that institutional constraints (e.g., tenancy rights, limited access to stable market outlets) can be equally important limitations for adoption (Feder, 1985).

Recently, some additional attributes of rural financial services have been recognized as important mediating factors for enhancing investment in improved land-use practices. Instead of focusing on the direct relationship between credit and investment, attention is given to some more indirect mechanisms related to the insurance potential of rural finance that might be helpful for enhancing farmers’ willingness to invest. This implies that rural finance (or its substitutes, like off-farm income) enables rural households to reduce income variance through more stable or better diversified income streams, thus creating adequate conditions for realizing subsequent capital investments.

The impact of credit access on the reallocation of resource use cannot be analyzed as a linear process, but may be divided into different steps. We identified three major stages of this investment process:

a. stabilization of income streams, based on short-term investments in yield-maintaining inputs;

b. diversification of income composition, based on
medium-term investments in alternative income-generating activities; and
c. intensification of resource use through in-depth fixed investment, the substitution of inputs, and technological change.

The latter process is usually envisaged as the "real" capital investment for more sustainable land management, but the other two preceding processes are required for creating the internal demand for funds and enhancing the ability to invest. This is consistent with other findings that indicate that intensification of land use while relaxing capital constraints will only take place when expected factor returns are likely to increase (Angelsen & Kaimowitz, 2000).

Agroecological approaches to sustainable natural resource management and land use are usually fairly optimistic about the available potential for increasing yields and output volume (Altieri, 1998; Uphoff, 2001). Attention is mostly focussed on returns to land and the cost-benefit ratio of investment, while implications for returns to labor and the variability of revenue streams receive less attention. The latter dimensions are, however, of major importance to enhance the adoption of new practices by small-scale peasant producers that face high risk and opportunity costs for scarce labor (Kuyvenhoven, Ruben, and Roseboom, 2000).

Two different natural resource management practices receive particular interest for their potential to improve farm household welfare. First, agroforestry systems can be implemented, where woody trees are spatially combined with cropping or livestock activities to reach optimal interactions in terms of water retention, nutrient recycling, organic matter supply, shading, and rooting zones (Nair, 1984; Arnold & Dewees, 1995). Only few agroforestry systems proved to be successful under farmers' conditions, due to their long gestation lag and high labor demands during the establishment period. The Quezungual system in Occidental Honduras represents a particularly successful example, since it is based on
natural regeneration and early pruning of multipurpose trees (i.e., fruits, fuelwood, construction wood, and fodder leaves) that provide quick returns and only demand limited efforts.

Second, weed management systems are important for reducing competition and crop loss. Burning the land before sowing is a traditional practice for weed control but leads to drastic losses in organic matter. Moreover, in subsequent years, propagation of weeds is strongly increasing after burning. Another procedure to control weed incidence is based on the use of herbicides (gramoxone). Both methods tend to reduce soil cover and moisture management but have the advantage of controlling labor demands. Therefore, the abandonment of slash-and-burn practices can only take place when farmers are entitled to rely on yield-increasing inputs. However, an immediate and drastic shift towards agroforestry systems is not likely to occur before land scarcity (due to prolonged fallow periods) makes intensification an attractive option and resources for in-depth investment can be mobilized from alternative income sources.

**Adoption of Improved Land-Use Practices**

Provision of rural financial services is usually considered an important incentive for the adjustment of farming systems. Access to credit is, however, not always a direct stimulus for changing land use and resource allocation, but it could also be considered an indirect requirement for enabling the abandonment of dysfunctional practices and the adoption of improved management strategies. The latter pathway of transition is likely to occur when farmers are enabled to economize on critical and scarce resources (usually land and labor) through a process of input substitution and activity diversification.

The adjustment of land-use practices in Occidental Honduras follows a particular sequence of innovations, based on the gradual reduction of labor demands for agriculture and the generation of additional income sources from off-farm employment. Access to finance proves to be particularly important during the early phases of transition, enabling
poorer farmers to abandon the practice of burning crop residues (thus saving labor for weeding) and to diversify their farming and nonfarm activities.

To detect the precise role of access to rural microfinance for the adoption or disadoption of specific land-use practices, we conducted a detailed analysis of the impact of relevant farm and household characteristics for (1) the abandonment of burning, (2) the use of chemical fertilizers, and (3) the adoption of agroforestry systems (see Table 2). Special attention was given to the variables related to land use and labor allocation, as they are main indicators of the relative resource scarcity. In addition, the impact of the degree of diversification and the level of organization in changes in resource-use practices can be identified.

The abandonment of traditional burning is negatively associated with farm size and family size, indicating that smaller farmers who face labor shortages face major problems in adjusting their land-use practices. Households that are better incorporated into the community organization are more likely to be able to economize on labor use. In this stage, access to credit is of major importance for the purchase of yield-increasing and labor-reducing inputs.

For the adoption of chemical fertilizers during the second stage of adjustment, access to credit becomes relevant to enhance crop diversification and to livestock purchasing. Additional resources for this diversification process become available by engaging in off-farm employment. The latter option is more available to farmers with a higher education level. The final transition to agroforestry proves to be favored by the availability of (long-term) credit, but relies in addition on the availability of other (nonfarm) income sources. Farmers in this stage have also guaranteed their basic food provision through the earlier intensification of basic grains production. Consequently, risks of investing in perennial tree crops can be better faced, and borrowing for consumptive purposes is no longer required.
Table 2. Probabilities of adoption of land-use practices

<table>
<thead>
<tr>
<th>Variable</th>
<th>Abandonment (of Burning)</th>
<th>Sig. Fertilizer Use</th>
<th>Sig. Agroforestry Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>5.771449</td>
<td>* -0.7191304</td>
<td>* 1.940134</td>
</tr>
<tr>
<td>Soil slope</td>
<td></td>
<td>-0.6879458</td>
<td></td>
</tr>
<tr>
<td>Altitude (meters)</td>
<td>0.0028735</td>
<td>* 0.0009159</td>
<td>-0.0001628</td>
</tr>
<tr>
<td>Distance to market (km)</td>
<td></td>
<td>0.0020671</td>
<td></td>
</tr>
<tr>
<td>Farm size (m²)</td>
<td>-0.1603069</td>
<td>*</td>
<td>0.1834912</td>
</tr>
<tr>
<td>Hired land (%)</td>
<td></td>
<td></td>
<td>-0.3063177</td>
</tr>
<tr>
<td>Family size (members)</td>
<td>-1.248559</td>
<td>**</td>
<td>0.0722933</td>
</tr>
<tr>
<td>Worker-consumer ratio</td>
<td>-1.480156</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Education (years)</td>
<td></td>
<td>0.033266</td>
<td></td>
</tr>
<tr>
<td>Female-headed (1=yes)</td>
<td></td>
<td></td>
<td>-0.3206663</td>
</tr>
<tr>
<td>Access to credit (1=yes)</td>
<td>1.924188</td>
<td>** 1.230489</td>
<td>** 0.7668741</td>
</tr>
<tr>
<td>Off-farm employment (1=yes)</td>
<td>-0.570149</td>
<td>** 0.0061206</td>
<td>* 0.3528751</td>
</tr>
<tr>
<td>Food security (maize per capita)</td>
<td></td>
<td></td>
<td>0.2913535</td>
</tr>
<tr>
<td>Organization level (number of memberships)</td>
<td>2.86309</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Degree of diversification (%)</td>
<td></td>
<td>9.168981</td>
<td>* 0.3443048</td>
</tr>
<tr>
<td>Psuedo R-squared</td>
<td>0.5019</td>
<td>0.2894</td>
<td>0.1265</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-9.089467</td>
<td>-20.571345</td>
<td>-61.328178</td>
</tr>
</tbody>
</table>

Note. *, **, and *** indicate significance at the 0.10, 0.05, and 0.01 levels, respectively.
Rural Credit, Poverty Alleviation, and Resource Reallocation

Agricultural production systems in the Lempira region show serious signs of productivity decline and soil deterioration. Internal pressure on agricultural production systems arises from the strongly increasing population density and related tendencies toward farm fragmentation, while external pressure on the natural resource base is reinforced by the emerging market integration with neighboring El Salvador. During the last decade, the percentage of farms relying on chemical fertilizers and herbicides increased from 25% to almost 80%, especially on subfamily farms (0–4.3 manzanas). This enabled farmers to increase maize yields from an average of 15 qq/mzs in 1992 to almost 28 qq/mzs in 1999. Purchasing power for financing these input demands is most likely based on informal credit systems, since only a minor share of (small) farmers had access to formal financial services.

The structure of poverty in the Lempira region is strongly correlated with typical farm and household characteristics: poor families are characterized by small land area, large family size, low educational level, and limited assets (see Table 3). Differences in disposable income seem to be related to the structure of agricultural land use and the household activity

<table>
<thead>
<tr>
<th>Poverty category</th>
<th>Indicator (per capita income)</th>
<th>Share of households (%)</th>
<th>Farm size (mzs)</th>
<th>Family size (persons)</th>
<th>Education (years of schooling)</th>
<th>Animal holdings (heads)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very poor</td>
<td>&lt;1 US$/day</td>
<td>55.5</td>
<td>5.5</td>
<td>8.1</td>
<td>2.8</td>
<td>2.4</td>
</tr>
<tr>
<td>Poor</td>
<td>1–2 US$/day</td>
<td>18.5</td>
<td>17.3</td>
<td>8.1</td>
<td>4.0</td>
<td>13.9</td>
</tr>
<tr>
<td>Less poor</td>
<td>&gt;2 US$/day</td>
<td>26.0</td>
<td>32.4</td>
<td>6.1</td>
<td>4.5</td>
<td>21.1</td>
</tr>
</tbody>
</table>

Correlation with poverty (significance):

<table>
<thead>
<tr>
<th>Correlation</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.519</td>
<td>(0.000)</td>
</tr>
<tr>
<td>-0.359</td>
<td>(0.000)</td>
</tr>
<tr>
<td>0.242</td>
<td>(0.000)</td>
</tr>
<tr>
<td>0.497</td>
<td>(0.000)</td>
</tr>
</tbody>
</table>

Note. From CDR-ULA Lempira Field Survey (2000).
mix. Poor households are strongly oriented toward basic grains production, while better-off households tend to diversify into coffee and livestock activities. Similarly, poor households are most dependent on agricultural income sources, while better-off households receive a major income share from wage employment and nonfarm activities.

Changes in land-use systems have been rather dynamic in the region, reinforced by coordinated efforts of technical assistance and training programs provided by several multilateral and nongovernmental agencies. In earlier periods, development cooperation projects focused strongly on food-for-work activities as a device to guarantee food security. This proved to be effective for employment and income generation (and also contributed to improved infrastructure and public service provision), but food imports were at the same time a disincentive for the improvement of local production systems. Since regional markets for food are thin and highly unreliable, rural households give priority to maize production on their own fields (and storage facilities) as a guarantee of continuous access to basic food. Markets for coffee and livestock products are substantially better developed, and consequently the degree of poverty and the level of market integration are inversely related.

Rural financial markets are highly imperfect in the Lempira region. More than 55% of the households indicate reluctance to borrow due to high risks or insufficient resources. Informal and local systems provide the major share of credit, mostly in small amounts (up to US$100) and for rather short periods. Financial institutions seem to offer, however, essentially different products and services for specific types of farm households (see Table 4). This may be related to a kind of life cycle pattern of credit demands forthcoming from the change in the typical functions of financial services during different stages of farm development.

Access to short-term rural finance by poorest households is basically used to reinforce food security through the purchase
Table 4. Structure of financial services

<table>
<thead>
<tr>
<th>Farm household category</th>
<th>Origin of loans (% formal)</th>
<th>Average amount (in lempiras)</th>
<th>Average term (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very poor</td>
<td>49.7</td>
<td>1,330</td>
<td>10.3</td>
</tr>
<tr>
<td>Poor</td>
<td>94.7</td>
<td>4,840</td>
<td>16.1</td>
</tr>
<tr>
<td>Less poor</td>
<td>100.0</td>
<td>7,658</td>
<td>14.4</td>
</tr>
</tbody>
</table>


of yield-increasing inputs. Reliance on burning of crop residues will become less attractive when maize yields continue to decline due to the loss of soil organic matter content. In order to be able to reduce income variability, diversification of land and labor into alternative agricultural activities becomes a feasible option but requires access to medium-term credit in larger amounts. Finally, this income diversification could provide the collateral for longer-term borrowing and in-depth investments in agroforestry systems and soil and water conservation structures.

The described pathway of transition of land-use practices is directly related to farm household factor availability and returns to critical production factors. Abandonment of traditional slash-and-burn practices is caused by the declining availability of land (shorter rotation cycles) and increasing demand for external chemical inputs that are required for the stabilization of yield levels of traditional crops. Burning of land will initially be maintained in order to reduce nutrient fixation and to facilitate nutrient uptake. This system is still highly intensive in labor and labor productivity tends to be low, while involvement in other activities and off-farm employment is still limited.

The decision to abandon burning practices can be made once the returns from the basic grains fields are stabilized and minimum food security is guaranteed. This enables farmers to
invest in alternative activities that yield higher returns to land and labor. Consequently, labor intensity in food production is substantially reduced (at the cost of a slight reduction in maize yields) and some efforts are made to become engaged in alternative activities that provide income flows which are less covariant with basic grains production. In this stage, the land cover index also improves due to more intercropping and the establishment of perennial crops.

When agroforestry practices are added to the system, fixed investments in soil and water conservation practices take place. The perceived complementarities between both activities increase the efficiency of external fertilizers and internal sources of nutrients (leaves, manure, crop residues). Interestingly, these adjustments further reduce labor demand and are less intensive in terms of external input requirements (especially herbicides). Consequently, returns to all factors tend to improve due to positive synergy effects between external and internal inputs, e.g., a higher efficiency of nutrient uptake can be guaranteed when soil organic matter content is maintained at a higher level (the contribution of agroforestry systems) and leaching or runoff is better controlled (the contribution of soil conservation practices).

The transition toward agroforestry systems is very unlikely to occur when the livelihood conditions of stable food supply and income diversification are not sufficiently guaranteed (Raintree, 1985). Credit provision is not per se required to adopt these agroforestry systems (given the lower capital intensity per unit of land), but financial services are indispensable in earlier stages in order to create the minimum conditions for income diversification that enable subsequent adoption. Even while agroforestry systems are found somewhat more frequently on larger farms with more secure tenancy that are located in lowland and intermediate altitude zones, these aspects are not indispensable. Only in very small farms (<0.5 mzs.) does the introduction of agroforestry rarely take place. In addition, agroforestry is clearly related to
increasing population density and the scarcity of land for rotation and clearing. This points to a positive role of population density as an incentive for making investments in soil conservation practices, as registered also in some sub-Saharan countries by different authors (Boserup, 1965; Tiffen, Mortimore, and Guchuki, 1994).

Another fundamental aspect of the transition toward agroforestry refers to the role of the Communal Banks, not only as financial institutions, but also as agencies for collective action and enforcement of community control. Since the abandonment of burning is considered a common interest for reducing weed incidence, control on free riding is essential to prevent negative externalities. Joint compliance is enforced through the restriction of credit supply to farmers that keep burning their land. Visual inspection of such a regulation is relatively easy (the smoke can be detected everywhere). Membership of the communal banks thus developed a new moral order that facilitated the subsequent adjustment of their farming systems and livelihoods.

Finally, the Quezungual agroforestry proved to have a strong impact on local bargaining relations. Since farmers improved their food security situation with less land rotation and reduced fallow, demand for hiring-in land decreased. Therefore, renting rates were lowered and traditional sharecropping relations (based on delivering 50% of harvest as rent) were replaced by less-demanding lease contracts (only crop residues as rent). This may eventually lead to a reduced concentration of land and more stable land-use rights that favor again the adoption of sustainable natural resource management practices.

Discussion and Policy Implications

Most current analyses of rural financial services devote major attention to the design of operational frameworks for sustainable microfinance institutions. Assessment of the
potential impact at the household or individual level is rarely done and usually based on proxy variables (e.g., willingness to pay). Gradually, attention has been shifting from “sustainable households” toward “sustainable institutions,” thus considering MFI performance almost identical to poverty alleviation. Recognizing the fungibility of money implies that little direct information is available regarding the use of financial services for the adjustment of farming systems and rural livelihood strategies. Attribution problems further inhibit a clear linkage between credit, income, and wealth. Understanding the microfoundations of rural finance remains, however, one of the fundamental challenges for an adequate client-oriented design and for appropriate targeting of rural financial services.

Our review of the role of financial services for the transition of land-use and production systems in the Lempira region of Honduras permits us to draw some important conclusions regarding the multiple functions of savings and credit during different stages of the farm household lifecycle. Increasing population density and reduced natural soil fertility challenge small farmers with declining returns to land and labor. In such circumstances, access to financial services fulfills in the first place a role for the purchase of yield-increasing external inputs, e.g., chemical fertilizers (for stabilizing maize yields) and herbicides (for reducing labor intensity). Informal credit products provided in small amounts seem to be able to satisfy this initial demand.

Once maize yields have been stabilized and a minimum level of food security is guaranteed, subsequent borrowing tends to be used for income diversification purposes. Main options in the Lempira region include the establishment of perennial crops (coffee) and especially the purchase of cattle that can be easily commercialized through crossborder trade. Coffee production enables farmers to obtain legal land titles, thus reinforcing security of tenure. Revenues from these activities tend to be somewhat higher and more stable compared to basic grains, thus reducing the vulnerability for income shocks.
This transition asks for a financial system that is able to furnish larger amounts of credit for longer periods. Such products are not included in the current portfolio of the community banks. Finally, in-depth investment in improved land-management practices takes place through the establishment of Quezungual agroforestry regimes combined with the implementation of a wide range of soil and water conservation practices. This reduces again the need for plot rotation and enhances the internal availability of nutrients for more intensive land-use systems.

Some general lessons might be drawn from this experience with a long-term process to adjust resource use within a fragile eco-region. First, the transition toward more sustainable land-use practices is not a linear process but takes place along various steps that represent distinct phases of the livelihood strategy. Second, rural financial services fulfill quite different functions during each of these phases. Third, greater reliance on internal inputs for sustainable agriculture can only be reached after a stage of more intensive use of external inputs. Fourth, financial services can contribute perfectly well to rural development and poverty alleviation in less-favored areas. Investments in less-favored land may indeed yield simultaneously positive welfare and sustainability implications that benefit poor households.

Notes

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1. The human development index of Lempira is calculated at 0.368 compared to the national HDI of 0.575, which is already one of the lowest in Latin America.

2. The percentages refer to the share of each production system within the field survey (N = 173). Data sampling took place through a stratified random procedure at village and household level. After comparison with agrarian census data, the sample proved to be slightly biased in favor of larger producers.
3. Landless farmers may rent-in land but are less inclined to invest in soil conservation or agroforestry systems. When land is rented for cropping purposes, the landowner usually receives the crop residues (rastros) as compensation, which are used as fodder for livestock during the dry period.

References


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