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Transaction Costs of Borrowing and Credit Rationing in Agriculture: A Simultaneous-Equations Approach

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Abstract

A simultaneous-equations model of loan transactions in rural areas is estimated. Results highlight the importance of transaction costs affecting both lender and borrower behavior. Interest rate effects are insignificant. Risk-related factors condition lender rationing behavior, while the borrower's resource endowment is important in shaping demand behavior.

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1. Introduction

The role of transaction costs of borrowing as a rationing mechanism in agricultural credit markets of less-developed countries has been well documented in recent research[1/]. Financial intermediaries circumvent market regulations through non-price mechanisms that generate transaction costs for lenders and borrowers. It has been shown that lenders are constrained by a narrow range of explicit interest rates they could charge on loans, therefore they use the selective application of their loan procedures to screen and ration out potential borrowers[2/]. The results of these rationing practices are high transaction costs of borrowing, i.e., implicit-pricing, with a regressive incidence by loan-size categories. A review of recent case studies in five less-developed countries found levels of transaction costs as a percent of the loan amount ranging between 1.2% to 21.7%. Less-extreme levels of average transaction costs varied between 3% and 5% of the loan amount, but in all cases the costs associated with small loans were found to be considerably higher than those corresponding to large loans (Cuevas and Graham, 1984). The most recent findings correspond to Honduras, where the average level of borrowing transaction costs was almost 5% of the loan amount, thus representing a 30-percent "tax" over the explicit interest rate charged on loans (16%).

To investigate the determinants of borrowing transaction costs previous studies have specified single-equation models for the level of transaction costs, with different sets of explanatory variables on the right-hand side of the equation (Ahmed, Cuevas). The basic assumption underlying these models is that lenders are "price-setters" of explicit and implicit interest charges. They take as given the profile of loan demand such as loan amount, farm size, enterprise type, and other characteristics of the borrower that indicate the magnitude of risk involved in individual loan transactions. Since explicit-interest rates are constrained to a narrow range determined by financial regulations and/or the sources of funds with which lenders operate, credit rationing will be exercised primarily through implicit-price (transaction costs) adjustments (Cuevas). It has been found that borrowing transaction costs, as a percent of the loan amount, decrease with increases in loan size, decline when the explicit interest rate increases, and differ between lending institutions (Cuevas). Other variables that appear to be significant are associated with the social and political status of the borrower in the community (Ahmed).

Even under a price-setting analytical framework, the specification of the loan amount as a pre-determined variable on the right-hand side of the transaction costs function is questionable. Instead this amount may be considered a point on the borrower's demand for liquidity. If it is also assumed that borrowers do consider transaction costs as part of the loan total price, then the model should be specified as a system of simultaneous equations in which transaction costs and loan amount are endogenous variables. Furthermore,

if the true model involves a loan-demand function where the loan amount depends on the magnitude of transaction costs, the single-equation estimation of a transaction costs function would yield biased and inconsistent estimates of the parameters in the model.

In this paper we investigate the role and determinants of transaction costs under a simultaneous-equations approach. We show that this approach contributes to a better understanding of the rationing role that transaction costs play in credit markets. We also show that several risk-related characteristics of the borrower are important determinants of the magnitude of transaction costs imposed by the lender. On the other hand, the borrower's resource endowment is a significant factor affecting his/her demand for liquidity. The following section sets forth the model to be estimated using a simultaneous-equations technique. We then present the results of this estimation and test the main hypotheses associated with the model. Major conclusions follow.

2. Simultaneous-Equations Model and Estimation.

The model is specified under the price-setting framework described in the previous section, with transaction costs and loan amount as endogenous variables. Loan demand is assumed a function of the total cost of borrowing (interest rate and transaction costs), and the resource endowment that influences the potential size of the individual's investment projects (Jaffee and Russell). Some limitations of this specification are discussed in the next section.

The exogenous variables that enter the transaction-costs equation are: (a), the explicit interest rate charged on loans, whose range is limited by financial authorities; (b), a set of risk-related characteristics of the borrower that are a part of the information gathered by the lending institution, namely the area of the farm, the previous repayment record of the client, and the type of collateral associated with the loan transaction; and (c), the nature of the existing bank-client relationship as measured by the length of period during which the client has held deposit accounts with the lending institution. A dummy variable is included to capture differences between lending institutions (private banks versus development bank). The exogencus variables in the loan-demand equation are: (a), the explicit-interest rate; and (b), a group of variables that reflect the borrower's resource endowment. These variables are the area of the farm, the total number of hired workers, and the size of the herd of cattle.

The two equations in the model can now be specified. The transaction cost equation is written as follows:

$$\ln TC = a_0 + a_1 \ln L + a_2 \ln(i) + a_3 \ln A + b_1 COL + b_2 DEL + b_3 CLI + b_4 BANK \quad (1)$$

where,

TC is borrowing (non-interest) transaction costs, in percent,

L is loan amount,

i is the explicit-interest rate charged on the loan,

A is the area of the farm,

COL is a dummy variable for the type of collateral,

COL=1 if collateral is real estate, COL=0, otherwise,

DEL is a dummy variable for the previous repayment performance of the borrower,

DEL=1 if delinquent at any time in the past,

DEL=0, otherwise,

CLI is the number of months the client has held deposit accounts with the lending institution, and

BANK is a dummy variable for type of lending institution,

BANK=1 if private bank, BANK=0 if development bank.

The loan-demand equation is written as follows:

$$\ln L = c_0 + c_1 \ln TC + c_2 \ln(i) + d_1 \ln A + d_2 LAB + d_3 CAT \qquad (2)$$

where the variables not yet defined are:

LAB, the total number of hired workers computed as a weighted sum of permanent workers plus temporary workers, and

CAT, the total number of units in the cattle herd.

The estimation of this two-equation system drew upon data obtained in a survey undertaken in Honduras in August 1983. The sample included some 400 observations of farmer-borrowers in the seven major agricultural regions of the country. About half of the observations correspond to clients of the agricultural development bank, and the other half to borrowers from private banks. The estimation techniques used were two-stage least squares (2SLS), limited-information maximum-likelihood (LIML), and three-stage least squares (3SLS). The results presented in the following section correspond to the 2SLS estimation. The use of LIML or 3SLS did not improve either the overall goodness-of-fit or the significance of individual coefficients in the model[3/].

3. Results and Implications

The estimated parameters and significance levels of the two equations in the system are reported in table 1. Overall, R-square levels are rather low but not unusual for cross-sectional data sets. Discussion of individual coefficients requires some caution since in both equations there are groups of variables that capture the effect of single "factors", i.e., risk in the transactions-costs equation, and resource endowment in the loan-demand equation. These variables are thus likely to be correlated among themselves, therefore their individual effects will not be statistically significant due to multicollinearity. In these cases the appropriate joint tests for the relevant group of coefficients are presented in table 2, together with other relevant tests involving more than one individual estimate.

The first important finding shown in table 1 is the significance of transaction costs in the loan-demand equation. Loan amount is inversely related to the magnitude of transaction costs, whereas the estimated coefficient for the interest-rate variable is not significantly different from zero. If the "total-price" elasticity is defined as the sum of the estimated coefficients for interest rate and transactions costs, its estimated value is -0.6, not statistically different from zero as shown by the F-test reported in table 2. These results indicate that transaction costs are indeed playing the role of price signals in loan transactions. Explicit-interest rates do not appear to affect the behavior of lenders or borrowers,

Table 1. Estimated Parameters of the Transaction-Costs Equation and the Loan-Demand Equation. Two-Stage Least-Squares.

Right-Hand Side Variables	Jointly-Dependent Variables (1) Transaction Costs (ln TC) Estimate	Asymptotic t-ratio	(2) Loan Amount (ln L) Estimate	Asymptotic t-ratio
Loan Amount (ln L)	0.2970	0.6979	--	--
Transaction Costs (ln TC)	--	--	-1.5840	-4.4807*
Interest Rate (ln i)	0.2387	0.5211	0.9842	1.5642
Area of the Farm (ln A)	-0.3661	-2.0326+	-0.1084	-0.7113
Type of Collateral (COL)	0.1675	0.7807	--	--
Delinquency Status (DEL)	0.1944	1.2093	--	--
Bank-Client Relationship (CLI)	-0.0012	-1.2111	--	--
Banking Institution (BANK)	-0.9165	-1.7755o	--	--
Hired Labor (LAB)	--	--	0.0012	1.2620
Cattle (CAT)	--	--	0.0019	2.7668*
Intercept	-0.8853	-0.2781	7.5460	4.0241*
R^2	0.1357		0.2206	
F-Value	7.47*		18.97*	

N = 341

Significance levels: *, .01
+, .05
o, .10

since the corresponding coefficients are not statistically significant in either equation. Our interpretation of this result is that the limited range within which interest rates can vary is too narrow to elicit any meaningful response by the participants in the market.

Table 2. Tests of Significance of Different Joint Effects in the Transaction-Costs and Loan-Demand Equations.

Factor, Null Hypothesis	F-Value	Conclusion (significance level)
Transaction-Costs Equation, Effect of Risk-related characteristics	2.8046	Ho rejected (.03)
Ho: $a_3=b_1=b_2=0$		
Loan Demand Equation, Effect of "Total Price"	0.6795	Ho not rejected (.41)
Ho: $c_1+c_2=0$		
Effect of Resource Endowment	3.0578	Ho rejected (.03)
Ho: $d_1=d_2=d_3=0$		

The joint effect of risk-related characteristics of the borrower is highly significant, as shown in table 2. This suggests that a major consideration in lenders' decisions towards the selective application of loan procedures is the perceived degree of risk associated with the loan application. Loan amount was not a significant variable, an unexpected result considering the findings reported in earlier studies. A possible explanation is provided by the estimated

effects of the bank-client relationship and the banking institution in question(see table 1). The signs of the estimated coefficients are negative in both cases, though only the bank variable is significant. As reported elsewhere, the average loan size borrowed from private banks was five times as large as those obtained from the development bank (Cuevas and Graham, 1985). Also, there is a positive and significant correlation between loan amount and the age of deposit accounts held by the borrower with the lending institution. These relationships suggest that these two variables, bank-client relationship and banking institution, are capturing the expected cost-decreasing effect of increasing loan amounts.

Even though the survey was not specifically designed to thoroughly document the resource endowment of farmer-borrowers, the variables specified in the loan-demand equation to capture this effect performed well. As indicated before, individual coefficients were not expected to be significant since the different components of the resource endowment are expected to be highly correlated among themselves. In fact only the "cattle" variable was individually significant, however the joint test for all three components indicates that resource endowment is a relevant determinant of the demand for liquidity. An important note here is that liquidity is not demanded solely for "investment purposes" as suggested by the specification used in this model. Liquidity will indeed be allocated to all "rewarding" uses, in terms of utility derived from consumption or under the form of returns to investment. Therefore an improved specification of the loan-demand equation should include variables that capture the effect of the current-expenditure side of the

potential uses of liquidity (e.g., family size, education), in addition to those that determine the potential size of investment project (i.e., resource endowment).

4. Summary and Conclusions

Previous studies of borrowers transactions costs have been couched in single equation terms. This approach assumes that the loan amount demanded is fixed and exogenously given and operates only on the lenders behavior towards the borrower. However, this variable also reflects borrower behavior towards the optimum amount to borrow, an effect not considered in the single equation approach. Therefore we hypothesize that borrower loan demand can be influenced by the transactions costs incurred in negotiating the loan and the resource endowment of the borrower. Hence a two equations simultaneous system is more appropriate in capturing these dual effects of lender and borrower behavior.

Our results highlight the importance of transaction costs in affecting both lender and borrower behavior. Interest rate effects are insignificant. Risk related characteristics stand out as important factors conditioning lender loan rationing behavior while the resource endowment played a comparably significant role in shaping borrower behavior. Future studies should attempt to refine the loan demand specification to include variables that capture the effects of potential uses of liquidity for expenditures (in addition to investments). In the end the importance of non-interest

transaction costs stands out as a strategic variable in lender and borrower behavior in rural financial markets.

Notes

1/ Ahmed, Cuevas, Cuevas and Graham (1984).

2/ On these issues see Baltensperger, Benston and Smith, Jaffee and Russell.

3/ Overall survey results and descriptive analysis are reported in Cuevas and Graham (1985).

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