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Credit Use, Factor Substitution and Rural Income Distribution: A Study on Maize Farmers in Occidental Honduras

RUERD RUBEN
HUBERT KOLK*

INTRODUCTION

Rural households use financial services for a wide variety of purposes. Credit can be applied in the production process as a device for hiring-in land, purchasing external inputs or contracting wage labor. In addition, credit can also be used for consumptive purposes, like the acquisition of food and non-food items, durables or for making investments in education or health (Wilk, 1989). Both directions of credit use could improve farm household welfare, but only the former leads to adjustments in production technologies, while the latter may influence reservation prices.[1] In the

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* Wageningen University, Department of Social Sciences, Development Economics Group <ruerd.ruben@wur.nl>. Field data for this paper is collected by a research team of the Center for Rural Development Studies (CDR) of Free University Amsterdam, in close cooperation with the Pan-American School for Agriculture "El Zamorano" and the Food and Agriculture Organization (FAO) rural development program "Lempira Sur". We are grateful for comments on an earlier version of the manuscript by Luis Clercx and two anonymous reviewers.

[1] Credit can also be considered as an insurance device, enabling rural households to maintain stocks for covering unexpected income shortfalls (see: Udry, 1990). Using credit for the diversification of activities also reduces the co-variance of income flows.

case that credit is used directly in the farm production process, substitution between production factors is likely to take place and consequently factor returns are subject to change. When credit is used mainly for consumption purposes, prices of factors of production and eventually of outputs will be modified due to adjustment of household preferences.

In this article, we focus attention on differences in the allocation of production factors between farmers who have been supplied with micro-credit and farmers who did not make use of credit services. Our main interest is to illustrate how credit use influences farmers' decisions regarding factor use and whether credit enhances input substitution. It is usually thought that credit will be applied to substitute material inputs for land, but its impact on labor use is less well known. Credit can be helpful for substituting hired for family labor, albeit at the cost of reduced labor productivity, or credit can be applied to improve family labor productivity when better complementarities with available material inputs are reached.

Maize production in the Lempira department of Occidental Honduras is important for household subsistence, given the limited accessibility of the area and the high transaction costs for purchasing maize as a fundamental food crop (Clercx *et al.*, 2000). Marginal agroecological conditions make maize production, however, hardly profitable and offer scarce incentives for higher fertilizer applications. Most households gain additional income from off-farm employment and try to diversify activities into coffee and livestock production. Labor can be considered as the most critical factor for household welfare, and therefore investments for improving maize production are only attractive when labor productivity can be increased.

Rural households can obtain credit from several sources. Both formal banks and informal agencies provide credit services at different conditions. Most studies regarding the impact of credit focus on interest rates, repayment schedules and collateral requirements as rationing devices (see Ledgerwood, 1999 for a useful survey). We largely ignore these differences in credit delivery conditions and instead focused our attention on the demand side. This enables us to analyze in more detail the impact of credit use on adjustments in production systems and land use technologies. We expect that credit could be helpful in the transition from primarily land-based production systems towards more capital-based systems that enable farmers also to improve their returns to labor.

Standard production theory indicates that the allocation of production factors might change due to the extra inflow of capital. This analysis can be based on the comparison of production function estimates. Distinction should be made, however, between (*a*) shifts of the production function and (*b*) substitution between production factors. The former occurs when the use of all production factors changes proportionally, while the latter refers to an adjustment in the relative composition of the production factors (Byerlee, 1994). We focus attention on this factor substitution process, assuming that other fixed investments are largely exogenous. In order to account for possible adjustments in the consumptive behavior of the households, we included daily per capita maize consumption as a control variable.

The remainder of this article is structured as follows. First, we discuss the relationship between credit and factor substitution and present our hypotheses regarding the role of credit for agricultural intensification in marginal areas. Next, we present the methodology used for estimating the differences in factor shares between households with and without credit. A brief discussion of the data set and the presentation of empirical results follow this. We conclude with some suggestions for improving the effectiveness of credit supply to semi-subsistence households.

CREDIT AND FACTOR SUBSTITUTION

After the publication of Adam's seminal study on the limited effectiveness of rural credit services (Adams *et al.*, 1984), a wide debate has started amongst analysts and practitioners regarding the potential impact of credit on agrarian production and its contribution to rural poverty alleviation. Positions ranged from some who considered the fungibility of credit impeding its effective use as an incentive for strengthening rural farmers, to others who debated the adverse effects of credit supply on resource allocation decisions. Consequently, an important part of the field studies regarding rural financial services have been devoted to institutional design and outreach issues (Yaron, 1992). The publication of Hulme and Mosley's survey on the performance of micro-finance programs marked a shift towards more in-depth impact assessment studies (Hulme and Mosley, 1996).

The analysis of the impact of credit on farming systems and livelihoods is, however, seriously hindered by three conceptual and methodological difficulties. First, time series are scarcely available for making thorough before-and-after analyses, and therefore most field studies rely on a with-and-without comparison based on cross-section data (Satapathy and Tripathy, 2001; Singh and Rawat, 2001). The latter approach may only result in acceptable outcomes when other factors that cause differences in performance can be adequately controlled. Secondly, difficulties arise in the composition of representative field samples that permit unbiased estimates. Clear difference should be made between farmers who do not use credit because of objective limitations (no access, *e.g.* due to lack of collateral) or for subjective reasons (no credit demand). The latter category includes both poor and risk-averse farmers who prefer not to borrow, as well as wealthy farmers who are able to self-finance their investments (van den Berg, 2001). It is therefore likely that credit use demonstrates an inverse U-shape relationship with farm size and wealth. Thirdly, it proved to be difficult to avoid endogeneity problems in empirical estimates on the impact of credit use. Since production and consumption decisions are strongly related at the farm household level, almost all indicators of income and wealth can hardly be estimated independent from the use of credit (Iqbal, 1986).

We cannot pretend that the approach we used in this article permits to overcome all these constraints. Focusing our attention on the particular implications of credit use for resource allocation decisions might, however, be helpful to disentangle some of the earlier arguments, and could be helpful to identify the effect of credit use on the factor distribution of income. It is generally acknowledged that supply of credit increases the factor share accruing to capital suppliers in detriment of the share for landowners. Far less is understood, however, what the impact of credit use is on changes in the factor share for labor. The latter is particularly important for assessing the welfare implications at farm household level.

It is therefore useful to analyze the relationship between credit use and adjustment in production technologies. The adjustment of output elasticities may take different directions, depending on the possibilities for substitution among production factors. Consequently, relative factor shares of land, labor and capital are likely to change as well, although their value will be different from the output elasticities when increasing or decreasing returns to scale occur. Since maize production is characterized by a wide variety of potential production technologies, use of credit is expected to result in a substantial shift in factor use and input allocation. The degree of intensification of maize production depends, however, also of the possibilities for mobilizing complementary factors, especially (family and hired) labor. It is therefore possible that the division of labor between farm and off-farm activities also changes. Finally, minimum requirements of food consumption have to be satisfied at the household level. This implies that any increase in per capita maize demand requires a proportional adjustment in maize production (when food consumption is mainly satisfied by internal supply) or should be satisfied from other income sources (when food is purchased on the market).

Approach

The aim of this study is to determine differences in factor use between households that do and do not use credit. Since the latter category might include both poor farmers that are risk-averse or cannot get access to finance, as well as large farmers who are able to self-finance their investments, we limited the sample to include only small farm households (between 1 and 40 *manzanas* or up to 28 hectares) with roughly similar wealth endowments.[2]

The analytical approach for analyzing the relationship between production technology and factor use is based on the theory of functional income distribution pioneered by Hicks (1963). Singh (1999) has applied this approach in a study on the effects of technical change on functional income distribution in Indian paddy agriculture to identify the substitution effects of technological change on the use and productivity of inputs. We relied on a similar approach to find out whether such substitution effects in factor use can be attributed to differences in credit use. In principle, credit can be considered as one of the instruments for generating technological change, and we may thus expect that farmers with and without credit operate under different production technologies and thus perceive different factor shares.

A suitable method for determining the relative factor shares makes use of Cobb-Douglas production function. This function initially takes this form:

$$Q = L^{X} \cdot K^{Y} \qquad [1]$$

where total production (Q) is a function of the production factors labor (L) and capital (K). The production function estimates are based on physical amounts of inputs and outputs, including internal provision and use. Both factors have a share in the production: *x* for labor and *y* for capital, where *x* and *y* add up to 1 when constant returns to scale are assumed. The latter assumption implies that an increase in both L and K with the same relative amount will lead to the exact same or neutral increase of Q. For a single factor, however, diminishing returns to scale are in effect, implying that an increase in K, while holding L constant, will lead to less than proportional

2 In order to avoid selection bias in our estimates, large farmers who are able to finance their inputs from own resources, as well as very small farmers who possess insufficient collateral for borrowing have been excluded from the sample.

increase in Q. The factor shares *x* and *y* –or elasticities– reveal the impact of a change in input use on the output. When constant returns to scale hold, output elasticities will be equal to the factor share.[3]

The Cobb-Douglas production function is further extended in this study to consider farm and household-specific effects. Therefore, a scale parameter (α), an error term (e^{μ}) and several extra variables with their factor shares are included into equation [1], resulting in the following estimable equation:

$$Q_{0,1} = \alpha \cdot L^{\beta_1} \cdot A^{\beta_2} \cdot F^{\beta_3} \cdot e^{\mu} \Big| \beta_4 S, \beta_5 O, \beta_6 P \qquad [2]$$

where L, A and F represent the production factors labor, land and fertilizer respectively. The element S represents the household food security, while the element O represents engagement in off-farm employment. The last variable, P is a dummy which indicates whether the farmer is also involved in commercial production of coffee and livestock. The latter activities are usually more capital-intensive and may compete for credit resources, but also contribute to income diversification. Equation [2] will be tested under two condition of credit use, hence the subscript added to the dependent variable Q is either 0 (farmers without credit) or 1 (farmers with credit). We used the Chow test to determine whether this separation is justified (Pindyck and Rubinfield, 1998). In the case pooling is not permitted, separate functions for farmers with and without credit should be estimated.

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[3] In case that the elasticities do not add up to 1, a correction should be made to calculate the share of the production factors:

$$R_i = \frac{a_i}{\sum_{i=1}^{n} a_i}$$

where the share of the production factor (R_i) is equal to the output elasticity of the production factor (a_i) as a ratio of the total output elasticity of all production factors (Singh, 1999). With this expression it is possible to calculate the factor shares under different returns to scale.

The resulting output coefficients or factor shares ($\beta_1 \ldots \beta_3$) are not fully informative when no basis for comparison is available. We relied on method suggested by Bisaliah (1982) for evaluating proportional changes in factor shares:

$$Z_i = \frac{(R_i)_C - (R_i)_{NC}}{\left|(R_i)_{NC}\right|} \qquad [3]$$

where the subscripts C and NC refer to the use of credit or not for a household. So $(R_i)_C$=the factor share of a production factor *i* for a household that uses credit and $(R_i)_{NC}$=the factor share of the same production factor *i* without credit. The resulting Z_i gives the proportional rate of change in factor share of production factor *i* for credit. When $Z_i>0$ the factor share of input *i* increases due to credit use, while if $Z_i<0$ the factor share of input *i* decreases.

Before we perform the production function estimates, we should ascertain that the technological change is not induced by differences in factor prices. Adjustments in relative factor shares can occur due to changes in input use or can be occasioned by differences in input prices. The second potential cause of change was analyzed with a Kruskal-Wallis test to determine whether the prices of the inputs were different for households with credit and without credit (see table 1). We included fertilizer prices for typical NPK formula used in maize production, labor costs for hired and exchange labor (paid partly in food), and prices for hiring-in flat and hilly land.

TABLE **1**

Kruskal-Wallis Test for Fertilizers, Labor and Land Prices

Production factor		*Price*	*Chi²*	*Prob.*
Fertilizer	NPK Formula	166 lps/bag	0.103	0.7481
Labor	Payments partly in food	27 lps/day	0.832	0.3618
	Wage payment	37 lps/day	0.965	0.3258
Land	Flat	13.700 lps/mzs	1.911	0.1669
	Hilly	9.025 lps/mzs	1.759	0.1847

Note: 1 manzana = 0.7 ha ; 1 US$ = 14.8 lempira ; 1 bag = 40 kg.

The results indicate that prices of the production factors do not diverge significantly between farmers using and not using credit. The main implication of these tests is that prices are not accountable for adjustments in relative factor shares. It is therefore justified to assume that only the amounts of inputs influence the factor shares. The direction and magnitude of this impact will be determined in the following sections.

SETTING AND DATA

The model is tested with data on maize fields in the department of Lempira, located in the Occidental region in Honduras. The Lempira region is characterized by scarce physical and social infrastructure as demonstrated by its low human development index. Most farmers produce basic food crops like maize and beans mainly for consumptive purposes. Poor soil fertility and hilly slopes of the plots lead to low yields in maize production. Occasionally farmers undertake extensive livestock farming or are engaged in coffee production, but these diversification options are only available to wealthier farmers (Ruben *et al.*, 1997). Poor farmers rely on credit use for the purchase of yield-increasing inputs (mainly NPK fertilizers).

Local markets in the Lempira department are characterized by limited competition and imperfect integration. Especially land markets have notorious failures. Land prices do not include improvements that were made regarding soil fertility, quality and structure, making it difficult to measure land value by its sale price. Labor deployed on the farm is mainly family labor, but wage labor can be contracted from landless farmers and through exchange amongst neighbors.[4] The market of fertilizers is better organized, since the use of chemical fertilizers is widespread in the entire region and its distribution is adequately organized. The output market for maize is mainly locally oriented, with most smallholders consuming a

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[4] Wage labor is contracted under different conditions (*i.e.* with and without breakfast and lunch), but wage rates are remarkable uniform throughout the Lempira region. Larger farmers may apply credit for hiring-in wage labor, whereas most small farmers usually rely on credit for input provision.

substantial part or their own harvest and trade only occurring to balance seasonal deficits. Maize trade takes place at the local or sometimes the regional market. The market for credit services is segmented, with formal credit only available to large farmers, leading to the emergence of over a large number of informal credit suppliers (traders, moneylenders) and some semi-formal credit agencies (*Bancos Comunales*), some of them supported by non-governmental agencies.

The sample survey includes 135 randomly selected farm households. Information was collected regarding maize yields, input use on maize plots and other farm and household activities. In addition, food self sufficiency is calculated in terms of per capita consumption of maize from farm production. Descriptive statistics are presented in table 2. Significant differences of means are recorded only for the variables land and food self-sufficiency. Farmers with credit received an average amount of Lps. 5 700 (or 385 US$) at interest rates varying between 25 and 40% per year. They cultivate less land for maize production and consequently satisfy a smaller share of their family subsistence needs with maize from their own fields, relying more on commercial food purchase. Input use intensity seems not to differ very much between farmers with and without credit, and this might easily lead to the erroneous conclusion that these farmers all operate with similar production technologies.

TABLE **2**
Descriptive Statistics
(Mean values for farms with and without credit)

Variable	**Description**	**Mean**	
		Without credit	*With credit*
Yield	Production of maize (kg/ha)	522	584
Labor	Labor use (hours/ha)	53.076	59.117
Land	Area of maize (ha)	1.432*	1.273*
Fertilizer	NPK Formula (quintal/ha)	2.416	2.472
Food Self-sufficiency	Maize consumption (lbs/capita/day)	3.231*	2.260*
Off-farm employment	Off-farm labor (days/year)	64.132	64.075
Crop diversification	Farm with coffee or cattle (1=yes)	0.140	0.160
Credit use	Amount (lempiras)	—	5.700

Note: 1 quintal = 100 libras = 45 kg ; 1 manzana = 0.7 ha; * = significant at 10%

Maize Production Systems

Maize production is a rather labor-intensive activity involving numerous labor days for land clearing, sowing, weeding and harvesting activities. Maize yields under rainfed conditions vary between 400 and 700 kg/ha, but losses may be high under erratic drought conditions (like the yearly *Canícula* or due to *El Niño*) or with scarce availability of nutrients and organic matter due to soil degradation and erosion. Maize yields can substantially increase when chemical fertilizers are used, but efficient nutrient uptake requires timely and regular applications.[5] Availability of credit can thus be an incentive for higher fertilizer applications only if sufficient labor is available to guarantee adequate plant surveillance. These care activities are usually performed better by family labor, and cannot be done with the same dedication by hired laborers. Farmers who face low returns to labor on their own plot, may be inclined to become more engaged in off-farm activities that usually offer a higher remuneration (Ruben and van den Berg, 2001). Better access to credit could reverse this tendency and provide an incentive for devoting more time to on-farm activities.

Fertilizer applications have been strongly rationed during the last decade due to higher prices, occasioned by the devaluation of the exchange rate and abolition of input subsidies. Local farmers are now experimenting with substitutes for chemical fertilizers, like agroforestry systems and cover crops, but most of these alternatives tend to be labor-intensive and only guarantee results in the longer run (Ruben *et al.*, 2003). Even for subsistence farmers, the purchase of rather small amounts of chemical fertilizers remains an attractive device for maintaining yields at an acceptable level.

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[5] We focus on so-called Formula fertilizers with a fixed NPK composition that are generally used by Lempira maize farmers. Organic fertilizers (*i.e.* cover crops, dung) are sometimes used by local farmers –although in small proportions– they do not give immediate yield effects and are therefore excluded from this analysis.

The importance of maize in local farm production system is, however, subject to some modifications. Although land is a semi-fixed input, local farmers can hire-in plots for maize cultivation. This is especially the case when credit becomes available, since this enables farmers to negotiate more flexible rent contracts instead of being dependent on traditional patron-client arrangements (Hayami and Otsuka, 1993). On one hand, most livestock farmers are quite willing to offer degraded pasture land for maize cultivation, since this facilitates weed control while the crop residues are accepted as rent payment. On the other hand, the intensification of maize production systems leads to a reduction of fallow periods and consequently the demand for hiring-in land clearly decreased. In addition, when efficiency in maize production increases, more farmland may be used for diversification activities (like coffee or livestock) that usually guarantee higher and more stable revenue streams.

Farm Household Livelihood Strategies

Maize production is a critical component of farm household livelihoods in remote rural areas. Since local food markets are imperfectly integrated, farmers will continue to produce maize for self-consumption, even when production is not fully profitable. The availability of credit could, however, induce farmers to intensify their maize production in order to free resources for other activities, like engagement in off-farm employment or investment in diversification crops like coffee or livestock.

Farmers in the Lempira department possess limited margins for improving their household food security, and food consumption is almost directly related to the efficiency reached at their maize plots. Reducing the maize area while maintaining or increasing maize production is only feasible when fallow can be reduced.[6] Therefore, fertilizer applications

[6] In addition, soil and water conservation measures (agroforestry and other soil cover techniques) are applied in order to control soil erosion and nutrient depletion, and to improve moisture management (see: Ruben *et al.*, 2003).

are required to enhance returns to land and labor. The complementarity between labor and fertilizers is of special importance, since both factors are scarce to the household economy, although for rather different reasons. The purchase of fertilizers is constrained due to capital shortages, while labor is becoming scarce due to the availability of more attractive off-farm employment opportunities. Reliance on credit may therefore be expected to reinforce farmers livelihoods only when it contributes to substantial higher marginal returns to labor and when it enhances more stable household revenues.

Results

The model presented in section 3 has been tested and the parameter estimates will be discussed. We estimated the following log-linear Cobb-Douglas :

$$\log Q = \beta_0 + \beta_1 \cdot \log L + \beta_2 \cdot \log A + \beta_3 \cdot \log F + \beta_4 \cdot S + \beta_5 \cdot O + \beta_6 \cdot P + p \cdot \varepsilon \quad [5]$$

The parameters used for the production factors and the farm households characteristics are the same as used in equation [3]. We tested for heteroscedasticity and estimated the function with robust standard errors. Using this approach permits us to avoid multicollinearity and generates unbiased and consistent estimates. The results are presented in table 3.

Before discussing the results of the non-pooled production function estimates, we have to analyze first whether the use of separate models for farmers with and without credit is justified. Therefore, we rely on the Chow test to determine whether the difference between the restricted and unrestricted error sum of square is significant (Chow, 1960). The division of the sample in two homogeneous group (farmers with and without credit use) proved to be legitimate. The results of these non-pooled regressions thus provide an accurate representation of reality.[7]

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[7] Reliance on separate estimates (non-pooling) implies that the shape of the production functions is essentially different and that we cannot just assume a horizontal shift of the function.

TABLE **3**
Maize Production Function Estimates
(with/without credit)

Variable	Description	Without credit		With credit	
		Coeff.	*St. Err.*	*Coeff.*	*Std. Err*
Labor	Ln of total labor (hrs)	0.218*	(0.123)	0.307**	(0.131)
Land	Ln of area (ha)	0.660***	(0.126)	0.375**	(0.157)
Fertilizer	Ln of formula (quintal)	0.181*	(0.092)	0.414***	(0.114)
Self sufficiency	Maize consumption (lbs/cap/day)	0.051***	(0.017)	0.051***	(0.018)
Off-farm	Off-farm work (days)	0.000	(0.000)	–0.002*	(0.001)
Diversification	Coffee or cattle (1=yes)	–0.150	(0.116)	–0.219	(0.154)
R^2		0.7225		0.7049	
Number of observations (N)		69		66	

Note: *, ** and *** = significant at 10%, 5% and 1% level respectively.

The parameter estimates of the production function (table 3) give positive and significant results for the factor use variables. For farmers without credit use, marginal returns to land are almost 2 times higher compared to farmers with credit. The use of credit results in a substantial increase of the marginal products for capital, and to a minor extent also for labor. Food self-sufficiency has a similar effect for farmers with and without credit. This implies that an increase in the internal food requirements is likely to be met with an expansion in farm-level maize production. Engagement in off-farm employment only reduces maize yields in farmers using credit, indicating that clear trade-offs exist between farm and off-farm work. Finally, the sum of the primary coefficients (for land, labor and fertilizer) are close to 1 in both production functions, thus the case of constant returns to scale holds true.

We used the output elasticities of land, labor and fertilizer to calculate their respective factor shares using equation [3]. Results are presented in table 4 and show significant adjustments in input substitution rates subject to credit use.

Table 4 shows that factor shares of all inputs have changed, some of them dramatically. The factor share of the production factor labor increased with almost 36% for credit-using farmers. A substantial reduction occurs in the factor share of land for credit-using farmers, while their factor share of fertilizers increases with more than 120%. These changes in factor shares are indicative for substantial adjustments in rural income distribution that might occur when farmers could get wider access to credit resources.

TABLE **4**
Differences in Factor Shares
(farmers with and without credit)

Variable	*Description*	*Without credit*	*With credit*	*Z (% change)*
Labor	Ln of labor (hrs)	0.206*	0.280**	35.9
Land	Ln of Land (ha)	0.623***	0.342**	–45.1
Fertilizer	Ln of Formula (quintal)	0.171*	0.378***	121.1

Note: *, ** and *** = significant at 10%, 5% and 1% level respectively.

Labor productivity and the factor share of labor tends to increase for farmers who use credit. Even while credit use implies that the production process becomes more capital-intensive, the effective use of purchased chemical fertilizers is very much dependent on labor availability. Complementarities between fertilizers and labor thus result in positive relative changes in both shares for farmers relying on credit use. Quite to the contrary, the share of the production factor land strongly decreased.[8] Due to the intensification of maize production in Lempira, land availability is becoming far less a constraining factor for expanding agricultural production. In the longer run, however, land quality and distance may become more important factors once market prices for hiring-in and out land start to recognize differences in fertility and location.[9]

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8 It should be noted, however, that yield-increasing inputs will increase the long-term value of land even when the short-term factor share decreases. This particularly holds for physical soil-conservation measures but is far less relevant for fertilizers that usually have only a short residual effect.

9 This tendency is further reinforced when (non-)point externalities of land use systems are recognized, like its water retention capacity or contributions to carbon fixation. This opens opportunities for payment for environmental services that recognise these additional functions of land.

The strongly increasing importance of fertilizers for increasing maize yields in marginal areas is clearly acknowledged. This is also in line with other studies that illustrate the relatively strong response of agricultural production to fertilizer applications in less-favored areas (Barbier and Bergeron, 2001). We should note, however, that the actual intensity of fertilizers use by credit-using farmers is only slightly higher compared to farmers without credit (see table 2). But the fertilizer-land ratio of the former group is about 15% higher, which explains the substantial improvement in marginal returns to fertilizer use. Local traders in charge of input provision and fertilizer delivery capture the major share of these revenues. It is likely that at least part of the fertilizers are delivered as suppliers credit and have to be paid directly after the harvest. Consequently, the implications of credit use for food self-sufficiency tend to be ambiguous when farmers face the obligation to sell a major share of the harvest in order to be able to cancel their debts.

These results seem to indicate that credit provision for maize producers in rural Lempira could have a profound effect on the restructuring of local power relations. Landowners tend to lose some of the influence and input providers are likely to take over their position. Family farmers and wage laborers might benefit from higher labor rewards (Isgut, 2004; Ruben and van den Berg, 2001). More importantly, traditional exchange relations will gradually be transformed into market relations where negotiation and bargaining can take place based on demand and supply. Farmers using credit could be able to increase the factor share of farm labor and may thus devote more time to the production and conservation of maize fields. The latter implications may be considered a promising device towards more sustainable land management (Jansen *et al.*, 2003). Credit can to be helpful for enhancing the complementarities between yield-increasing inputs (fertilizers) and family labor in such a way that win-win options become potentially available.

CONCLUSION

In this paper we analyzed the impact of credit use on resource use and income distribution among rural farmers in Lempira department of Honduras. The empirical estimates show that households that are able to use credit rely on a more input and labor-intensive maize production technology compared to households that do not use credit. This is partly due to the substitution of land by capital inputs, but can also be attributed to the emerging complementarities between fertilizers and labor.

When credit use influences resource use and factor shares, it may be expected that income distribution and local social relations change as well. Farmers who produce maize at marginal fields and with low-input technologies are likely to rely on an extensive pattern of growth, based on expanding the fields devoted to maize production. On the other hand, farmers that have access to credit will be more inclined to increase input use in their maize fields in order to reach higher yields. The latter strategy of agricultural intensification could be considered as a more suitable device for sustainable resource management (Ruben *et al.*, 1997 Reardon and Vosti, 1995; Lee and Barrett, 2000).

Further analysis is required to identify the income and wealth implications of credit provision to maize farmers in Occidental Honduras. Informal lenders may provide credit in kind in order and take the crop as a collateral for securing repayment. Farmers, however, might prefer to use part of the credit for other (consumptive or diversification) purposes. This indeed occurs in Lempira, since the maize harvests of credit-using households were only slightly higher compared to those farmers who relied on their own resources. The allocation of credit to these other purposes might indirectly contribute to higher labor productivity or better security, thus enabling farmers to adjust their production systems and livelihood strategies.

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