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**Abstract:** Access to adequate start-up capital has been identified as an important deterrent to microenterprise development and growth. Using firm level data from Mexico's National Survey of Microenterprises, we estimate a stochastic frontier production function with inefficiency effects related to the main sources of start-up capital. Microenterprises utilizing bank loans, carryover business capital, moneylenders and credit from clients and suppliers are more technically efficient than those relying on family, friends and on own financial sources. Bank loans led to the highest degree of technical efficiency, indicating a well functioning screening process despite information asymmetries. Banks tend to offer the largest average loan size with the longest terms which are significant factors in allowing microentrepreneurs to overcome capital constraints.

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## 1. Introduction

The efficiency and potential for development of the microenterprise sector in emerging economies have been important issues of debate in the development literature. Many argue that microenterprises, particularly in the informal sector, represent a vibrant segment of the economy that provides jobs to the poor (de Soto, 1989; Schumacher, 1974). Others caution that microenterprises are characterized by low productivity given their overly abundant use of labor with low marginal productivity, low education levels, small scale of operations and lack of adequate capital inputs. In many developing countries, the microenterprise sector employs from 50 to 75 percent of the manufacturing workforce, yet only contributes about 25 percent of the value added (Perkins et al., 2001).

Lack of access to adequate start-up capital has been recognized as an important obstacle to microenterprise development and growth (Otero & Rhyne, 1994). This is the case because inadequate initial financing restricts the ability of entrepreneurs to invest in much needed capital equipment and labor services (Levine, 1997; Heino & Pagán, 2001; Nabi, 1989). As such, access to adequate credit plays an important role in both the short and long term growth of microentrepreneurial activities, which are well known to reduce poverty by generating income and jobs (Morduch, 1999). This has been an issue for virtually all developing countries, where formal capital markets are not only underdeveloped but also they tend to exclude a large share of the population, especially the poor. As a result, these excluded entrepreneurs have to turn to informal financial intermediaries to obtain the necessary resources to start up their projects.

In order to better understand issues related to the productivity of the microenterprise sector, this paper seeks to provide a clearer understanding of the causes of inefficiency, how and why efficiency may be related to sources of financing and how technical efficiency varies between the formal and informal sectors. A stochastic frontier production function with inefficiency effects is estimated using 1998 firm-level data from Mexico's National Survey of

Microenterprises (Battese and Coelli, 1995). To date, no similar study has analyzed the source of financing as a determinant of technical efficiency in the microenterprise sector.

A microenterprise can be categorized as technically efficient if it is able to produce maximum output given available resources. In particular, the study analyzes the differences in the impact of alternative credit access mechanisms (both formal and informal), taking into account whether the microentrepreneur is in the formal or informal sectors. The operational definition of informality employed here is that the informal sector is comprised of firms not registered with fiscal authorities (see Roubaud, 1995).

The translog production function includes input-related terms as well as industry and region controls. Unlike other studies of technical efficiency, the inefficiency effects in this analysis include controls for the main source of start-up capital utilized (i.e., banks, informal moneylenders, friends, etc.) as well as other factors known to be related to technical efficiency (e.g., number of years in business and the level of education of the entrepreneur).

We find that those microenterprises that were initially funded through bank loans, carryover business capital<sup>1</sup>, moneylenders, or credit from clients and suppliers are more technically efficient than those funded through other means such as own funds and capital provided by friends and relatives. Formal sector businesses are more efficient than their informal sector counterparts. We also find that the effects of alternative credit schemes substantially differ by formal/informal sector.

The paper is organized as follows. Section 2 discusses conceptual issues related to the role of start-up credit on firm profitability and efficiency. Section 3 presents the methodology. Section 4 discusses the data and the main findings. A discussion and interpretation of the results is offered in Section 5. Section 6 provides some concluding remarks and the policy implications of the results.

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<sup>1</sup> This category includes any type of capital related to former employment including capital from the liquidation of a business, severance pay, carryover assets, etc.

## 2. Start-up Capital and Technical Efficiency in Microenterprises

Access to credit is critical for business expansion, particularly in countries where the banking system is underdeveloped and where there are substantial restrictions to obtaining a loan. Mexico is a case in point given the fact that the demand for credit has been identified as high in both urban and rural areas (Sánchez & Pagán, 2001). Microenterprises are usually defined in the development economics literature as a firm employing a small number of workers—typically six or less (Pagán & Sánchez, 2001). Many microentrepreneurial activities are household and family based, and about half of these businesses operate in the informal sector. Most microenterprises do not operate at an efficient scale and they do not usually adopt new technology unless they are able to obtain sufficient capital to increase its scale of operation.

Mexico provides an ideal milieu for testing the determinants of technical efficiency of microenterprises. These firms employ about one fifth of Mexico's working age population and the number of microenterprises has increased substantially over the last decade (Pagán & Sánchez, 2001). Although the urban self-employment rate hovered around 17-18% over the late 1980's, employment in firms with five workers or less increased from 38.6% of total urban employment in 1987 to 44.6% in the late 1990's (INEGI, 2000). This expansion of both formal and informal microenterprises has also been attributed to the recurrent financial crises that Mexico has experienced over the last 20 years, being the most notorious the so called *tequila* crisis of 1994.

As a result of this expansion, policymakers and international organizations have begun to pay attention to the promotion of entrepreneurship given the role that microenterprises have in providing alternative employment opportunities and fueling economic growth (World Bank, 1994). Supporting microentrepreneurship through microfinance has become a cornerstone of domestic economic policy in Mexico.<sup>2</sup>

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<sup>2</sup> For example, Mexico's 2001-2006 National Development Plan clearly supports these ideas by emphasizing that the country should have "a solid system of financing to support productive initiatives of low income individuals and social groups, and to promote self-employment and the

The early work of Tybout (1983) and Nabi (1989) has shown that investment and growth potential are substantially diminished in the presence of credit constraints (see also Evans and Jovanovic, 1989). Limited credit access forces microentrepreneurs to use up their savings and assets which in turn could have a detrimental effect on optimal asset accumulation at the household level (Jalan & Ravallion, 1999). On the other hand, other causes of credit constraints have been identified by Montiel, et al. (1993). They argue that credit constraints may be present when (a) there is a financial crisis, (b) the institutional and legal frameworks under which the financial system operates is weak, and (c) there exists strong government intervention as pointed out by McKinnon (1973).

These elements are or have been present in Mexico. First, the tequila crisis of 1994-95 hit the banking system in such a way that virtually all the national banking credit was frozen. The financial deepening indicator, measured as the ratio of M4 to GDP, dropped from 60 percent in 1992 to 38 percent in 1996, suggesting that the financial intermediation in the country decreased abruptly (Hernández & Villagómez, 2000). In other words, little credit was available in the country for the period 1994-2000.<sup>3</sup>

Second, credit restrictions arise in countries where institutional monitoring and enforcement mechanisms are weak and institutional credit for individual needs is difficult to obtain. In a recent study, La Porta, Lopez-de-Silanes, Shleifer and Vishny (1999) find that in general Latin American countries – which belong to the family of French-civil-law tradition – have weak legal protection mechanisms for investors. In particular, in their sample of 49 countries, they show that Mexico has one of the weakest indexes of rule of law.<sup>4</sup> Finally, until the late 1980s, Mexico had been a financially repressed economy and government credit restrictions took the form of credit targeting and interest rate caps.

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development of viable, sustainable and competitive microenterprises.” (Poder Ejecutivo Federal, 2001: p. 112). The National Development Plan also maintains that adequate credit access can also be effective in incorporating microenterprises into the formal sector (p. 112).

<sup>3</sup> During the 1996-2000 period, the Mexican economy grew at an average yearly rate of four percent. This growth was largely based on exports. Interestingly, Hernández and Villagómez (2001) have documented that this sector financed its activities through international loans – not through national financial markets – as they did not face exchange risks.

<sup>4</sup> These authors construct an index of rule of law based on the efficiency of the judicial system, rule of law, corruption, risk of contract repudiation and risk of expropriation.

It is for all of these reasons that individuals who are looking for the capital to set up, or run, micro-businesses—and who are denied credit for such purposes by the banking system—find it relatively easier to raise credit from their friends, relatives or moneylenders (Adams, 1992). Consequently, the size of the informal micro-credit market has been increasing significantly in Mexico and friends, relatives and moneylenders have now become important sources of credit.

### 3. Methodology

To analyze the linkages between start-up capital (initial credit access) and technical efficiency effects in microenterprise production, we utilize the stochastic frontier production model proposed by Battese and Coelli (1995). The translog production frontier for firm  $i$  is given by:

$$(1) \quad \ln Q_i = \beta_0 + \beta_1 \ln K_i + \beta_2 \ln L_i + \beta_3 \ln K_i^2 + \beta_4 \ln L_i^2 + \beta_5 \ln K_i \ln L_i + \gamma' X_i + v_i - u_i,$$

where  $\ln Q$  is the log of the value of monthly output (in Mexican pesos),  $\ln K$  is the log of the value of total capital equipment,  $\ln L$  is the log of the total number of workers, the  $\beta$ 's are the parameters to be estimated,  $X_i$  is a vector of industry and region controls with an associated vector of parameters ( $\gamma$ ),  $v$  is a normally distributed error term with a zero mean and variance  $\sigma_v^2$ , and  $u_i$  is a random variable that follows a truncated normal distribution with mean  $\mu_u$  and variance  $\sigma_u^2$ .

To analyze possible sources of technical inefficiency, the inefficiency effect,  $u_i$ , in the stochastic frontier translog production function can be specified as:

$$(2) \quad u_i = \theta' Z_i + w_i,$$

where  $Z_i$  represents a vector of explanatory variables related to technical inefficiency for the  $i$ th firm, the  $\theta$ 's are the inefficiency parameters to be estimated, and  $w$  is an error term that follows a truncated normal distribution. The parameters

in equations (1) and (2) are estimated jointly by maximum likelihood (Battese & Coelli, 1995; Kumbhakar and Lovell, 2000).<sup>5</sup>

Following the microenterprise and production literature, factors that can potentially be related to technical inefficiency are: the number of years that the microenterprise has been in business, the years of schooling of the owner (Seyoum, Battese & Fleming, 1998), whether the business was inherited and whether the firm operates in the formal or informal sector (measured here by whether the business is registered with Mexico's fiscal agency, the *Secretaría de Hacienda y Crédito Público*, SHCP). In addition, and as discussed in the previous section, the main source of start-up capital (e.g., own sources, banks and other credit institutions, friends, moneylenders, carryover business capital, credit from suppliers and/or clients) can also have an effect on technical efficiency by not allowing firms to use resources efficiently, by decreasing the likelihood that microenterprises use the appropriate technology and by altering efficient production practices.

#### 4. Data and Empirical Results

We use firm-level data from the 1998 National Survey of Microenterprises (*Encuesta Nacional de Micronegocios*, ENAMIN). The ENAMIN includes basic economic, financial and demographic data for 14,030 microenterprises in Mexico. The ENAMIN defines a microenterprise as an economic unit of up to six workers—including the owner—in the service, trade and construction sectors, and up to 16 workers in the manufacturing sector (INEGI, 1996). The sample is representative of microenterprises in all urban areas in Mexico with more than 100,000 inhabitants. The ENAMIN is unique in that it has information on whether the business is formal or informal and whether their initial source of financing occurs through a credit extended by a bank or by a friend or relative, among other categories.

Table 1 presents some descriptive statistics for the sample employed to estimate the stochastic frontier model. After excluding observations (firms) with missing values in any of the variables, the sample falls to 10,332 firms. According to the ENAMIN data, most urban

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<sup>5</sup> The variance parameters are estimated as  $\sigma^2 = \sigma_v^2 + \sigma_u^2$  and  $\gamma = \sigma_u^2 / (\sigma_v^2 + \sigma_u^2)$  (Battese & Corra, 1977). The specification for the log likelihood function can be found in Battese and Coelli (1993).

microenterprises in Mexico are owner-operated and employ an average of 1.40 workers (Pagán & Sánchez, 2001). About three-fifths of firm owners joined the sector either to become financially independent or to complement family income. Only about two-fifths of microenterprises operate in the formal sector in the sense that they are registered with the *Secretaría de Hacienda y Crédito Público*, Mexico's fiscal authority.<sup>6</sup>

**Table 1. Descriptive Statistics**

<i>Variable</i>	<b>Full Sample</b>		<b>Formal Sector</b>		<b>Informal Sector</b>	
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
Ln Output	7.314	1.180	7.827	1.097	6.980	1.111
Ln Capital	8.715	2.623	10.476	1.856	7.569	2.406
Ln Labor	0.335	0.488	0.553	0.554	0.193	0.378
Ln Capital Squared	82.840	49.431	113.191	41.483	63.081	43.861
Ln Labor Squared	0.350	0.652	0.612	0.829	0.180	0.425
Ln Capital x Labor	3.368	5.239	6.032	6.366	1.634	3.362
Manufacturing (1=Yes; 0=No)	0.148	0.355	0.104	0.306	0.176	0.381
Trade (1=Yes; 0=No)	0.321	0.467	0.407	0.491	0.265	0.441
Services (1=Yes; 0=No)	0.532	0.499	0.489	0.500	0.559	0.496
Mexico City (1=Yes; 0=No)	0.068	0.251	0.073	0.260	0.064	0.245
Northern State (1=Yes; 0=No)	0.143	0.350	0.159	0.366	0.133	0.340
Central State (1=Yes; 0=No)	0.389	0.487	0.390	0.488	0.388	0.487
Southern State (1=Yes; 0=No)	0.182	0.386	0.175	0.380	0.187	0.390
Border State (1=Yes; 0=No)	0.218	0.413	0.203	0.402	0.228	0.420
Years of Schooling of Owner	7.734	4.801	9.858	5.087	6.351	4.045
Years in Business	8.415	9.122	8.701	8.763	8.228	9.344
Formal Sector (1=Yes; 0=No)	0.394	0.489	—	—	—	—
Inherited Business (1=Yes; 0=No)	0.021	0.142	0.033	0.179	0.013	0.112
Personal Savings/Resources (1=Yes; 0=No)	0.608	0.488	0.612	0.487	0.605	0.489
Bank (1=Yes; 0=No)	0.006	0.079	0.014	0.119	0.001	0.031
Savings & Loans (1=Yes; 0=No)	0.157	0.364	0.088	0.283	0.202	0.402
Friends/Relatives (1=Yes; 0=No)	0.137	0.344	0.161	0.367	0.122	0.328
Moneylenders (1=Yes; 0=No)	0.021	0.145	0.027	0.162	0.018	0.132
Previous Job (1=Yes; 0=No)	0.051	0.219	0.072	0.259	0.036	0.187
Credit from Suppliers/Clients (1=Yes; 0=No)	0.020	0.139	0.026	0.158	0.016	0.125
N	10,332		4,074		6,258	

The mean value of total capital equipment amounts to about \$6,093 Pesos. Capital equipment includes the value of tools and equipment, machinery, vehicles

<sup>6</sup> For alternative definitions of the informal sector see Roubaud (1995) and Pagán and Tijerina-Guajardo (2000).

and other miscellaneous capital expenses. Microenterprise owners have been in business for roughly 8.4 years and their average educational attainment is 7.7 years. About one fifth of the businesses in the sample are located along the U.S.-Mexico border and most of them are located in central Mexico (38.9%). Slightly more than half of the firms are in the service sector, 32.1% in trade and 14.8% in the manufacturing sector. When it comes to the different sources of start-up capital, microentrepreneurs mostly use their own resources/savings (60.8%) followed by credit from savings & loans (Cajas de ahorro; 15.7%), friends/relatives (13.7%), carryover business capital (5.1%), moneylenders (2.1%), credit from suppliers/clients (2.0%) and banks (0.6%).

A comparison of means across the formal and informal sectors reveals that formal sector microenterprises produce more output and are better capitalized than those in the informal sector. Formal sector firms also employ more workers, have been in business longer and they are more likely to utilize a bank for start-up capital than their informal sector counterparts.

Table 2 reports the results of estimating the stochastic frontier model with inefficiency effects [equations (1) and (2)]. Three specifications were estimated: the first one includes the full sample and the second and third sets of results are for separate formal and informal sector samples, to deal with the possibility of biases due to differences across sectors. The model was estimated using FRONTIER 4.1 (Coelli, 1996). The translog production function frontier results are reasonable and the production function estimates also suggest that the translog specification is preferable to the Cobb-Douglas model.<sup>7</sup> The variance parameter estimates  $\gamma=0.831$ , 0.885 and 0.875 suggest that a relatively large portion of the residual variation in the output of firms is related to technical efficiency.

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<sup>7</sup> This was formally tested using a likelihood ratio test. The  $\chi^2$  test statistic rejects the Cobb-Douglas specification in favor of the translog model.

Table 2. Stochastic Frontier Results: Full Sample and Formal/Informal Sectors

	All			Formal			Informal		
	Coefficient	t-ratio	t-ratio	Coefficient	t-ratio	t-ratio	Coefficient	t-ratio	t-ratio
<i>Frontier</i>									
Constant	6.071 ***	70.849	5.666 ***	23.262	6.231 ***	65.734			
Ln Capital	0.320 ***	19.962	0.378 ***	8.937	0.301 ***	16.670			
Ln Labor	-0.281 ***	-3.118	-0.240	-1.472	-0.022	-0.154			
Ln Capital Squared	-0.011 ***	-13.414	-0.013 ***	-6.976	-0.011 ***	-11.619			
Ln Labor Squared	0.184 ***	4.268	0.235 ***	4.444	-0.015	-0.174			
Ln Capital x Labor	0.053 ***	5.809	0.033 **	2.159	0.048 ***	3.276			
Manufacturing (1=Yes; 0=No)	-0.330 ***	-11.440	0.004	0.085	-0.461 ***	-14.202			
Trade (1=Yes; 0=No)	-0.220 ***	-9.740	-0.218 ***	-6.431	-0.208 ***	-7.010			
Northern State (1=Yes; 0=No)	0.062	1.412	0.138 **	2.058	0.001	0.019			
Central State (1=Yes; 0=No)	0.002	0.060	0.031	0.506	-0.028	-0.565			
Southern State (1=Yes; 0=No)	0.006	0.132	0.029	0.442	-0.011	-0.212			
Border State (1=Yes; 0=No)	0.355 ***	8.633	0.405 ***	6.266	0.316 ***	6.080			
<i>Technical Inefficiency Effects</i>									
Constant	-0.169	-0.347	-2.380 **	-2.451	-0.844	-1.109			
Years of Schooling of Owner	-0.210 ***	-4.915	-0.571 ***	-4.649	-0.196 ***	-3.957			
Years in Business	-0.074 **	-5.360	-0.074 ***	-5.821	-0.097 ***	-3.754			
Formal Sector (1=Yes; 0=No)	-1.028 **	-3.843							
Inherited Business (1=Yes; 0=No)	0.537 **	2.261	-0.601	-1.423	0.747	1.611			
Bank (1=Yes; 0=No)	-2.588 **	-2.287	-4.141 ***	-3.639	-0.727	-0.237			
Savings & Loans (1=Yes; 0=No)	-0.437 **	-3.598	0.198	0.861	-0.414 ***	-2.781			
Friends/Relatives (1=Yes; 0=No)	-0.040	-0.388	0.065	0.548	-0.034	-0.222			
Moneylenders (1=Yes; 0=No)	-0.886 **	-2.917	-2.423 ***	-3.682	-0.763 *	-1.766			
Previous Job (1=Yes; 0=No)	-1.335 ***	-3.949	-1.509 ***	-4.524	-2.072 ***	-3.468			
Credit from Suppliers/Clients (1=Yes; 0=No)	-0.789 **	-2.783	-3.185 ***	-3.967	-0.476	-1.002			
$\sigma^2 = \sigma_v^2 + \sigma_u^2$	3.443 ***	5.579	5.747 ***	5.109	3.934 ***	4.548			
$\gamma = \sigma_u^2 / (\sigma_v^2 + \sigma_u^2)$	0.831 ***	27.921	0.885 ***	37.476	0.875 ***	34.181			
Log likelihood function	-14,431.726		-5,621.304		-8,703.909				
n	10,332		4,074		6,258				

\*\*\*/\*\*/\* significant at the 1, 5 and 10 percent levels, respectively.

The results for the technical inefficiency effects suggest that years of schooling and years in business are both negatively related to inefficiency. That is, owners with more education and business experience have a higher ability to use resources efficiently. Informality—as measured by being registered with the SHCP—is positively related to inefficiency. Those that inherited their business run more technically inefficient operations than those who started their business on their own.

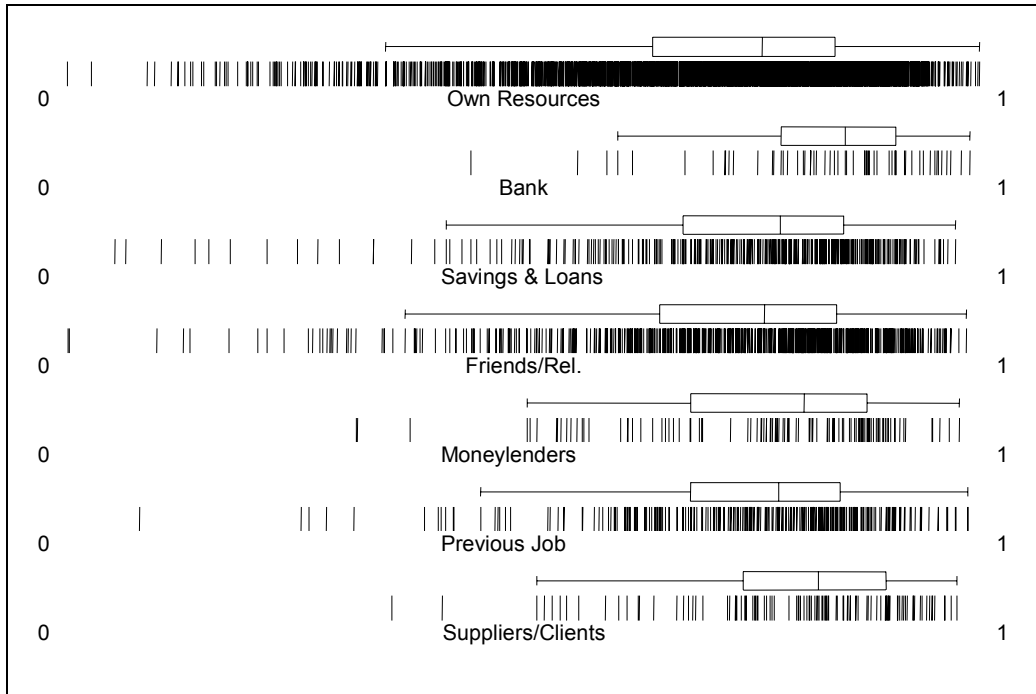
**Table 3. Relative Technical Efficiency Rankings by Source of Start-up Capital\***

	All	Formal	Informal
Personal Savings/Resources	--	--	--
Bank	1	1	--
Savings & Loans	5	--	3
Friends & Relatives	--	--	--
Moneylenders	3	3	2
Carryover Business Capital	2	4	1
Credit from Suppliers/Clients	4	2	--

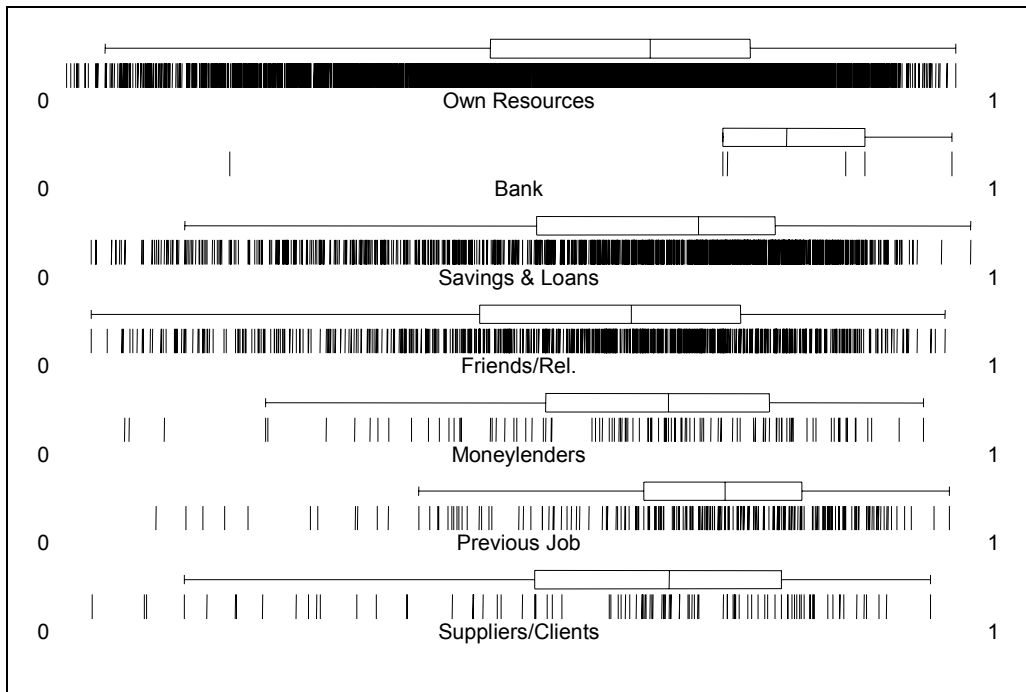
\*Statistically insignificant coefficients are ranked at the same level as the base category used (personal savings/resources)

Table 3 ranks the estimated coefficients by their magnitude in terms of efficiency. When it comes to start-up credit, the results suggest that those who received initial financing through a bank are more technically efficient than those using other forms of financing. In the informal sector, using carryover business capital was the most significant source of financing leading to technical efficiency. Start-up capital coming from personal savings and from friends and relatives were not significant in any of the three estimations.

**Figure 1**  
**Box Plots and One-Way Scatterplots of Technical Efficiency,**  
**by Source of Start-up Capital: Formal Sector**



**Figure 2**  
**Box Plots and One-Way Scatterplots of Technical Efficiency,**  
**by Source of Start-up Capital: Informal Sector**



Figures 1 and 2 present box plots and one-way scatterplots of the technical efficiency indexes by the source of start-up capital (Chambers et al., 1983). The boxplots are consistent with the ranking of each start-up capital source reported in Table 3, in terms of the median of the distribution for technical efficiency by source of start-up capital. An interesting result here is that the 25-75% inter-quartile range (the boxes) tend to be smaller for the start-up capital sources found to be more consistent with higher technical efficiency. This result applies to the formal sector and, to a lesser extent, to the informal sector. This suggests that formal sector firms using bank loans, credit from suppliers/clients and moneylenders are more uniformly efficient in the sense that the distribution of the efficiency index is more compact. This is consistent with the idea that banks, suppliers, clients and moneylenders are better at investing in microenterprises that are more likely to have high technical efficiency and, thus, higher long-term profitability.

## 5. Discussion

Similar to previous findings, there was strong evidence of inefficiency and capital constraints in the informal sector. Formal sector firms had a capital to labor ratio 12.8 times greater than in the informal sector. The widespread use and diminishing returns to labor help to explain the inefficiency of the informal sector. Low technical efficiency in the informal sector was also associated with fewer years of schooling, averaging 3.5 years less than for microentrepreneurs in the formal sector, supporting the policy objective of better training and education in the informal sector.

The finding that the source of credit is a significant determinant of technical efficiency must be analyzed with caution. At first blush, one could conclude that technical efficiency would be enhanced if merely the source of credit were to change. Since money is fungible, it is not reasonable to imply that a dollar from a bank helps spur technical efficiency more than a dollar from friends and family.

Two main lines of argument can be offered to explain why the source of credit is related to the technical efficiency of the firm. Firstly, one could argue that the *ex*

*ante* screening by certain selective creditors merely reflects the higher potential for technical efficiency *ex post*. This endogeneity issue is partially solved in this study by using startup capital rather than credit once the firm has a history of technical efficiency. Nonetheless, a selection bias still may exist whereby the rankings of technical efficiency by credit source in Table 3 may simply reflect the stringency of the screening process by creditors with banks being the most rigorous and family and friends being the least.

Given asymmetric information, banks spend more time *ex ante* on screening than informal financial intermediaries. Through their screening process, banks target firms which are more likely to have economies of scale and demonstrate technical efficiency. Bank loans in Mexico have the reputation of being difficult to obtain, especially for small firms and microenterprises. According to a 1994 survey of rural and peri-urban areas conducted by the Mexican government, only 6.4 percent of the general population had received a bank loan. For the microenterprises in this survey, less than one percent had obtained startup capital from a bank. The screening process in the banking sector favors formal sector businesses since a credit application typically entails formal business registration, proof of business and home ownership, literacy, tax returns, excellent bank references and a collateral requirement (Mansell, 1995, p. 76). Defaulting on a bank loan can lead to stiff penalties, including seizure of collateral, and most likely has legal ramifications. These results suggest that banks lend to microentrepreneurs that have superior technical efficiency *ex post*, despite the asymmetric information problems.

Startup capital from moneylenders and commercial credit were related to higher levels of technical efficiency as well. Mansell (1995) has documented anecdotal evidence that street vendors in Mexico (informal sector) buy their merchandise using moneylender credit.<sup>8</sup> These lenders know all their clients very well and only lend to viable businesses. Given their information advantages, both

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<sup>8</sup> Mansell (1995) argues that this type of lending is important even though the interest rate charged on the credit is enormous (around 10 percent a day, which yields a 3,000 percent interest rate on an annual basis). Her argument is that the daily net profit of a street vendor must then be above 10 percent.

moneylenders and local suppliers seem to be relatively good at screening and monitoring projects that will lead to technical efficiency.

It has been argued that credit from friends and relatives allegedly solves weak institutional and enforcement problems because reciprocity and social pressure is frequently observed in these relationships (Adams, 1992). These information advantages may allow for better loan screening, thereby resulting in higher technical efficiency. On the other hand, others have characterized informal loans as part of a "moral economy" in developing countries where the poor have interdependent utility functions and help one another in times of need (Coate & Ravallion, 1993; Morduch, 1999). The findings of this study support the notion that the poor may lend to one another without regard to loan use, profitability, or technical efficiency but as more of a reciprocal insurance contract.

A second type of argument that can be put forward is that firms may become more technically efficient because of the special nature of loans stemming from different sources. In addition to differences in screening, loans vary from one another in other important ways: e.g., loan size, interest rate, loan term, monitoring, repayment rate and penalties. While this survey does not contain these details, several recent finance studies about Mexico shed light on how sources of credit vary (Cuevas & Campos, 2001; Mansell, 1995). Table 4 highlights loan terms and conditions by source using a rural microenterprise survey in Mexico.

**Table 4. Terms and Conditions of Loan by Credit Source**

	<b>Average amount (US \$)</b>	<b>Nominal annual interest rate</b>	<b>Average term</b>
Personal Savings	\$85	0	none
Bank	\$1,235	market	17 months
Savings and Loan <sup>i</sup>	\$710	market	9 months
Friends and Relatives	\$75	0	<1 month
Moneylenders	\$205	120%-240%	4 months

Source: survey data from Cuevas and Campos (2001)

i: 1998 data from Caja Popular Mexicana, Mexico's largest Savings and Loan

One of the most important distinctions between sources of credit is the average loan size. Table 4 shows the relatively small amounts of capital that are available through personal savings or from friends and relatives. The small average loan sizes are probably insufficient in making a large impact in the efficiency of the firm. Banks offer loans that are nearly 17 times the average loan size of loans from friends and family.

Another drawback of informal sources of startup capital is their short term. Loans from family and friends have very short terms, often days or weeks, thereby reducing the efficacy of long-term investments. Moneylenders and savings and loans offer loans with an average loan term of 4 and 9 months respectively for short and medium term investments. Banks offer the longest term thereby allowing firms to invest at market rates over a longer horizon.

Interest rates also vary according to loan source. While banks and savings and loans offer market rates, these loans tend to be the most difficult to obtain. If a microentrepreneur uses a moneylender instead, interest rates are quite high thereby reducing the possibility of using a moneylender as a long-term investment strategy. In contrast, using own funds or friends and family typically carries no interest rate, however, the loan amounts are quite small.

The widespread use of informal financial intermediaries in Mexico exemplifies the well documented void of formal financial sources of credit for microenterprises (Mansell, 1995, Cuevas & Campos, 2001). Results from this survey indicate that microentrepreneurs may benefit from having access to stable financial institutions that could provide microenterprise credit in amounts that exceed the amounts available from personal savings and friends and family with longer terms, market interest rates, and simple application procedures and requirements. Savings and loans have filled this void in some cases by offering larger loans at market interest rates. Nearly 20 percent of informal firms and 16 percent of formal firms obtained startup capital from a savings and loan. However, given the weak regulatory environment, many of the Mexican savings and loans have failed in recent years due to a lack of appropriate prudential supervision, portfolio management and accounting standards (Cuevas & Campos, 2001).

## 6. Concluding Remarks

The availability of sufficient start-up capital is an important deterrent to microenterprise development and growth. Firms with inadequate access to start-up capital are more likely to be technically inefficient because they do not invest in the resources necessary to foster long-term growth and profitability.

Using firm-level data from the National Survey of Microenterprises, we estimate a stochastic frontier production function with inefficiency effects that include the main sources of start-up capital among the factors thought to be associated with technical inefficiency. We find that microenterprises using bank loans, carryover business capital, moneylenders and credit from clients and suppliers are more technically efficient than those firms not resorting to external financing, and those relying to family and friends. Firms operating in the informal sector are also more technically inefficient than those in the formal sector.

Loans from family and friends are different than bank loans in that they are significantly smaller in nature, are short term, and have low or zero interest rates. While one would presume that information advantages exist, loans to friends and family may be offered as a type of social insurance whereby a person may provide a loan knowing that it may be reciprocated at some point down the road. As such, family and friends are less likely to screen and monitor these investments the way a bank would because they are providing these funds to help out microentrepreneurial friends and family members, and for insurance purposes.

Bank loans, with their characteristically larger loan sizes, longer terms, and rigorous screening, are associated with the highest level of technical efficiency. However, a relatively small share of microentrepreneurs utilize bank loans and must resort to other types of financing.

Future research can more precisely document the relationship between loan sizes, terms and conditions, and their relationship to technical efficiency, production efficiency and/or profitability. In addition, more work is needed in

disentangling whether the relationship between credit source and technical efficiency is due to stringent screening or differences in loan terms and conditions.

## References

- Adams, Dale. (1992). "Taking a Fresh Look at Informal Finance." In *Informal Finance in Low-Income Countries*. Dale Adams and D. Fitchett, eds. Boulder, CO: Westview Press.
- Battese, G.E. and T.J. Coelli. (1995). "A Model for Technical Inefficiency Effects in a Stochastic Frontier Production Function," *Empirical Economics*, **20**, 325-32.
- \_\_\_\_\_. (1993). "A Stochastic Frontier Production Function Incorporating a Model for Technical Inefficiency Effects." Working Papers in Econometrics and Applied Statistics, No. 69, Department of Econometrics, University of New England.
- Battese, G.E. and G.S. Corra. (1977). "Estimation of a Production Frontier Model: With Application to the Pastoral Zone of Eastern Australia," *Australian Journal of Agricultural Economics*, **21**, 169-79.
- Chambers, John, William Cleveland, Beat Kleiner and Paul Tukey. (1983). *Graphical Methods for Data Analysis*. Belmont, CA: Wadsworth International Group.
- Coate, Stephen and Martin Ravallion. (1993). "Reciprocity without Commitment: Characterization and Performance of Informal Insurance Arrangements," *Journal of Development Economics*, **40**, 1-24.
- Coelli, Tim. (1996). "A Guide to FRONTIER Version 4.1: A Computer Program for Stochastic Frontier Production and Cost Function Estimation." Center for Efficiency and Productivity Analysis Working Paper 96/07. University of New England.
- Cuevas, Carlos and Pilar Campos. (2001). "Mexico Rural Finance: Savings Mobilization Potential and Deposit Instruments in Marginal Areas," World Bank Report No. 21286-ME.
- de Soto, Hernando, (1989). *The Other Path*, New York: Harper and Row.
- Evans, David S., and Boyan Jovanovic. (1989). "An Estimated Model of Entrepreneurial Choice under Liquidity Constraints," *Journal of Political Economy*, **97**(4), 808-26.
- Heino, Heikki and José A. Pagán. (2001). "Assessing the Need for Microenterprises in Mexico to Borrow Start-up Capital," *Journal of Microfinance*, **3**(1), 131-44.
- Hernández, Fausto and A. Villagómez. (2000). "El Sector Financiero en el TLC." In *NAFTA: Natural Partners?*. R. Fernández de Castro, ed. Mexico City: Porrúa ITAM.
- Hernández, Fausto and A. Villagómez (2001). "Estructura de Deuda Pública en México," *Revista de Análisis Económico*, ILADES/Georgetown University. Chile.

- INEGI. (2000). *Encuesta Nacional de Empleo Urbano*. Various years <www.inegi.gob.mx>. Aguascalientes, Ags.: Instituto Nacional de Geografía, Estadística e Informática.
- \_\_\_\_\_. (1996). *Encuesta Nacional de Micronegocios 1994*. Aguascalientes, Ags.: Instituto Nacional de Geografía, Estadística e Informática.
- Jalan, Jyotsna and Martin Ravallion. (1999). "Are the Poor Less Well Insured? Evidence on Vulnerability to Income Risk in Rural China," *Journal of Comparative Economics*, **26**, 338-357.
- Kumbhakar, Subal C. and C. A. Knox Lovell. (2000). *Stochastic Frontier Analysis*. Cambridge: Cambridge University Press.
- La Porta, R. F. López de Silanes, A. Shleifer and R. Vishny. (1999). "Law and Finance," *Journal of Political Economy*, **52**(2), 1131-1137.
- Levine, Ross. (1997). "Financial Development: Views and Agenda," *Journal of Economic Literature*, **35**(2), 688-726.
- McKinnon, R. (1973). *Money and Capital in Economic Development*. Washington, DC: Brookings Institution.
- Mansell, Catherine. (1995). *Las Finanzas Populares en México*. México, DF: Milenio-CEMLA, ITAM.
- Montiel, Peter, Pierre-Richard Agenor and Nadeem Ul Haque. (1993). *Informal Financial Markets in Developing Countries: A Macroeconomic Analysis*. Oxford: Blackwell.
- Morduch, Jonathan. (1999). "The Microfinance Promise," *Journal of Economic Literature*, **37**, 1569-1614.
- Nabi, Ijaz. (1989). "Investment in Segmented Capital Markets," *Quarterly Journal of Economics*, **104**(3), 453-62.
- Otero, Maria and Elisabeth Rhyne. (1994). *The New World of Microenterprise Finance: Building Healthy Financial Institutions for the Poor*. West Hartford, CT: Kumarian Press.
- Pagán, José A. and Susana M. Sánchez. (2001). "Explaining Gender Differences in Earnings in the Microenterprise Sector." In *The Economics of Gender in Mexico*, Elizabeth G. Katz and Maria C. Correia, eds. Washington, DC: The World Bank, Chapter 5, pp. 174-203.
- Pagán, José A. and José A. Tijerina-Guajardo. (2000). "Increasing Wage Dispersion and the Changes in Relative Employment and Wages in Mexico's urban Informal Sector: 1987-1993," *Applied Economics*, **32**, 335-47.
- Perkins, D.H., S. Radelet, D.R. Snodgrass, M. Gillis and M. Roemer. (2001). *Economics of Development*, New York: W.W. Norton & Co.
- Poder Ejecutivo Federal. (2001). *Plan Nacional de Desarrollo: 2001-2006*. México, DF: Presidencia de la República.

- Roubaud, François. (1995). *La Economía Informal en México*. Mexico, DF: Fondo de Cultura Económica, INEGI and Orstom.
- Schumacher, E.F. (1974). *Small is Beautiful*, London: Sphere Books.
- Seyoum, E.T., G.E. Battese and E.M. Fleming. (1998). "Technical Efficiency and Productivity of Maize Producers in Eastern Ethiopia: A Study of Farmers Within and Outside the Sasakawa-Global 2000 Project," *Agricultural Economics*, **19**, 341-8.
- Sánchez, Susana M. and José A. Pagán. (2001). "Gender Issues in Workforce Participation and Self-Employment in Rural Mexico." In *The Economics of Gender in Mexico*, Elizabeth G. Katz and Maria C. Correia, eds. Washington, DC: The World Bank, Chapter 6, pp. 204-226.
- Tybout, James R. (1983). "Credit Rationing and Investment Behavior in a Developing Country," *Review of Economics and Statistics*, **65**(4), 598-607.
- World Bank. (1994). "Enhancing Women's Participation in Economic Development." World Bank Policy Paper.