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**START UP CAPITAL, MICROENTERPRISES AND TECHNICAL
EFFICIENCY IN MEXICO**

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 resorting to bank loans, carryover business capital, moneylenders and credit from clients and suppliers are more technically efficient than those relying to family, friends and to own sources. The results suggest that banks are better at screening and monitoring start-up capital investments than family and friends (and other alternative sources), but this result could also arise because friends and family members provide these funds for insurance purposes.

Resumen

El acceso a un adecuado financiamiento inicial para abrir un micronegocio se ha identificado como un importante obstáculo para dicha apertura, con la consiguiente baja en la tasa de crecimiento de dicho tipo de negocio. En este trabajo usamos la Encuesta Nacional de Micronegocios publicada por INEGI para estimar una frontera estocástica de producción con efectos ineficientes para identificar si los distintos canales de financiamiento afectan la eficiencia de una microempresa. Las formas de financiamiento eficientes resultaron ser, en orden de importancia, el financiamiento bancario formal, reinversiones, crédito concedido por agiotistas y financiamiento de proveedores. Por su parte, el crédito proveniente de amigos y parientes y los recursos propios, provenientes de ahorro personal fueron ineficientes. Estos resultados sugieren que los bancos llevan a cabo una mejor evaluación del proyecto que la familia y amigos. Esto, sin embargo, puede interpretarse alternativamente que el crédito de amigos y parientes es una forma de seguro del tipo social.

Introduction

The efficiency and potential for development of the microenterprise sector in emerging economies have been debated 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 between 50 and 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 & Rhine, 1994). This is the case because inadequate initial financing restricts the ability of entrepreneurs to invest in much needed capital equipment and labor services (Levinc, 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 (World Bank, 1996). 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 (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 capital¹, 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.

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 (Mahon, 1999; 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 (Sánchez, 1998). The high concentration of employment in this sector highlights the importance of microentrepreneurship in the long-term economic development initiatives of the Mexican government.² The National Survey of Microenterprises 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 informally by a friend or relative, money lender, among other categories.

¹ 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 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 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).

In Mexico, the microenterprise sector has grown substantially over the last decade. 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). 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). 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.

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. 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 1994-2000.³

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 (1998) 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.⁴ 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.

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. Consequently, the size of the informal micro-credit market has been

³ 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.

⁴ 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.

increasing significantly in Mexico and friends, relatives and moneylenders have now become important sources of credit.

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, allowing individuals to help and monitor each other during difficult times, such as the recent financial crisis in Mexico. These continuing social and economic ties that have developed over the years act as a mean of enforcing the terms of the loan (Adams, 1992). Furthermore, the relationship of the borrower and the lender minimizes the moral hazard that might be associated with credit and, hence, implies lower monitoring costs. As such, one would expect that microenterprises financed by this type of credit would show a higher level of profitability and/or production efficiency, and a lower defaulting rate as suggested by the group lending literature (Morduch, 1999b).

On the other hand, others have argued that credit from friends/relatives is not an effective financial mechanism in the sense that these agents are not able to accurately assess the potential profitability of a business venture.

This paper concentrates on the first issue, that is, whether friends and relatives screen borrowers—and, thus, their projects—better than banks. As mentioned, this type of lender has been identified, in adverse selection models (Ghatak, 1999; Ghatak & Guinnane, 1999), to have informational advantages, as they supposedly know the characteristics of projects relevant to their creditworthiness better than a bank. Our model below allows us to assess whether there are differences in the levels of technical efficiency that can be linked to the type/source of start-up capital employed. We use technical efficiency as our business success outcome because this measure is most likely related to the long-term sustainability and profitability of a microenterprise.

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:

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

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 β 's are the parameters to be estimated, X_i is a vector of industry and region controls with an associated vector of parameters (γ), v is a normally distributed error term with a zero mean and variance σ_v^2 , and u_i is a random variable that follows a truncated normal distribution with mean μ_u and variance σ_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 θ '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).⁵

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.

As discussed in Section 2, informal lending (e.g., credit coming from friends and relatives, and moneylenders) is a market response of economic agents to their economic environment. This type of credit has, in principle, several advantages stemming from informational benefits *vis a vis* banking credit. However, few attempts have been made to study it, especially from the profitability and efficiency point of view. Most of the work in this area has concentrated in designing effective group lending programs. This has been the case due to the very nature of this activity; that is, information on such types of credit is not easily obtainable. Thus, few systematic efforts have been made at collecting

⁵ 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).

information useful to evaluate and determine the size of this credit market in developing countries.

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 on 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, most urban 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.⁶

The mean value of total capital equipment amounts to about \$6,093 Pesos. Capital equipment includes the value of tools and equipment, machinery, vehicles 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 resort to 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 resort to 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.⁷ 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.

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

⁷ This was formally tested using a likelihood ratio test. The χ^2 test statistic rejects the Cobb-Douglas specification in favor of the translog model.

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 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 suggesting that these types of start-up capital are not any more efficient than using own sources.

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 microenterprises are more technically efficient than their informal sector counterparts. 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 informal microenterprises also are more capital constrained than formal businesses. Formal sector firms had a capital to labor ratio 12.8 times greater than in the informal sector. Also, banks and commercial credit were associated with a relatively higher technical efficiency in the formal sector but not in the informal sector. This is probably the case because the informal loans available to the informal sector

microenterprises are not large enough to lead to significant capital investments which can in turn enhance technical efficiency.

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. A capital input from any source should increase the technical efficiency of the firm, provided that the firm is capital constrained and that the owner invests the money into the firm.

There are several reasons as to why the source of credit would affect the technical efficiency of the firm. Sources of credit vary from one another in important ways: e.g., loan size, interest rate, loan term, loan use, screening, 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.

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. Although this type of startup capital has little or no associated interest rate, its small amount is probably insufficient in making a large impact in the efficiency of the firm. Loans from family and friends have very short terms, often days or weeks, thereby reducing the efficacy of long-term investments. Although information advantages may exist for these types of loans, their small amounts and short terms limit their potential of contributing to technical efficiency. These loans represent a "moral economy" in developing countries where the poor help one another in times of need and it is a type of social insurance arrangement (Coate & Ravallion, 1993).

In contrast, banks offer loans that are nearly 17 times the average loan size of loans from friends and family (Table 4). Also, banks offer the longest term thereby allowing firms to invest at market rates over a longer horizon. Through their screening process, banks target firms which are more likely to have economies of scale and demonstrate technical efficiency. Therefore, it is not surprising to find that firms with startup capital from banks were more likely to be technically efficient.

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 (SHCP, 1994), 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.

Given the difficulty obtaining bank loans, microentrepreneurs must seek other forms of finance that are capable of giving significantly large loan amounts with appropriate terms and conditions. The findings in this study suggest that using carryover capital from a prior business, moneylenders, and commercial credit are all ways that microentrepreneurs have found to enhance the technical efficiency of their firms through capital investment without going through traditional financial institutions.

Startup capital from moneylenders was a significant determinant of technical efficiency in both the formal and informal sectors, despite the associated high interest rates. Mansell (1995) has documented anecdotal evidence that street vendors in Mexico (informal sector) buy their merchandise using moneylender credit.⁸ These lenders know all their clients very well and only lend to viable businesses. Given their information advantages, moneylenders seem to be relatively good at screening and monitoring projects that will lead to technical efficiency.

It is interesting to see that an important credit source related to technical efficiency is carryover business capital, especially in the informal sector. During a financial crisis, unemployment increases and some individuals use up part of their savings from previous jobs to start microenterprises. Empirical results indicate that they indeed choose projects that are relatively technically efficient when self-financing through carryover business capital.

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.

⁸ 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.

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 resorting to 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 smaller in nature, are short term, and often have no interest rate. 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.

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Figure 1

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

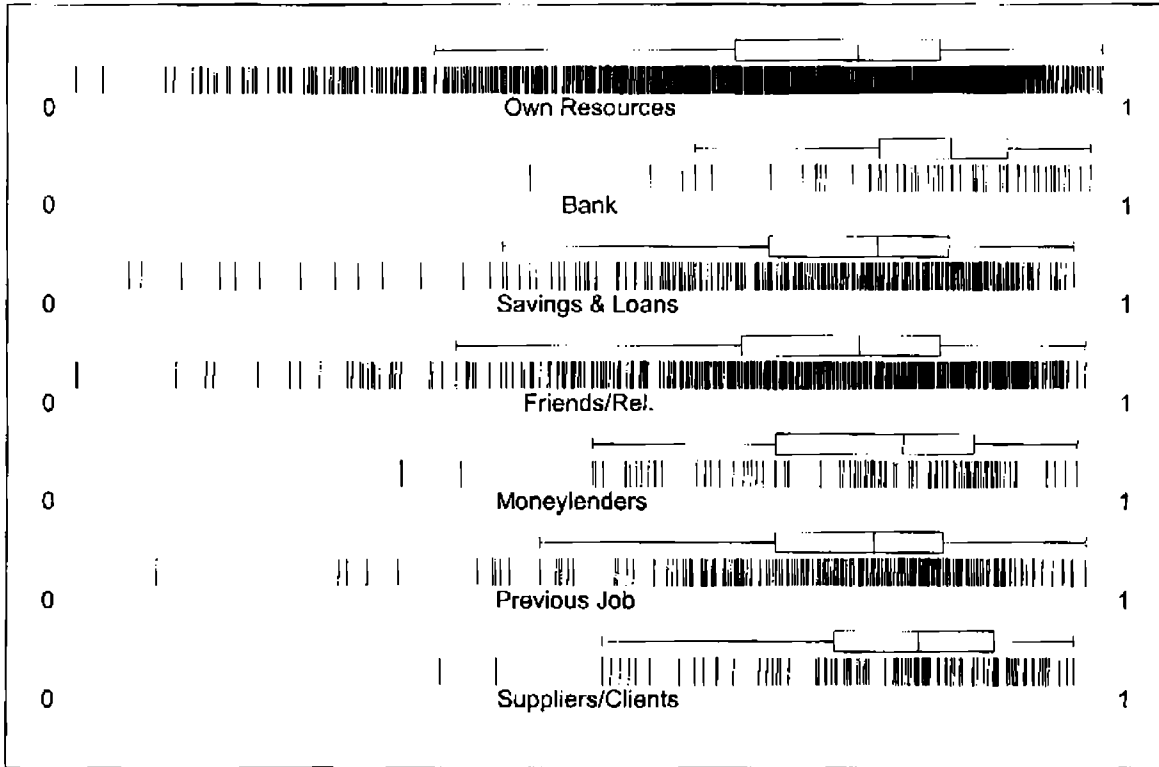


Figure 2

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

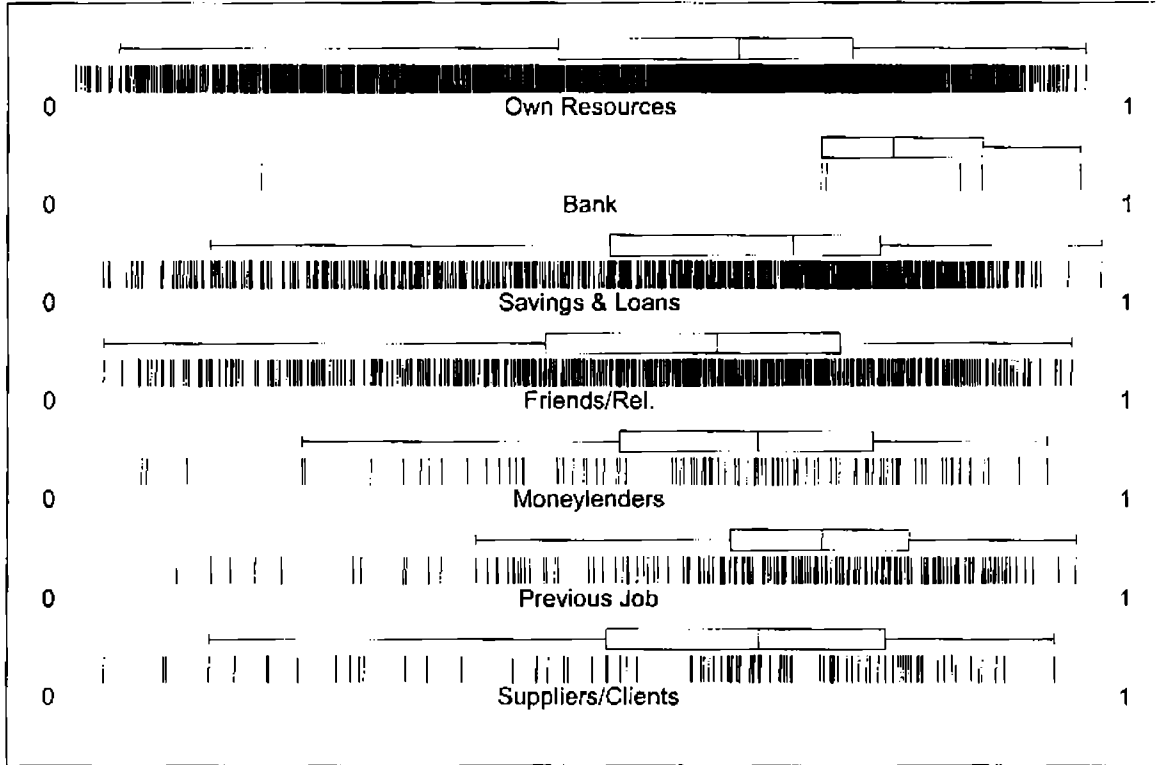


Table 1. Descriptive Statistics

Variable	Full Sample		Formal Sector		Informal Sector	
	Mean	SD	Mean	SD	Mean	SD
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	

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

	All		Formal		Informal	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	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	

*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 4. Terms and Conditions of Loan by Credit Source

	Average amount (US \$)	Nominal annual interest rate	<i>Avera ge ler m</i>
<i>Personal Savings</i>	\$85	0	none
Bank	\$1,235	market	17 months
Savings and Loan ⁱ	\$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